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KCSE

Physics

20 SERIES EXAMS

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SERIES 1
PAPER 1.

1. (a) Define the term *length* (1 mark)

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(b) State the SI unit of the quantity in (a) (1 mark)

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2. Explain why mercury in glass forms a convex meniscus (1 mark)

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3. **Figure 1** shows a force pump during upstroke.

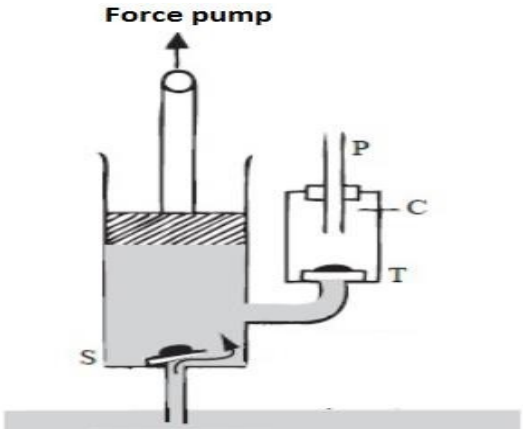


Figure 1

Valve S opens and valve T closes as shown. Explain this observation. (2 marks)

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4. Describe how potassium permanganate solution can be used to demonstrate that matter is made of tiny particles. (3 marks)

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5. (a) State one special feature of a clinical thermometer that makes it suitable for measuring body temperature (1 mark)

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(b) Explain why boiling water is not suitable for sterilizing the clinical thermometer (1 mark)

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6. Distinguish between *least count* of a vernier callipers and *pitch* of a micrometer screw gauge (1 mark)

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7. Explain how the racing cars have been designed so that they can negotiate sharp corners at high speeds without toppling (2 marks)

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8. A body is projected vertically upwards. Sketch a velocity-time graph for the motion up to the maximum height. (2 marks)

9. **Figures 2** shows an aerofoil.

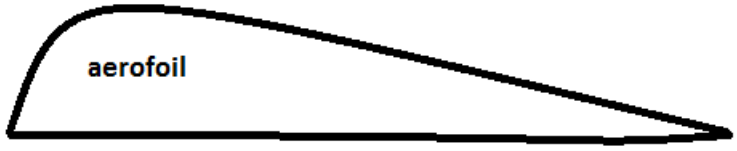


Figure 2

Explain how the aerofoil is able to be lifted during flight (3 marks)

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10. Apart from the gravitational field strength, state two other factors affecting the pressure in liquids (2 marks)

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11. (a) A body moving in a circular path with a uniform speed is able to accelerate. Explain. (1 mark)

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(b) Distinguish between elastic and in-elastic collision (1 mark)

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12. A steel needle sinks yet a ferry floats in water. Explain this observation (1 mark)

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13. **Figure 3** is a setup used to determine specific heat capacity of a metal .

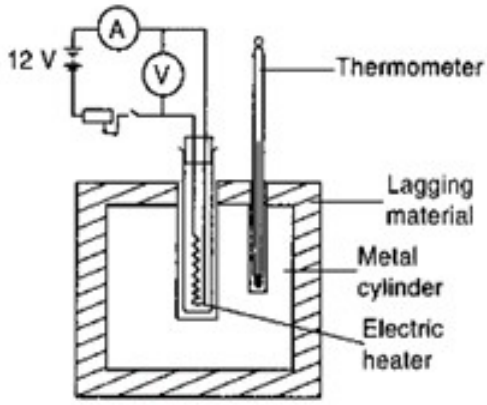


Figure 3

Other than current and the potential difference, state two other quantities that must be measured during the experiment. (2 marks)

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SECTION B (55 MARKS)

Answer ALL questions in this section in the spaces provided

14. (a)A rifle of mass 4.0 kg fires a bullet of mass 12.0 g with a muzzle velocity of 700 ms^{-1}. Assuming that the rifle is free to move, calculate the velocity of recoil. (3 marks)

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(b) **Figure 4** shows a cross-section of a handle of a screw jack 70 cm long. The pitch of the screw is 0.8 cm.

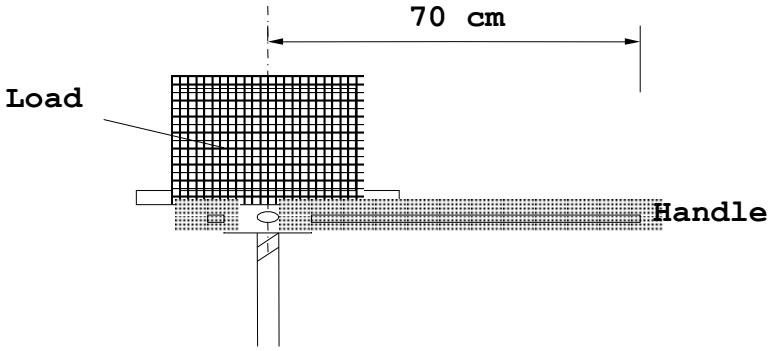


Figure 4

Given that the efficiency of the machine is 65%, calculate:-

(i) The velocity ratio of the system (2 marks)

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……...

(ii) The mechanical advantage of the screw jack. (2 marks)

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(c) Sketch a graph of efficiency against Load for the machine (2 marks)

(d) Draw a single moving pulley with a velocity ratio of 2. (2 marks)

15. (a) Define the term *latent heat of vaporization.* (1 mark)

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(b) **Figure 5** shows a set up by a student to determine the specific latent heat of vaporization of a liquid.

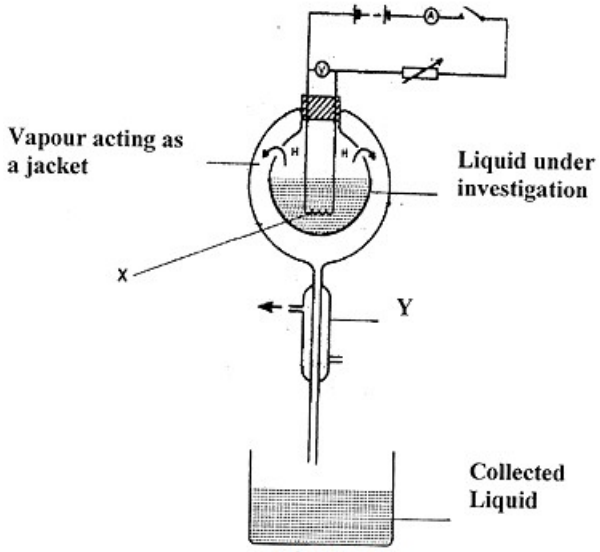


Figure 5

(i) Identify the parts labeled X and Y. (2 marks)

X ……..

Y.…….

(ii) State **TWO** measurements that should be taken apart from the current, potential difference and time. (2 marks)

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(iii) Describe how the set up can be used to determine the specific latent heat of vaporization of the liquid. (5 marks)

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(iv) Stat is the purpose of the part labelled Y (1 mark)

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16. (a) State *Pressure Law* for an ideal gas (1 mark)

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(b) State **one** basic assumption of the Kinetic Theory of gases. (1 mark)

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(c) **Figure 6** shows a set up that may be used to verify Pressure Law.

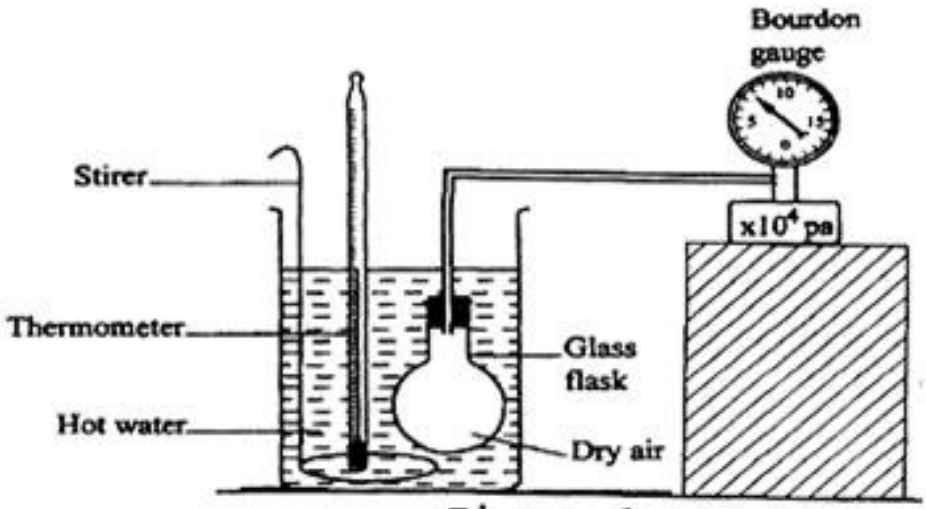


Figure 6

(i) State the measurements that may be taken in the experiment. (2 marks)

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(ii) Explain how the measurement in (i) above may be used to verify Pressure Law. (4 marks)

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(iii) A car tyre is at an air pressure of 4.0×10^5 Pa at a temperature of 27 ^{0}C. While it is running, the temperature rises to 75 ^{0}C. Calculate the new pressure in the tyre assuming the tyre does not expand. (3 marks)

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17. . (a) State Archimedes's Principle. (1 mark)

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(b) An object weights 1.04N in air, 0.64N when fully immersed in water and 0.72N when fully immersed in a liquid. If the density of water is 1000kgm $^{-3}$, find the density of the liquid.(4 marks)

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(c) State the Law of floatation. (1 mark)

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(d)**Figure 7** shows a buoy, B, of volume 40 litres and mass 10 kg. It is held in position in sea water of density 1.04gcm^{-3} by a light cable fixed to the bottom so that ¾ of the volume of the buoy is below the surface of the sea water.

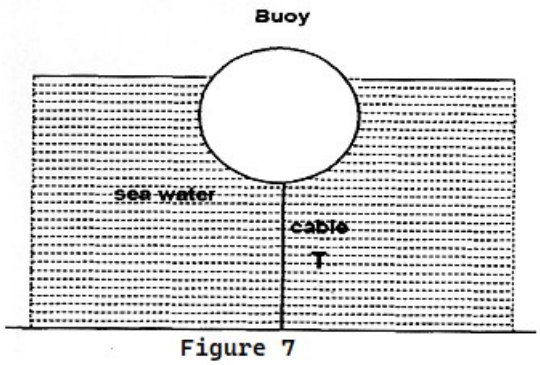


Figure 7

Determine the tension T in the cable. (3 marks)

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(e) **Figure 8** shows a diagram of a hydrometer which is suitable for measuring the densities of liquids varying between 1.0gcm^{-3} and 1.2gcm^{-3}.

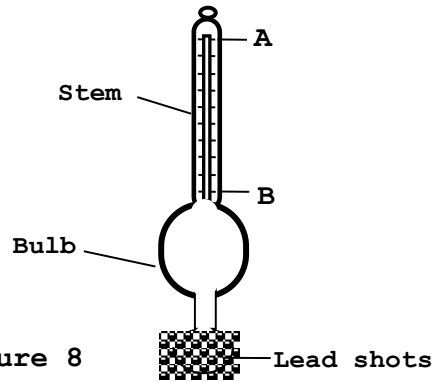


Figure 8

(i) On the diagram indicate the label corresponding to 1.0 and 1.2g/cm^3. (2 marks

(ii) State how the sensitivity of the above instrument be increased (1 mark)

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18. (a) State Hooke's law. (1 mark)

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(b).The following results were obtained in an experiment to verify Hooke's law when a spring was extended by hanging various loads on it.

Load, L (N)	0.00	1.00	2.00	3.00	4.00	5.00	6.00
Length of spring (cm)	10.00	11.50	13.00	14.50	16.00	18.50	24.00
Extension, e (cm)	0.00						

(i) Complete the table for extension, e, above. (1 mark)

(ii) Plot a graph of Load (y-axis) against extension. (5 marks)

(iii)From the graph, determine the spring constant, *k*. (3 marks)

SECTION A: (25 marks)

*Answer **all** questions in this section in the spaces provided*

1. Two mirrors **A** and **B** are placed at an angle of **60°** to each other. A ray of light is incident on mirror **A** as shown in **figure 1**.

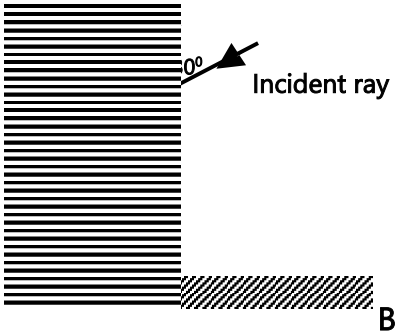


Figure 1

Complete the ray diagram to show how it travels after striking the two mirrors (3 marks)

2. **Figure 2** shows an object placed in front of a pinhole camera.

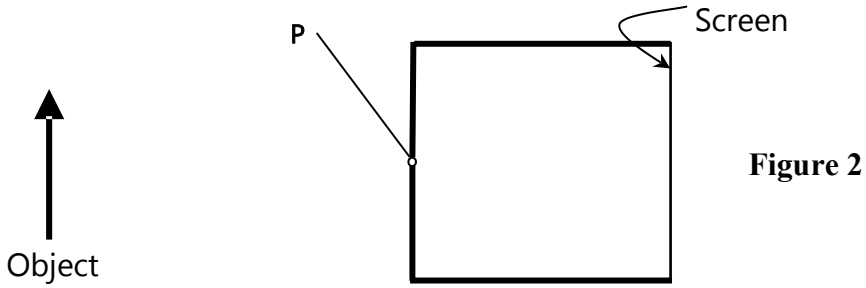


Figure 2

(a) Compare the size of the image formed to that of the object (1 mark)

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(b) Explain what happens to the image formed when the diameter of P is doubled (2 marks)

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3. Increase in temperature weakens the strength of a magnet. Explain (2 marks)

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4. Give a reason why it is not advisable to light a cigarette near a charging battery. (1 mark)

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5. **Figure 3** shows a conductor AB placed between the poles of two bar magnets and connected to a circuit as shown

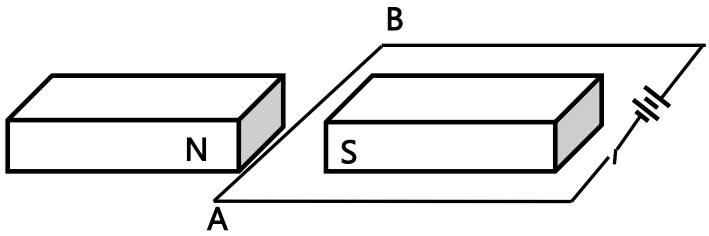


Figure 3

Indicate with an arrow the force that acts on the conductor **AB**. (1 mark)

6. A concave mirror has a focal length 15cm. State **TWO** characteristics of an image observed in the mirror when an object is placed at a distance less than the focal length from the mirror. (2 marks)

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7. When *Alpha* and *Beta* particles are passed through air it is observed that *Alpha* particles are more ionizing than *Beta* particles. Give **two** reasons for this. (2 marks)

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8. State how the deflection system of a television set differs from that of a CRO. (1 mark)

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9. **Figure 4** shows an image **I** formed by a concave lens. F and F^1 are the principal foci of the lens.

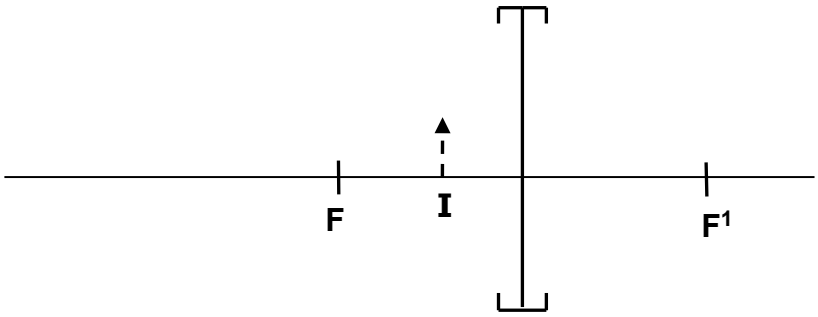


Figure 4

Complete the diagram to locate the position of the object. (3 marks)

10. (a) State the adjustment that should be made on the *x-ray* tube to increase the hardness of the X-rays produced (1 mark)

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(b) **Figure 5** shows an arrangement of the electromagnetic waves

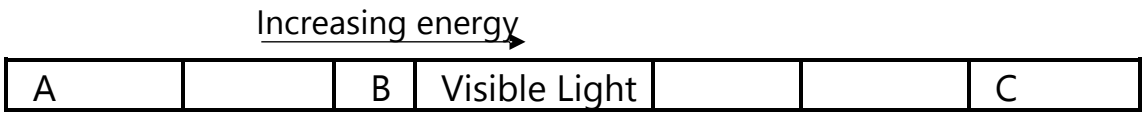


Figure 5

(i) Other than the energy of the waves state **TWO** other properties which differentiate the electromagnetic waves from each other. (2 marks)

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(ii) State **ONE** use of radiation marked B (1 mark)

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11. Define *donor impurity* as used in semiconductors (1 mark)

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12. **Figure 6** shows a set up that was used in charging a material **Y** negatively by induction.

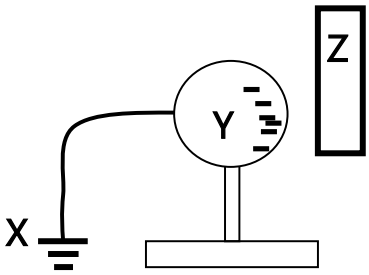


Figure 6

Explain what happens between X and Y. (1 mark)

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13. **Figure 7** shows straight waves moving towards a curved reflector.

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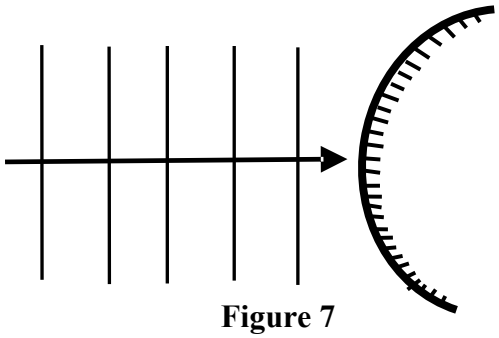


Figure 7

Complete the diagram to show the reflected waves. (1 mark)

SECTION B: (55 marks)

*Answer **all** questions in this section in the spaces provided*

14. (a) **Figure 8** shows a set up used to observe interference of light waves.

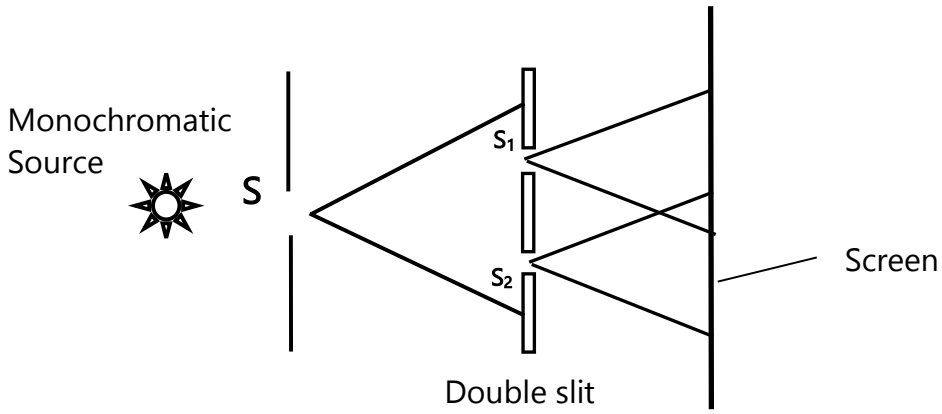


Figure 8

i) State the function of the slits S_1 and S_2 (1 mark)

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ii) State and explain what is observed on the screen. (3 marks)

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iii) State what is observed on the screen when white light is used instead of monochromatic source. (1 mark)

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(b) In a class demonstration, a physics teacher used the set up in **figure 9** to study sound waves.

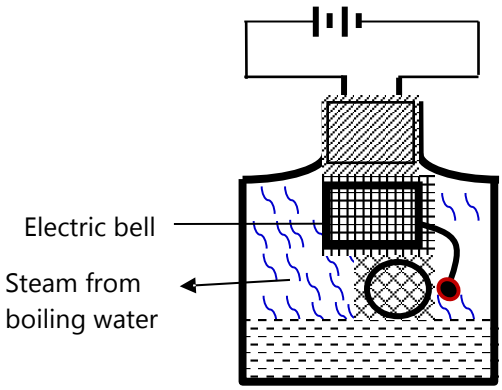


Figure 9

Explain what happens to the sound heard from the bell as the bottle and its contents are cooled to 0°C. (2 marks)

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(c) **Figure 10** shows the features of a simple camera.

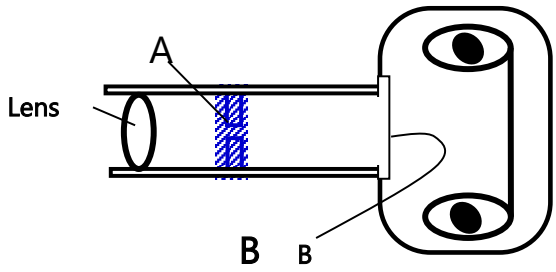


Figure 10

State the functions of the parts labelled A and B (2 marks)

A……..

B……

15. .

(a) Other than the peeling-off of the silvering on mirrors. State **TWO** other disadvantages of plane mirrors over prisms in making periscopes. (2 marks)

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(b) Name **ONE** factor that determines the velocity of photoelectrons produced on a zinc metal surface when light is shone on it. (1 mark)

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(c) The graph in **figure 11** shows the variation of stopping potential, V_s with incident radiation's frequency, f for a certain metal producing photoelectrons.

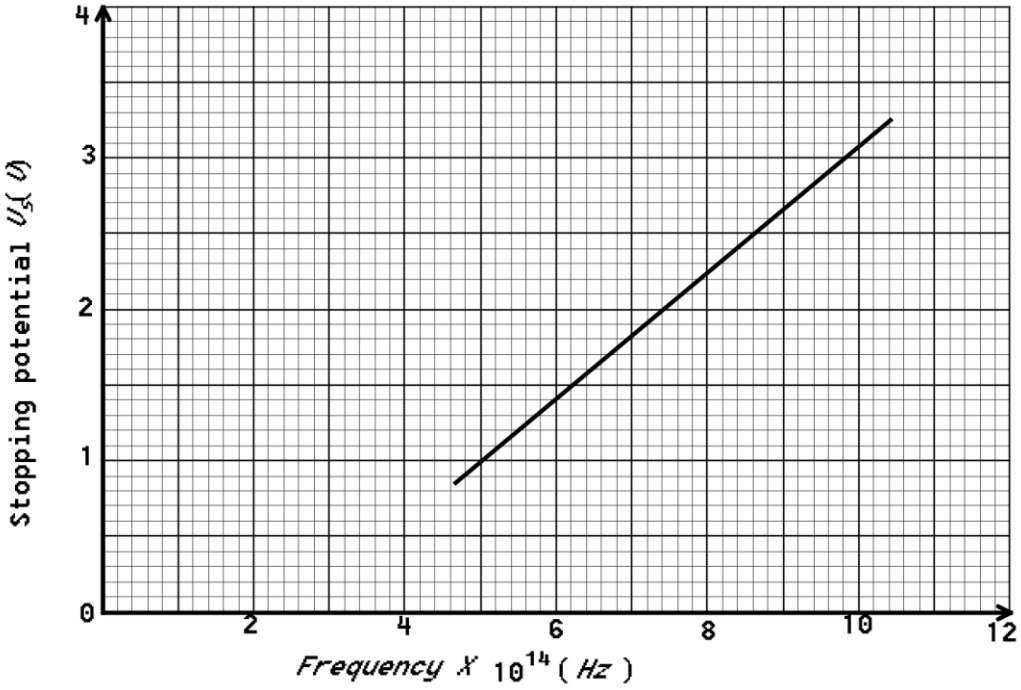


Figure 11

(i) Explain what is meant by the term *stopping potential* (1 mark)

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(ii) Use the graph to determine the maximum wavelength of the radiation that would dislodge electrons from the zinc surface.($c = 3.0 \times 10^{8} ms^{-1}$)
(4 marks)

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(d) A beaker of height 10 cm is filled with water. An optical pin which is at the bottom of the beaker is then viewed from the top of the beaker. How far does the pin appear from the surface, given that the refractive index of water is $\frac{4}{3}$ (3 marks)

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16. (a) **Figure 12** represents two parallel plates of a capacitor separated by a distance, *d*. Each plate has an area of A square units.

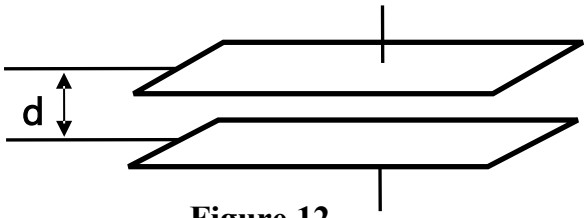


Figure 12

Suggest **two** adjustments that can be made on the capacitor so as to reduce the effective charge stored per unit voltage (2 marks)

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(b) **Figure 13** shows a capacitor **C** being charged.

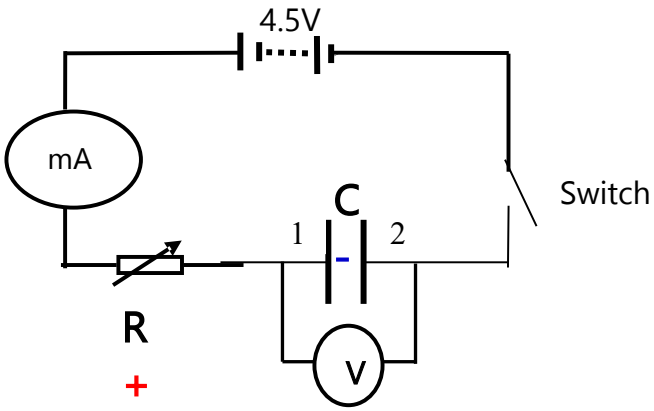


Figure 13

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Explain how the capacitor is charged. (3 marks)

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(c) **Figure14** shows the set – up for a simple cell.

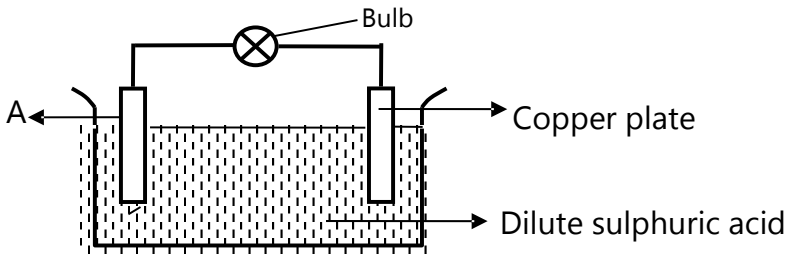


Figure 14

Explain how terminal A achieves its charge (2 marks)

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(d) **Figure 15(a)** and **(b)** represent displacement-distance and displacement-time graphs for the same wave.

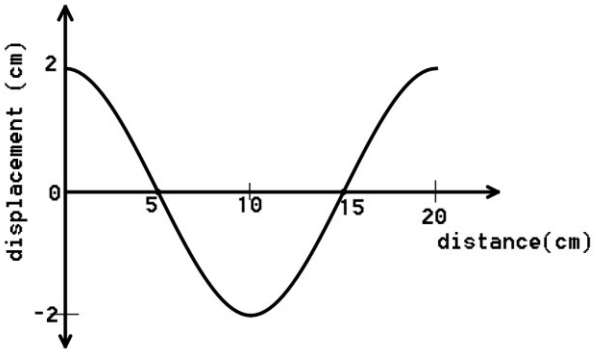


Figure 15(a)

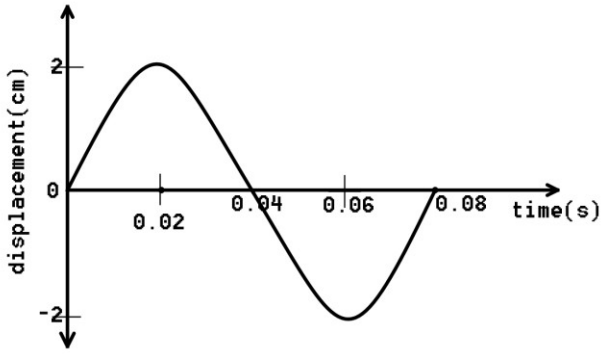


Figure 15(b)

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Determine the velocity of the wave. (4 marks)

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17. (a) In **figure 16**, a student moved the bar magnet out of the coil and observed current to follow into the coil as indicated

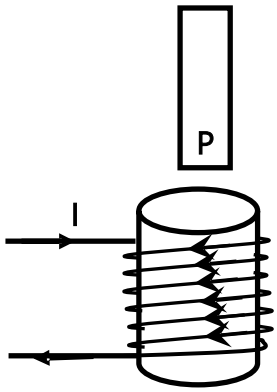


Figure 16

(i) Determine the polarity of P of the magnet (1 mark)

……

(ii) Explain briefly the source of electrical energy in the circuit (3 marks)

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(b) A transformer has 400 turns in the primary coil and secondary coil has 200 turns. The transformer is connected to 240V a.c mains.

(i) If a current of 2.5A flows in primary coil and 4.8A flows in secondary coil. Calculate the voltage across the secondary coil if the efficiency of the transformer is 95% (2 marks)

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(ii) State how is energy loss in the transformer due to hysteresis minimized (1 mark)

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(c) An insulated copper wire was wound on an iron nail to form a weak electromagnet. State ***two*** changes that could be made to increase the strength of the electromagnet. (2 marks)

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(d) A cell drives a current of 3.2A through a 2.8 Ω resistor. When it is connected to 1.6Ω resistor, the current that flows is 5A. Calculate the internal resistance ,*r* for the cell. (3 marks)

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18. (a) **Figure 17** shows a modern mains appliance

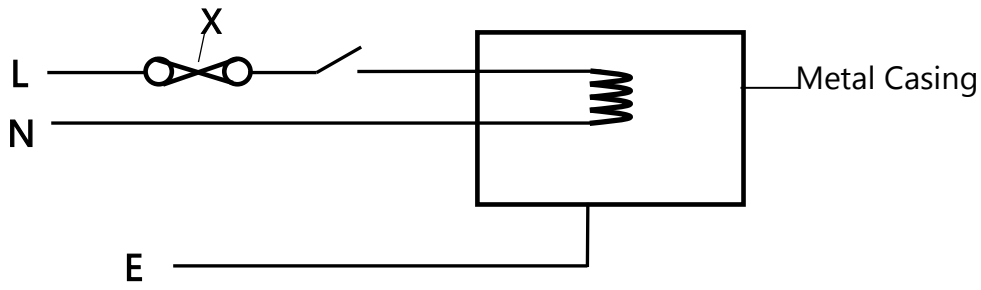


Figure 17

(i) State the purpose of lead **E** (1 mark)

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……

(ii) Explain why component **X** is connected to the live wire (1 mark)

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(b) **Figure 18** shows the Geiger-Muller tube;

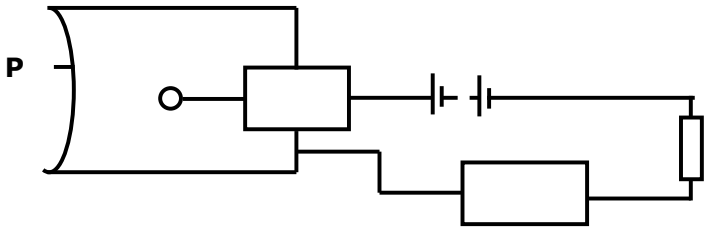


Figure 18

Explain the property of the component **P** that makes it suitable for its function (2 marks)

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(c) A radioactive element A of half - life 31 days decays to element B. A sample of A of mass 32g is kept in a container. Assuming B is stable; calculate the mass of B that will be in the container after 124 days. (3 marks)

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(d) A group of Form 4 students set up two circuits in **figure 19** to study the nature of wave forms from a given signal.

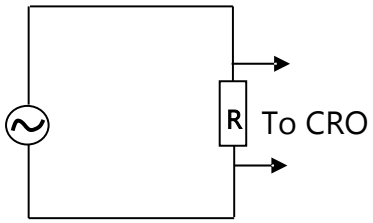


Figure 19 (i)

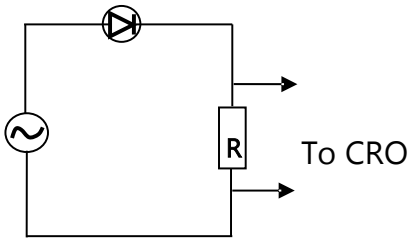
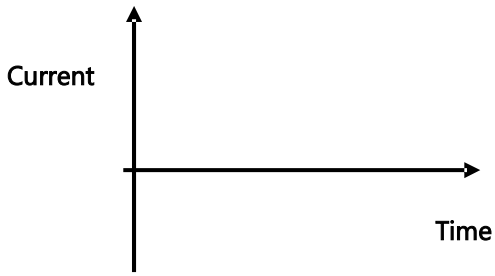
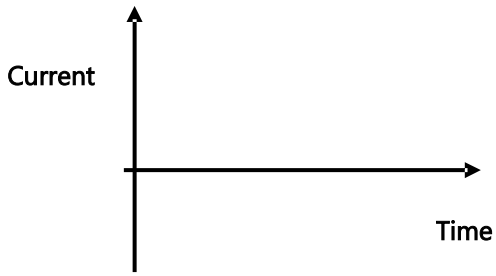


Figure 19 (ii)

On the axes below sketch graphs to show the variation of current and time as displayed on the CRO in each case (2 marks)



(i)



(ii)

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(e) **Figure 20** shows a cathode ray oscilloscope.

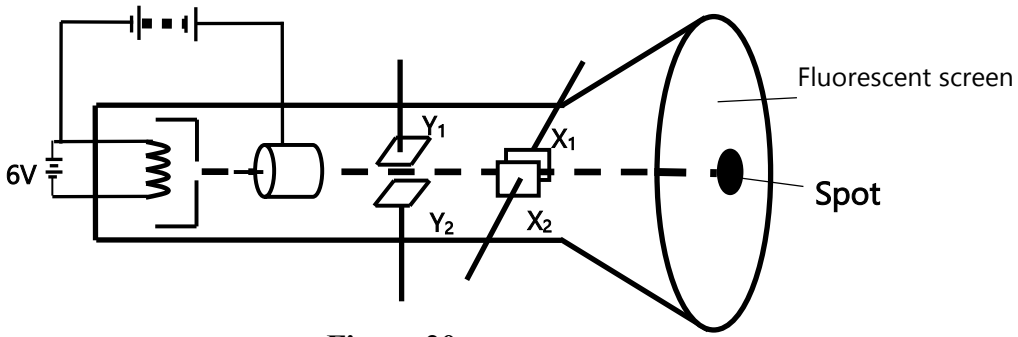


Figure 20

(i) State what would be observed on the screen if an a.c.voltage is connected across the *y – plate* and set at a low frequency (1 mark)

……

……

……

……..

(ii) Explain how the spot formed on the screen can be made brighter (2 marks)

……

……

……

……..

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Question 1

You are provided with the following

- 2 size D dry cells
- A cell holder
- A switch
- An ammeter
- A voltmeter
- Six connecting wires
- A wire labelled **AB** mounted on millimetre scale
- A micrometer screw gauge

Proceed as follows:

a) i) Measure the diameter **d** of the mounted resistant wire AB (1 mark)

d = ……..... mm

d = …….. m

ii) Determine the cross section area **A** of the wire in **SI unit** (2 marks)

……

……

……..……

b) Set up the apparatus as shown **figure 1**

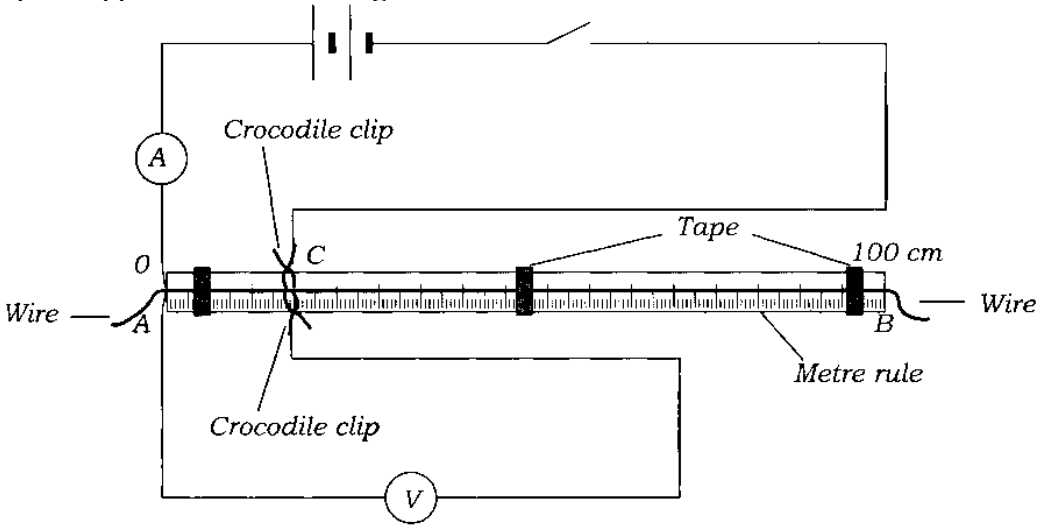


Figure 1

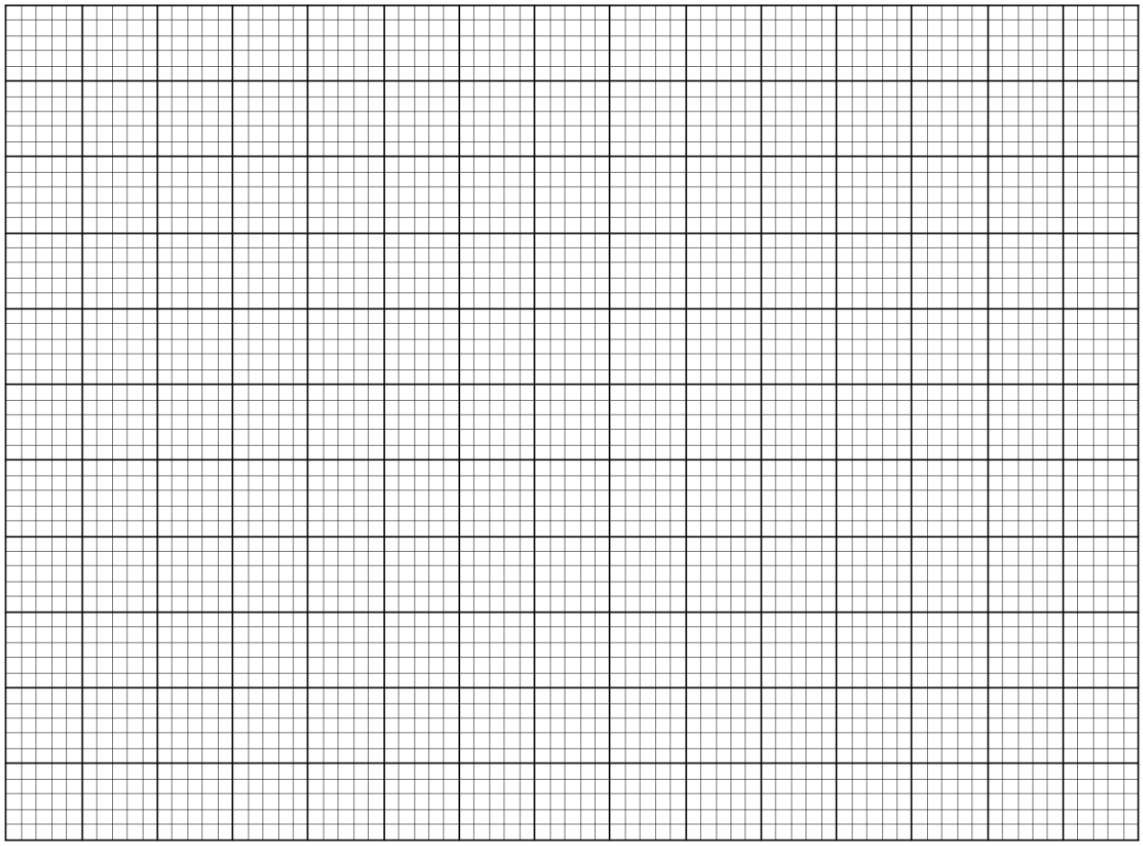
c) Close the switch. Connect the leads with the crocodile clips from the switch and the voltmeter to the wire at C . Adjust the length along the wire such that length AC = 0.2m. Close the switch , and record the current I and voltage V in **table 1**.

d) Repeat the procedure in (c) above for other values of L given and complete **table 1** (7 marks)

Table 1

Length L (m)	0.2	0.3	0.5	0.7	0.9
Current I (A)					
Voltage V (V)					
$\frac{1}{I}$ (A^{-1})					
$\frac{L}{V}$ (m/V)					

e) Plot a graph of $\frac{1}{I}$ against $\frac{L}{V}$ (5 marks)



f) Determine

i) The slope **S** of your graph (3 marks)

……

……

……

ii) **K** with units given that $\mathbf{S} = \frac{K}{A}$ (2 marks)

……

……

……

Question 2

PART A

You are provided with the following

- A pulley
- Retort stand
- Three pieces of thread
- One 100g mass
- Two 50g mass
- One 20g mass
- A metre rule
- A knife edge
- Set square from a mathematical set

Proceed as follows:

a) Balance the metre rule on the knife edge and record the balancing point G.

G =……cm mark (1 mark)

b) Using the 40 cm thread, hang a 50g mass at a distance 10 cm from one end of the metre rule. Suspend the metre rule on the knife edge as shown in **figure 2**. Adjust the point of support until the metre rule balances.

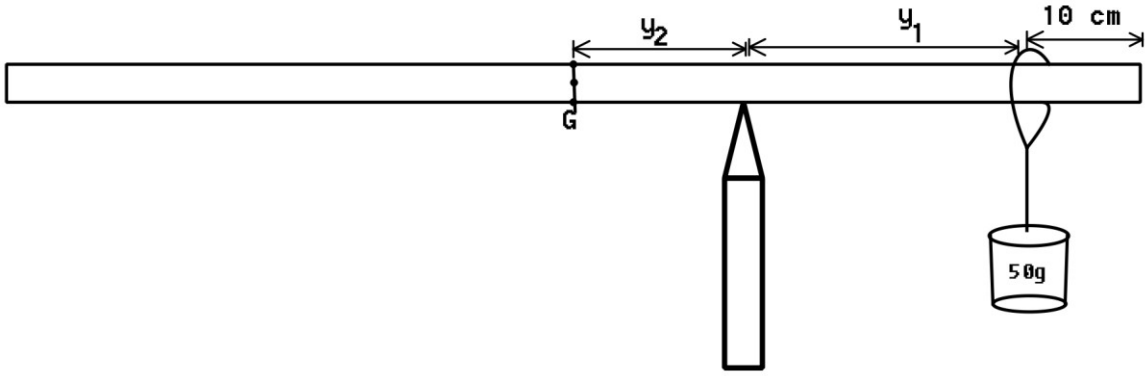


Figure 2

i) Measure the distances y_1 and y_2 (2 marks)

y_1 = …… cm

y_2 = …… cm.

ii) Use the principle of moments to determine m_1 the mass of the metre rule in kilogram (3 marks)

……

……

……

……..……..

……

c) Now set the apparatus as shown in **figure 3**. String is 20 cm from end B at R while the knife edge is at 10 cm from end A of the metre rule.

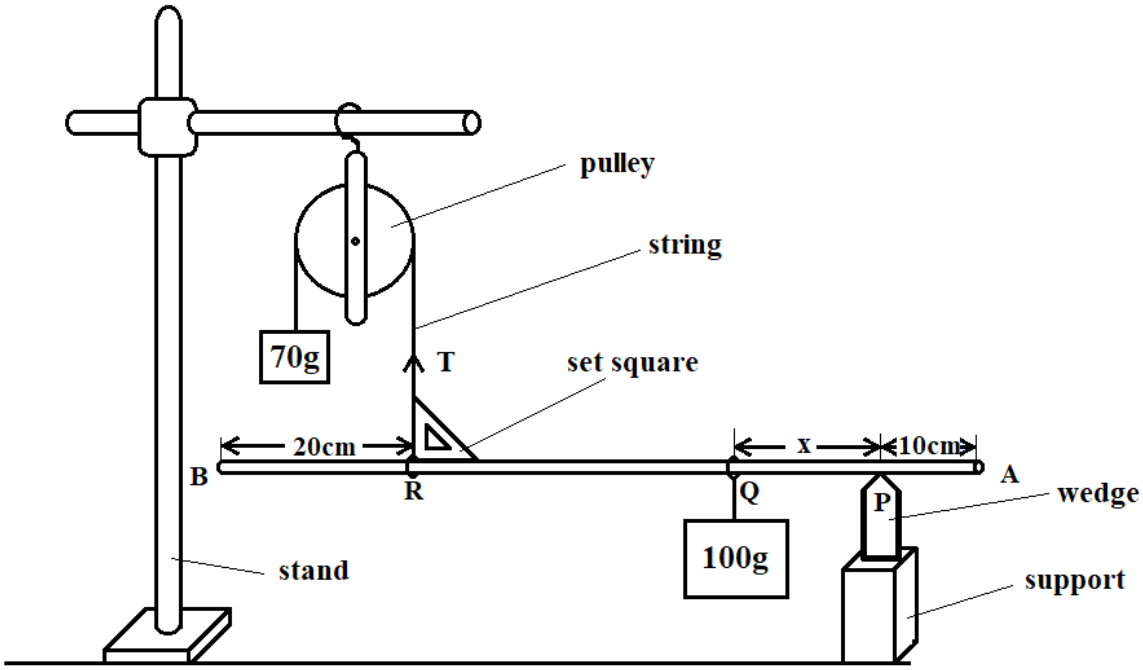


Figure 3

Adjust the position of the 100g mass suspended on the metre rule until the metre rule is in equilibrium. Ensure the thread from the pulley is kept perpendicular to the rule.

i) Measure and record the distance ***x*** between knife edge and the mass. (1 mark)

x = …….. cm

ii) Determine the tension **T** on the string (1 mark)

T = …… N

iii) Determine m_2 using the equation $m_2 = \dfrac{70T - x}{10(G - 10)}$ (2 marks)

……

……

……

……..……

iii) Determine $\dfrac{m_1}{m_2}$ (1 mark)

……

……

PART B

Proceed as follows :

d) Fix the pulley on the clamp to hang freely. Place the 60 cm thread on the pulley to make equal lengths on both sides.

e) Suspend mass X = 50g and mass Y = 60g on the pulley as shown in the **figure 4.**

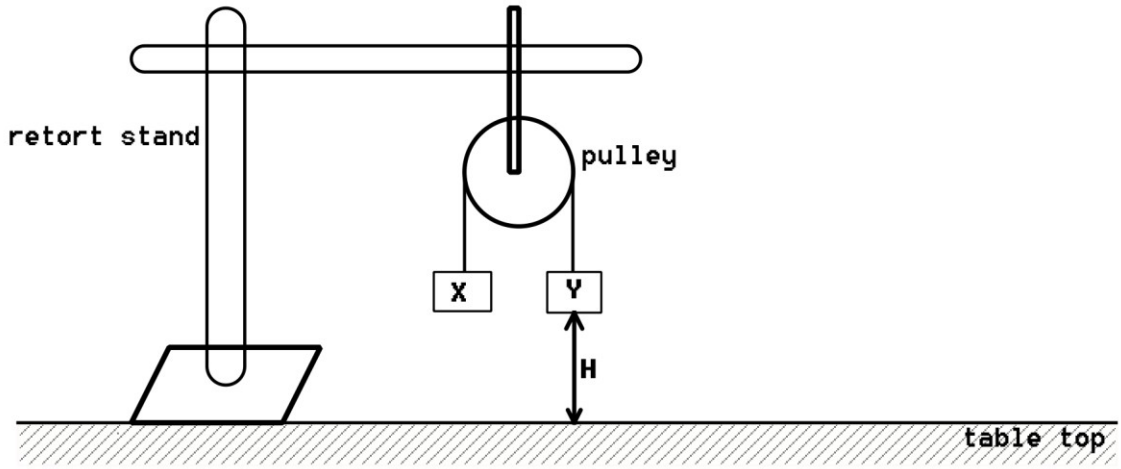


Figure 4

f) Adjust the position of the clamp to make height **H = 30 cm** between mass Y and surface of the table. Set mass Y free to fall slowly while mass X rise upwards. Use the stopwatch to measure the time t_1 taken by mass Y to touch the table surface.

i) Time of fall t_1 =…… s (1 mark)

ii) Calculate the constant u_1 given that $u_1 = \frac{2H}{t_1^2}$ (1 mark)

……

……

……

iii). Calculate the constant c_1 given that $c_1 = \frac{(X+Y)}{(Y-X)}u_1$ (2 marks)

……

……

……

g) Repeat the procedure in (d) to (f) above for the masses X = 60g and Y = 70g. Record time t_2 .

t_2 = ……s (1 mark)

h) Determine the constants u_2 and c_2

I. u_2 given that $u_2 = \frac{2H}{t_2^2}$ (1 mark)

……

……

……..

II. c_2 given that $c_2 = \dfrac{(X+Y)}{(Y-X)}u_2$ (1 mark)

……

……

……

i) Find c the average value of c_1 and c_2 stating its unit (2 marks)

……

……

……

SERIES 2
PAPER 1.

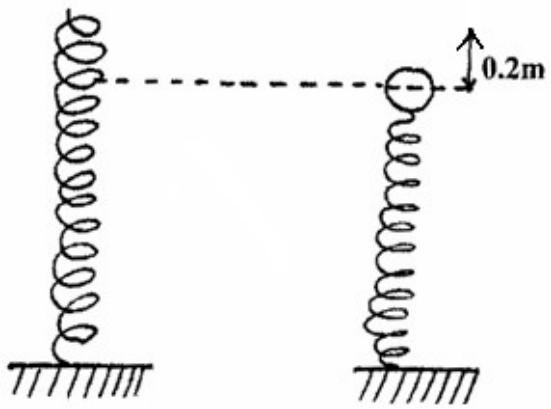
SECTION A: (25 MARKS)

Answer all the questions from this section.

1. (a) A body in circular motion moving at constant speed is said to be accelerating. Explain this. (1mk)

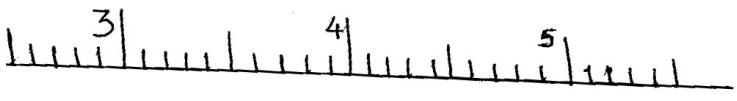
(b) A stone of mass 450g is rotated in a vertical circle at 3 revolutions per second. If the string has a length of 1.5m, determine its linear velocity. (2mks)

2. A steel ball of mass 0.05kg was placed on top of a spring on a level ground. The spring was then compressed through a distance of 0.2m.



If the spring constant is 15N/m. Calculate the maximum height reached when the spring is released. (3mks)

3. The figure below shows part of the main scale of vernier calipers.



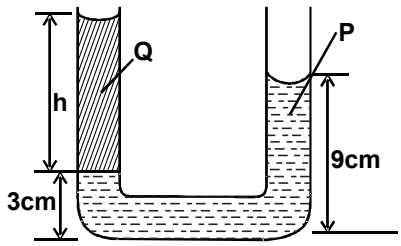
Insert the vernier scale to the main scale, to show a reading of 3.62 cm (1 Mk)

4. A liquid flows into a pipe of varying cross sectional area. The inlet cross section is 10cm in diameter. If the liquid leaves the pipe at $0.5m^3/s$ find the inlet velocity of the liquid. (3 mks)

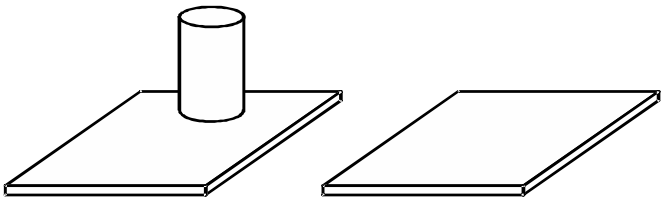
5. Explain the reason why a dropping dust particle in a still room does not trace a straight vertical path. (1mk)

6. Sketch a velocity-time graph for an object thrown vertically upwards until it gets back to it's initial position (2mks) (2mks)

7. In the figure below, U-tube contains two immiscible liquids P and Q. If the density of Q is 900kg/m³ and that of P is 1200kg / m³, Calculate the height of liquid Q. (3 marks)



8. The diagram shows a solid cylinder standing on a horizontal surface. The cylinder is in stable equilibrium.



On the horizontal space provided, sketch the cylinder in neutral equilibrium (1 mark)

9. In terms of intermolecular forces, explain the difference between liquid and gaseous state. (1 mark)

10. State and explain why it would be advisable to use hollow bricks in place of normal building stones in countries which experience winter. (2marks)

11. Sketch on the axis, a graph of mass per unit volume of water against temperature from 0^0C to 10^0C. (2mks)

12. A student dropped a drop of oil and water respectively on a clean glass surface as shown in

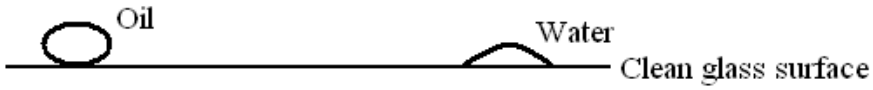


Figure 3

Explain the difference in the shapes formed on the surface of glass (2mks)

13. What does mechanics as a branch of physics entail? (1mk)

SECTION B: 55 MARKS

Answer all the questions from this section.

14. (a) State Newton's second law of motion in terms of in momentum. (1mk)

(b) A trolley of mass 5kg travelling to the right at 2m/s collides heads on with another trolley of mass 3kg travelling at 4m/s to the left. Find their velocity after collision if the collision is perfectly inelastic.(3mks)

(c) A bullet of mass 2g is fired with a velocity of 300m/s into a wooden block of mass 5kg suspended from a long string. The bullet sticks into the wood and the two move together.

(i) Find the velocity of the block and the bullet immediately after collision took place. (3mks)

(ii) Calculate the height to which both swing upwards. (3mks)

15. (i) Define specific latent heat of fusion (1mk)

(ii)300g of ice at 0^0c is dropped into a copper calorimeter containing warm water of mass 60g at 60^0c. it's observed that only 80% of ice melted.

(Take: Specific heat capacity of water = 4200 $Jkg^{-1}k^{-1}$

Heat capacity of copper = 400 JK^{-1})

(a) Determine the final temperature of the mixture. (1 mk)

(b) Determine the heat lost by calorimeter. (2 mks)

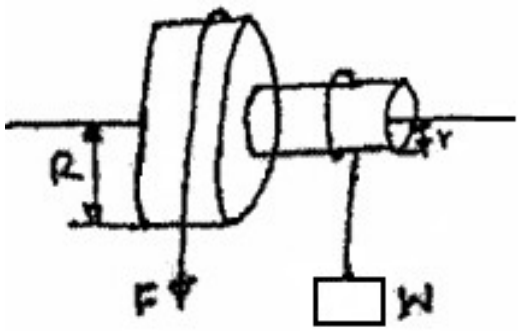
(c) Determine the heat lost by warm water. (2 mks)

(d) Determine the specific latent heat of fusion of ice. (3 mks)

(e) It's observed that if the temperature of warm water used was 80^0c, then all the ice could have melted. What would be the final temperature of the mixture?
Use the value of specific latent heat of fusion obtained in (d) above. (3 mks)

16. (a)Draw a single pulley arrangement with a velocity ratio of 2. (2mks)

(b) Figure shows a wheel and axle being used to raise a load W by applying an effort F. the radius of the large wheel is R and of the small wheel r as shown.



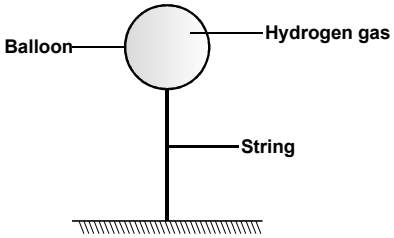
(i) Show that the velocity ratio (V.R) of this machine is given by R/r. (3mks)

(ii) Given that r = 5cm, R = 8cm, determine effort required to raise a load of 20N if the efficiency of the machine is 80%. (4mks)

(iii) It is observed that the efficiency of the machines increases when it is used to lift large loads. Give a reason for this. (1mk)

17. (a) State the Archimedes principles. (1 mk)

(b)A rubber envelope of a hydrogen filled balloon having volume of $2m^3$ is held in position by a vertical string as shown below.



The mass of the balloon is 1.3kg. Given that density of hydrogen is $0.1kg/m^3$ density of air is $1.3kg/m^3$. Find

(i) total weight of the balloon including the hydrogen gas. (2 marks)

(ii) the upthrust. (2 marks)

(iii) the tension in the string. (2 marks)

(c) A solid weighs 50N in air and 44N when completely immersed in water. Calculate

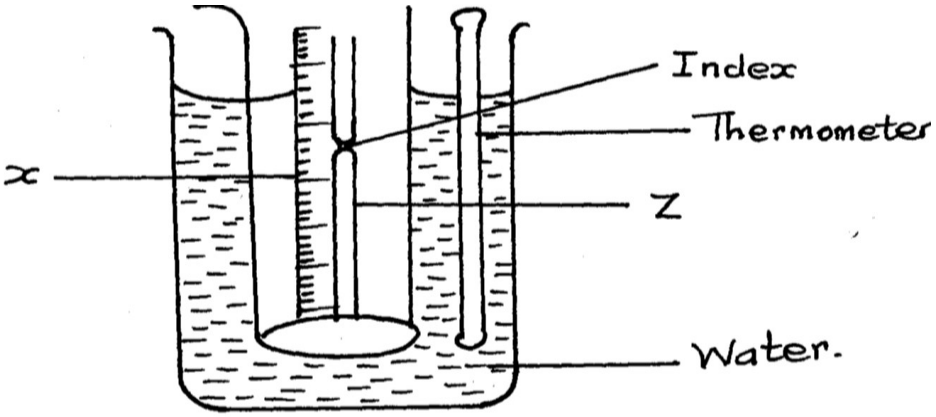
(i) relative density of the solid. (2 marks)

(ii) density of the solid. (2 marks)

18. (a)Two identical containers A and B are placed on a bench, container A is filled with oxygen gas and B with hydrogen gas such that the two gases have equal masses. If the containers are maintained at the same temperature, state with a reason the container which pressure is higher.

(2 mks)

b) The fig below shows a set-up of an experiment used to investigate Charles's law



(i) Name the parts labeled X and Z (1mk)

X……..Z…….

(ii) State the measurements to be taken in this experiment (2mk)

(iii) Explain how the readings taken in (ii) above may be used to investigate Charles law (2mks)

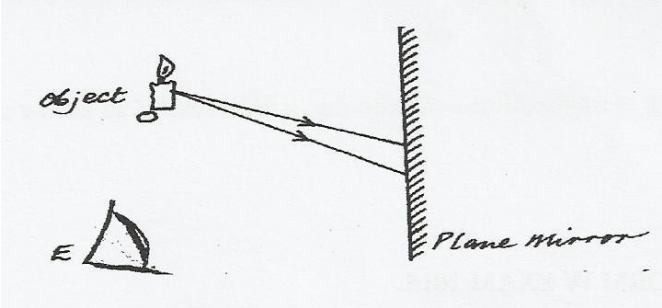
(iv) State two purposes of mercury index (2mks)

v) A constant mass of hydrogen gas occupies a volume of $4.0cm^3$ at a pressure of $2.4x\ 10^5$ Pa and temperature of 288K. Find its volume at a pressure of $1.6xl0^5$Pa when the temperature is 293K (3mks)

SERIES 2
PAPER 2.

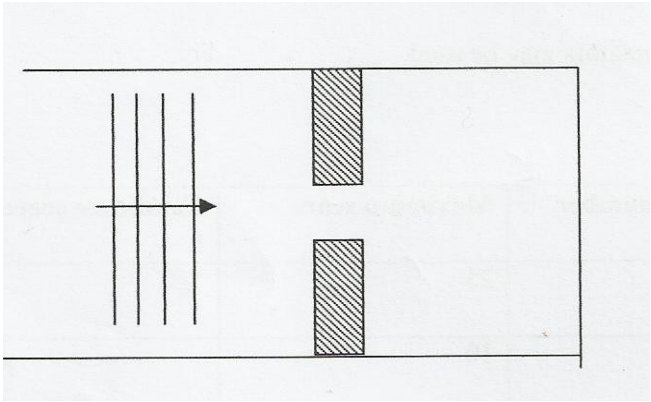
SECTION A: (25 MARKS)

1. Figure 1 below shows an object O placed in front of a plane mirror.



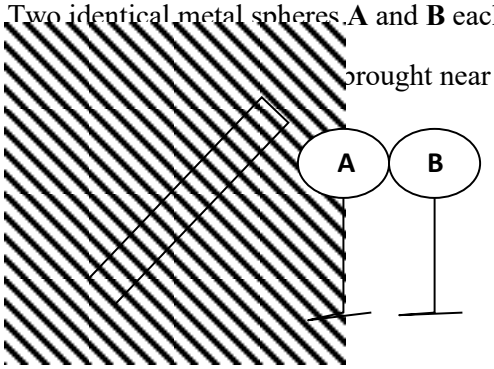
On the diagram, draw rays to locate the position of the image I, as seen from the eye, E. (2 marks)

2. The figure 2 below water waves of different wave length incident on aperture which is greater than the wave length of the wave.



Complete the diagram to show the pattern of the wave beyond the aperture. (1 mark)

3. Two identical metal spheres **A** and **B** each standing on an insulating base are in contact.



rought near sphere **A** as shown in the figure 3 below.

In what way will sphere **A** differ from **B** if it is separated while the rod is near?

4. A metal iron has work function of 6.8 x 10^{-19}J. Calculate the minimum frequency of light that can cause photoelectric emission. (Take h = 6.63 x 10^{-34} Js) (2 Marks)

5. The figure 4 below shows a rectifier circuit for an alternating current input.

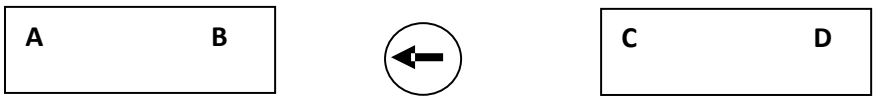


(a) On the circuit, indicate the flow of current to illustrate rectification. (1 Mark)

(b) Sketch a graph to show how the voltage across R varies with time. (2mks)

6. The image formed by a convex mirror is virtual. State two other characteristics of image formed by the convex mirror. (2 Marks)

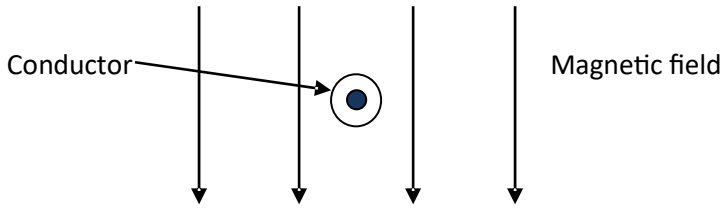
7. Figure 5 below shows a plotting compass placed between two strong magnets.
Fig. 5



(I) Give the polarity of the end **D** of the right hand magnet. (1mk)

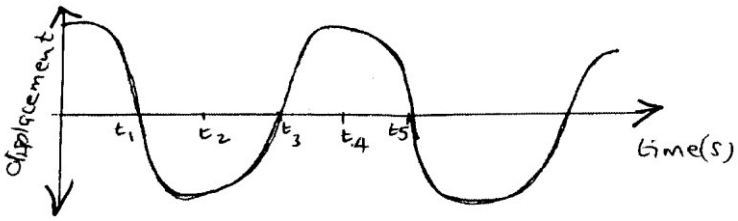
(II) Draw on the diagram the resulting magnetic field pattern between B and C. (2mks)

8. Figure 6 below shows a conductor in a uniform magnetic field carrying current in the direction shown.



Indicate on the diagram the direction of motion of the conductor. (1mk)

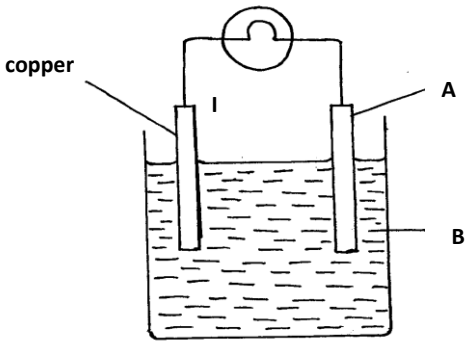
9. The figure 7 below shows a wave profile for a wave whose frequency is 2HZ



Determine the value of t_3(s) (2mks)

10. State Lenz's law of electromagnetic induction (1mk)

11. The figure below 8 below shows a simple cell.



Use the information on the figure to answer the questions below.

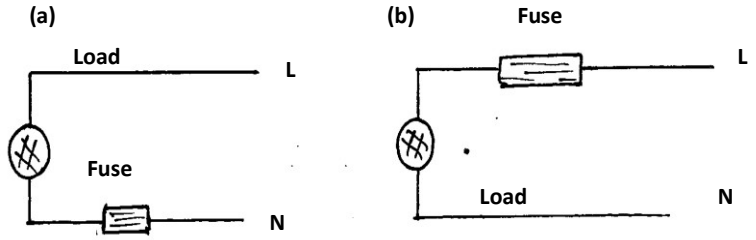
(a) Name the parts labeled **A** and electrolyte **B.** (2mks)

A

B

(b) It is observed that the bulb goes off after a short time. Explain this observation (1mk)

12. The figure 9 below shows how a fuse may be connected in electric current



In either case the fuse blows out but (a) is dangerous while (b) is not. Explain (2mks)

13. The figure shows part of electromagnetic spectrum

Ultra violet rays	**Micro waves**	**X-rays**	**Red light**

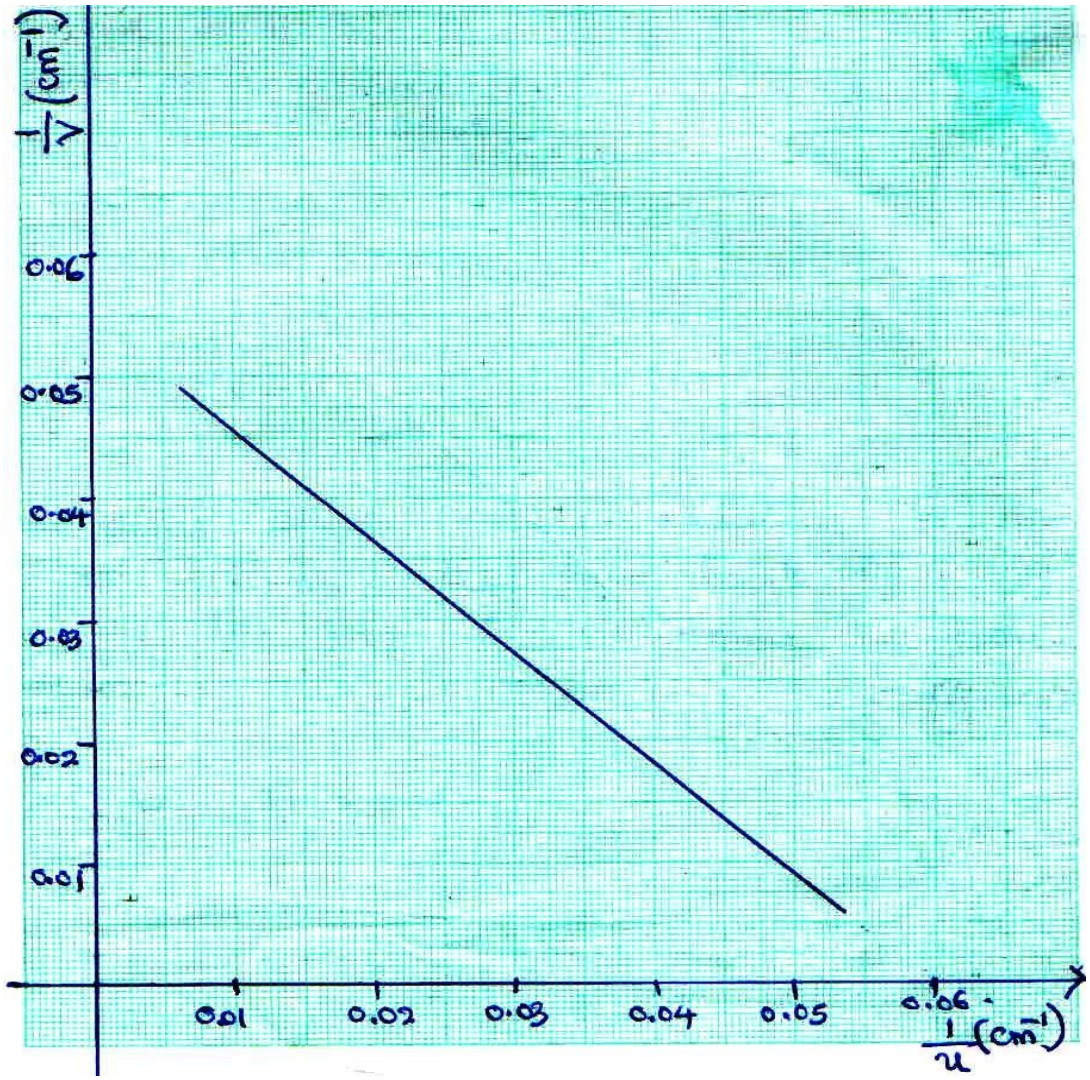
Arrange the electromagnetic waves in the order of decreasing energy. (1mk)

SECTION II: (55 MARKS)

ANSWER ALL QUESTIONS IN THIS SECTION

14. (a) The graph below shows values obtained in an experiment to determine the focal length of a convex lens. Use the graph to determine the focal-length of the lens.(2mks)

GRAPH OF $\frac{I}{u}$ AGAINST $\frac{I}{V}$



(b) An object is placed 30cm in front of a converging lens of focal length 20cm.
(i) By calculation determine the position of the image. (2 mks)

(ii) State the nature of the image (1 mk)

(c) A current of 13A flows through a heating element of resistance 8.5Ω for 1.5 minutes.
Calculate the quantity of heat supplied. (3mks)

(d) A house has five rooms with 240V, 60W bulbs. If the bulbs are switched on from 7.00p.m. to 10.30p.m.

a. Calculate the power consumed per day in Kilowatt-hours. (2mks)

b. Find the cost per week for lighting these rooms at Kshs. 6.70 per unit. (2mks)

15. (a) State **two** advantages of a C.R.O as a voltmeter (2mks)

(i)

(ii)

(b) A television tube is a cathode ray tube modified. State two modifications (2mks)

(i)

(ii)

(c) State the functions of the following parts of a C.R.O (3 mks)

(i) Grid

(ii) X-plates

(iii) Fluorescent screen

(d) **Figure15** shows the parts of an x-ray tube.

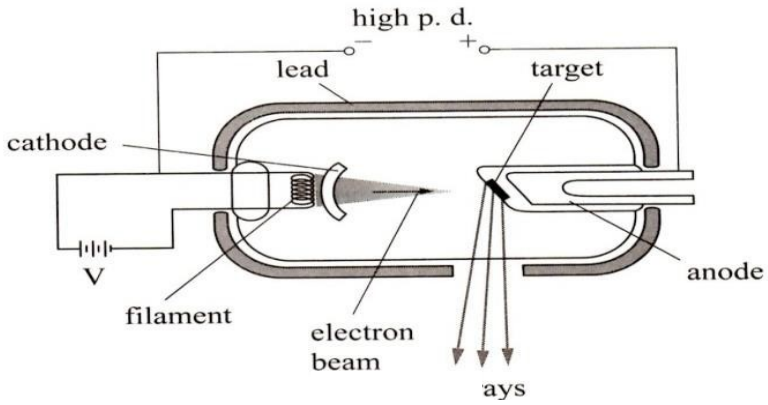


Figure 15

a) ***Explain*** why:

i) The cathode is concave shaped (1mk)

ii) A high potential difference is applied between the cathode and the anode (1mk)

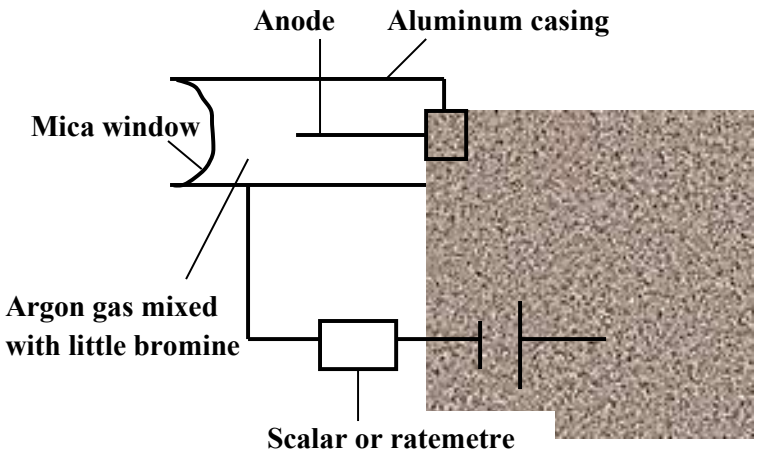
iii) Most of the tube is surrounded by lead. (1mk)

iv) The target of X-ray tube is made of metals of high melting point. (1mk)

16. (a) Define Radio-activity (2mks)

(b) When carrying out experiments with radioactive substances the source should never be held with bare hands but with forceps. Explain? (1mk)

c) The figure below shows a G.M tube.

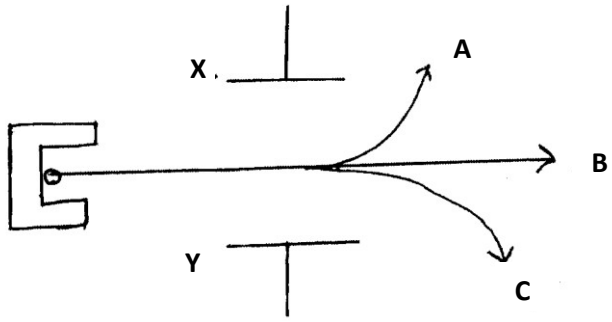


i) What is the purpose of the mica window? (1mark)

ii) What is the purpose of the bromine (1mark)

iii) Briefly explain how it works. (2marks)

(e) The diagram in the figure below shows paths taken by three radiations **A,B** and **C** from a radioactive isotope through an electric field.



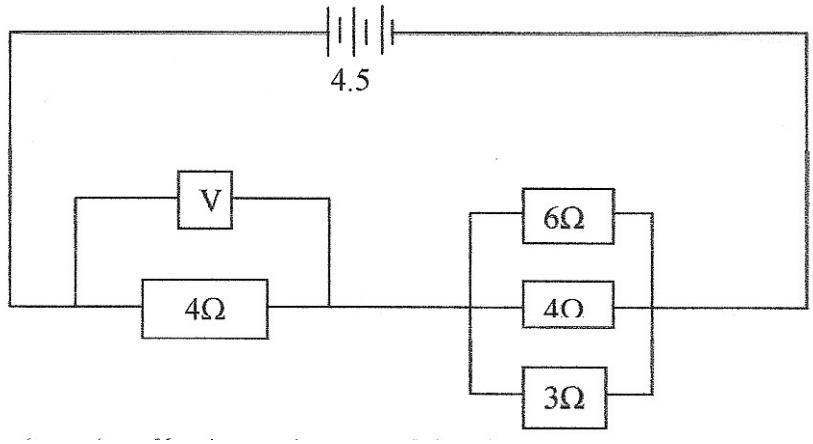
(i) State the charge on plate **Y** (1mk)

(ii) Identify the radiations **A** and **C** (2mks)

(iii) Give a reason why **C** deviates more than **A** (1mk)

17. (a) Study the circuit diagram below and answer the questions that follow.

Fig



Calculate the effective resistance of the circuit and hence the voltmeter reading (4mks)

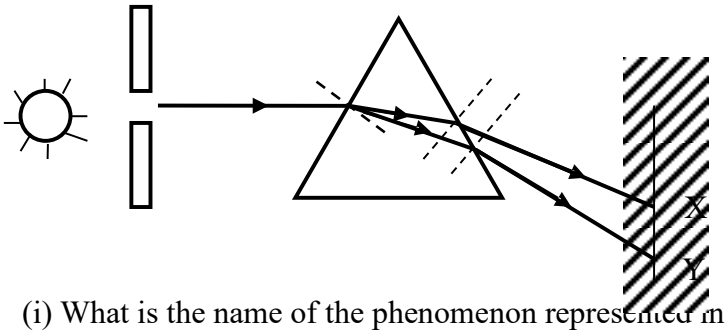
(b)An echo sounder of a ship received the reflected waves from a sea bed after 0.20s.

(i)Determine the depth of the sea bed if the velocity of sound in water is 1450m/s (2mks)

(ii)When the ship above passes over a sunken reef, the echo sounder receives an echo after 0.16s. Determine the height of the sunken reef (2mks)

(c) A step-down transformer has 400 turns in the primary coil and 20 turns in the secondary coil. A 50Ω resistor is connected to the secondary output. If the effective primary voltage is 240v, determine the current through the 50 Ω resistors. (3mks)

18 (a) The diagram below shows a narrow beam of white light onto a glass prism.

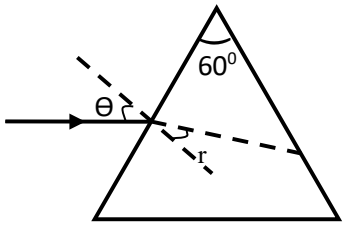


(i) What is the name of the phenomenon represented in the diagram? (1 mk)

(ii) Name the colour at X and Y (1 mk)

(iv) What is the purpose of the slit (1 mk)

(b) The figure below shows the path of ray of yellow light through a glass prism. The speed of yellow light in the prism is 1.8×10^8 m/s



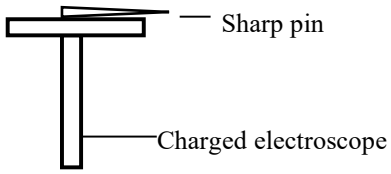
(i) Determine the refractive index of the prism material (Speed of light in vacuum, $C = 3.0 \times 10^8$ m/s) (2 mks)

(ii) Show on the same diagram, the critical angle C and hence determine its value. (3 mks)

(iii) Give that $r = 31.2^0$ determine the angle θ (3 mks)

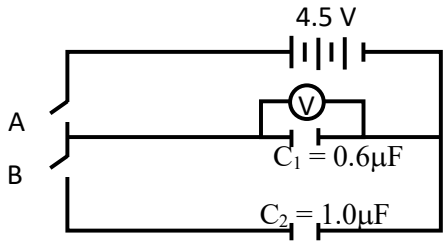
19. (a) Define capacitance (1 mk)

(b) In the figure below, a sharp pin is fixed on a cap of a leaf of the electroscope. The electroscope is highly charged and then left for some time.



State and explain the observation made after sometime (2 mks)

(c) The figure below shows a circuit where a battery of e.m.f. 4.5V, switches A and B, two capacitors C_1 =0.6μF and C_2 = 1.0μF and a voltmeter are connected.



(i) Determine the charge on C_1 when both switch A is closed and switch B is open.(2 mks)

(ii) What is the effective capacitance when both switches are closed? (2 mks)

(d) State two ways in which the capacitance of a parallel plate capacitor can be reduced.(2 mks)

PAPER 3
QUESTION 1

You are provided with the following:

- Salt solution in a 250ml container
- Two identical cylindrical 100g masses
- A string
- A metre rule
- Knife edge
- Two pieces of thread.
- 250 ml empty measuring cylinder
- Water 100ml.

Procedure

(a) Determine the volume V, of one of the masses by using the apparatus provided. Record the volume, V.

V =……..... (1mark)

Explain how you have determined the volume, V. (2marks)

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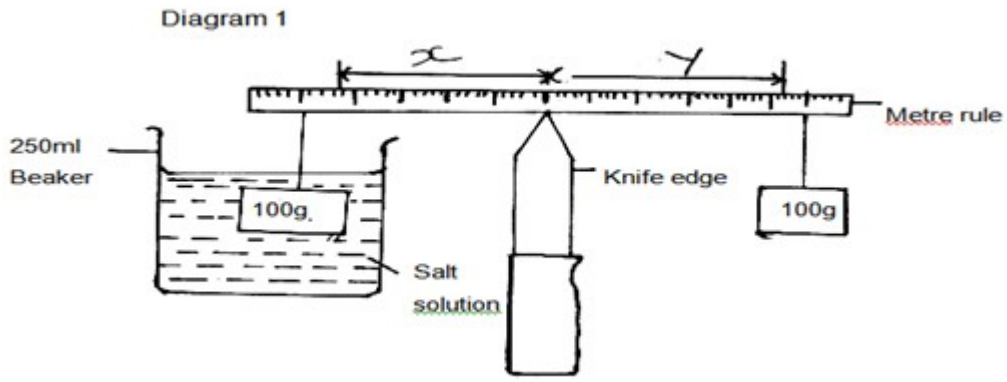
i) Determine the Centre of gravity of the metre rule

Centre of gravity =…… cm ($^1/_2$mark)

(ii) Arrange the apparatus as shown in diagram 1 below. Show that the metre rule is at equilibrium, starting with

X = 100mm.

Diagram 1



Measure and record the length, Y.

Y……Cm($^1/_2$mark)

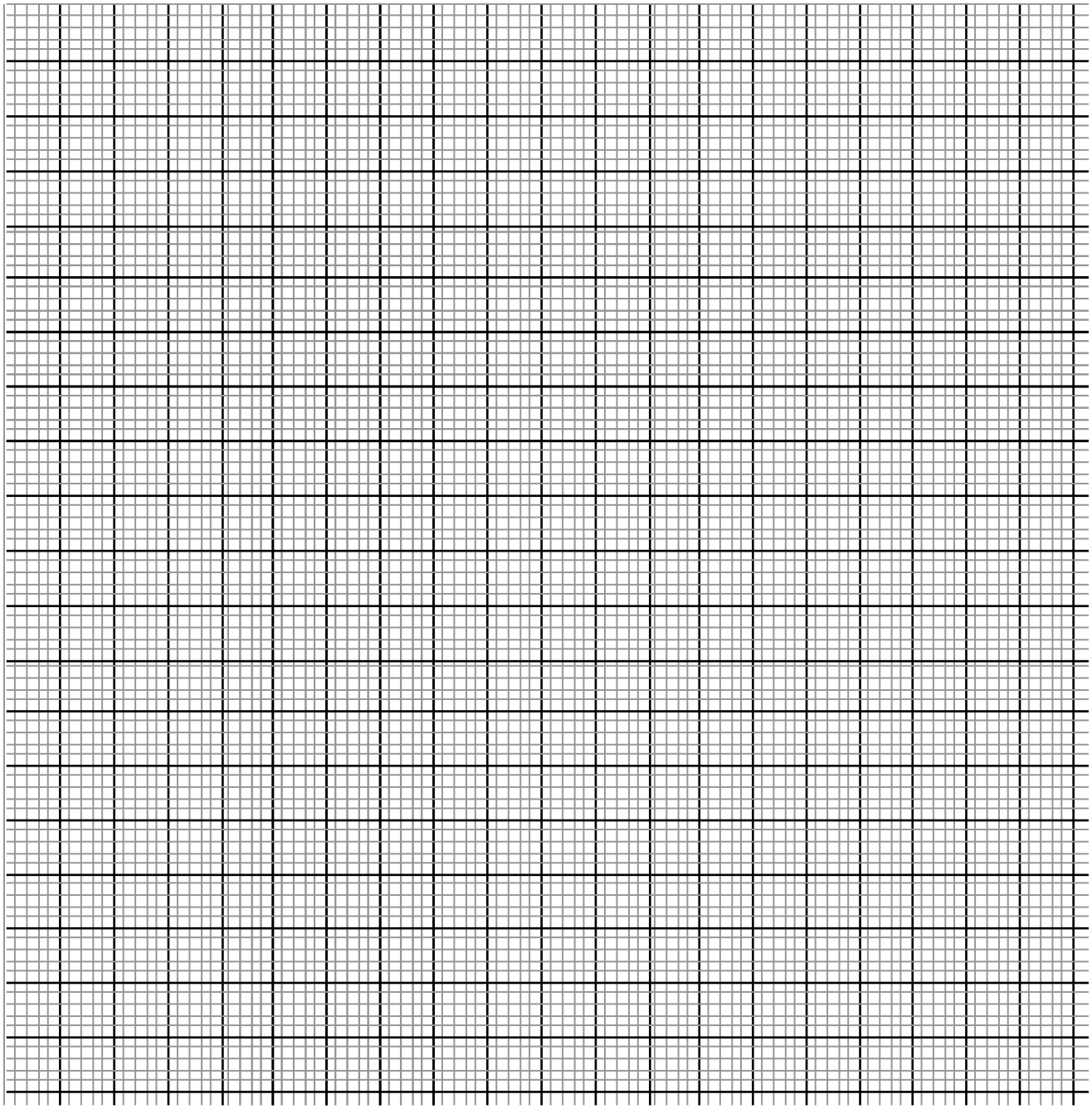
(b) Repeat procedure a (ii) with the following values of X and fill table 1 below.

Table 1

X (mm)	100	150	200	250	300	350
Y(mm)						

(3marks)

(i) On the grid provided, plot a graph of Y(cm) (y-axis) against X(cm). (7marks)



(ii) Determine the gradient, N, of the graph. (2marks)

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……iii) The gradient, N, given by the equations N = F/W, where F is the apparent weight of the mass in the salt solution and W is the actual weight of the mass. Calculate the value F and the up thrust, U.

F=…… (1mark)

U=…… (1mark)

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iv) Hence determine the density, rho (p) of the salt solution.(2marks

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QUESTION 2

You have been provided with the following apparatus

- Resistor
- Cell size D new
- Cell holder
- Two resistor wires mounted on mm scales, marked W and X.

a) Proceed as follows.

i) Measure and record the diameter of wire W

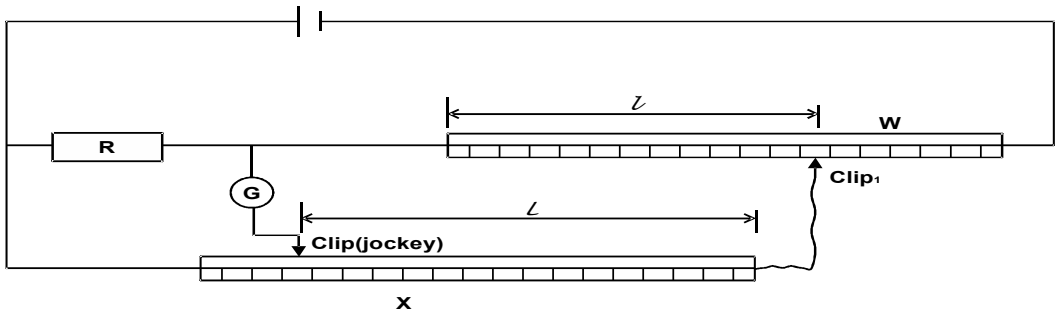
D =..... mm(1mark)

i) Use the information to calculate the cross-sectional area of the wire. (A)

A =..... m^2 (2marks)

ii) Set up the apparatus as shown in the diagram 2 below.

Diagram 2



iv) Move the crocodile clip along W such that the length l = 10cm, then move the jockey to obtain a balance

point along the wire X. Record the length L the value of the balance point along wire X.
b) Repeat steps (iii) for values of l = 20cm, 30, 40, 50, 70 and 80cm and complete the table 2.

l (cm)	10.0	20.0	30.0	40.0	50.0	70.0	80.0
L (cm)							
$\frac{1}{L}(cm^{-1})$							

(6 marks)

c) In the graph provided below plot a graph of l (cm) against $\frac{1}{L}(\text{cm}^{-1})$ (5 marks)

d) From the graph find the slope S of your graph. (3 marks)

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e) From the graph state the value of $\frac{1}{L}(\text{cm}^{-1})$ when l (cm)= 0 (1 mark)

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f) Given that l $= \frac{100R}{JL} - \frac{R}{j}$ find the value of J when R = 10 ohms. (2 marks)

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SERIES 3
PAPER 1.

SECTION A (25mks)
Answer all the questions in this section

1. Under which branch of Physics is the functioning of a refrigerator studied? (1mark)

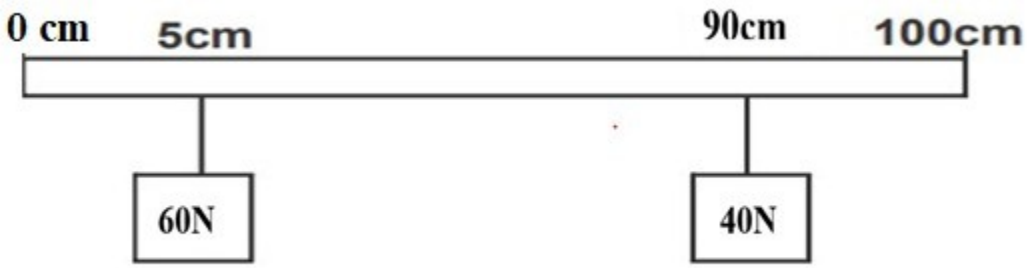
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2. An empty density bottle has a mass of 25g. When full of sea water, its mass is 66.2g and when full of a liquid X, its mass is 65g. Given that density of sea water is 1030kg/m^3, find the density of liquid X. (2marks)

3. The rate of heat flow in thermal conductivity increases with increase in cross-section area. Explain this observation. (2marks)

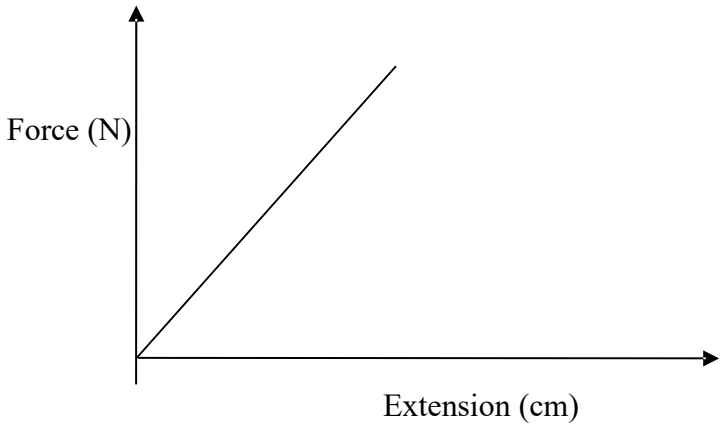
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4. The figure below shows a weightless uniform metre rule supporting two weights. The metre rule is pivoted somewhere such that it is horizontally balanced. (Pivot not shown).



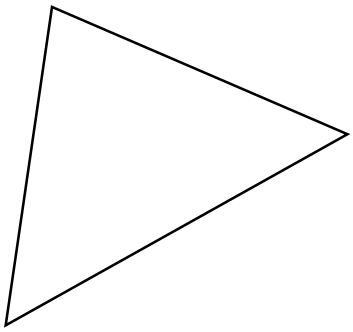
The 60N weight is at 15cm mark while the 40N weight is at 90cm mark. Determine the position of the pivot from zero cm mark. (3marks)

5. The following is a graph of force against extension for a spring



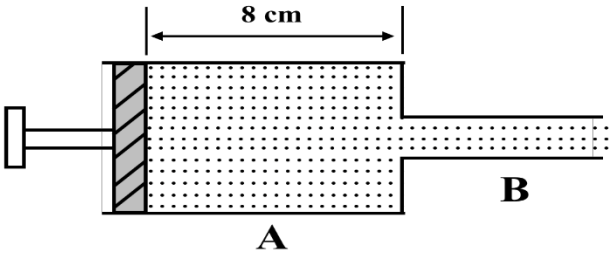
On the same axes, sketch a graph of force against extension for a spring double the length, same thickness, same material as the spring above (1mark)

6. The figure below shows a uniform cardboard in the shape of triang



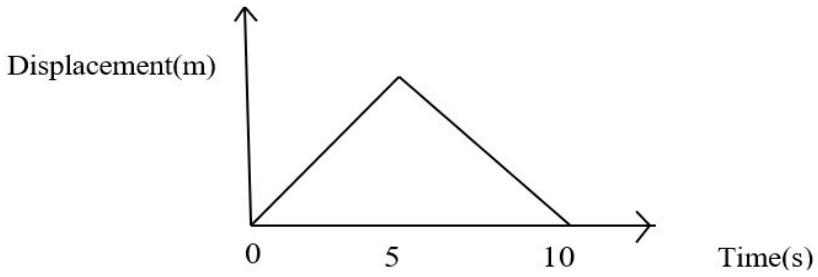
Locate the centre of gravity of the cardboard. (2 marks)

7. The figure below shows a syringe filled with a liquid. The diameter of section A of the syringe, D_1= 1.0 cm and that of section B, D_2 = 2 mm. The length of section A is 8.0 cm.

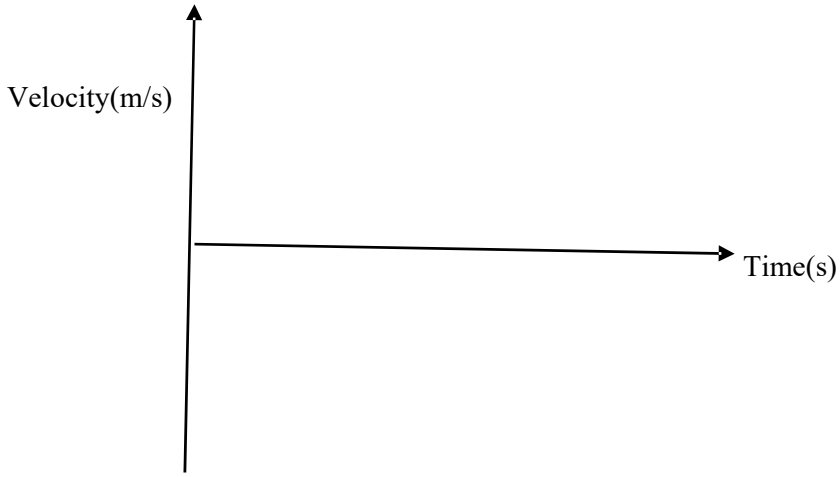


If the piston travels the length, 8 cm in 2 s, determine the velocity of the liquid in section B. (2marks)

8. The figure below shows the displacement time graph for the motion of an object.



Sketch the velocity time graph for the object. (2marks)



9. State the law of conservation of energy (1mark)

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10. State one factor that determines the critical speed with which a car can negotiate a bend on a level ground. (1mark)

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11. A 100ml solution of water and potassium permanganate is mixed with 900ml of water. It is observed that the total volume is 990ml.Explain. (2marks)

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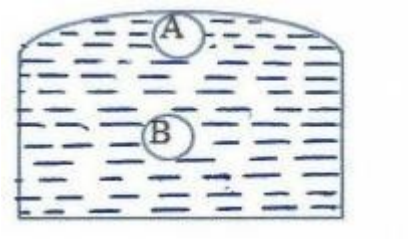
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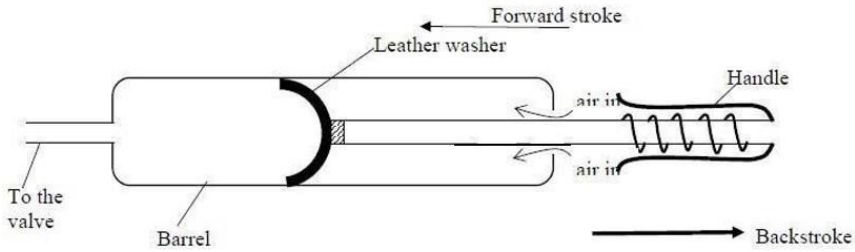
12. The diagram below shows the force acting on two water molecules, molecule A on the surface of the water and molecule B below the surface of water. (2 marks)



Explain why molecule A experiences surface tension while molecule B does not (2marks)

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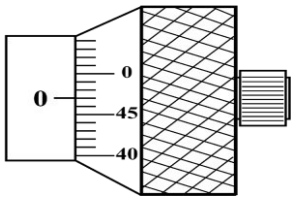
13. The bicycle pump shown below is one of the applications of pressure in gases.



Explain how the pump operates during backstroke
(2marks)

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14. The figure below shows part of the scales of a micrometer screw gauge whose jaws are completely closed.



A student used the same micrometer screw gauge to measure the diameter of a test tube of actual diameter 2.15mm. What was the reading shown by the micrometer screw gauge. (2marks)

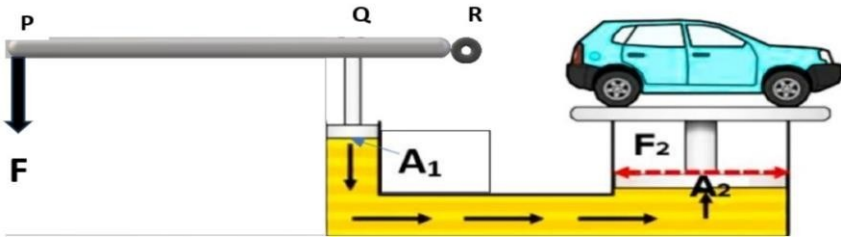
SECTION B (25mks)

Answer all the questions in this section

15. (a) Define Load as used in machines. (1mark)

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(b) The diagram below shows a simple hydraulic lift used to lift a car in a garage. Use the diagram to answer the questions that follows



Given that PQ = 1.2m, QR = 0.2m, $A_1 = 0.006m^2$, $A_2 = 3m^2$ and F =150N; determine:

i. Force acting on the Effort Piston of the hydraulic lift (2marks)

ii. The maximum weight of the car that can be lifted by the machine (2marks)

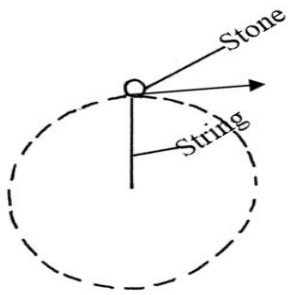
iii. Determine the velocity ratio of the system (2 marks)

iv. Calculate the efficiency of the system (2 marks)

16. (a)Define the term radian (1mark)

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(b)The diagram below shows an stone of mass 0.5kg whirled in a vertical circle of radius 2.0m at a uniform speed and makes 120 revolutions per minute.





Determine;
i) Angular velocity. (2marks)

ii) Linear velocity (2marks)

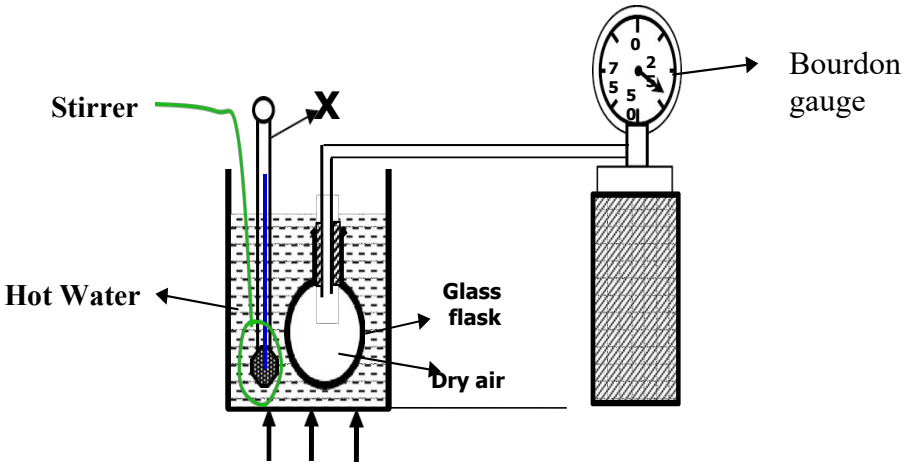
(c) If the stone was whirled with the centre of the path10m from the ground and released at the point as shown above;

i. sketch the path on the diagram which the stone takes as it falls to the ground (1mark)

ii. determine the time of flight the stone takes to the ground (2 marks)

iii. what is the total horizontal distance travelled by the body from the release point? (2marks)

17. a) The diagram below shows a set up that a student used to investigate a law.



i) State the law being investigated (1mark)

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ii) State the measurements that need to be taken in the experiment (2marks)

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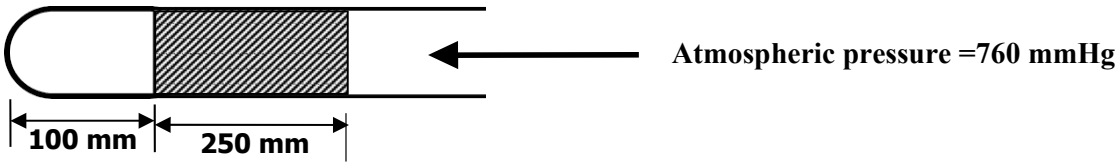
iii) Describe how the law is verified using the measurements named (ii) above. (3marks)

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iv) Using kinetic theory of gases, explain why a bicycle tyre explodes when it stands out in the sun for long (2marks)

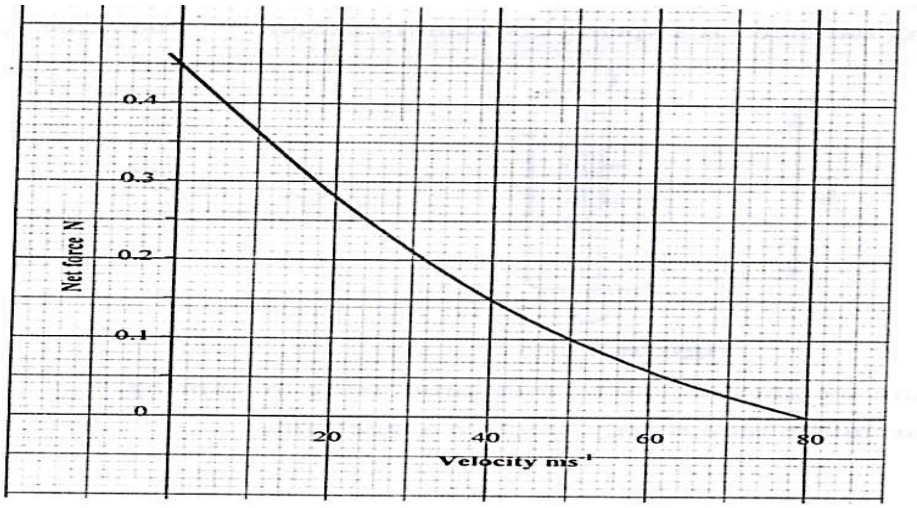
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b) Air is trapped inside a glass tube by a thread of mercury 250mm long. When the tube is held horizontally the length of the air column is 100mm.



Given that the atmospheric pressure is 760mmHg and the temperature is kept constant, calculate the length of air column when the tube is held vertical with the open end down. (3marks)

18. (a)The figure below shows a graph of net force on a body against its velocity as it falls through a liquid.

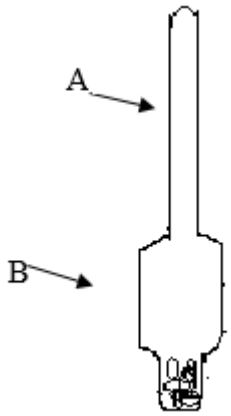


Determine the terminal velocity of the body. (1 mark)

(b) State the law of flotation (1 mark)

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(c)The diagram below shows a hydrometer



i. The hydrometer above is placed on liquids of densities 1.2 g/cm^3 and 1.8 g/cm^3. Mark the readings on the hydrometer. (1 mark)

ii. What would be the effect of reducing the cross-sectional area of the part labelled A (1mark)

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iii. What is the function of the part labelled B (1 mark)

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(d) A solid floating on water displaces 16cm^3 of water. When the same solid floats on liquid P,it displaces 20cm^3 (take density of water =1000kg/m^3)

Determine;

(i) The weight of the solid. (2marks)

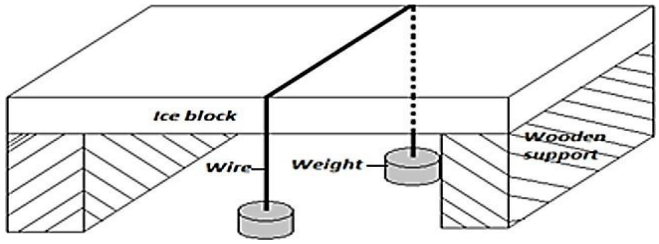
(ii) Density of liquid P. (2marks)

(iii) Volume displaced when placed in a liquid of density 0.8 g/cm^3. (2marks)

19. (a) Distinguish between heat capacity and specific heat capacity. (1 mark)

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(b) In an experiment to determine the effect of pressure on the melting point of ice, the following set-up was used



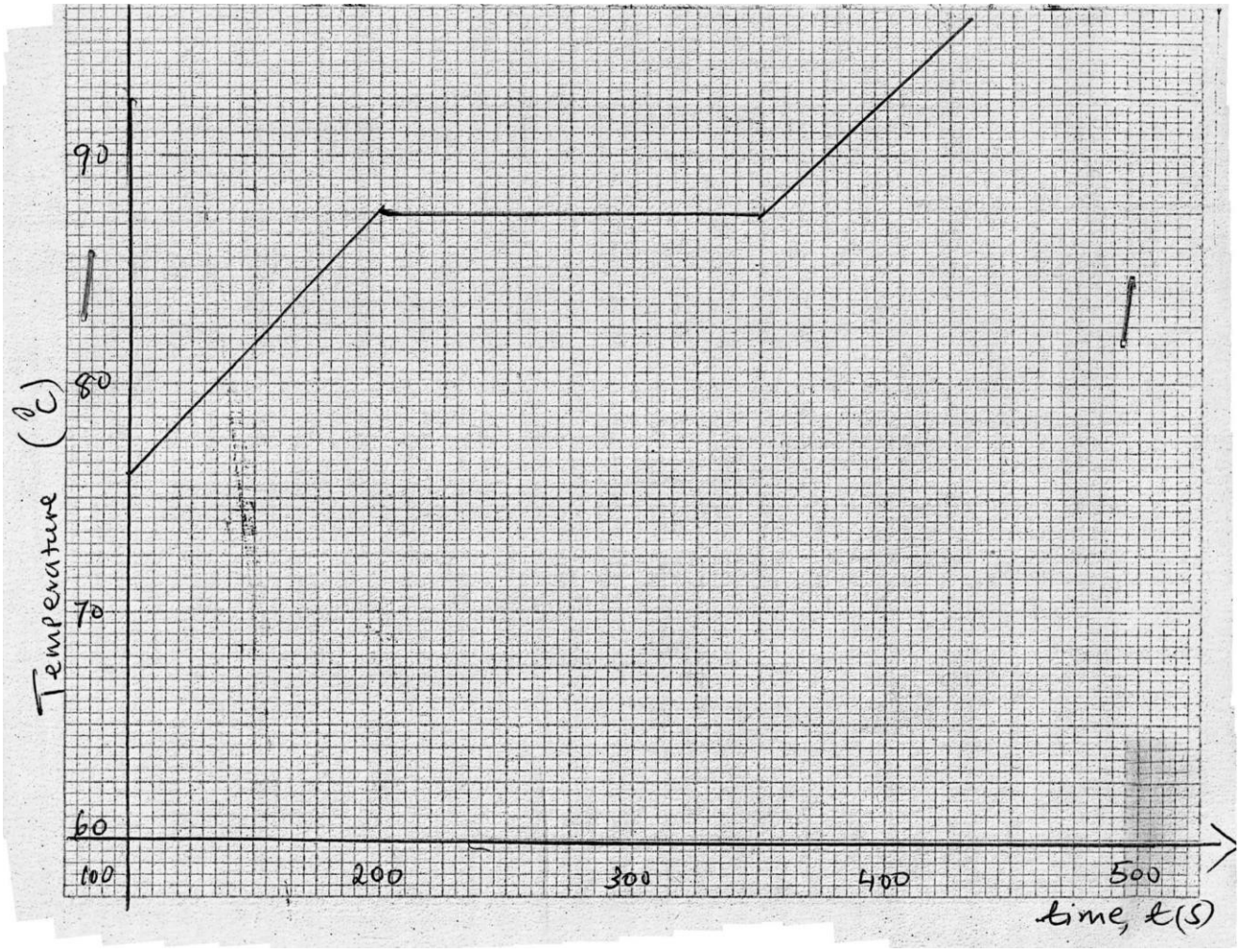
i) It is observed that the wire cuts its way through the ice block, but leaves it as one piece. Explain this observation (2 marks)

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ii) State what would be observed if the copper wire was replaced with a cotton string. (1 mark)

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c) A solid of mass 120g was heated in a container by an electric heater rated 100W for some time. The graph below shows the variation of temperature of the solid with time.



i) From the graph, determine the melting point of the solid. (1mark)

ii) Explain what happens between the times t=350 seconds and t=450 seconds. (1mark)

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iii) Determine the specific latent heat of fusion of the solid. (3marks)

iv) Determine the specific heat capacity of the solid. (3marks)

(c)Explain why a pressure cooker is preferred in high altitude areas (1 mark)

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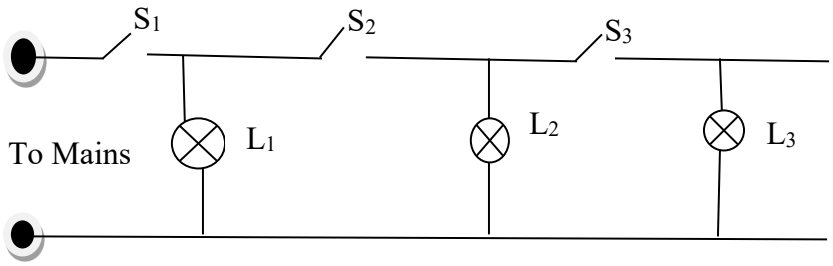
PAPER 2
SECTION A [25 marks]

Answer **ALL** the questions in this section in the spaces provided.

1. State how the quality of an X-ray beam can be increased. (1mk)

2. State why repulsion is the sure test for polarity in magnetism. (1mk)

3. The figure below shows an attempt to supply each of the three lamps $\mathbf{L_1}$, $\mathbf{L_2}$ and $\mathbf{L_3}$ with a switch.



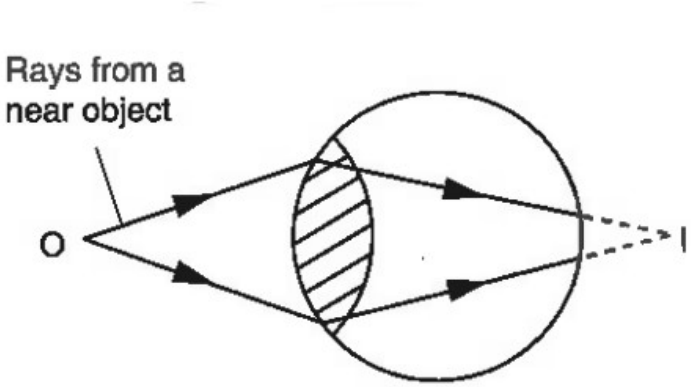
a) Explain why this is a poor connection. (1mk)

b) Re-draw the diagram to show the correct connection in (a) above. (1mk)

4. Pure silicon can be changed to a P-type semi-conductor by adding an impurity. Explain how this can be achieved. (2mks)

5. Explain how an increase in cross sectional area of a metallic conductor reduces its electrical resistance. (1mk)

6. Figure show a human eye with a certain defect.

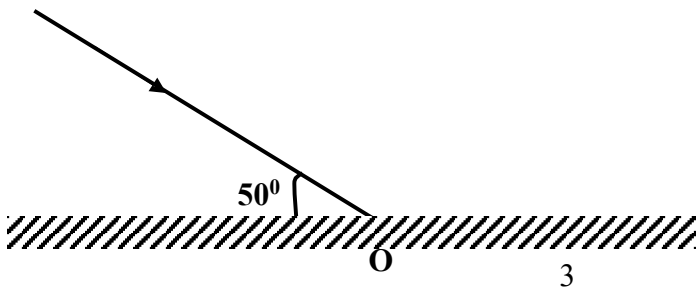


i) Name the defect. (1mk)

ii) State the cause of the defect named above. (1mk)

iii) On the same diagram, sketch the appropriate lens to correct the defect and the rays to show the effect of the lens. (2mks)

7. A ray of light is incident on a plane mirror as shown below

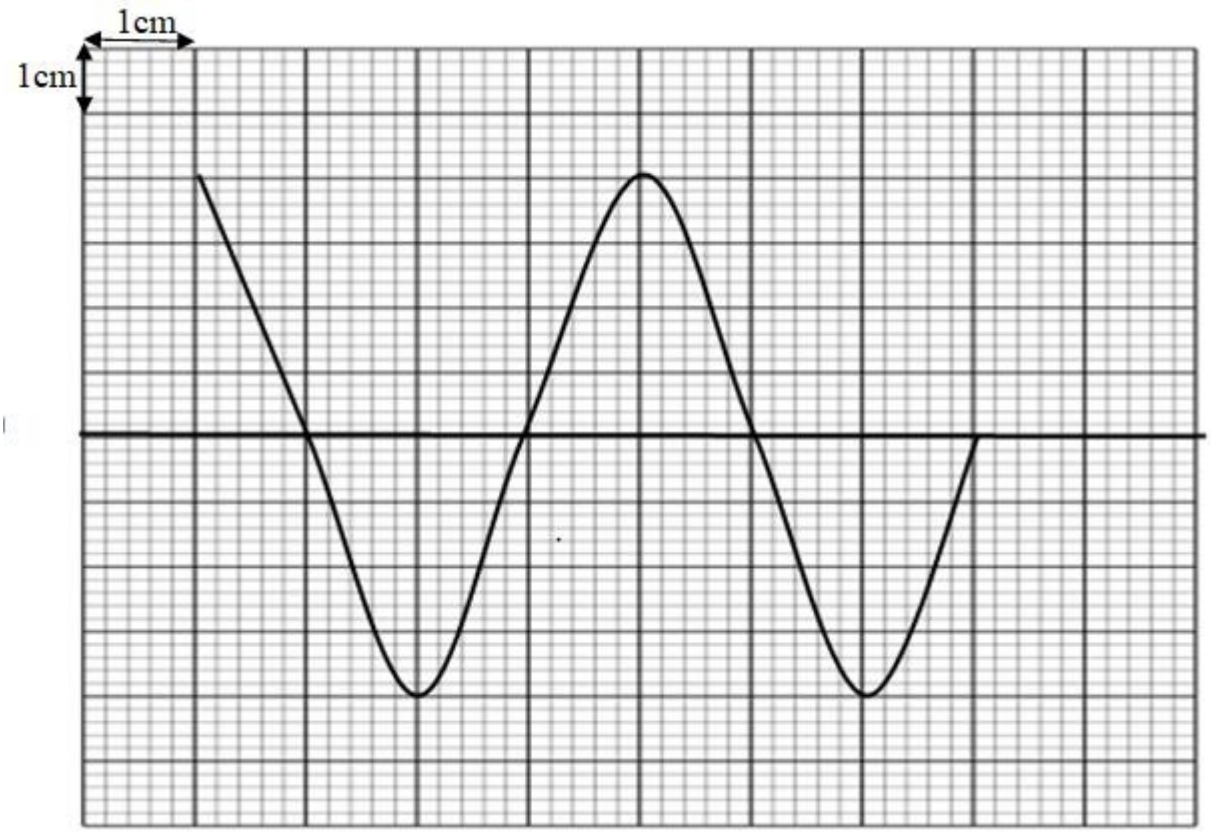


When the mirror is rotated clockwise about **O**, the angle between the reflected ray and the new reflected ray is **120^0**. Determine the angle of rotation of the mirror. (2mks)

8. Two light bulbs rated at **100W**, **240V** and **150W**, **240V** are connected to 240V mains in turn. Which of the two bulbs will light brightly if they are connected in series? (2mks)

9. A car battery is rated 60Ah and supplies a constant current for 1,200 minutes. Calculate the amount of current that can be circulated. (2mks)

10. An **a.c** voltage display on a C.R.O whose vertical sensitivity was set at **20V / cm** appeared as shown below.

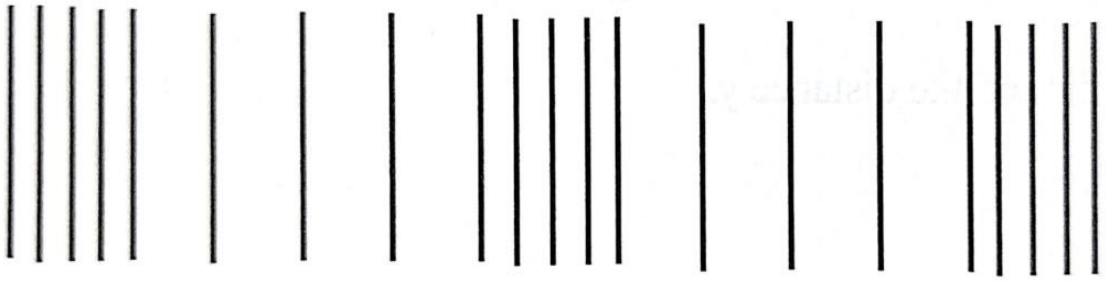


(a) Determine the peak value of the voltage. (1mk)

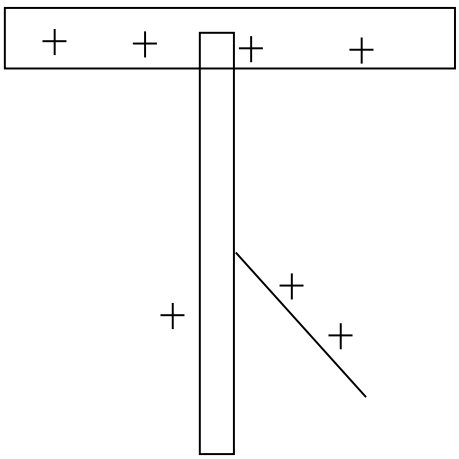
(b) If the time base was set at **25 ms/cm**, determine the frequency of the electrical wave.

(2mks)

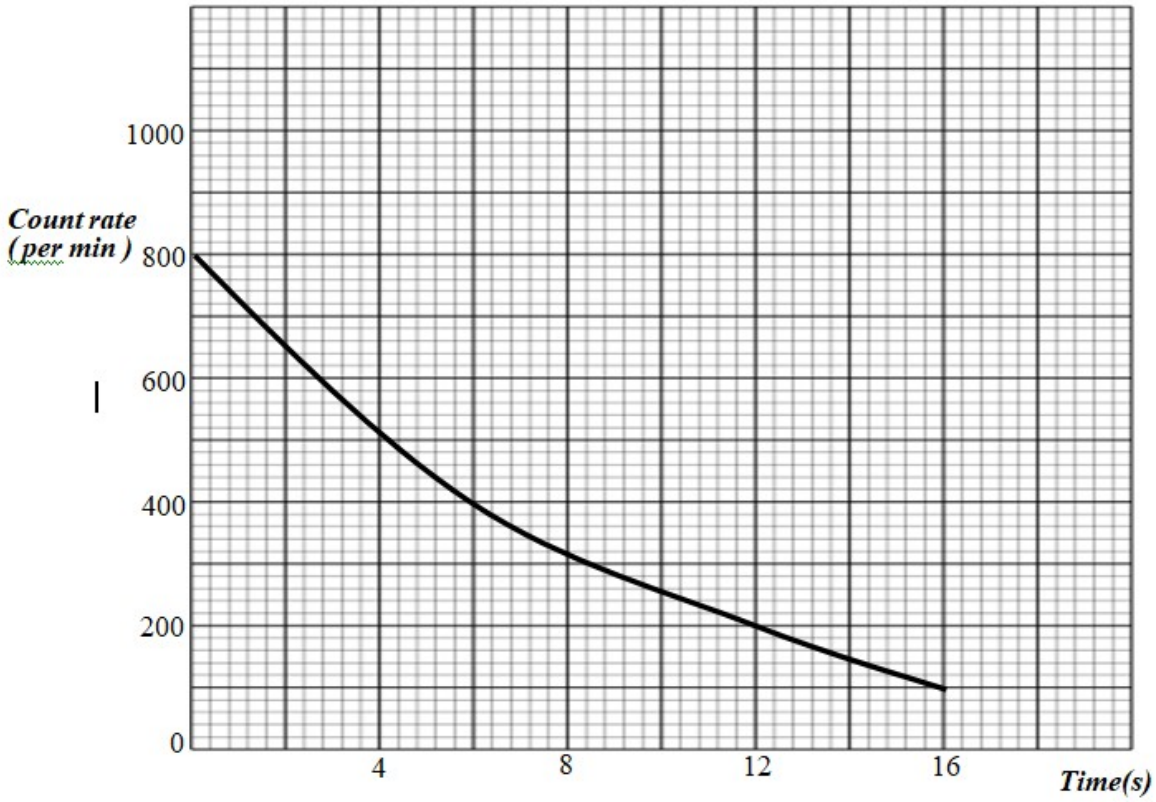
11. The diagram drawn to scale shows longitudinal waves from a slinky spring produced at a frequency of 3Hz. Calculate the speed of the waves. (2mks)



12 .The diagram shows a positively charged electroscope. A neutral rod is brought near the cap of the electroscope. State and explain the observation made. (2mks)



13.The figure below a decay curve for a certain element. The diagram is drawn to scale.



From the graph determine the half-life of the element . (1mk)

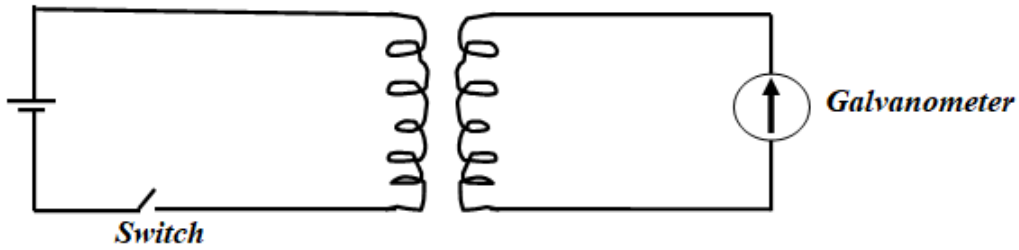
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SECTION B [55 marks]

Answer **ALL** the questions in this section in the spaces provided below

14. (a) State the Lenz's law of electromagnetic induction. (1mk)

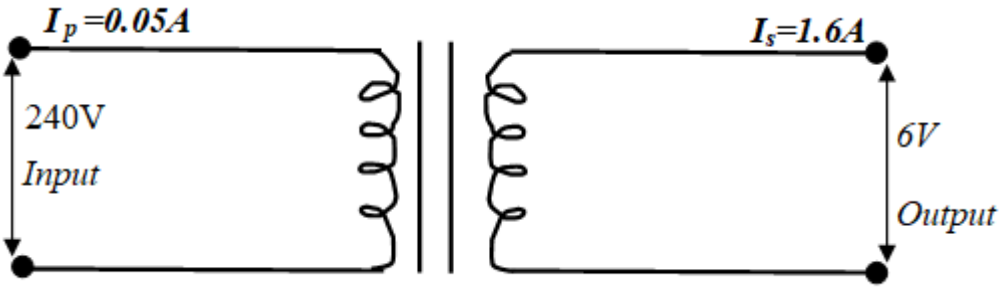
(b) The figure below shows circuit that can be used to demonstrate mutual induction.



(i) State what is observed when the switch is closed. (1mk)

(ii) Explain why when the switch is closed then opened the deflection of the pointer is greater than during closing. (2mks)

(c) The figure below shows a demonstration transformer used to step down **240V** mains supply to **6V a.c** for use in a power pack supply.



(i) If the number of turns in primary coil is **240**. Determine the number of turns in the secondary. (2mks)

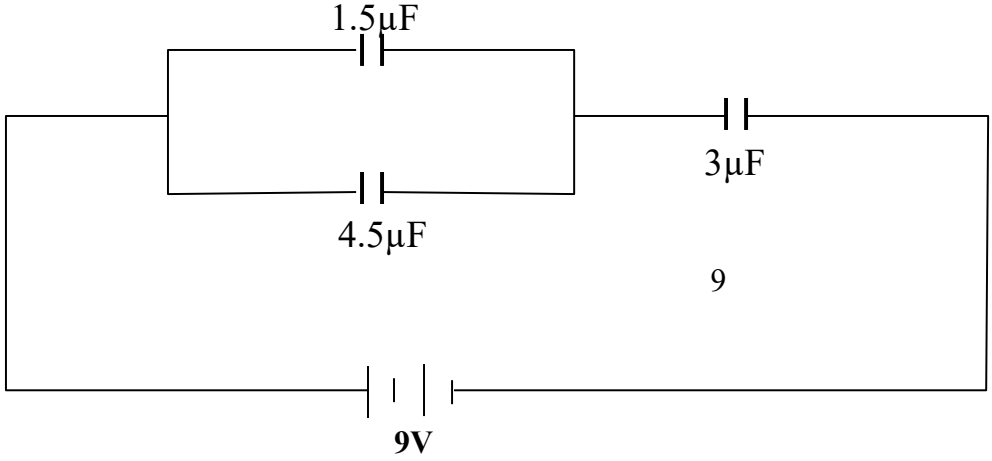
(ii) Determine the efficiency of the transformer. (3mks)

(iii) Power losses in the transformer be by copper losses and hysteresis loss among other causes. State one other cause of power losses. (1mk)

(iv). Explain how the power losses stated in (iii) above is minimized. (1mk)

15. (a) State **TWO** factors that affect the capacitance of a parallel plate capacitor. (2mks)

(b) The figure below shows three capacitors **1.5µF**, **4.5µF** and **3µF** connected to **9V** supply as shown.



Determine;

(i) The total capacitance of the circuit. (3mks)

(ii) The total charge stored in the capacitors. (2mks)

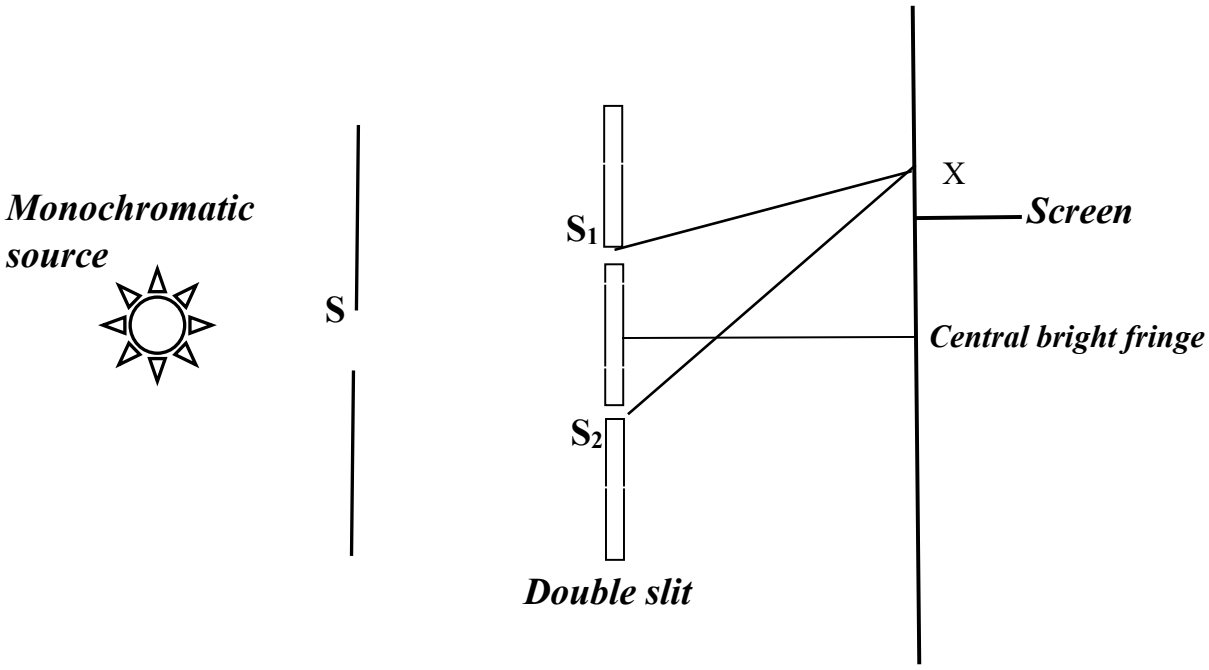
(iii) The charge stored in **3μF** capacitor. (2mks)

(c) The voltage across 4.5μ capacitor. (2mks)

(d) State **ONE** application of capacitors. (1mk)

16. (a) Distinguish between stationary waves and progressive waves. (1mk)

(b) In an experiment to observe interference of light a double slit is placed close to the monochromatic source of light as shown in the figure below



(i) State the function of the double slit S_1 and S_2 (1mk)

(ii) State and explain what is observed on the screen. (2mks)

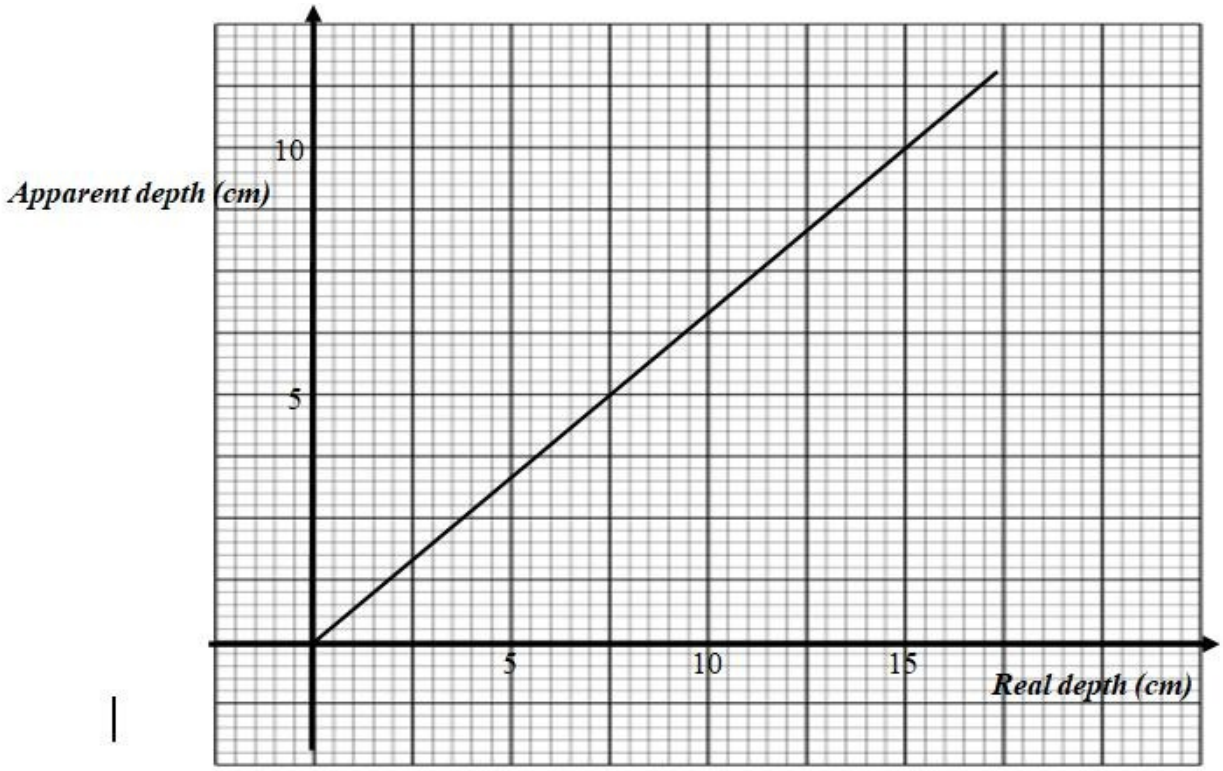
(iii) State what is observed on the screen if white light is used in place of monochromatic light. (2mks)

(iv) Given that **X** is the first dark fringe above the central bright fringe and **S_1X=40.00mm** and **S_2X=40.0009mm.** Determine the wave length of light used.
(2mks)

(c) Two men **A** and **B** were standing **200m** apart and **324m** each from a vertical cliff. Man **A** shots a gun and **B** heard the second gunshot being an echo from the cliff after **2 seconds**. Use the information to determine the velocity of sound in air. (3mks)

17. (a) State Snell's law. (1mk)

(b)The figure shows a graph of apparent depth against real depth for a given liquid.



From the graph determine the:

i) The refractive index of the liquid . (3mks)

ii) The velocity of light in the liquid if the speed of light in air is **3×10^8 m/s**. (2mks)

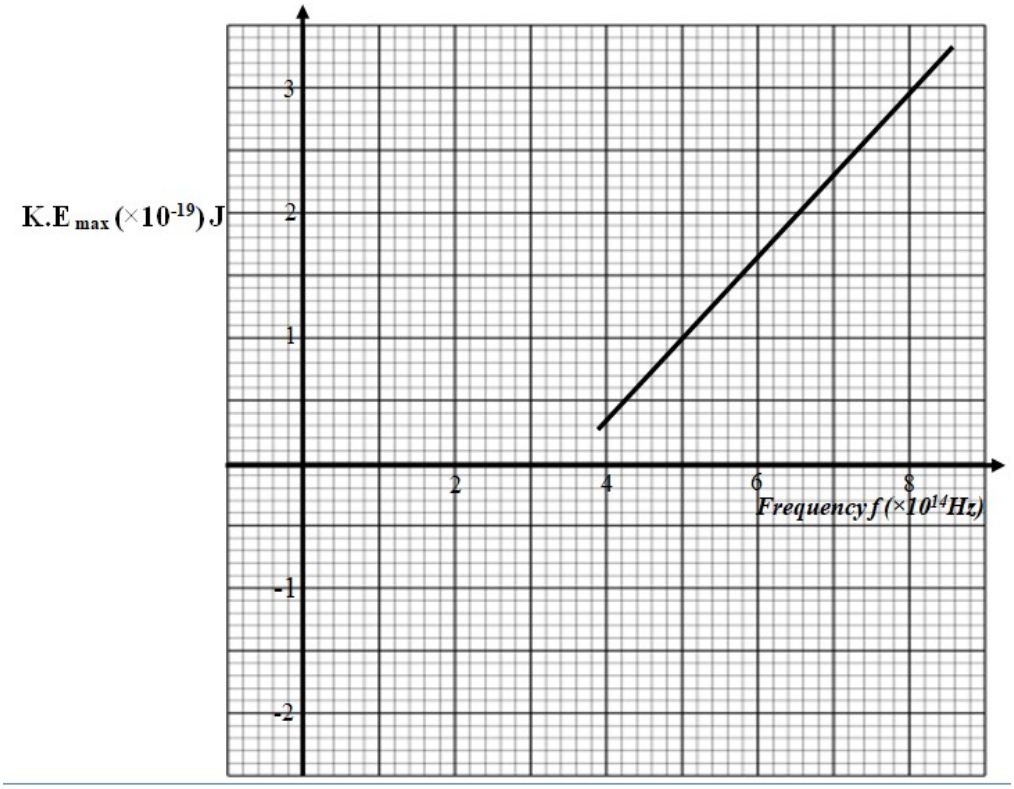
(c) One of the conditions for total internal refraction to occur is that angle of incidence must be greater than the critical angle of the medium, state the other condition. (1mk)

(d) State any **TWO** applications of prisms. (2mks)

18. (a) State **TWO** factors that determine the speed of photo electrons emitted from a metal surface. (2mks)

(b) Define work function (1mk)

(c) Figure shows a graph of maximum kinetic energy (**K.E$_{max}$**) of photo electrons against the frequency of the incident radiation of caesium metal



(d) Given that **hf = Q+ K.E $_{max}$** where **h** and **Q** are constant, use the graph to determine:

i) The threshold wave length. (c= 3 x 10^8 m/s) (2mks)

ii) The value of **h** (3mks)

iii) The value of **Q** (3mks)

iv) Lithium metal has a higher work function than caesium . On the same axes, sketch the graph for lithium. (1mk)

PAPER 3

Question 1

You are provided with the following:

- Triangular glass prism
- Soft board
- 4 optical pins
- At least 2 thumb tucks / pins
- A sheet of plain paper

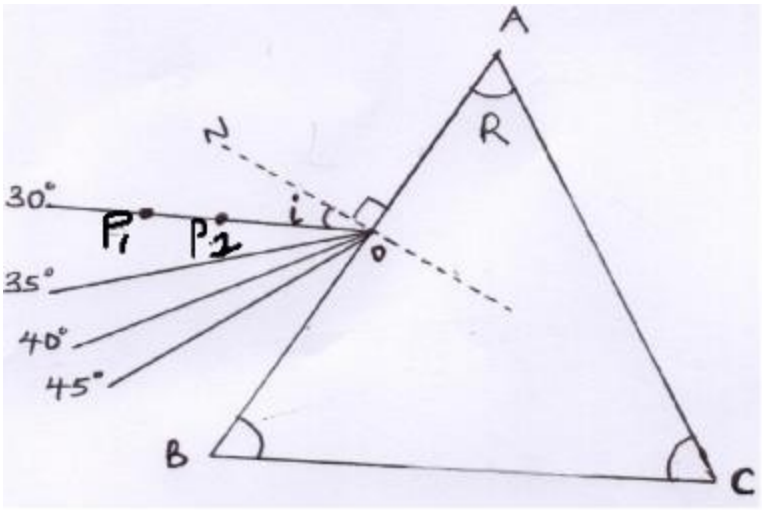
Procedure:

Proceed as follows:

(i) (a) Place the plain sheet of paper on the soft board and fix it there using thumb pins provided. Do not detach this sheet of paper from the soft board.

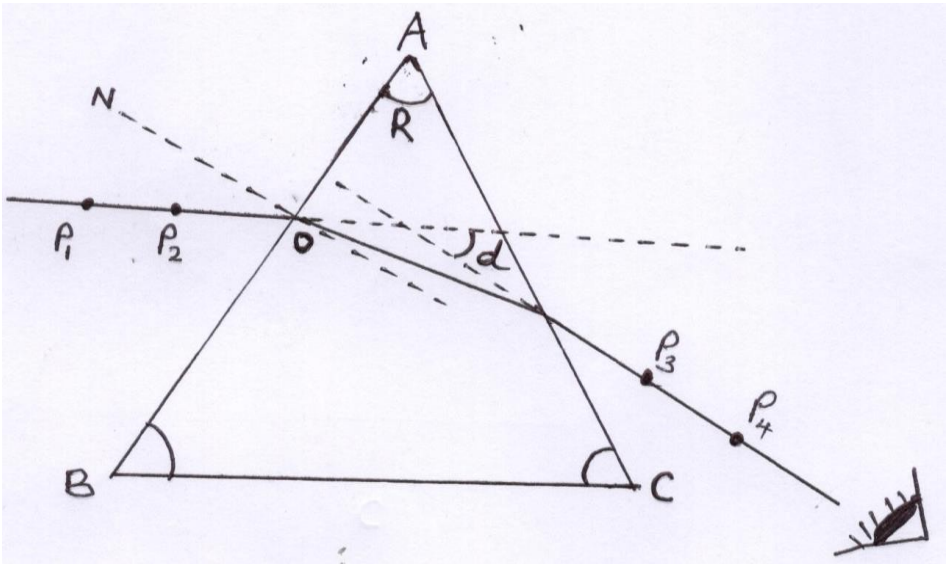
Place the prism near the centre of the paper. Use a pencil to trace the outline of the rectangle in contact with the paper. Remove the prism and use a ruler to extend the three sides of the outline. Label the vertices of the outline A, B and C.

(b) Mark a point N on side AB and draw a normal ON at this point. Draw lines at angles i = 30^0, 35^0, 40^0, 45^0, 50^0 and 60^0. See the figure below.



(ii) (a) Replace the prism on the outline. Fix two pins, P_1 and P_2 vertically on the 30^0 line such that they are about 2 cm apart.

By viewing the images of the pins P_1 and P_2 through AC, fix two other pins P_3 and P_4 in line with those images. Remove the prism. Draw a line joining P_3 and P_4 an extend into the outline. Now extend the 30^0 line so that it intersects with extended line of P_1 and P_2 pins.
See the following figures (NB. This worksheet must be collected and attached on the question paper).



(b) Use a protractor to measure the angle R of the prism.

R = ... (1 mk)

(c) Measure and record the acute angle **d** in the table below. (6 mks)

Angle, **i** (degrees)	30	35	40	45	50	60
Angle, **d** (degrees)						

(d) Repeat the procedure in (c) for other angles of **i** shown in the table. (5 mks)

(e) On the grid provided, plot graph of **d** (y-axis) against **i**. (5 mks)

(i) From the graph, determine the minimum value of

d min ..... (2 mks)

(ii) Determine the constant **K**, given that $K = \frac{(\sin 30 + \frac{d\ min}{2})}{\sin 30}$ (3 mks)

(iii) State the significance of K. (1 mk)

Question 2

Part A

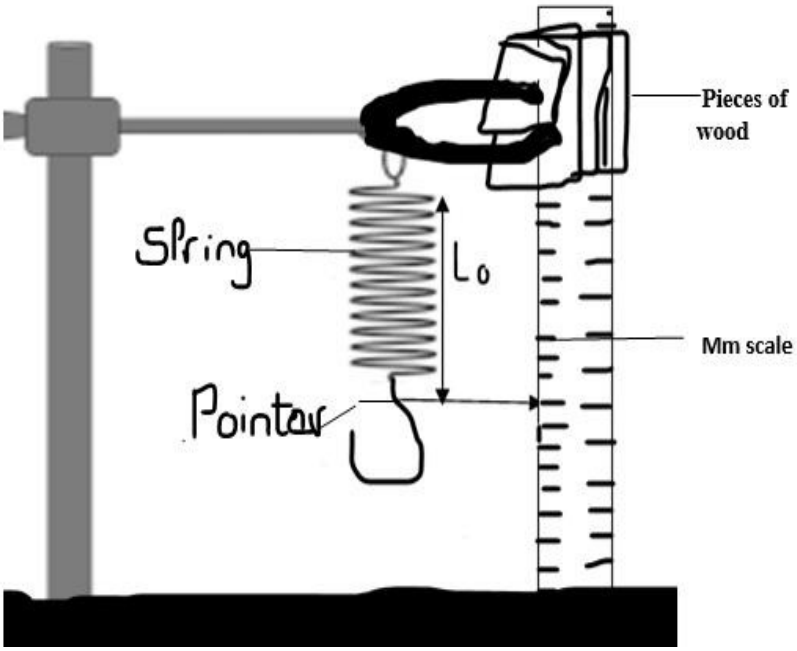
You are provided with the following apparatus.

- A metre rule
- One stopwatch , one stand, clamp and boss
- One spring
- Two pieces of wood
- A beam balance / electric balance (to be shared.
- One mass labeled

Procedure

Proceed as follows:

(i) Hang the spring vertically by clamping one end as shown in the following figure (use the small pieces of wood to clamp the spring)



(ii) Measure the length of the unloaded spring L_o and record it.

L_o = ...m (1 mk)

(iii) Hang the mass M at the lower end of the spring. Measure the length, L_1 of the loaded spring.

L_1 = ...m (1 mk)

(iv) Find the values of $L_1 - L_o$

$L = L_1 - L_o$ = ...m (1 mk)

(v) Using the beam balance determine the mass M of the object

M = ...kg (1 mk)

(vi) Hang the mass M from the lower end of the spring. Displace it by a small vertical distance and release so that the spring makes vertical oscillations. Measure and record the time for 10 oscillations.

Oscillations N	10
Time t (s)	
Q = $\frac{(N+10t)}{10}$ (S)	
Q^2 (S^2)	

Complete the table (3 mks)

Determine the constant, K given that

K = $\frac{MP}{13L}$ where P = $\frac{Q^2}{10}$ (3 mks)

Part B

You are provided with:
- A cell and a cell holder
- Six connecting wires with crocodile clips each
- A voltmeter (0 – 3V)
- A switch
- A resistance wire PQ mounted on a millimeter scale
- An Ammeter (0 – 1A)
- A micrometer screw gauge (to be shared)

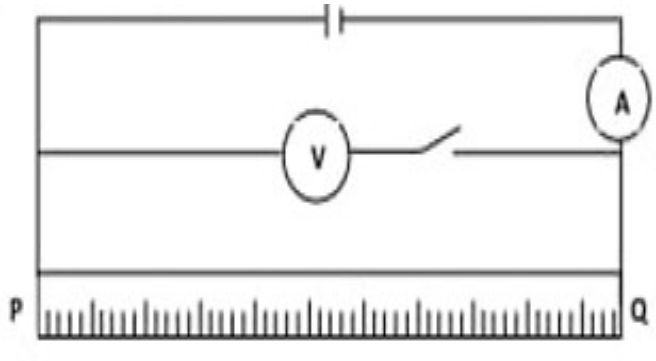
(a) (i) Measure diameter of the wire at two different points using micrometer screw gauge (2 mks)

d_1 = ...

d_2 = ...

(ii) Calculate the average diameter **d** in metres. (2 mks)

(b) Connect the cell, the ammeter and the 1.0m length of resistance wire PQ in series.



I. Close the switch S.

II. Measure the p.d. (v_o) across 1.0 m length resistance wire and the current I_o (2 mks)

V_o = ...

I_o = ...

III. Calculate the resistance of the wire R_o (1 mk)

R_o = ...

IV. Calculate the cross-section area of the wire (2 mks)

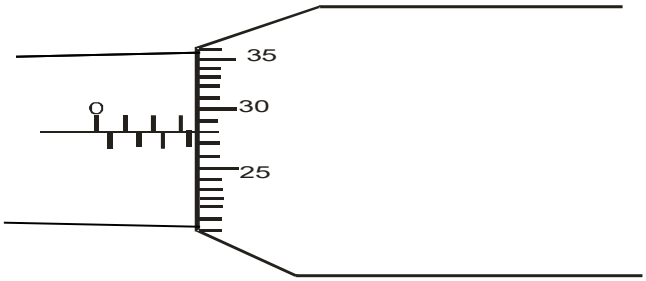
$A = \pi(\frac{d}{2})^2$

V. Determine the value of quantity K of the wire given the relation $K = \frac{R_o A}{L}$, where L is the length of the wire PQ. (2 mks)

SERIES 4
PAPER 1.

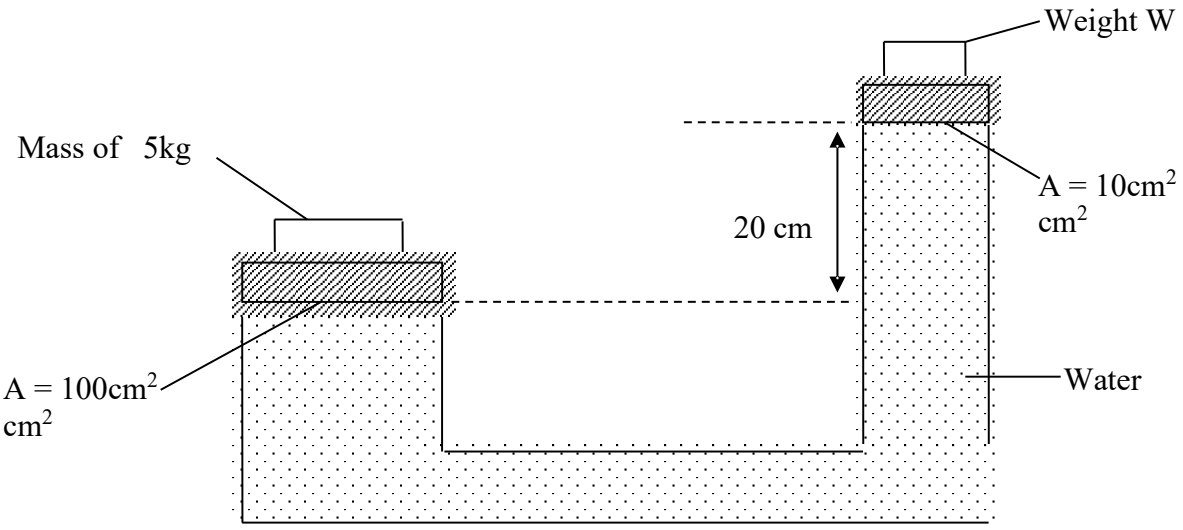
SECTION A (25 MARKS)

1. The micrometer screw gauge in figure below gives the reading of the diameter of a piece of a wire. Given that the length of the wire whose diameter was read by using figure below is 4cm, determine the volume of the wire. (3 marks)

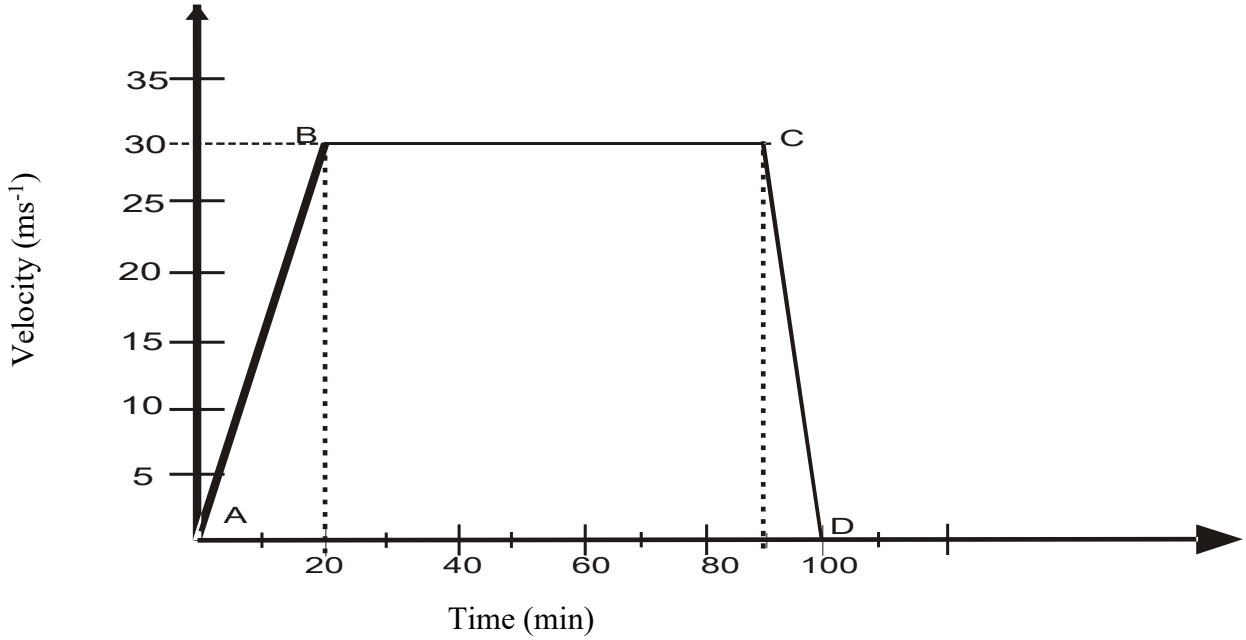


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2. The figure below shows two masses placed on light pistons. The pistons are held stationary by water of density 1000kgm^{-3}. Determine the weight W.(2marks)



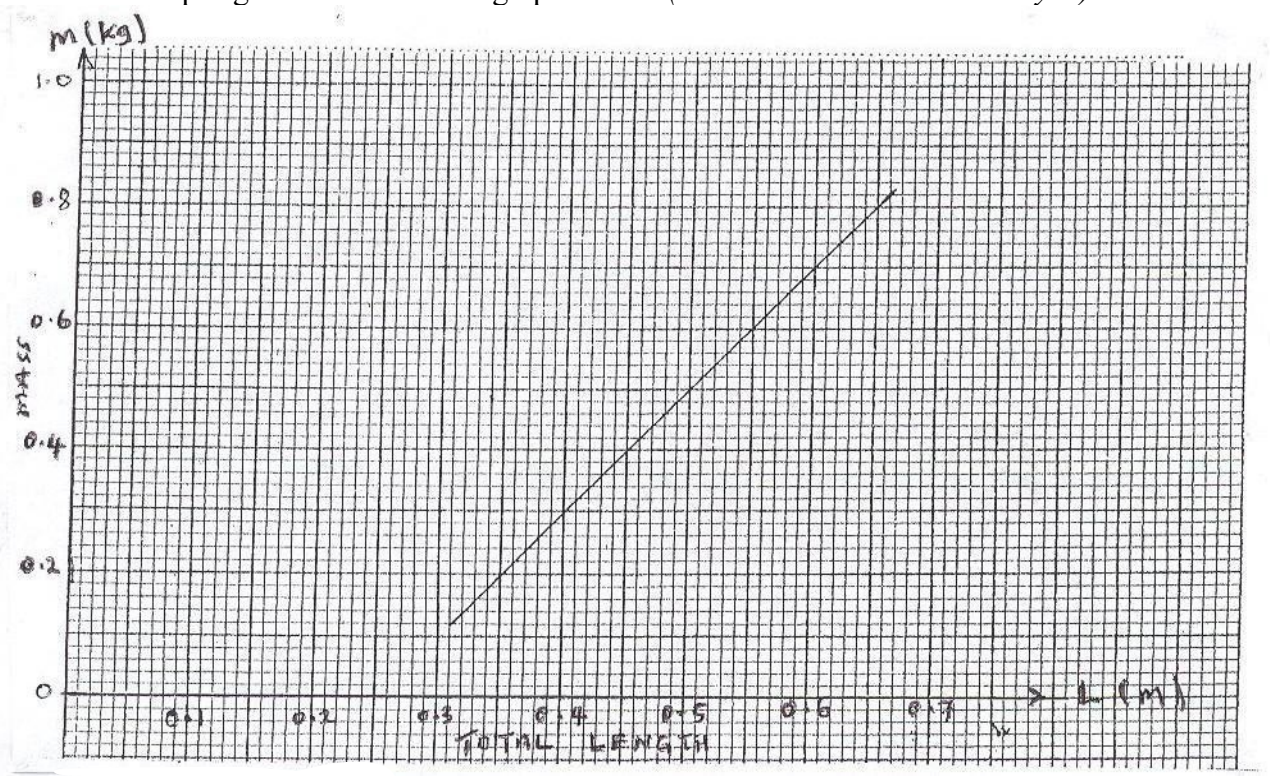
3. The following figure shows the velocity-time graph for the journey of a car in 100 minutes.



i) Determine the acceleration of the car between A and B and between C and D. (2 marks)

ii) Determine the distance covered by the car during the journey. (1 marks)

4. The result of an experiment to investigate how the total length of a spring varies with load on the end of the spring is as shown in the graph below. *(Assume Hooke's Law is obeyed)*

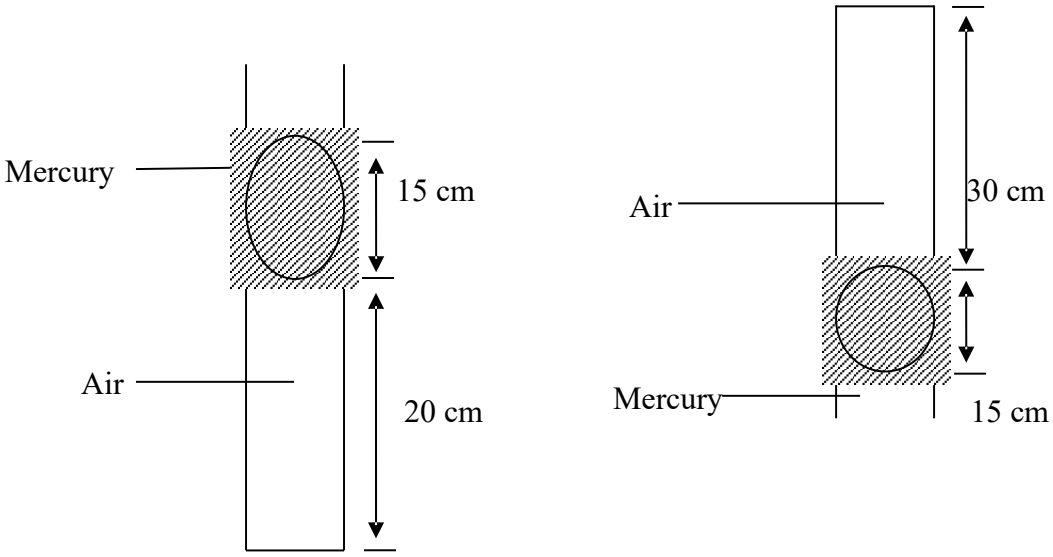


Calculate the energy increase stored by the spring when the load is increased from 4N to 8N.
(2marks)

5. State the two constant forces that act on a body falling through a fluid. (1mark)

6. A fixed mass of gas is enclosed in a vessel. Explain in terms of molecular theory how the pressure measured at the wall of the vessel is produced by the gas molecules. (2 marks)

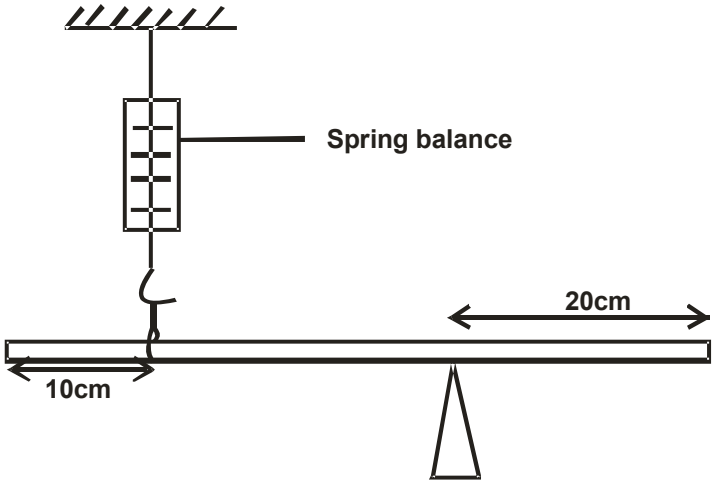
7. A uniform narrow-bored tube closed at one end contains dry air which is sealed by a thread of mercury15.0cm long. The tube is held in the following two positions as shown in the diagram below



(i) Calculate the atmospheric pressure (2 marks)

8. Explain the cause of random motion of smoke particles as observed in Brownian motion experiment using a smoke cell. (1mark)

9. The figure below shows a uniform bar of length 1.0 m pivoted near one end. The bar is kept in equilibrium by a spring balance as shown:



Given that the reading of the spring balance is 0.6 N, determine the reaction force at the pivot.

(3marks)

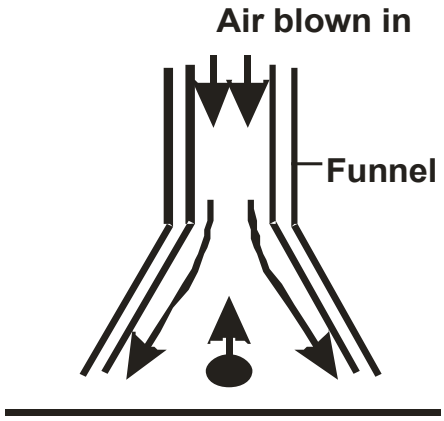
10. State the reason why it is colder during the night when the sky is clear than when it is cloudy.

(1mark)

11. In terms of intermolecular distances explain anomalous expansion of water. (1mark)

12. A resultant force F acts on a body of mass M causing an acceleration of A_1 on the body. When the same force acts on a body of mass 2M, it causes an acceleration of A_2. Express A_2 in terms of A_1 (2marks)

13. Figure shows a pith ball being lifted into a funnel end of a blower.



Explain this observation (2marks)

SECTION B (55 MARKS)

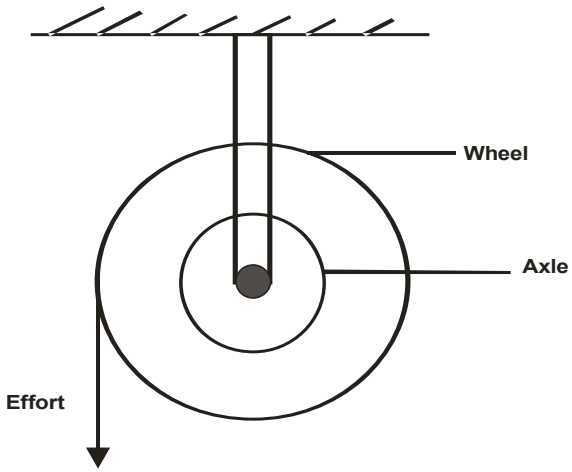
14. An object is fired vertically upward from the ground level with a velocity of 50ms $^{-1}$ and reaches a maximum height, h. It falls back to the ground and bounces to a height of 4m.

a) Sketch a velocity time graph to represent the motion of the object from the time it is fired till it bounces to the height of 4m. (1mark)



b.) Calculate the maximum height reached h. (2marks)

c) The figure below represents a wheel and axle used as a machine, whose efficiency is 80% to raise 400N of building materials. The wheel and axle has diameters of 75cm and 15cm respectively.



i) Mark on the diagram the correct position and direction of the load to be lifted. (1Mark)

ii) Name the principle on which this machine works. (1Mark)

iii) Calculate the effort needed to raise the load. (3Marks)

iv) The machine is operated manually and raises the load to a height of 5m in 20 seconds. Calculate the power developed by the operator. (3Marks)

15. a) State what is meant by the term specific latent heat of vaporization. (1 mark)

b) In an experiment to determine the specific latent heat of vaporization of water, steam at 100 ^{0}C was passed into water contained in a well lagged copper calorimeter. The following measurements were made.

Mass of calorimeter =50g

Initial mass of water =70g

Final mass of calorimeter + water + condensed steam = 123g

Initial temperature of water + calorimeter = 5^0 C

Final temperature of mixture = 30^0C

(specific heat capacity of water=4200JKg^{-1}K^{-1} and specific heat capacity of copper=390 JKg^{-1}K^{-1}.}

Determine:

i) Heat gained by calorimeter alone (2 marks)

ii) Heat gained by water only. (2 marks)

iii) Given that L is the specific latent heat of evaporation of steam

I. Write an expression for the heat given out by steam. (1 mark)

II. Determine the value of L (2 marks)

c) Steam at 100 ^{o}c was passed for some time into ice at 0 ^{o}c. At the end, temperature of the water obtained was 52^{o}C and its mass 2g. Calculate;

ii) Mass of the ice used. (2marks)

16 a) Define a radian (1mk)

b) Three masses are placed in a rotating table at distances 6cm, 9cm and 12cm respectively from the canter of rotation. When the frequency of rotation is varied it is noted that each mass slides off at a different frequency of rotation of the table. Table 1 shows the frequency at which each mass slides off.

Radius, r (cm)	12	9	6
Sliding off frequency rev/s	0.68	0.78	1.0

i) State two factors that determine the frequency at which each mass slides off. (2 marks)

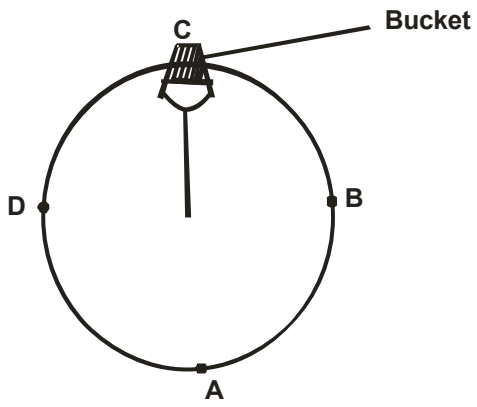
ii) Oil is now poured on the table before placing the masses. Explain the effect of this on the frequency at which the mass slides off. (2 marks)

c) A marked point on a rim of a wheel has a linear velocity of 11.2m/s. If the rim has a radius of 0.8m Calculate;

i)The angular velocity of the point (2 marks)

ii)The centripetal acceleration (2 marks)

d) The figure below shows a bucket filled with water moving round in a vertical circular path of radius 1m



If the mass of water is 5kg and the speed of the bucket is 20m/s Show by calculation that this net force is greater at point A than at point C. (2 marks)

17. The table below shows the volume V of a certain mass of a gas at different temperatures, T, obtained in an experiment to verify Charles law.

V (cm^3)	7.0	7.6	8.2	8.6	8.8
T (^oC)	15	40	65	80	90

(a) Draw a set-up of apparatus that could be used to verify the law. (2marks)

(b) i) Plot a graph of volume (y-axis) against temperature. (3marks)

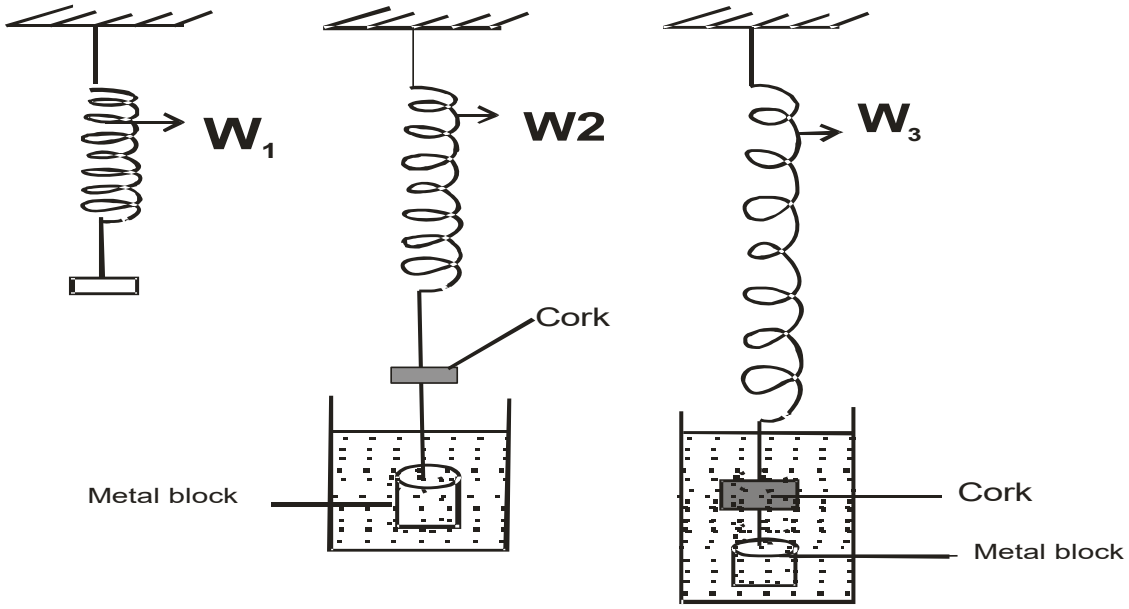
ii) From the graph determine the volume of the gas at 0^oc. (1Mark)

iii) Use the graph to determine the rate of expansion of the gas. (2Marks)

iv) Given that V=KT+C, write down the values of K and C. (2Marks)

18) (a) State Archimedes' principle. (1Mark)

b) A student was provided with water in a beaker, a spring balance, a metal block, a cork and a string. Using the arrangements shown in figure below she recorded the following results



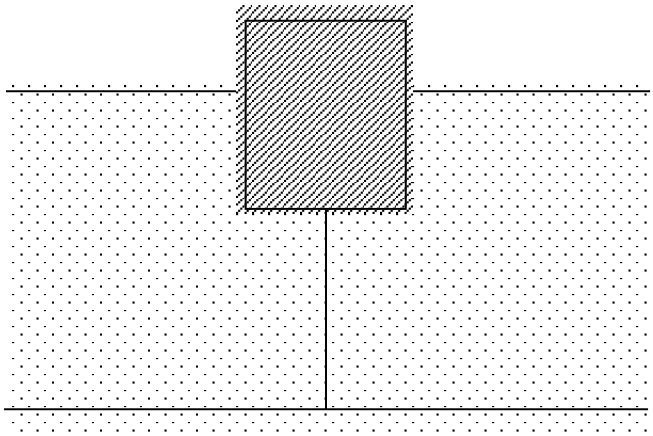
Weight of cork in air = W_1

Weight of cork in air and metal in water = W_2

Weight of both cork and metal in water = W_3

Derive an expression for the relative density of the cork. (3marks)

(c) A wooden block of mass 50g floats with 20% of its volume above the water surface and kept in place by string as shown below. The tension in the string is 0.06N.



Calculate: -

(i) The upthrust experienced by the object. (1 Mark)

(ii) The volume of the water displaced. (2 Marks)

(iii) The density of the object. (2 Marks)

(iv) What would happen if the string was cut and what volume of water would the block finally displace? (2 Marks)

d) The rubber used to make a balloon weighs 0.1kg.The balloon is inflated to a volume of 0.5m^3 with hydrogen whose density is 9.0 x10^{-2}Kg/m^3.Determine the maximum load the balloon can lift. (Density of air=1.3Kg/m^3) (3marks)

PAPER 2

SECTION A: (25 MARKS)

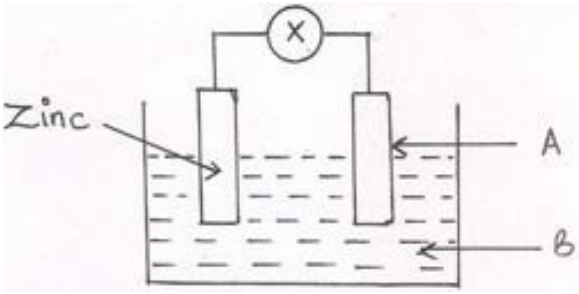
1.State the two laws of reflection of light. (2 marks)

2.A positively charged rod is brought near the cap of a lightly charged electroscope. The leaf divergence first reduces and as the rod comes nearer, it's divergence increases.

(a) State the charge on the electroscope. (1 mark)

(b) Explain the behaviour on the leaf. (2 marks)

3 The figure below shows a simple cell. Use it to answer question **3** and **4** below.

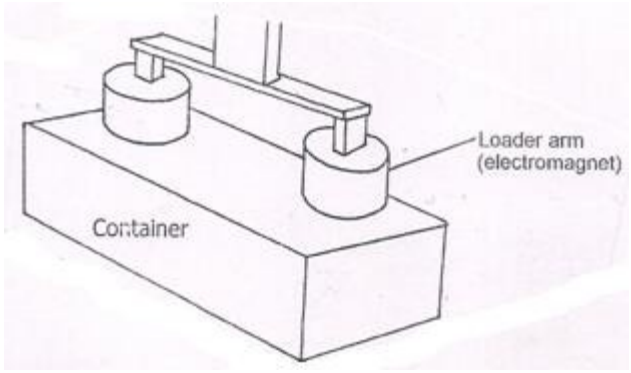


Name the parts labelled B. (1 marks)

Explain why the bulb goes off after sometimes. (1 mark)

4. Why is repulsion the sure test for the polarity of a magnet? (1 mark)

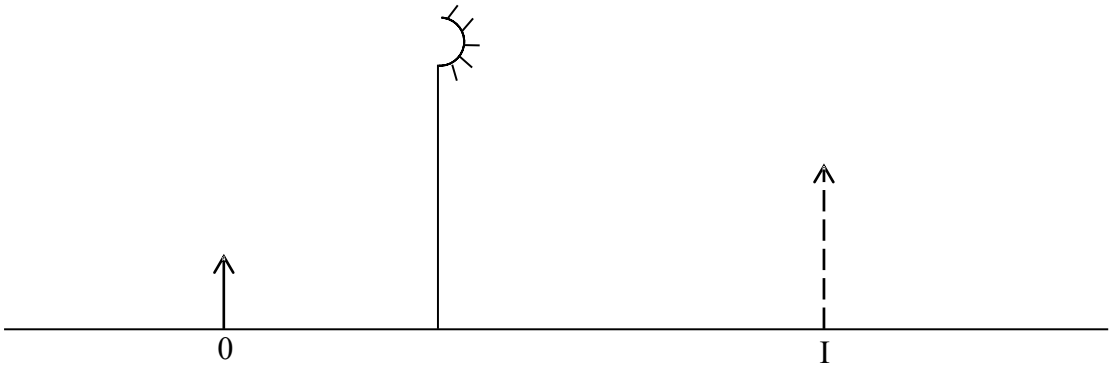
5. The figure below shows a container loader which uses electromagnet to offload containers from a ship.



(i) Why should the container be made of iron? (1 mark)

(ii) State **two** ways in which the loader can be made to lift a heavier container. (2 marks)

6.. The figure below shows an object O and its image I formed by a concave mirror. The diagram is drawn to scale.



Using a suitable ray, determine the focal length (f) and the radius of curvature (r) of the mirror. (3 marks)

f …… cm

r…….. cm

7 The following are electromagnetic waves and some of their characteristics.

A - Have high penetrating power

-Used to sterilize medical equipment

- Used to detect flaws in metals in industry

B - Causes heating effect

-Used in cooking, heating and drying

-Used in heat seeking missiles

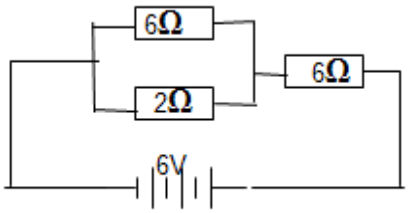
C -High penetrating power

-Used to locate bone fractures

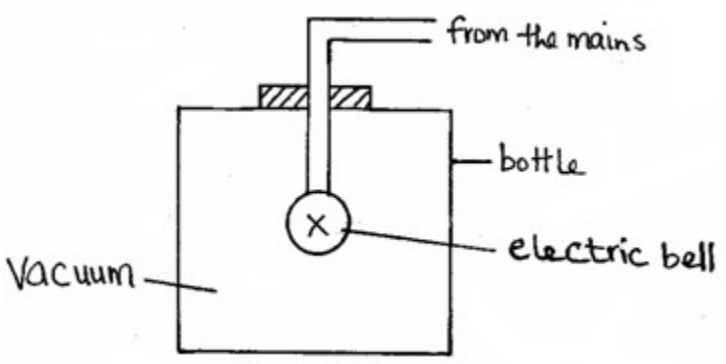
- Used to control germs and pests

Arrange the waves in order of increasing frequency (1mark)

8. The figure below shows a 6V battery connected to an arrangement of resistors. Determine the current flowing through the 2Ω resistor.
(3marks)



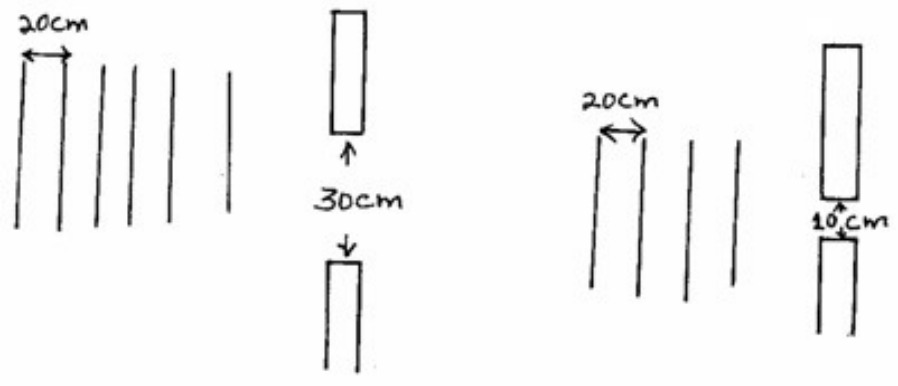
9.The figure below shows a set up to study sound waves.



State and explain what is observed on the bell when the switch is closed. (2 marks)

10. A water wave whose wavelength is 7.5cm in the deep end of an inclined tank has a wavelength of 3.0cm in the shallow end. If the speed of the wave in the shallow end is $0.6ms^{-1}$, calculate it's speed in the deep end. (3 marks)

11. The diagrams below show waves going through an opening. Draw the wave patterns of the aperture. (2 marks)



SECTION B: (55 MARKS) ANSWER ALL THE QUESTIONS IN THIS SECTION

12. (a) (i) State the difference between gamma and X-rays in the way they are produced. (1mk)

(ii) Give a reason why the target of an x ray tube is made of metals of high melting points. 1mark)

(iii) State with a reason the effect on the x rays produced in an x ray tube, when pd across the tube is increased. (2marks)

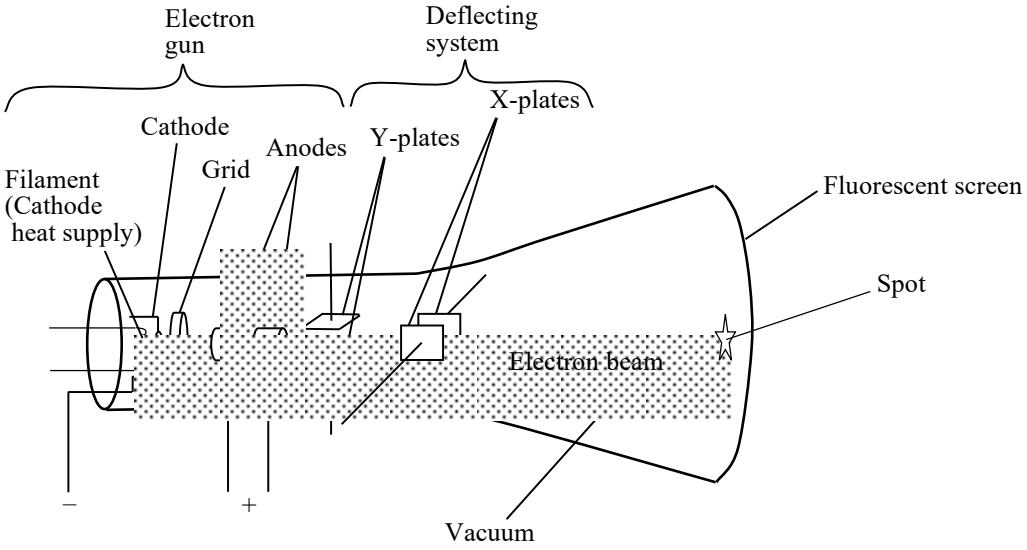
(iv) X rays are used for detecting cracks in metal beams.

I. State the type of x-rays used. **(**1mark)

II. Give a reason for your answer in (i) above. **(**1mark)

(b) in a certain X ray tube the electrons are accelerated by the p.d. of 12000V. Assuming all the energy goes to produce X-rays, determine the frequency of x rays produced. (Planck's constant = 6.62×10^{-34}Js, charge of an electron = 1.6×10^{19} (3 marks)

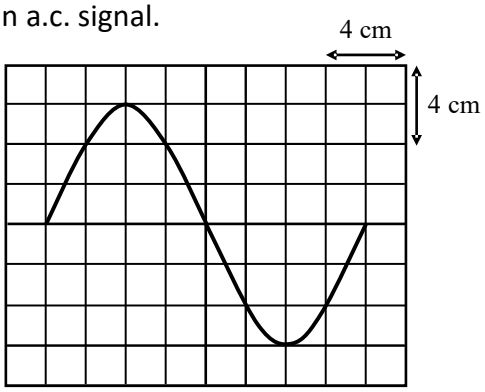
13 (a) The figure below shows the main features of a cathode ray tube (CRT) of a cathode ray oscilloscope (CRO).



(i) Describe how the electrons are produced in the tube. (2 marks)

(ii) State and explain the function of the grid. (2 marks)

(b) The diagram in figure below shows the screen of a CRO displaying the waveform of a certain a.c. signal.



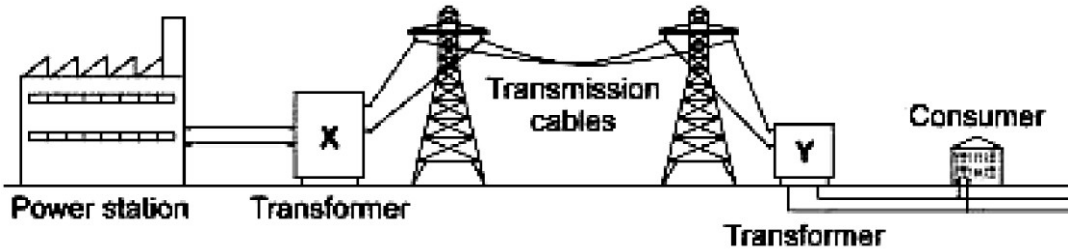
Y-gain = 80 V/division
Time base control = 2.5 ms/division

Determine:

(i) The frequency of the a.c. signal. (3 marks)

(ii) The peak to peak voltage of the a.c. signal. (2 marks)

14 (a) .The diagram below shows the National Grid system.



What type of transformer is;

X…… (1mark)

Y…… (1mark)

b) A house has the following appliances

Appliance	Power rating W	Time used in hours per day
Cooker	4000	1
TV set	150	3
Electric kettle	2000	0.5
Radio	300	6

i) Determine the appropriate fuse which would be required for the cooker and the radio respectively. The 240V mains available fuses are rated 40A, 35A, 20A, 13A, 3A &1A. (2marks)

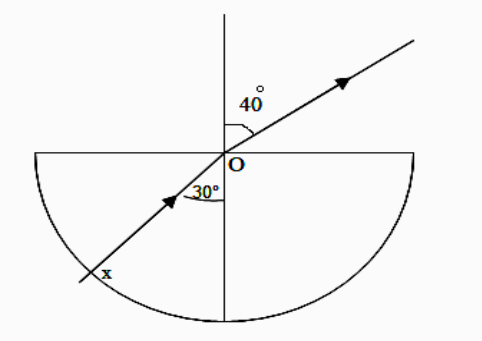
ii) Calculate the total cost of electricity paid in a month of 30 days given that all the appliances are used as shown above and 1KWh costs ksh1.85. (3 marks)

iii) State with reason the fuse suitable for the mains switch. (2marks)

(iv) State one advantage of using circuit breakers over fuses. (1mark)

15 (a) State what is meant by refractive index of a material. (1 mark)

(b) The figure represents a ray of light falling normally on the curved surface of a semi-circular plastic block at X, meeting the opposite face at an angle of incidence of 30^0 and emerging into the air at an angle of 40^0.



(i) State and explain what happens to the ray as it moves from:

I) Air to glass at X. (1marks)

II) From glass to air at O. (1marks

(ii) Calculate refractive index of the plastic. (3marks)

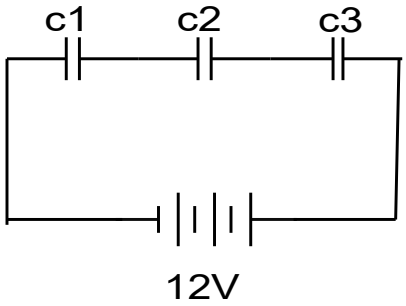
(iii) State the conditions to be satisfied for total internal reflection to occur. (2marks)

(iv)Calculate the critical angle for this plastic. (2marks)

16. (a) State what is meant by the term capacitance. (1mark)

(b) State **two** factors that determine capacitance of a parallel plate capacitor (2marks)

(c) The figure below shows a network of capacitors in series.



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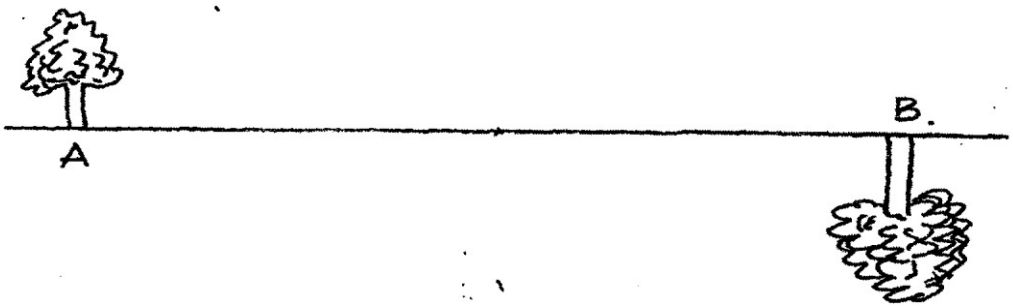
(i) Derive an expression for their effective capacitance C_E (3marks)

(ii) Given that C_1=10.5µF, C_2 =2µF and C_3= 3µF.
Calculate effective capacitance $C_E$in (i) above and hence
Determine the charge stored on each capacitor. (3marks)

(d) State two applications of capacitors. (2marks).

17 (a) Define the term principal focus for a convex lens (l mark)

(b) Figure 7 below shows an object A and its image B when an optical device is placed between A and B



i. State two characteristics of the image B (2marks)

ii. Name the optical device that should be placed between A to produce image B (l mark)

iii. Find the angle at which two mirrors are inclined when the number of images formed by the mirror is eleven. .(2 marks)

PAPER 3 QUESTION ONE

1. You are provided with the following:

- ✓ An ammeter
- ✓ A voltmeter
- ✓ Two cells (size **D**)
- ✓ A cell holder
- ✓ A switch
- ✓ A wire labelled **L** mounted on a millimeter scale
- ✓ A micrometer screw gauge (to be shared)
- ✓ Six connecting wires at least four with crocodile clips

Proceed as follows:

a) Using a micrometer screw gauge, measure and record the diameter **d** of the wire **L**. (1 mark)

d = ……mm

d = ……m

b) Place the two cells **in series** in the cell holder and use the voltmeter to measure the total electromotive force (emf) $\mathbf{E_0}$ of the battery. (1 mark)

$\mathbf{E_0}$ = ……V

c) Starting with the switch open, connect the circuit as shown in **figure 1 below**. **P** and **Q** are points on the wire **L** such that **PQ** is 60 cm. (**PQ** should remain 60 cm throughout the experiment)
N is a point on the wire such that **PN** is 10cm (0.1 m)

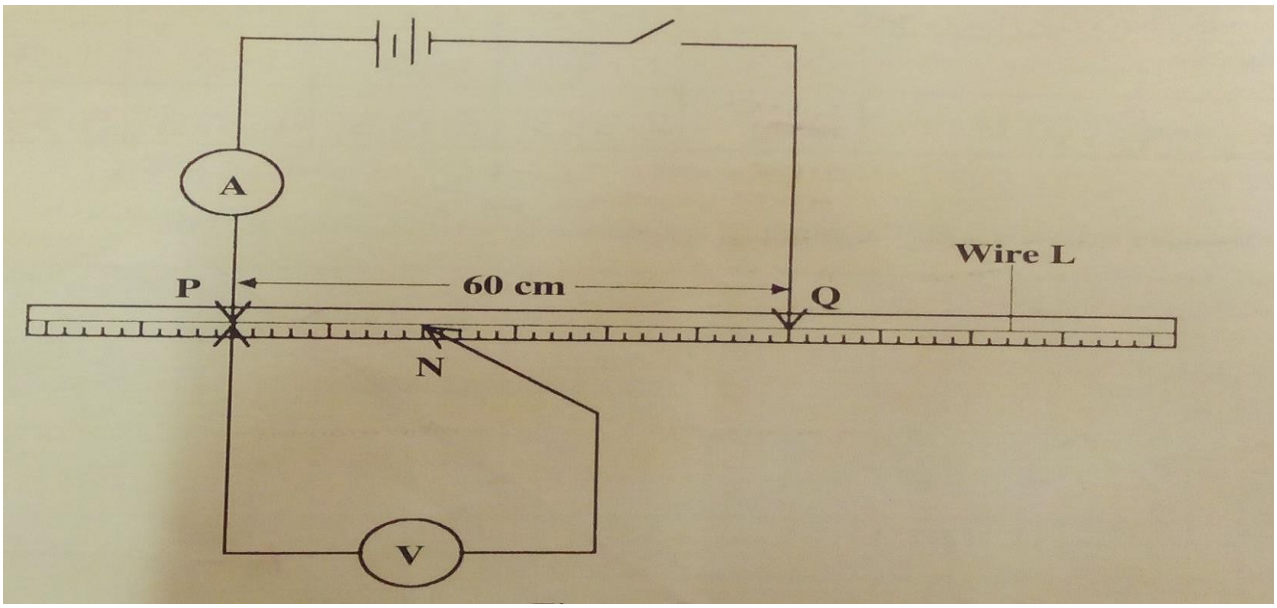


Figure 1

d) (i) Close the switch and record the current I. (1 mark)

I = ……**A**.

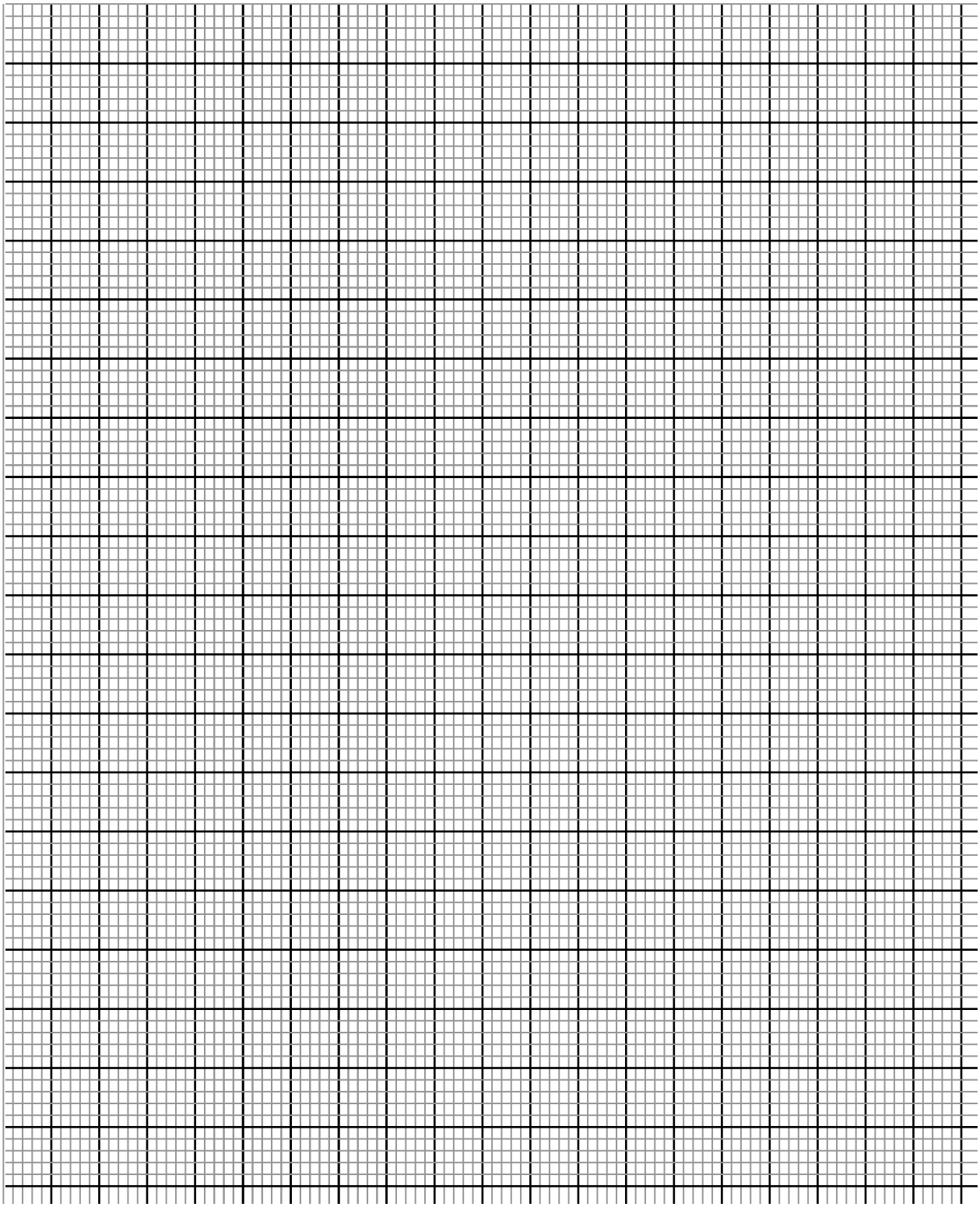
(ii) Measure and record in **table 1** the potential differences across **PN**.

(iii) Measure and record the potential difference across **PN** for the other values of **PN** shown in **table 1** and complete the table. *(The current is expected to remain constant)*
Hint: *The switch should be crossed only when reading the voltmeter.*

Table 1 **(4 marks)**

Length PN (m)	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**
p.d (V)						
Resistance $(\frac{v}{1})\Omega$						

e) On the grid provided, plot a graph of resistance (y-axis) against length.
(5 mark)



f) From the graph, determine:

(i)the slope **S** and its units. (3 marks)

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(ii) the constant **K** and its units given that

$$s = \frac{4k}{\pi d^2}$$ (3 marks)

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g) Determine constant t given that

$$t = \frac{E_0 - v_n}{I}$$

Where **V**n is the **p.d** at **PN** = 0.6 m. (2 marks)

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QUESTION TWO

2. You are provided with the following:

- ✓ Triangular glass prism
- ✓ Four optical pins
- ✓ Some sellotape
- ✓ A soft board
- ✓ A plain sheet of paper

Proceed as follows:

PART A

a) Fix the plain sheet of paper on the soft board using some sellotape. Place the triangular prism on the paper and trace its outline on the sheet of paper. Remove the prism and use a ruler to extend the three sides of the outline. See **Figure2**.

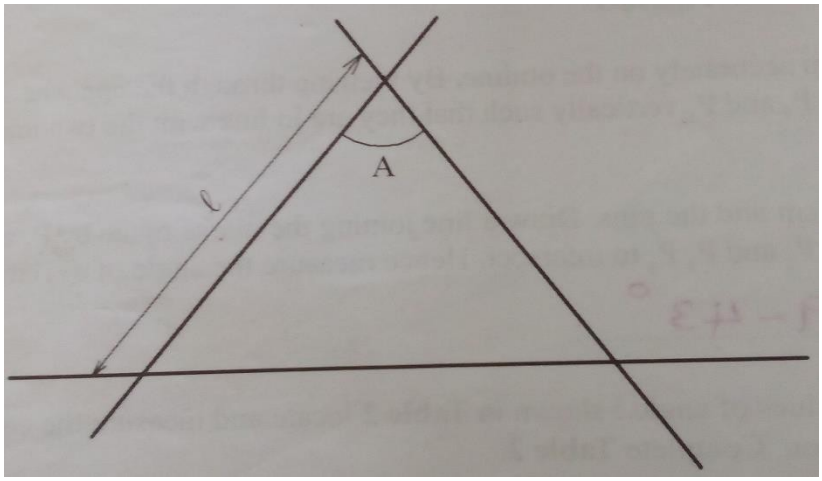


Figure 2

Measure angle **A** and the length $\boldsymbol{l}$.

A = ……. (1 mark)

$\boldsymbol{l}$ = ……cm (1 mark)

NB: The plain sheet of paper must be submitted together with the question paper.

b) At a point about a thirdway along one side of the outline from angle **A**, draw a normal. (2 marks)

c) Draw a line at angle i = 40° to the normal. Stick two pins P_1 and P_2 vertically on this line. (**see Figure 3**)

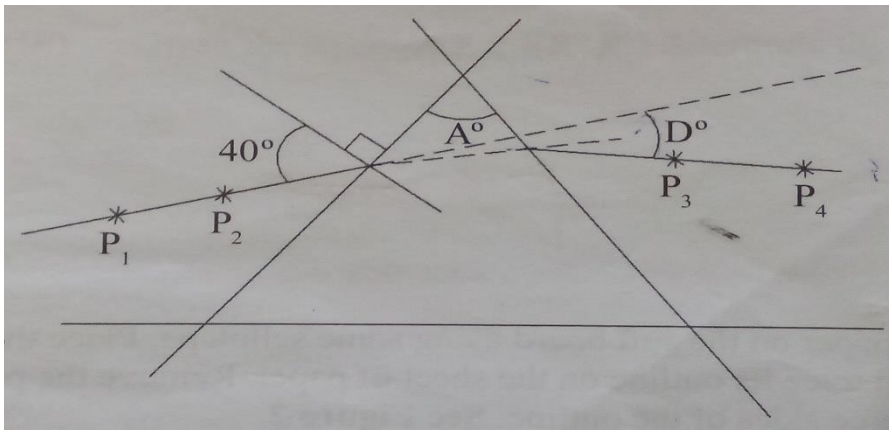


Figure 3

Place the prism accurately on the outline. By viewing through the opposite side, stick the two pins P_3 and P_4 vertically such that they are in line with the two images of pins P_1 and P_2.

d) Remove the prism and the pins. Draw a line joining the marks made by P_3 and P_4. Extend lines P_1 P_2 and P_3 P_4 to intersect. Hence measure the angle of deviation D.

D = ……. (1 mark)

e) For two other values of the angle i shown in **Table 2** locate and measure the corresponding angles of deviation. Complete **Table 2**.

Table 2 (2 marks)

i	40°	50°	60°
D			

f) (i) Determine the average value D_m of D. (1 mark)

……

……

……

(ii) Determine the constant K using the equation;

$$k = \frac{\sin(\frac{A+D\,m}{2})}{\sin\frac{A}{2}}$$ (3 marks)

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PART B

You are provided with the following:

- ✓ 100 ml beaker
- ✓ A meter rule
- ✓ Source of light
- ✓ A screen

Proceed as follows:

g) Place the 100 ml beaker on a meter rule and pour 80 cm^3 of water into it. Arrange a lamp (source of light) and a screen on either side of the beaker. (**see figure 4**)

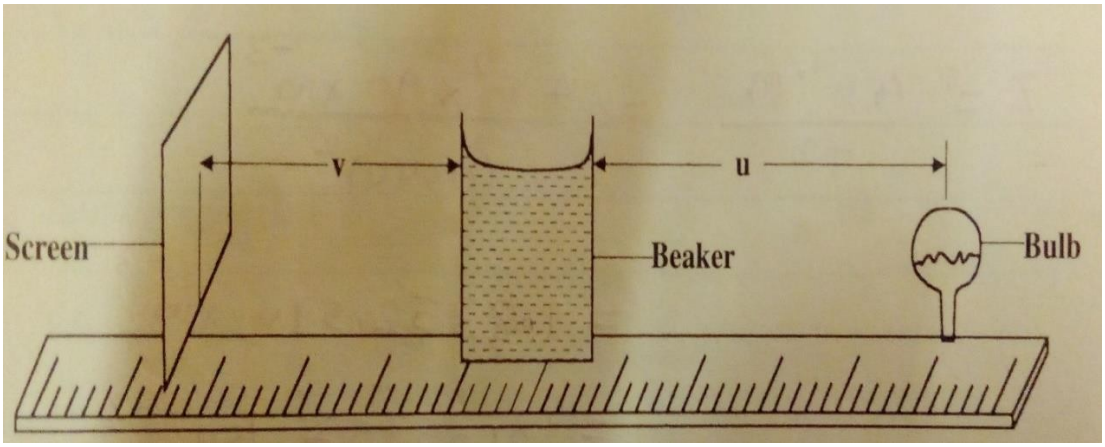


Figure 4

h) Adjust the position of the lamp on the metre rule so that its centre is a distance **u** = 12 cm from the beaker. Switch on the light. Adjust the position of the screen until a well focused vertical line *(the image of filament)* is formed on the screen. Measure and record in **table 3** the image distance **V** between the screen and the beaker.

i) Repeat part (b) for the values of **u** shown in **table 3** and complete the table.

Table 3 (4 marks)

Distance u (cm)	**12**	**16**	**20**
Distance V (cm)			
$\boldsymbol{y = \frac{Uv}{U+v}}$			

j) Determine **m**, the mean value of **y** using the values in **table 3**. (1 mark)

m = …….

k) (i) With the meter rule outside the beaker, measure the height **h** of the water meniscus above the bench. (1 mark)

h = ……cm

(ii) Determine the value of **P** given that (1 mark)

$P = \frac{5}{\sqrt{h}}$

……..

……..

(iii) Hence determine the value of f given that $f = \frac{P}{2m} + 1$ to one decimal place.

(2 marks)

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SECTION A (25 Marks)

1. A student measured the diameter of a nichrome wire as 0.36mm. On the space provided, draw the micrometer screw scale reading. **(2mks)**

2. (a) The diagram below shows a wire loop with a thread tied across it. The loop is dipped into a soap solution such that the soap film covers it as shown.



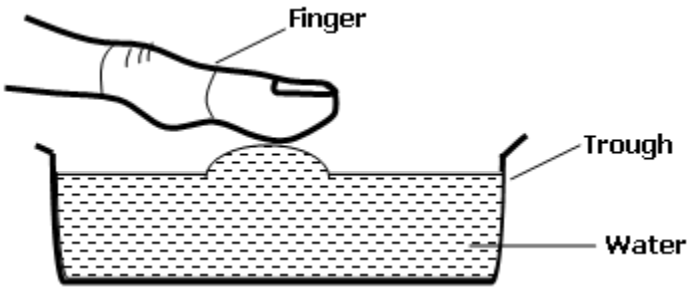
Region **X** is punctured. On the space alongside the diagram sketch the resulting shape of the wire loop. Give a reason for the shape. **(2mks)**

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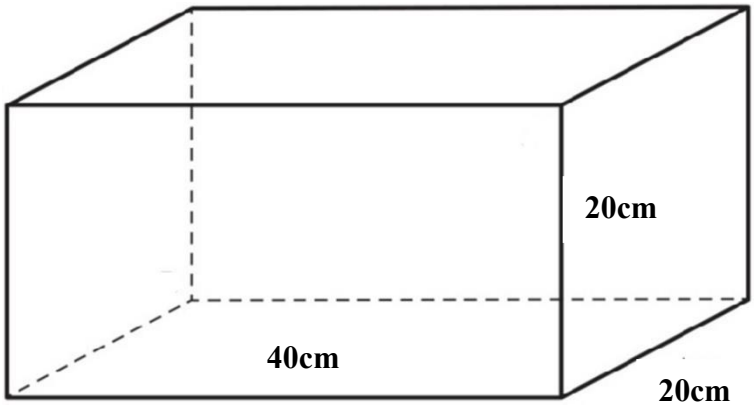
(b) Diana placed her finger on water as shown in the diagram below.



Name the force that lifts the water to the finger. **(1mk)**

……

3. The diagram below shows a cuboid with dimensions **20cm by 20cm by 40cm** of mass **5kg.**



State and explain how it should be placed on a flat surface in order to exert minimum pressure on the surface. **(2mks)**

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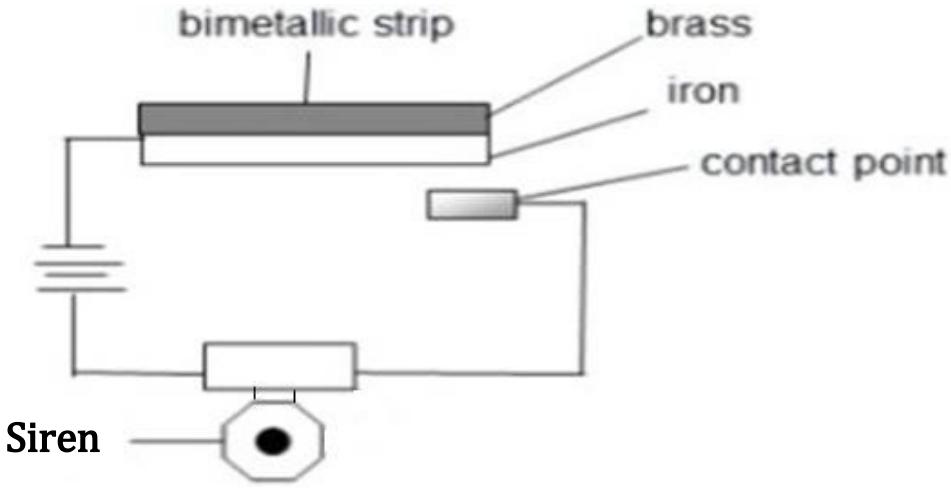
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4. Explain the formation of steam at **100^0C** using the particulate nature of matter. **(2mks)**

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5. The figure below shows a simple bimetallic strip used for detecting fire.



Describe how the fire alarm works. **(3mks)**

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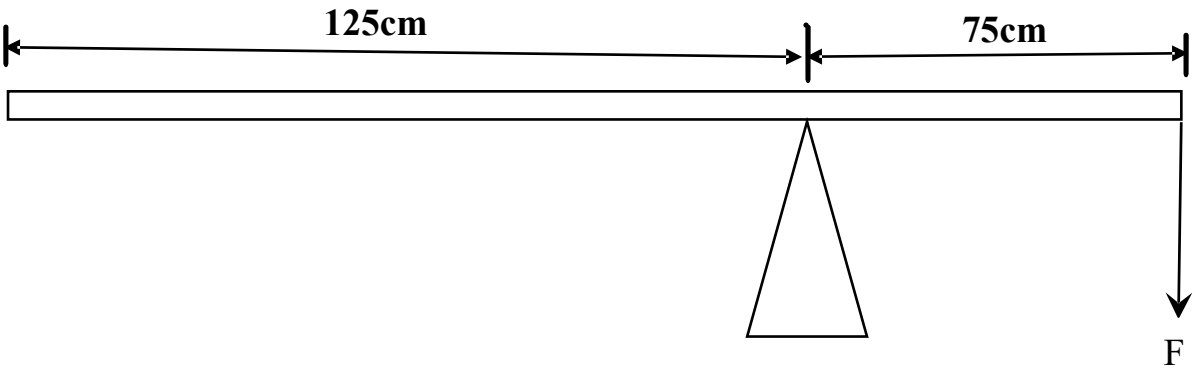
6. Jane stirred hot tea using a metal spoon and observed that the handle of the spoon soon becomes warm. State two ways through which the heat is conducted to reach the hand. **(2mks)**

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7. The diagram below shows a uniform metal bar of mass 150g balanced horizontally by a force, **F.**

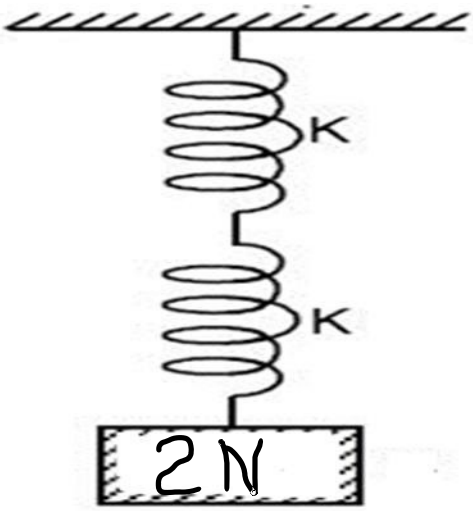


(i) Determine the value of the force, **F**. **(2mks)**

(ii) Calculate the reaction force on the pivot. **(1mk)**

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8. The diagram below shows an arrangement of two identical light springs. Each spring has a length of **5cm** when unstretched. The total length of the two springs is **15cm** when supporting a load of **2N.**

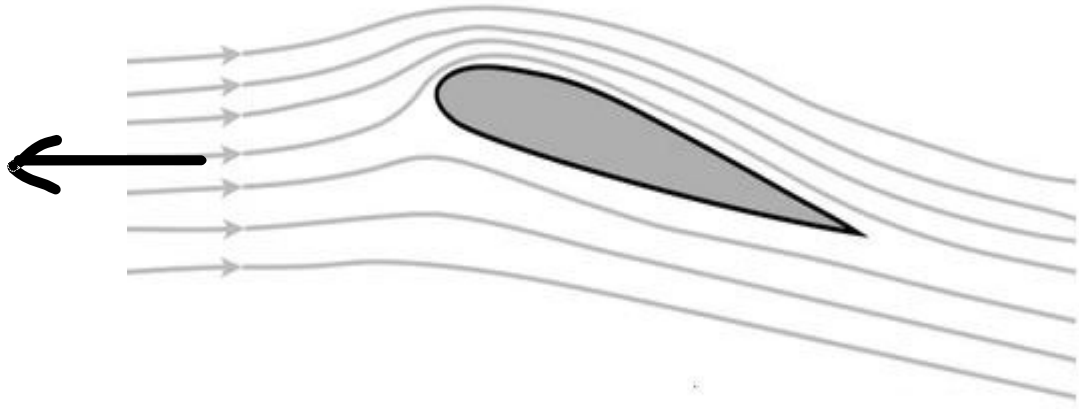


Calculate:

(i) The extension on each spring **(1mk)**

(ii) The combined spring constant **(2mks)**

9. The diagram below shows an aerofoil moving in the direction shown in air at a high velocity.



State and explain the direction of the force acting on the aerofoil. **(2mks)**

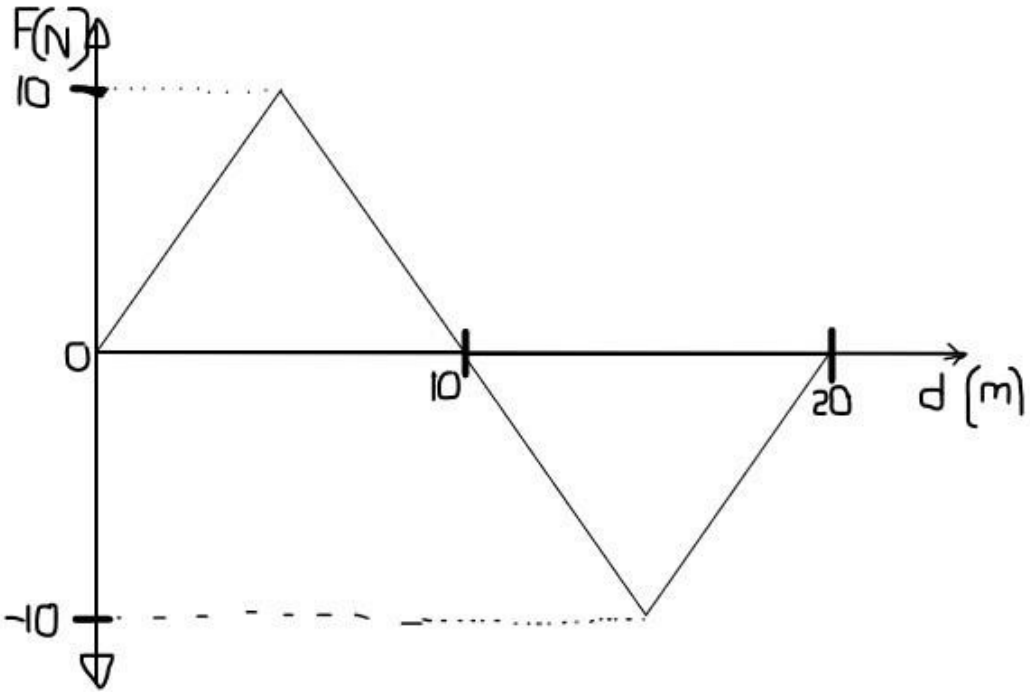
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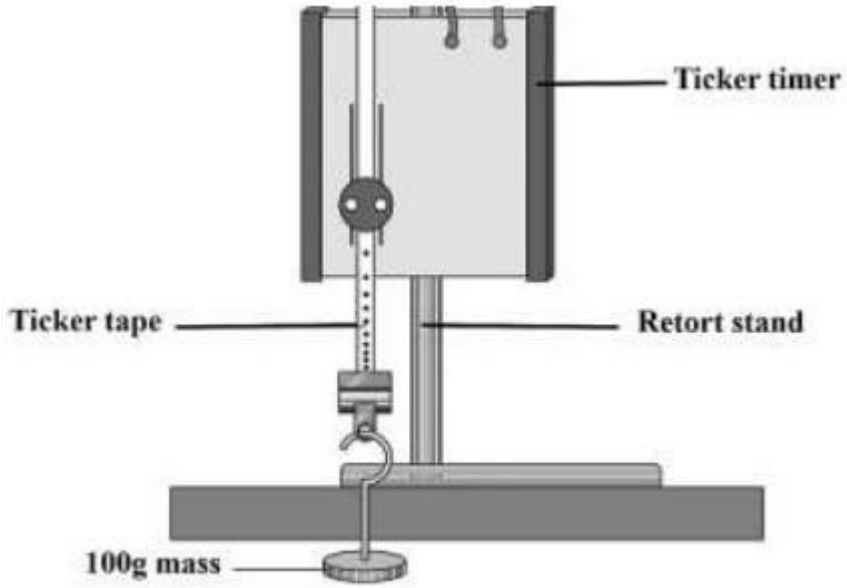
10. The diagram below shows a variation of force acting on an object over a distance of 20 metres



Find the total work done on the object. **(3mks)**

SECTION B (55 Marks)

11. (a) The set up below shows a ticker timer used to determine acceleration due to gravity at Moi Girls' High School - Eldoret.



Briefly describe how the set up can be used to determine the value of acceleration due to gravity at the school. **(3mks)**

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(b) A block of wood of mass **40kg** is pulled along a horizontal rough surface with a force of **150N.** Given that the coefficient of friction between the block and the horizontal rough surface is **0.2.** Calculate:

(i) The frictional force between the block and the surface. **(3mks)**

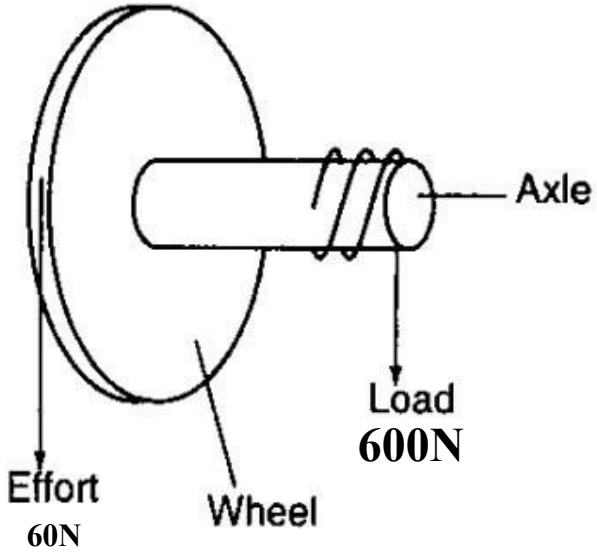
(ii) The acceleration of the block. **(2mks)**

12. (a) Define work and state it's SI Unit. **(2mks)**

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……

(b) The diagram below shows a wheel and axle as a machine used to lift a load of **600N** using an effort of **60N.**



If the radius of the wheel is **20cm** and that of axle is **2cm**, determine the machine's:

(i) Mechanical advantage **(1mk)**

(ii) Velocity Ratio **(2mks)**

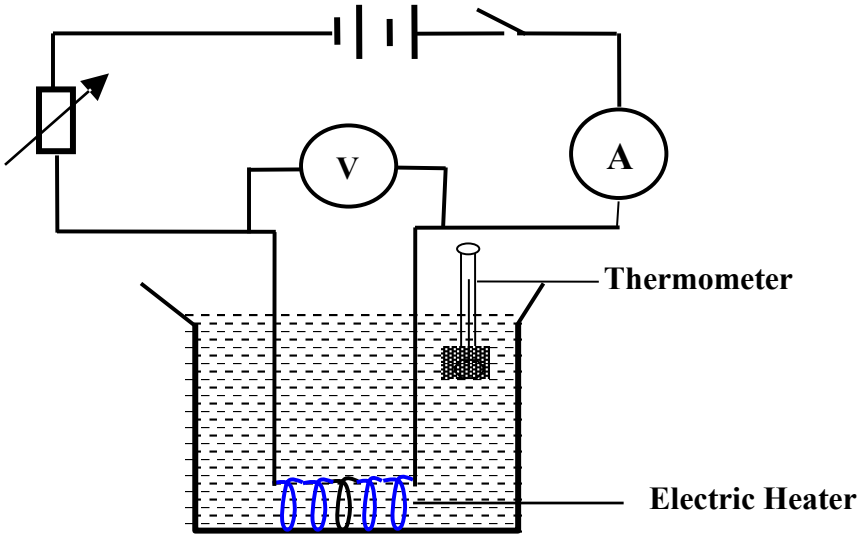
(iii) Efficiency **(2mks)**

13. (a) Define specific heat capacity **(1mk)**

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……

(b) Figure below shows a set up in an experiment to determine specific heat capacity of water.



The data below was obtained from the experiment.

- Voltage (V) across the heater =**12V**
- Current (I) in the circuit **= 1.4A**
- Time (t) for heating **= 600s**
- Mass (m) of water **= 0.4kg**
- Change in temperature ΔT **= 6°C**

Determine:

(i) The electrical heat energy **(2mks)**

(ii) Use the above results to determine the specific heat capacity of water. **(3mks)**

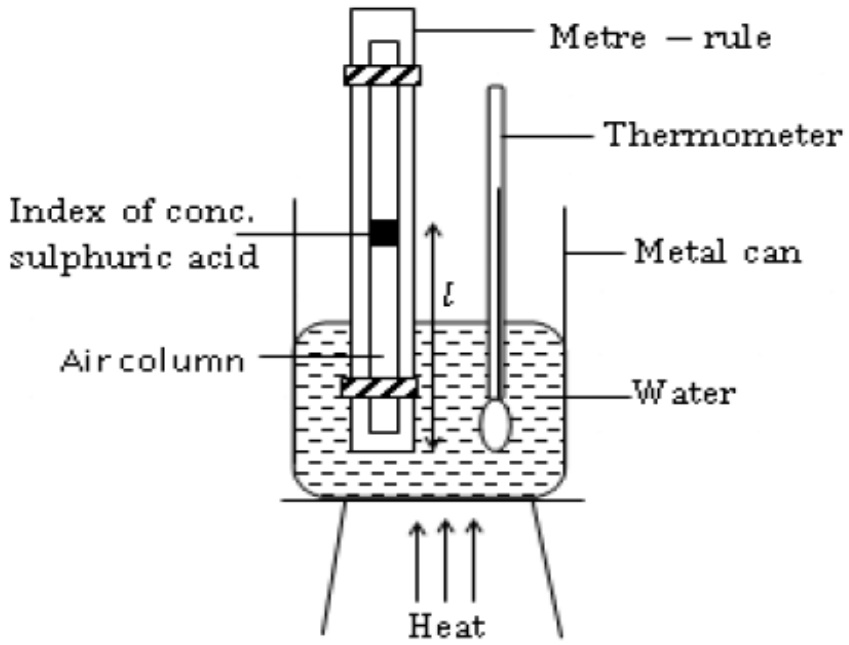
(iii) The power of the electrical heater. **(2mks)**

14. (a) If the volume of a fixed mass of a gas is tripled at constant temperature, what happens to its pressure. **(1mk)**

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(b) The diagram below shows apparatus used to verify Charles' Law.



(i) State the measurements to be taken from the apparatus **(2mks)**

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(ii) Describe how apparatus can be used to verify the law **(3mks)**

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(c) A gas has a volume of **20cm^3** at **27^{0}C** and at normal atmospheric pressure. Calculate the new volume of the gas if it is heated to **54^{0}C** at the same pressure. **(2mks)**

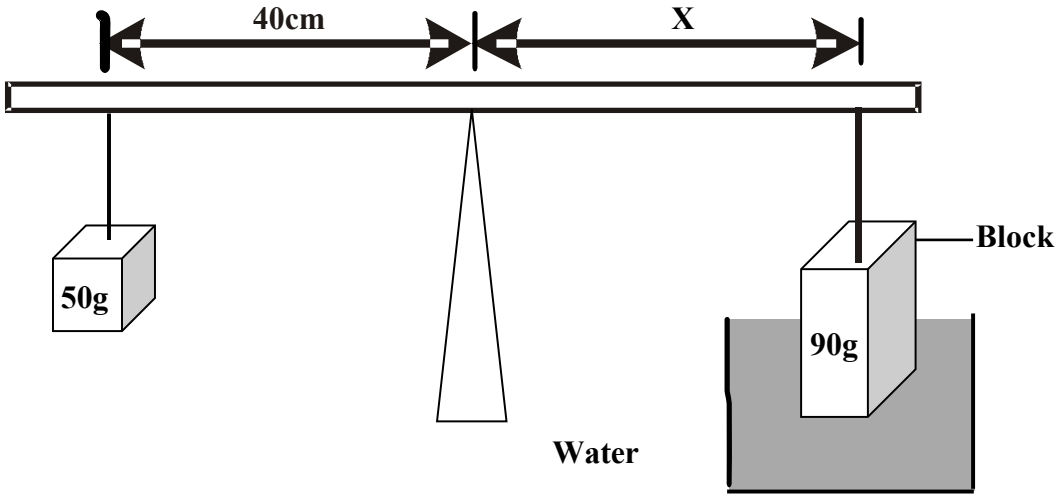
15. (a) State Archimedes Principle **(1mk)**

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(b) The system below is in equilibrium and balanced at the centre of gravity.



(i) When the temperature of the water is raised, the system is observed to tilt to the right. State the reason for this observation. **(2mks)**

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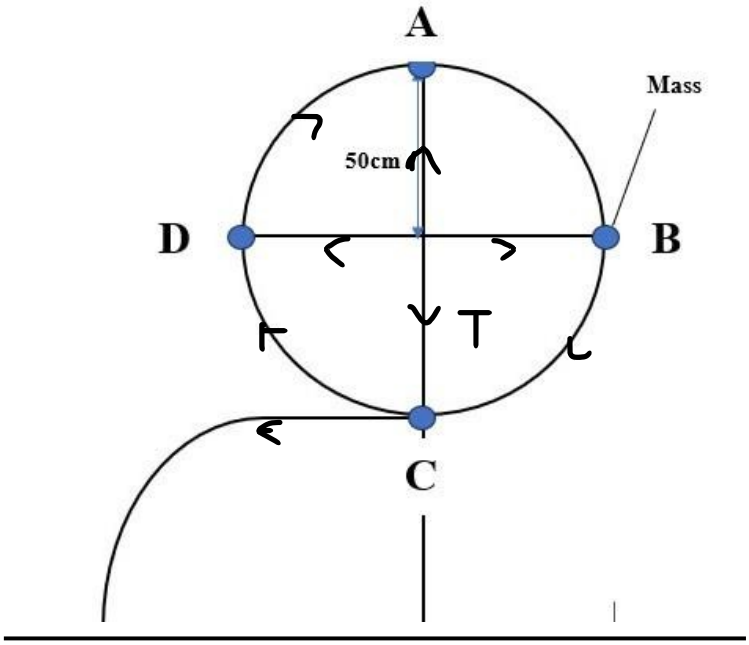
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(ii) Given that the block is half **($^1/_2$)** immersed and its dimensions are **2.0cm by 2.0cm by 6.0cm.** Calculate the volume of the water displaced by the block. **(2mks)**

(iii) Calculate Upthrust and hence the apparent weight of the block. ***(Given the density of water is 1000kg/m^3)*** **(2mks)**

(iv) Determine the value of distance X. **(3mks)**

16. A mass of **100g** is whirled in a vertical plane using a string of radius **50cm** as shown below in the clockwise at a speed of **2m/s.**



(a) Determine:

(i) The angular velocity. **(2mks)**

(ii) The tension, **T** on the string at point C. **(3mks)**

(b) If the string snaps at point C, **50cm** above the ground. Determine:

(i) The time taken for the mass to hit the ground. **(2mks)**

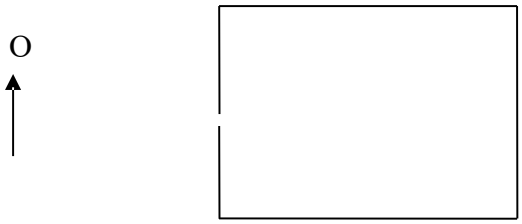
(ii) The horizontal distance travelled before hitting the ground. **(2mks)**

(c) Explain how a centrifuge may be used to separate cream from milk. (2mks)

SECTION A (25 MARKS)

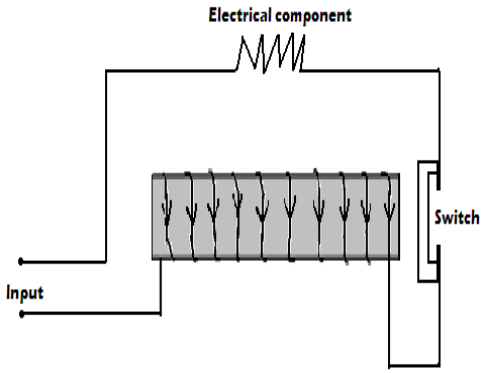
Answer all the questions in this section in the spaces provided.

1.The diagram below shows a pin hole camera and an object **O.**.



Using two rays on the same diagram show how the image is formed on the screen.(2mks)

2.The diagram below shows a circuit breaker rated 5A.



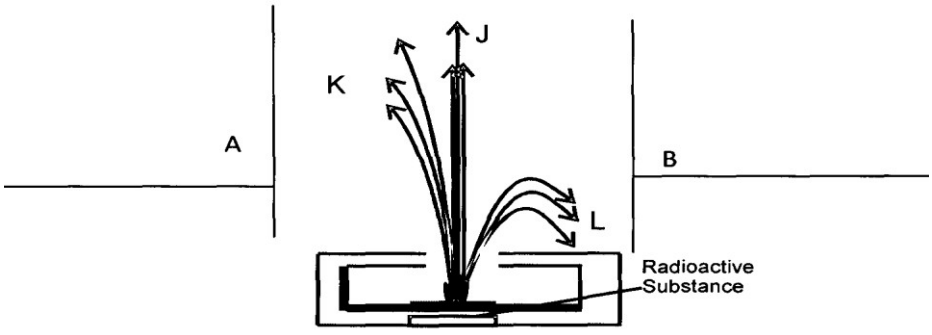
Briefly explain how it works when the current exceeds 5A. (2 mks)

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3.The diagram in the figure below shows paths taken by three radiations K, J and L from a radioactive source through an electric field.



I)State the charge on plate A giving a reason

……

……
……(2mks)

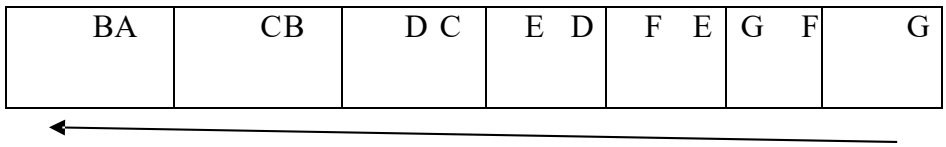
4.State two reasons why in determining the depth of an ocean using an echo sounder ,ultra sound is preferred to ordinary sound. (2mks)

……
……

5You are provided with 2 diodes, A resistor, a centre tapped step-down transformer ,a capacitor and enough connecting wires.In the space provided below, sketch the circuit diagram for a full wave rectifier . (3mks)

6.The figure below shows regions of the electromagnetic spectrum arranged in order of decreasing wavelenght. D is the region of visible light

A



Decreasing wave length

Indicate the region for ; (3 mks)

i)X - rays ……
ii)Name one detector of radiation A;…….
iii)Which part of the spectrum is applied in greenhouse…….

7. $^{226}_{88}Ra$ decays into $^{219}_{86}Rn$ by emission of an alpha particle and neutrons. Write a nuclear equation for the decay. (2mks)

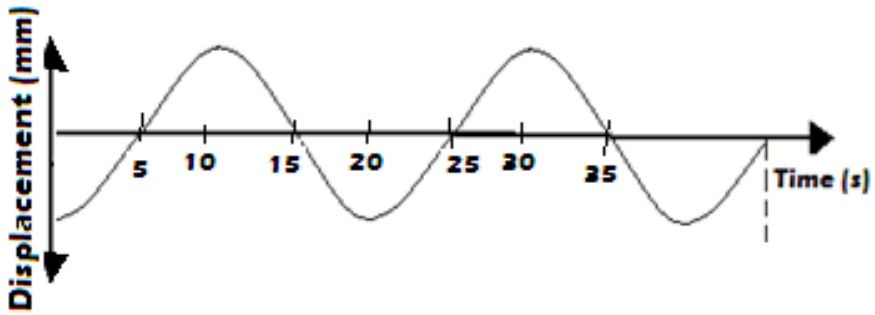
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8.An object is placed on the axis of a concave mirror of focal length 200mm.If the object is 100mm tall and is placed 300mm from the mirror by scale drawing and using rays determine its image position hence state its nature. (3mks)

9.Define the direction of the magnetic field. (1mk)

……
……
……

10.The sketch below is a displacement –time graph of a wave travelling at 300m/s



Determine the wavelength of the above wave. (3mks)

……
……
……

11.State two differences between human eye and a simple camera. (2mks)

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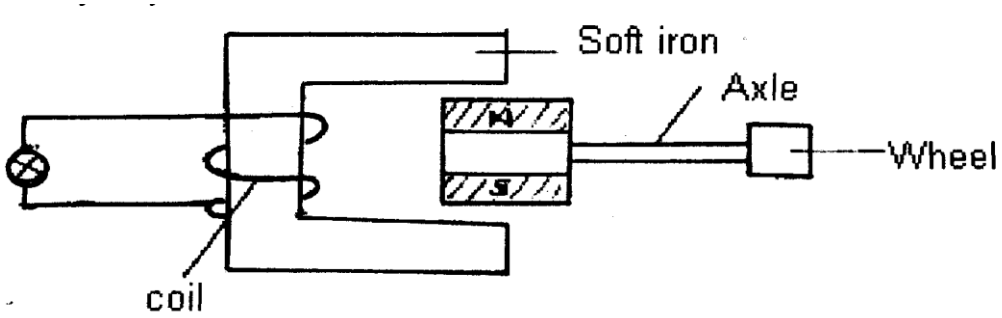
SECTION B(55 MARKS)

12.a)State the Faradays law of electromagnetic induction . (1mk)

……
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……

b) The figure shows a cross- section of a bicycle dynamo. The wheel is connected by an axle to a permanent cylindrical magnet and is rotated by the bicycle tyre



i) Explain why the bulb lights (2mks)

……
……
……
……

ii) State one wayin which the bulb can be made brighter. (1mk)

……
……

……c)An hair dryer rated 1000W,240V runs for 3hours everyday for seven days.Calculate;

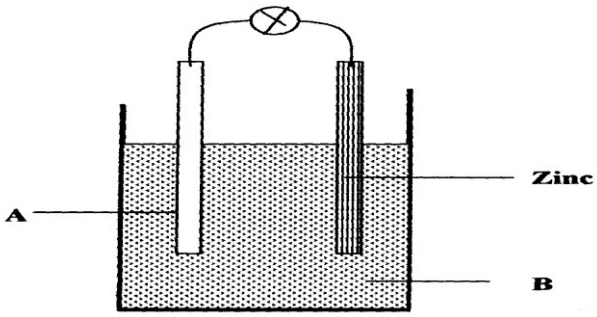
i)the number of kilowatt hour used during that period (2mks)

……
……
……

ii)the cost of electrical energy during the period if cost per unit is shs 5.50 per unit. (2mks)

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……
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……

13.a)Below is a figure of a simple cell.



Name;

i)electrode A. (1mk)

……

ii)solution B .(1mk)

……

iii) name the defect that takes place in electrode A and how it can be minimized.

(2mks)

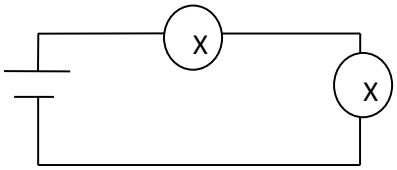
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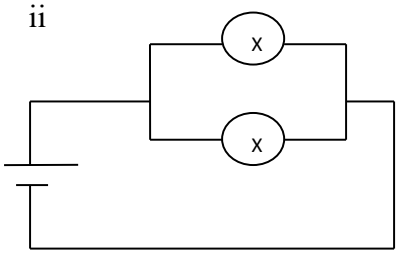
……..

b)Figure below shows circuit diagrams (i) and (ii) containing identical bulbs.

i.



ii



State the observation on the brightness of the bulbs in a) and b) giving a reason.

(2mks)

……

……

……

c)A battery of emf X volts drives a current of 0.42A through a 11Ω resistor.When the same resistor is replaced with a 5Ω resistor the current flowing becomes 0.86A.Determine;

i) the internal resistance of the battery. (3mks)

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……

ii)the value of X. (1mk)

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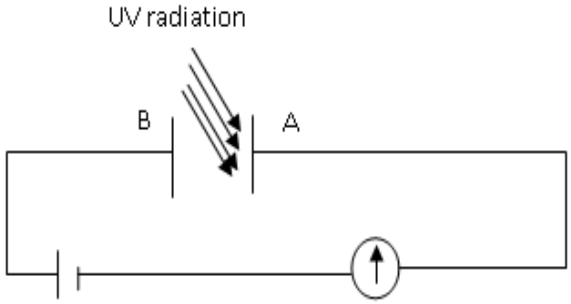
14.a)(i)The minimum energy required to cause a photoelectron to be emitted from a clean zinc surface is 4.0eV.Light with a frequency of 1.2 x 10^{15}Hz is irradiated onto the zinc surface.Show by calculation whether the photons of this light will cause photoelectric effect to occur.
(3 mks)

……
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ii)If the light source above is now replaced with a light source which produces light of frequency 1.5 x 10^{15}Hz,find the energy of the emitted photoelectrons.. (3mks)

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b) The diagram below was used by Valkim to investigate photoelectricity.



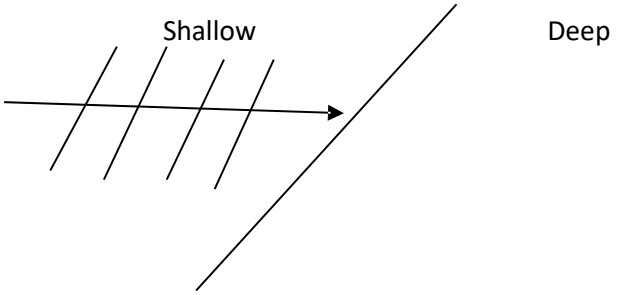
i) Explain how milliammeter reading is affected when the intensity of the UV light above is decreased. (1mk)

……
……
……

ii) Explain why there is no reading on the milliammeter when red light is used instead of UV light. (1mk)

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15.a)The figure below shows water waves fronts approaching a boundary between a shallow and deep region.

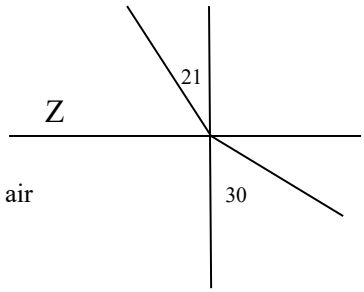


On the same diagram complete the figure to show the wave fronts after crossing the boundary. (2 mks)

b)Explain why light wave diffraction by a width slit of approximately 1mm is unnoticeable. (1mk)

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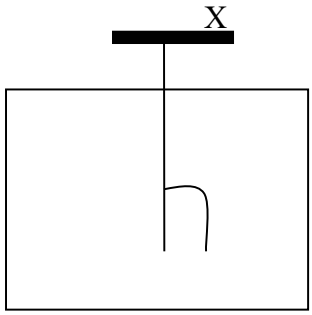
c)The diagram below shows a ray of light travelling from a medium Z into air.



Determine the refractive index of medium Z.(n of air = 1.000). (3mks)

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16.a)The diagram below shows an uncharged gold leaf electroscope.



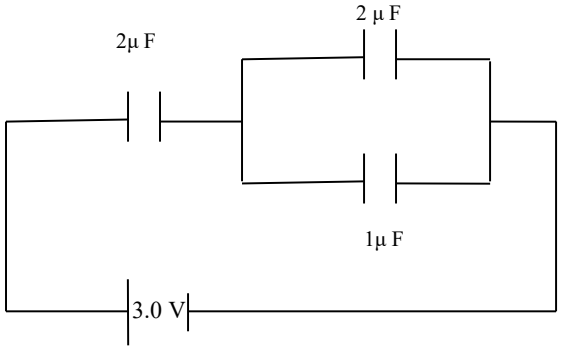
i)Name part X……..(1mk)

II)Why is part X usually circular in shape. (1mk)

……

……

b) The diagram below shows a network of capacitors in a circuit



Determine;

i)Effective capacitance in the circuit. (2mks)

……

……

……

……

……

ii)The charge across the 1μF capacitor. (2mks)

……

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……

iii)The energy in the 1μF capacitor. (3mks)

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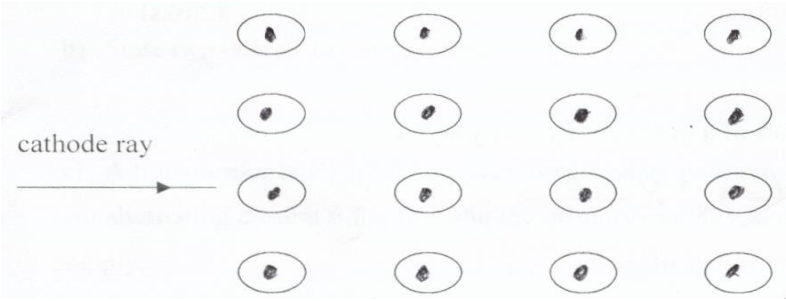
17.a)Define thermionic emission. (1mk)

……

……

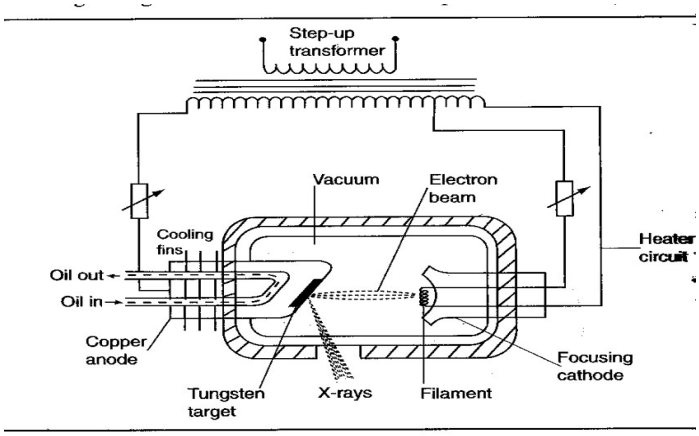
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b)The diagram below shows cathode rays directed into a magnetic field (the magnetic field is out of the paper).



Complete the diagram to show the path of the cathode ray. (1mk)

c)The diagram below is an X-ray tube .



i)Give a reason why the anode target rotates during operation. (1mk)

……
……
……

ii)What metal is suitable as an anode give a reason for it. (2mks)

……
……
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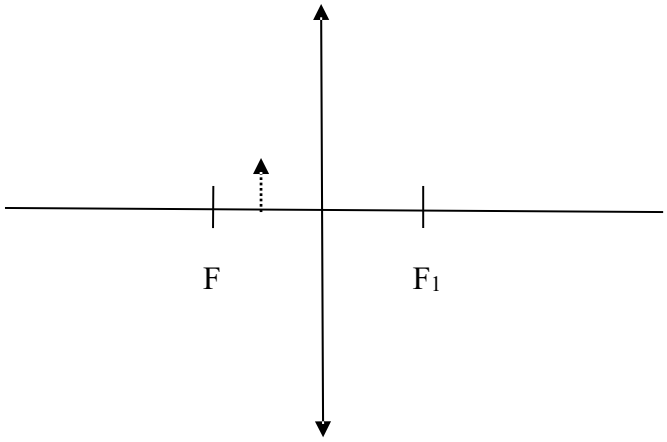
iii)The X-ray tube above produces electrons which are accelerated by a potential difference of 120Kv.Assuming all energy is used to produce X-rays,determine the minimum wavelength of X-rays produced. (3mks)

……
……

18.a)Define the term principal focus of a converging lens. (1mk)

……
……
……

b)Figure below shows an image **I** formed by a concave lens.**F and F_1** are the principal foci.



Complete the diagram using rays to show object position. (2mks)

c)An object 1cm tall stands on the principal axis of a convex lens 10cm from it. A virtual image of the object 2.5cm tall is formed by the lens. Determine the focal length of this lens.
(3mks)

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Paper 3 QUESTION 1

You are provided with the following apparatus:

- Rectangular glass block
- Two plain papers
- Four optical pins
- Four paper pins or thumb pins
- Protractor
- Half meter rule

Proceed as follows;

a) Place the glass block on the plain paper on its largest area, trace it's outline and mark it's sides **ABC** and **D**. Mark the point $\mathbf{P_0}$ on the center of side **BC** as shown in **Figure 1** below.

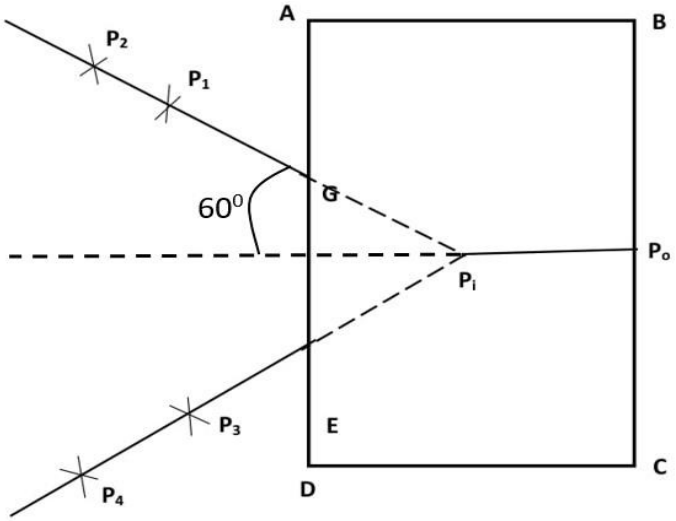


Fig. 1

b) Measure the breadth of the glass block.
(1mark)

b = …… cm

c)Replace the glass block and fix an object pin at $\mathbf{P_0}$ such that the pin lies along the surface of the glass block.

d)With your eye on the side **AD** approximately 60^0 from the line through $\mathbf{P_0P_1}$, fix pins $\mathbf{P_1}$ and $\mathbf{P_2}$ such that they are in line with the image $\mathbf{P_i}$ of $\mathbf{P_o}$ as seen from the side **AD** through the glass block.

e) From the same side **AD** closer to **D**, fix pins $\mathbf{P_3}$ and $\mathbf{P_4}$ such that they are in line with the image $\mathbf{P_i}$ of $\mathbf{P_0}$ seen through the glass block.

f) Remove the glass block and join $\mathbf{P_1}$ and $\mathbf{P_2}$, and $\mathbf{P_3}$ and $\mathbf{P_4}$ to meet at $\mathbf{P_i}$.

g) Join $\mathbf{P_0}$ to $\mathbf{P_i}$ and measure length $\mathbf{P_0P_i}$

P_0P_i =…….. **m**

(1mark)

h) Determine the ratio; $\frac{\boldsymbol{b}}{\boldsymbol{b-P_oP_i}} = \boldsymbol{n}$

(2marks)

(Hand in the outline with the question paper.)
(1mark)

Using another plain paper, proceed as follows;

i) Trace the outline of the glass block again on the second plain paper and label it **ABCD** as shown in the figure below.

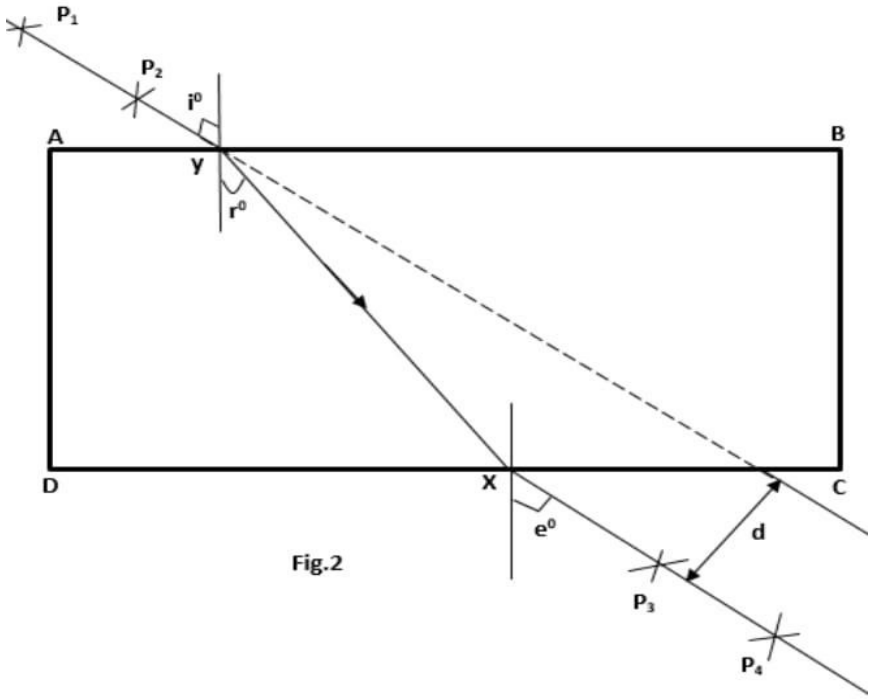


Fig.2

j) Construct a normal on the side **AB** approximately **3cm** from **A** and measure angle of incidence **i =35^0** (secure the plain paper using paper pins).

k) Replace the glass block on the outline and fix pins **P$_1$** and **P$_2$** along the line of **35^0**.

l) Viewing from the sides **CD** through the block, fix pins **P$_3$** and **P$_4$** such that they appear in line with the images of **P$_1$** and **P$_2$**.

m) Join **P$_3$** and **P$_4$** to **x** and join **x** and **y**.

n) Extend the line **P$_1$** and **P$_2$** to obtain lateral displacement as shown in the figure and measure the lateral displacement **d** and angle **r^0.**

o) Tabulate your results in table 1 below.

p) Repeat the procedure in **(i)** to **(n)** for angles of incidence **40^0,45^0,50^0**, **55^0,60^0** and tabulate your results below.

(Hand in the plain paper on which you have done your experiment together with the exam paper)

(1mark)

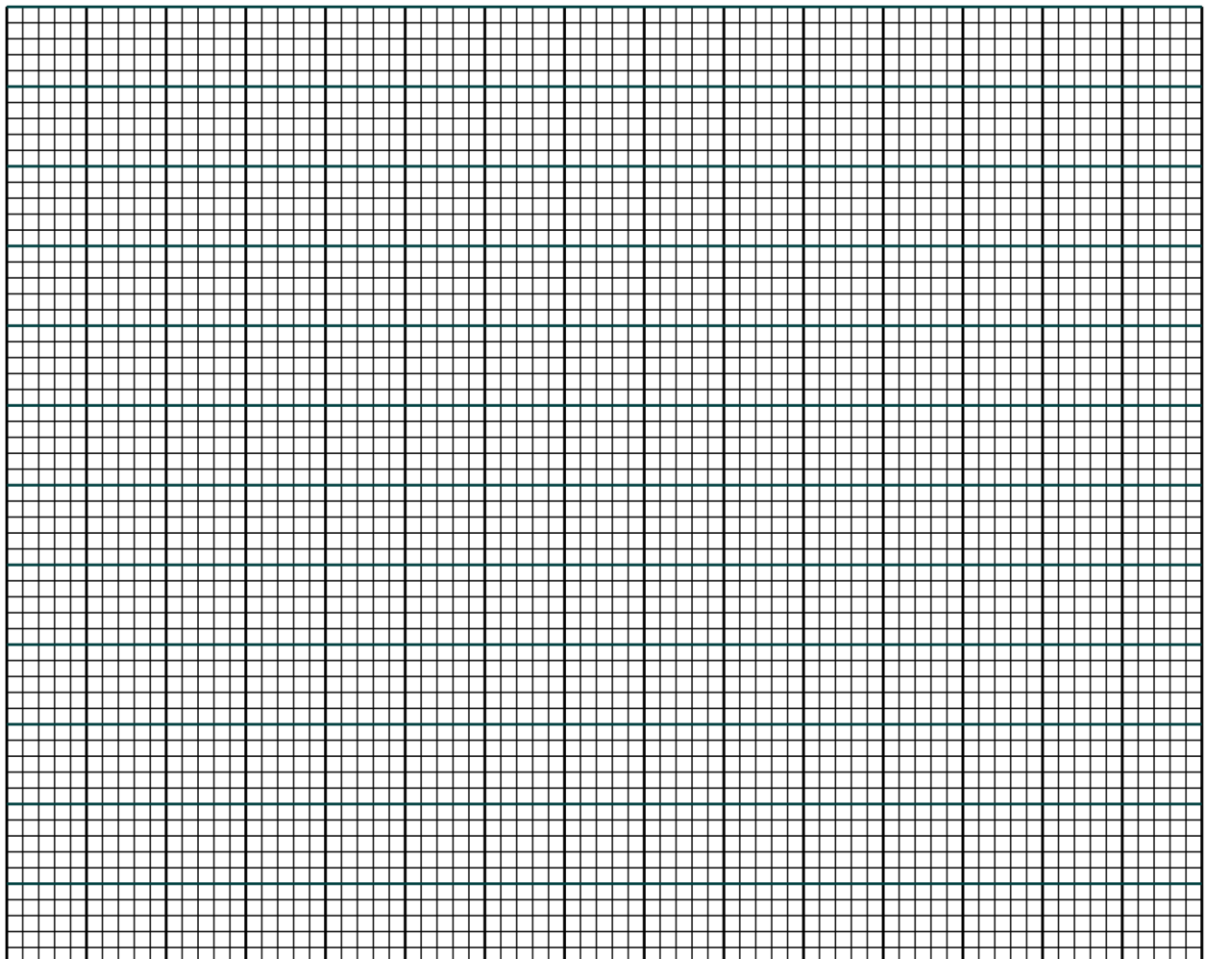
Table 1

(6marks)

i^0	35	40	50	55	60
r^0					

d (cm)					

q) Plot a graph of **d(cm)** against r^0 (5marks)



r) From your graph:

i) Determine the value $\mathbf{r^0}$ where the lateral displacement **d** equals to the breadth **b** of the block.

$\mathbf{r^0}$ = …… (1mark)

ii) Given that **k** sin $\mathbf{r}^0$=1, determine the value of **k.**
(2marks)

k = ……..

QUESTION 2

PART A

You are provided with the following

- A spiral spring
- A retort stand, boss and clamp
- 3 masses each 100g
- A stop watch
- A vernier calipers

(a) Measure the length and the diameter of the spiral spring provided using Vernier calipers.

(i) Length _____cm
(1/2 mk)

(ii) Diameter _____cm
(1/2 mk)

(b) (i) Attach the spiral spring on the stand and clamp as shown in the figure below:

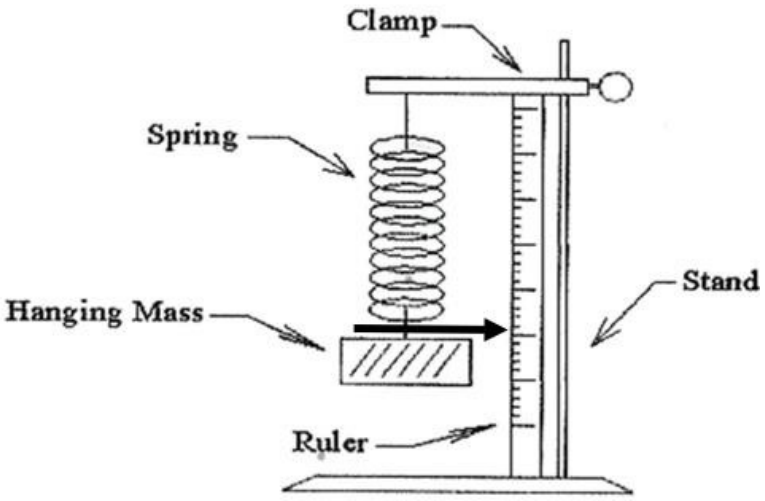


Fig . 3

(ii) Hang a **200g** mass at the lower end of the spiral spring and record the extension **e**

Extension **e** …… **cm** ……**m**
(1mk)

Give the mass a small displacement downwards and then releases it so that it oscillates vertically. Using the stopwatch, time 20 oscillations and record.

Time for 20 oscillations = _____ **s**
(1mk)

(iii) Calculate the periodic time, **T** for one oscillation

T = _____ **s**
(1mk)

(c) Repeat the same procedure using **300 g** mass as in the table below. Fill the table. (6mks)

Table 2

Mass m(kg)	Extension **e** (m)	Time for 20 Oscillations(s)	Periodic time T (s)	$T^2(s^2)$	$\frac{4\pi^2 e}{T^2}$
0.2					
0.3					

(d) Determine the value of $\frac{\mathbf{4\pi^2 e}}{\mathbf{T^2}}$ and hence find its average value **g**

g = ……
(2mks)

PART B

You are provided with the following:

- A voltmeter **(0-5V)**
- **Six** connecting wires
- A capacitor **220µF**
- **Two** dry cells size **D**
- Cell holder
- A stopwatch
- A switch

Proceed as follows

a) Connect the circuit as shown in the figure below.

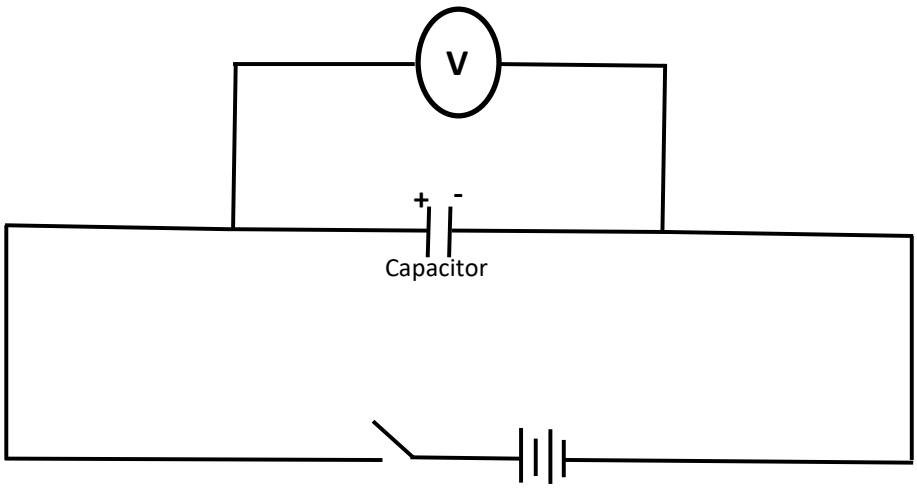


Fig. 4

Make sure that the terminals of the capacitor and those of the battery are correctly connected.

b) Close the switch, read and record the maximum voltage V_o, across the capacitor.

V_o=..... **volts**
(1mk)

c) While the voltmeter shows the maximum voltage V_o, open the switch, start the stop watch

and record the time **t** it takes to reach the value of $\frac{V_O}{2}$.

t =…… **s**
(1mk)

(d)Switch on the circuit for the voltmeter to read maximum $\mathbf{V_o}$. Start the stopwatch while simultaneously switching off the circuit and record time it takes to reach **2.0V** and tabulate the results .
(e) Repeat for the other values of **V** in table 3 below.

Table 3
(4mks)

Voltage (V)	2.0	1.75	1.50	1.25
Time ,t (s)				

(e) Determine the resistance **R** of the voltmeter given that **t= 0.693CR** where **C** is the capacitance of the capacitor and **t= time to drop from Vo to** $\frac{\mathbf{V_O}}{\mathbf{2}}$
(2mks)

R= …… Ω

SERIES 6
PAPER 1

SECTION A (25 MARKS)

Answer all the questions in this section in the spaces provided.

1. Vernier calipers with a zero error of -0.02 cm gave the diameter of a marble as 1.67cm. Use the above information to determine the reading on the vernier calipers. (2 marks)

……

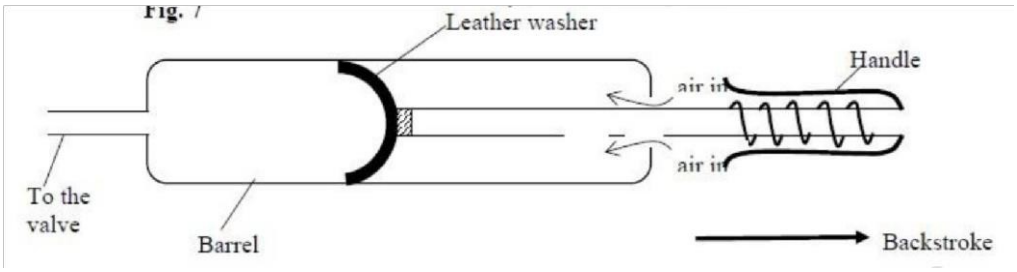
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2. The bicycle pump shown in Figure 7 below is one of the applications of pressure in gases.



During backstroke, the leather washer(valve) was observed to open. Explain this observation. (2 marks)

……

……

……

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3. A 60 g mass is suspended from a spring. When a 15 g mass is added, the spring stretches by 1.2 cm. Given that the spring obeys Hooke's law, determine the spring constant. (Take gravitational field strength, g=10Nkg^{1}). (3 marks)

……

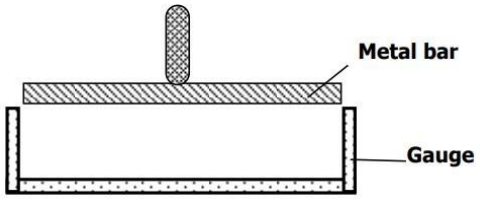
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4. The figure below shows a metal bar that fits into the gauge.



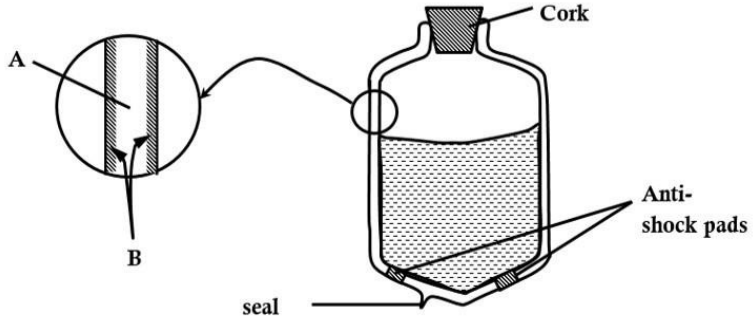
State and explain what should be done to the metal bar so that it doesn't fit into the gauge. (2 marks)

……

……

……

5.The figure shows a thermos flask.



(a) Name the parts labeled A and B. (2 marks)

A……

B……

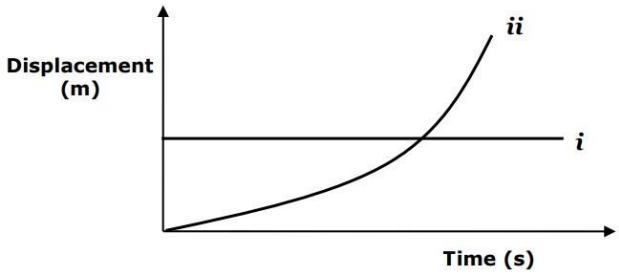
(b) State how the cork is effective in minimizing heat transfer by conduction between the thermos flask and the environment. (1 mark)

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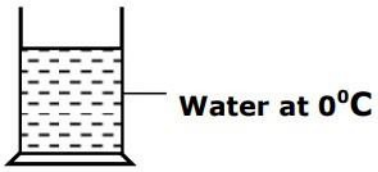
6. Describe the motion represented by the following graphs. (2 marks)



i. …… ii.

……

7. The figure below shows beaker containing water at 0^0 .The beaker is placed on a bench.



State and explain the changes in stability of beaker when water freezes.(2 marks)

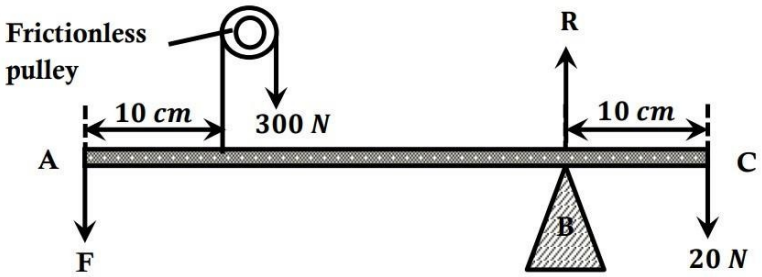
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8. The figure below shows a uniform rod AC of mass 20 kg which is 50 cm long and pivoted at B. A 20 acts at point C and a 300 force is passed through a frictionless N

N pulley. Determine the force F acting at end A. (3 marks)



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9. The pressure of the air inside a car tyre increases if the car stands out in the sun for some time on a hot day. Explain the pressure increase in terms of the kinetic theory of gases. (2 marks)

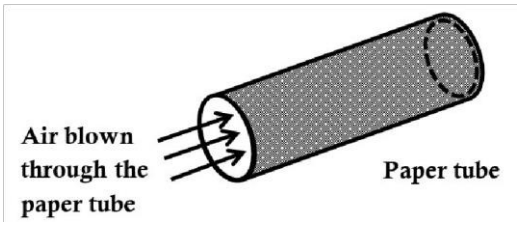
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10. Figure 5 shows a sheet of paper rolled into a tube. When a fast stream of air is blown into the hollow paper tube as shown in the diagram the paper tube collapses. Explain the observation. (2 marks)



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11. State two assumptions made in oil drop experiment. (2 marks)

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SECTION B (55 MARKS)

Answer all the questions in this section in the spaces provided.

12. (a) Name a type of force that act on an object for a short period of time and has large impact. (1 mark)

……

(b) A car of mass 2000kg traveling at 5m/s collides with a minibus of mass 5000kg traveling in the opposite direction at 7 m/s. The vehicles stick and move together after collision. If the collision lasts 0.1 s

(i) Determine the velocity of the system after collision. (3 marks)

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(ii) Calculate the rate of change of momentum on the car. (3 marks)

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(iii) Kinetic energy of the system was noted to be different. Suggest one way of how the kinetic energy may have been lost. (1 mark)

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(iv) When a bus surges forward passengers are jerked backward. Explain. (2 marks)

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13. (a) Define the term specific latent heat of vaporization. (1 mark)

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(b) Water of mass 200g at a temperature of 60^{o}C is put in a well lagged copper calorimeter of mass 80g. A piece of ice at 0^{o}C and mass 20g is placed in the calorimeter and the mixture stirred gently until all the ice melts. The final temperature of the mixture is then measured. (Latent heat of fusion of ice = 33,400Jkg^{-1}, specific heat capacity of water = 4,200Jkg^{-1}K^{-1} Specific heat capacity of the calorimeter = 900Jkg^{-}K^{-1}). Determine:

(i) The heat absorbed by the melting ice at 0^{o}C. (2 marks)

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(ii) The heat absorbed by the melted ice (water) to rise to temperature T.(2marks)

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(iii)The heat lost by the warm water and the calorimeter. (2 marks)

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(iv) The final temperature T of the mixture (3 marks)

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(v) Two students washed a towel each and took them outside to dry them in the sun. Student M folded the wet towel two times before placing it in the sun while student N spread the wet towel. Identify with a reason the towel that dried faster. (2 marks)

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14. a) The machine wheel and axle has a lot of application in real life. Name any one practical example of such machine. (1 mark)

……

b) A man uses a bow to fire an arrow of mass 0.2kg vertically upwards into the air. He stretches the bow by 0.15m with a maximum force of 100N

(i) Calculate the energy transferred to the arrow. (2 marks)

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(ii) Calculate the speed with which the arrow leaves the bow assuming all energy is transferred to the arrow. (2 marks)

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(iii) Determine the greatest height reached by the arrow before it begins to fall. (2 marks)

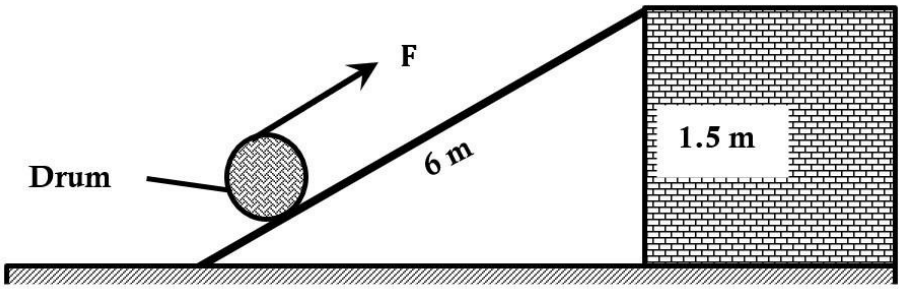
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c) A drum is rolled up a 6 m long ramp leaning on a wall as shown in figure below.

The drum weighs $420\ N$ and it is raised through a height of $1.5m$.



If a force F of $120N$ is applied parallel to the ramp, determine;

(i) The velocity ratio of the ramp. (2 marks)

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(ii) The mechanical advantage of using the machine. (2 marks)

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(iii) The efficiency of the machine. (2 marks)

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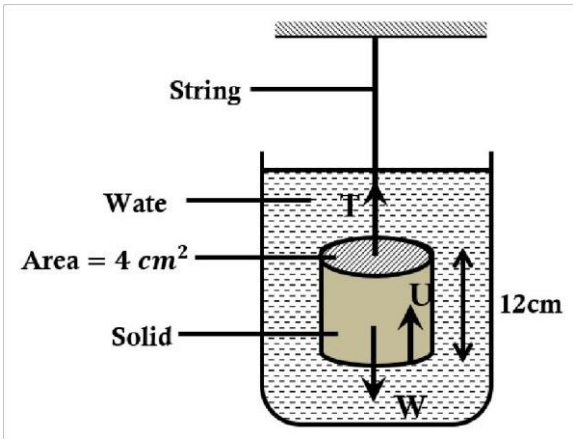
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15. (a) State Archimedes' principle. (1 mark)

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(b) A cylindrical solid of cross-section area 4 cm^2 and density 2.60gm^{-3}, is wholly immersed in water of density 1000 kgm^{-3} and supported by a string as shown in Figure 11. The three forces acting on the block are the tension T, on the string, the weight W, of the block and the upthrust, U due to water. (Take acceleration due to gravity as 10 ms^{-2})



(i) Write an equation connecting the three forces acting on the block when the block is in equilibrium inside the liquid (1 mark)

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(ii) Determine the weight, W of the block. (2 marks)

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(iii) Determine the weight of the liquid displaced by the fully submerged block. (3 marks)

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(iv) Hence determine the tension, T in the string. (1 mark)

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(c) Give a reason why an object weighs more in air than when fully immersed in water. (1 mark)

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16. (a) A lead shot of mass 40g is tied to a string of length 70cm. It is swung vertically at 5 revolutions per second. Determine;

i. Angular velocity (2 marks)

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ii. Linear velocity (2 marks)

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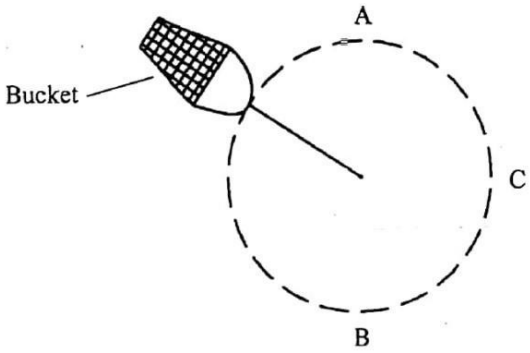
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iii. Maximum tension in the string. (3 marks)

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(b) Figure 2 below shows a bucket filled with water and tied to one end of a string which is used to whirl it in a vertical circular path with a uniform speed v.



(i) State two forces acting on the bucket at any instant. (2 marks)

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(ii) The speed of the bucket is gradually reduced. Explain what is likely to observed when the bucket is at point A. (2 marks)

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PAPER 2

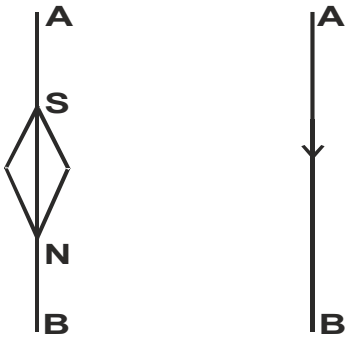
SECTION A (25 MARKS)

Answer all the questions in this section in the spaces provided.

1. State one factor that affects the speed of sound in solids. [1 mark]

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2. A current carrying wire is placed above a compass needle as shown in the figure a) below.



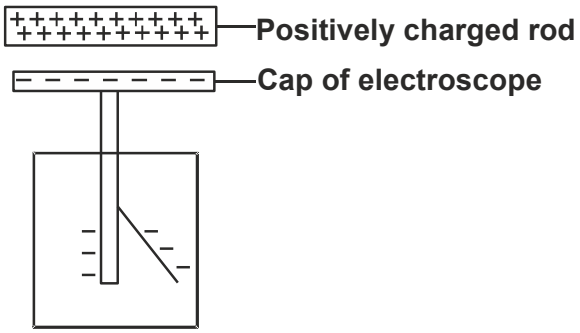
a)

b)

If the current flows in the direction A to B, show in the figure b) above the deflection of the compass needle.

[1 mark]

3. The figure below shows a highly positively charged rod being moved slowly downwards towards the cap of a negatively charged leaf electroscope. It is observed that the leaf initially falls then rises.



Explain this observation. [2 marks]

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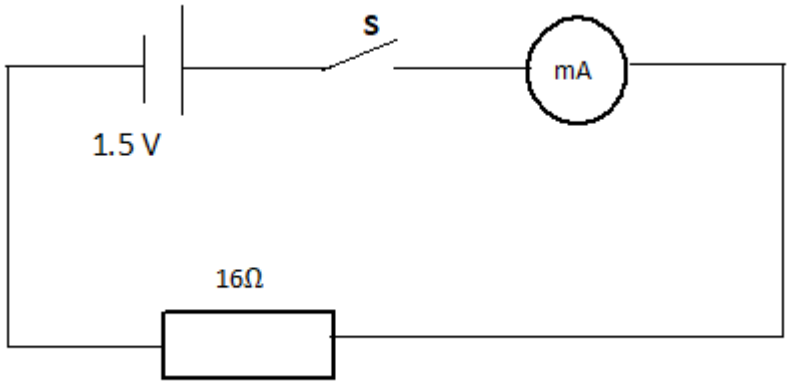
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4. When the switch is closed in the figure below, the milliammeter reads 75 mA. Determine the internal resistance of the cell. [3 marks]



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5. Figure shows the table of electromagnetic. Spectrum in the increasing order of wavelengths.

P	**x-rays**		**Q**	**Infra-red**		

a) Identify the radiation marked P and Q [2 marks]

P……

Q……

6. Using the mode of propagation, distinguish between longitudinal waves and transverse waves. [2 marks]

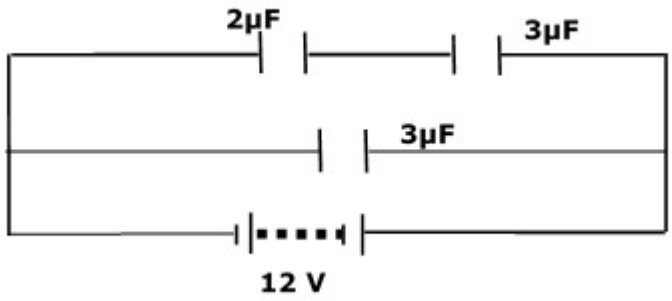
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7. Three capacitors are connected as shown in the diagram below.



From the diagram above, calculate the total capacitance. [3 marks]

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8. The following is part of a radioactive decay series. Find the value of a and b on the following equation. [2 marks]

$$^{234}_{92}U \longrightarrow {}^{a}_{b}X + 2\,\alpha$$

a……

b……

9. Using domain theory, explain how heating causes demagnetization. [2 marks]

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10. State two conditions that should be satisfied for total internal reflection of light to take place. [2 marks]

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11. When a magnet is plugged into a coil, an e.m.f is induced. State two factors that determine the magnitude of e.m.f induced. [2 marks]

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12. Determine the cost of using an electric heater rated 3kW for 12 hours for 1 week given that the cost of electricity is Ksh. 12 per unit. [3 marks]

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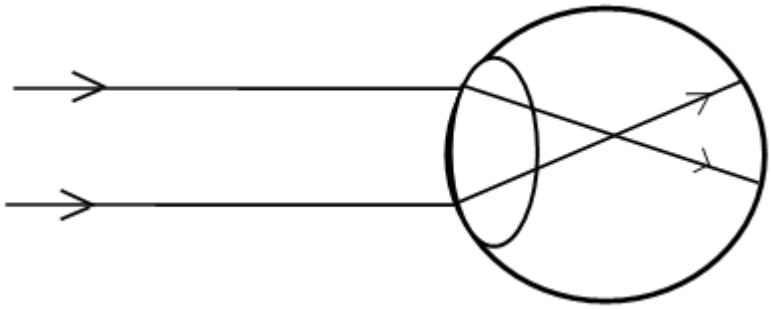
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SECTION B (55 MARKS)

Answer all the questions in this section in the spaces provided.

13. (a). The figure below shows how a distant object is focused in a defective eye.



i. State the nature of the defect. [1 mark]

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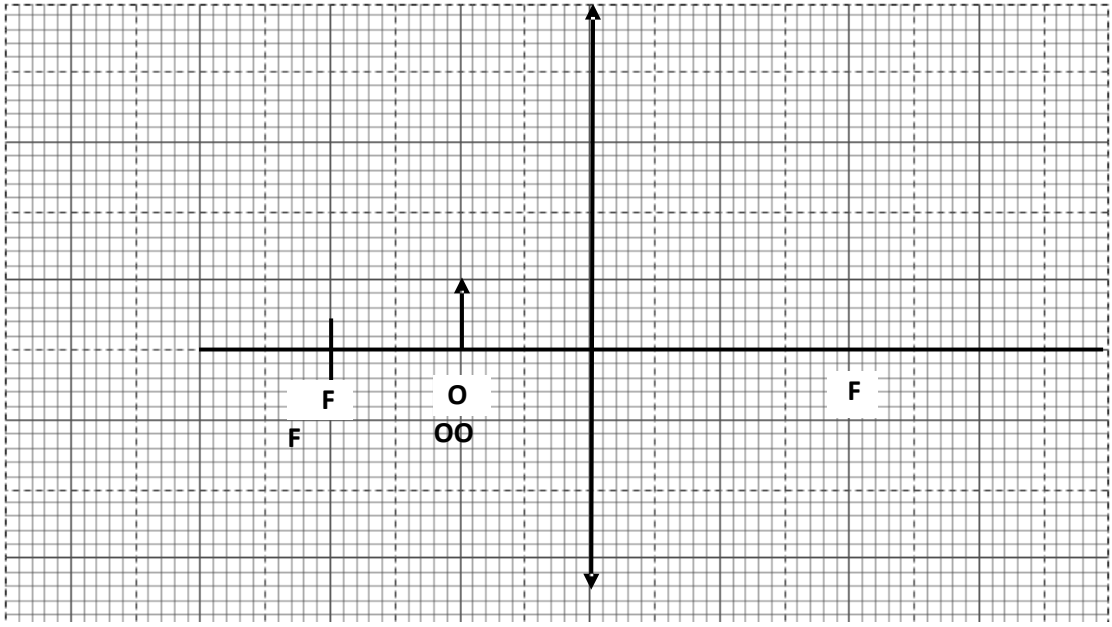
ii. On the same diagram, sketch the appropriate lens to correct the defect and sketch rays to show the effect of the lens. [2 marks]

iii. State one possible cause of the defect. [1 mark)

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(b). The figure below shows an object 1cm high is placed 2cm in front of a convex lens.



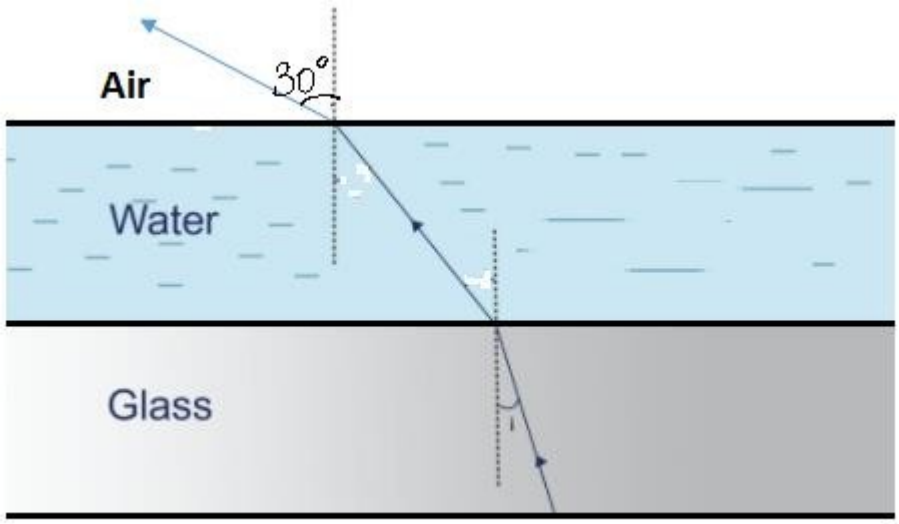
i. On the same axes, draw a ray diagram to show the position of the image formed. [3 marks]

ii. State the nature of the image formed. [1 mark]

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(c). Given that the refractive indices of glass and water are 1.5 and 1.33 respectively, find the angle of incidence, i in the glass as shown in the figure below. [3 marks]



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For ms call 0724351706

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14. (a). State Lenz's law of electromagnetic induction. [1 mark]

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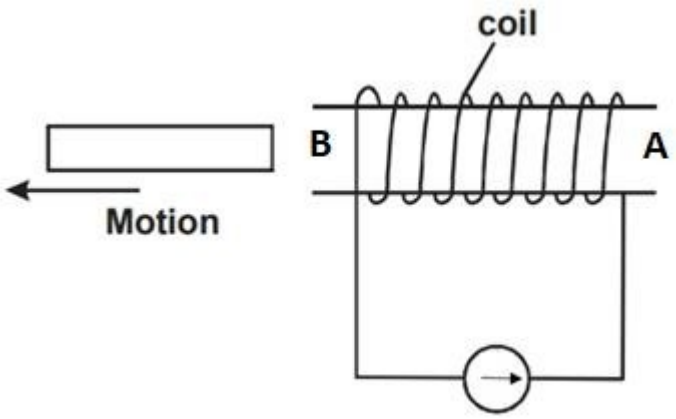
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(b). The diagram below shows a bar magnet being withdrawn from a solenoid.

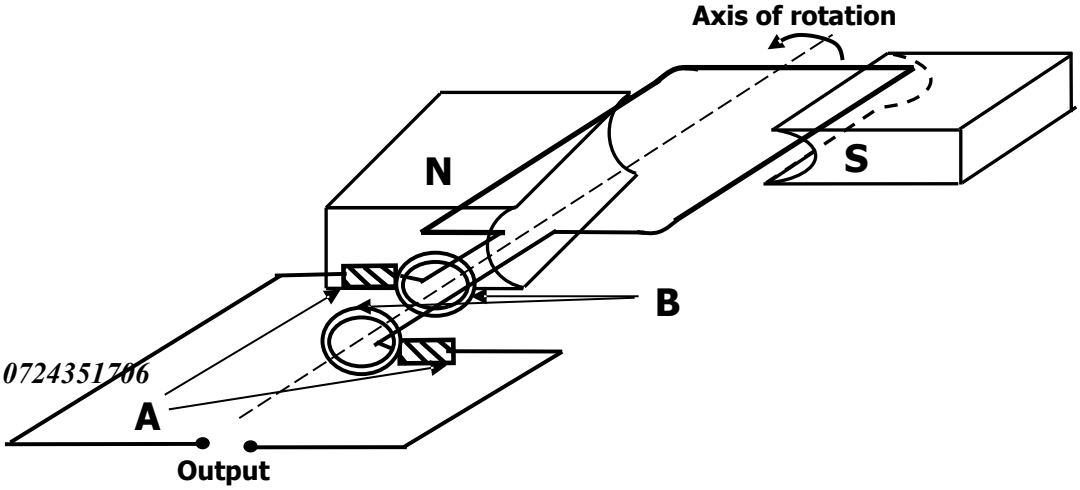


The centre zero galvanometer is observed to deflect in the direction shown. State the polarity of;

[1 mark]

A .....

(c). The figure below shows certain machine



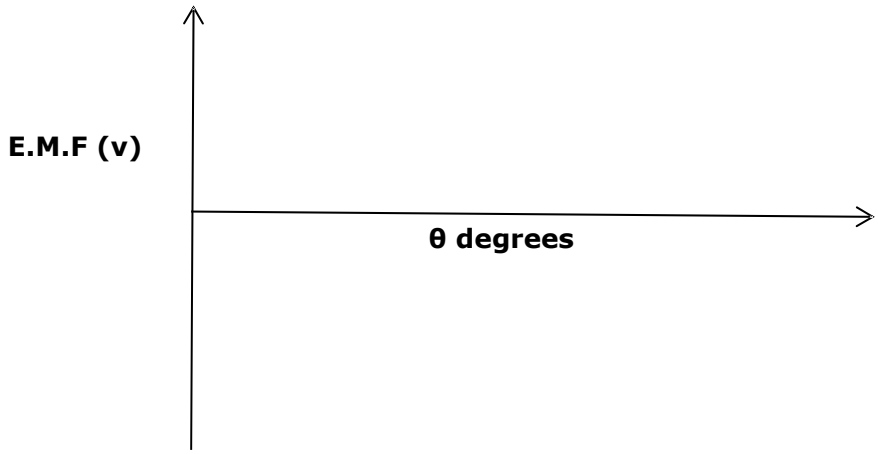
For ms call 0724351706

I. State the name of the type of generator shown above. [1 mark]

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II. On the axes below sketch a graph to show how potential difference across **R** varies with the inclination angle. The coil is initially horizontal. [1 mark]



(d). A student designed a transformer to supply a current of 10A at a P.d. of 60V to a motor from an a.c. mains supply of 240V. If the efficiency of the transformer is 80%, calculate the power supplied to the transformer. [3 marks]

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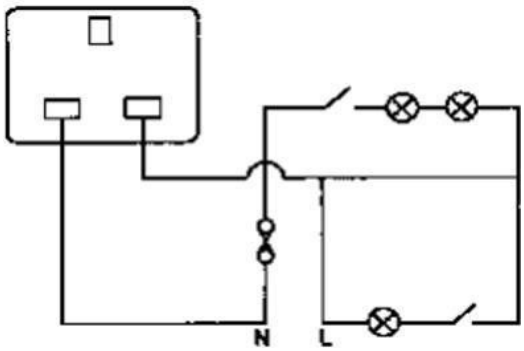
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(e). The figure below shows a domestic wiring system



i) Point out two faults in the circuit. [2 marks]

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ii) What is the fuse made of and why is it necessary in the circuit? [2 marks]

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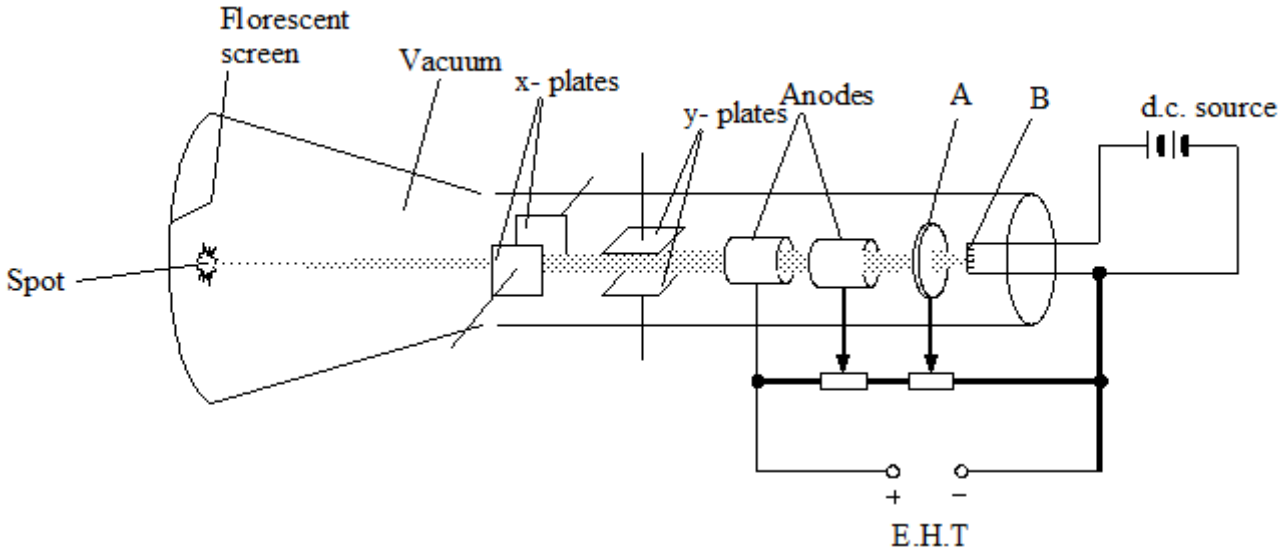
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15. (a). The figure below shows the features of a cathode ray oscilloscope.



(i) Name the parts labeled A and B [2 marks]

A……

B……

(ii) Explain how the cathode rays are produced in the cathode ray oscilloscope. [2 marks]

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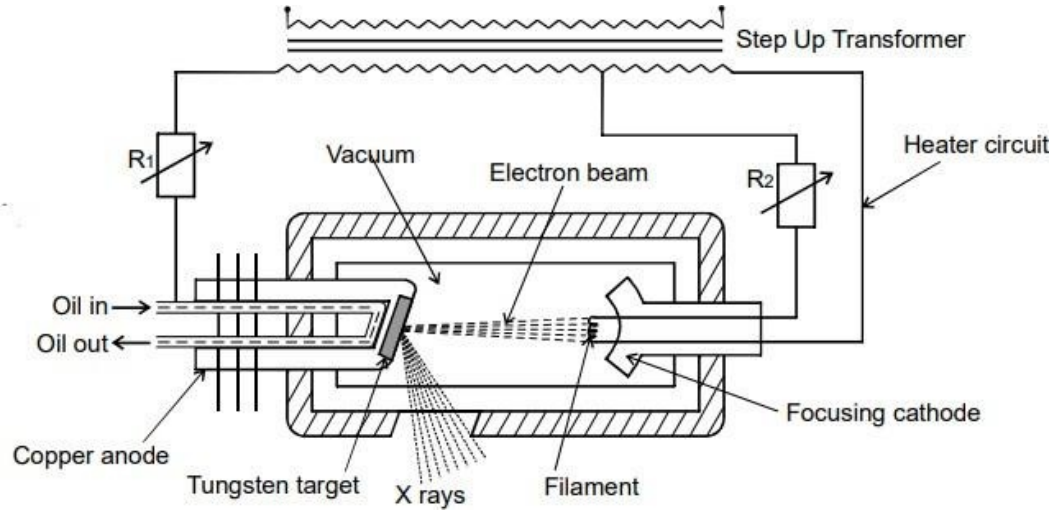
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(b). The figure below shows a simplified illustration of an X-ray tube.



i. State the functions of R_1 and R_2. [2 marks]

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ii. State why the cooling fins are necessary. [1 mark]

For ms call 0724351706

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(c). An x-ray tube has an electron beam current of 10mA and its accelerating voltage is 50KV. The efficiency of the x-ray tube 0.5%. Given that the Plank's constants $h = 6.63 \times 10^{-34}$ Js, Charge on an electron $e = 1.6 \times 10^{-19}$C and Velocity of light $c = 3 \times 10^{8}$m/s. Determine;

i. The number of electrons hitting the target per second. [2 marks]

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ii. The power lost in the tube in form of heat. [2 marks]

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iii. The minimum wavelength of the x-rays produced. [3 marks]

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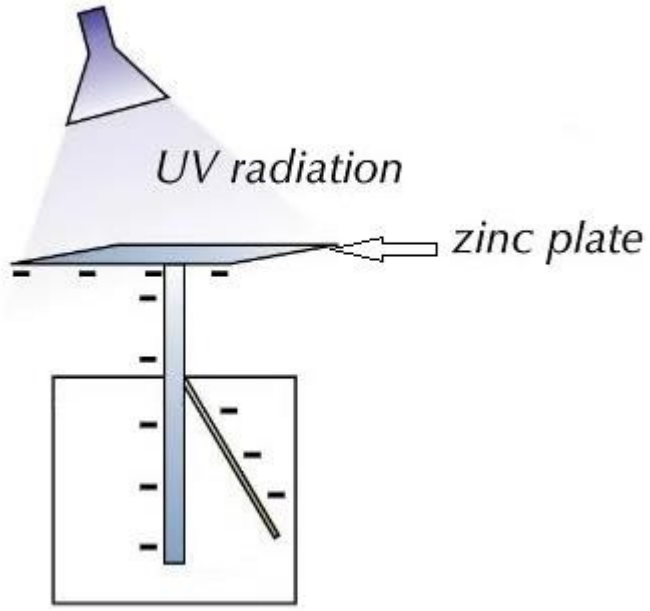
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16. (a). The figure below shows ultra violet light from a mercury vapor lamp striking a polished zinc plate placed on a negatively charged gold leaf electroscope.



State and explain the observation made. [3 marks]

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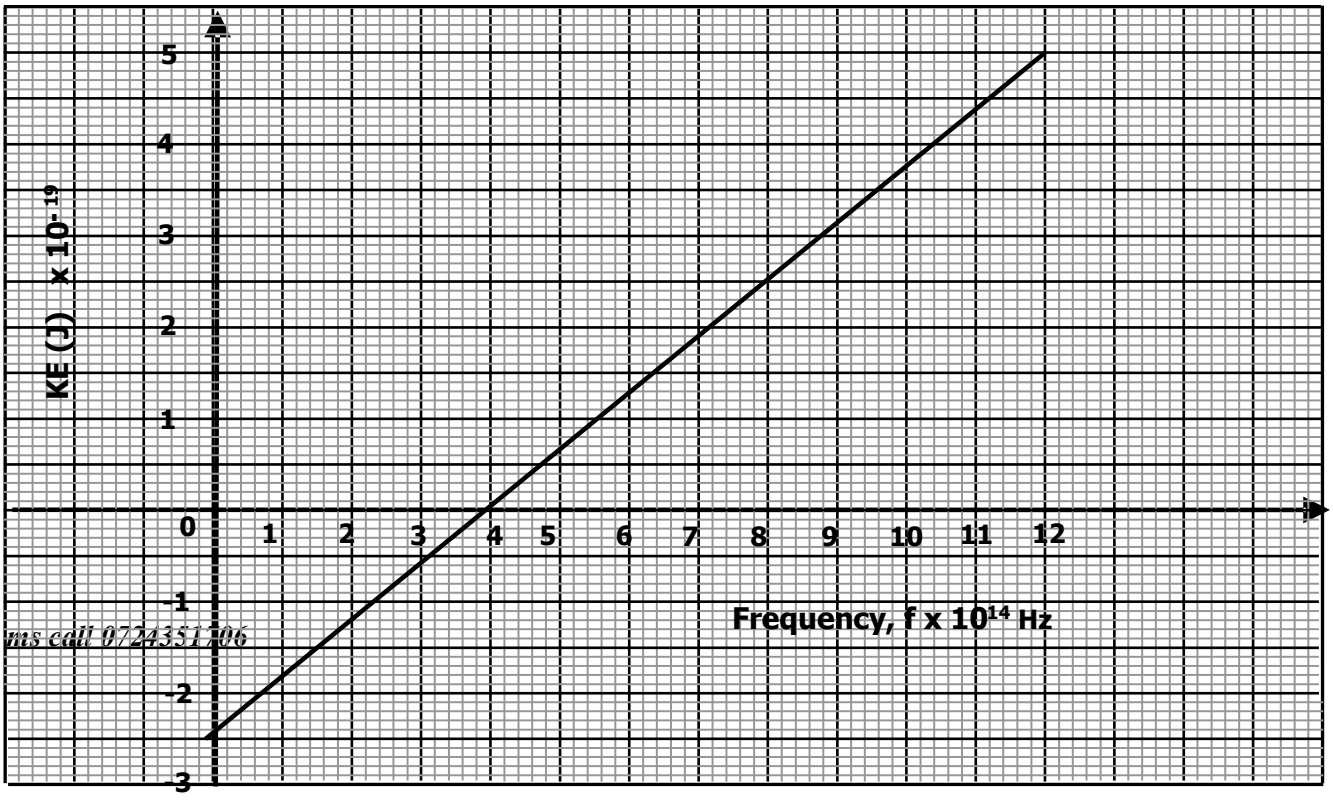
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(b). The graph below shows the variation of kinetic energy (**K.E**) of a photoelectron emitted against frequency of the incident radiation. *(Take Charge of an electron= 1.6 x 10^{-19}C).*



For ms call 0724351706

From the graph the determine the.

i) Threshold frequency of the metal used. [1 mark]

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ii) Planks constant (**h**). [3 marks]

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iii) Work function of the metal in eV. [3 marks]

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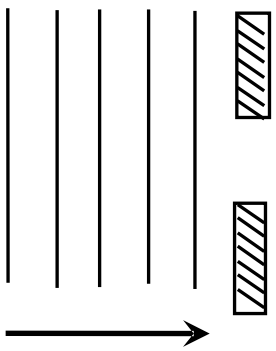
17. (a). On the grid provided sketch a graph of displacement (y-axis) against time of a wave whose amplitude 1.0 cm and frequency 4.0Hz over a time interval of 1.0 seconds. [3 marks]

(b). Describe with the aid of a diagram how you would produce stationary waves on a string. [3 marks]

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(c). The figure below shows wave fronts approaching an opening. Complete the diagram to show the appearance of the wave fronts after crossing the opening. [1 mark]



(d). The frequency of a radio wave is 200KHz. Calculate the wavelength of the radio wave.

(Given c = 3 x 10^8m/s). [2 marks]

For ms call 0724351706

PAPER 3 QUESTION 1

You are provided with:

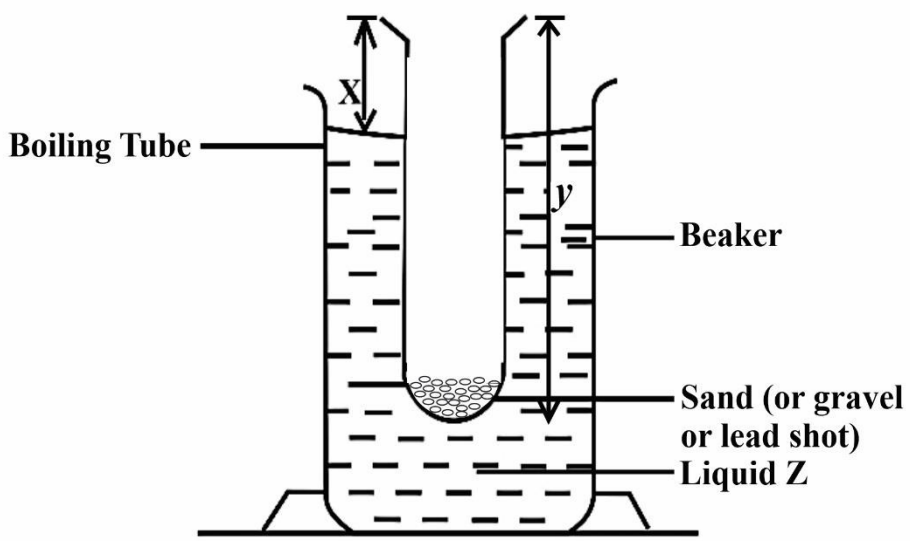
- Test tube
- Some sand
- beaker
- water
- Vernier callipers (to be shared)
- Weighing balance (to be shared)
- Glass block
- 4 optical pins and 4 drawing pins
- Meter rule
- Plain paper and a soft board

PART A

PROCEDURE

1. Place the boiling tube in the Liquid L and keep it upright. Add some sand a little at a time until the tube floats freely upright in the liquid.

2. Measure the length x of the tube above the liquid level. Remove the tube from the liquid and measure its total length y as indicated in the diagram below.



(i) *x*=……cm (1mark)

X=……..m (1mark)

(ii) *y*= ……..cm (1mark)

Y=……..m (1mark)

3. Wipe off the liquid from the outside of the tube and measure the mass of the tube and its content.

m ……g (1mark)

m …… kg (1mark)

4. Using the Vernier callipers, measure the outer diameter of the tube at about the middle of the tube.

d = ……..cm (1mark)

D=…….m (1mark)

5. Given that $K = \frac{m}{\pi(\frac{d}{2})^2(y-x)}$

determine the value of K in SI unit. (3marks)

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6. State what quantity k represents? (1mark)

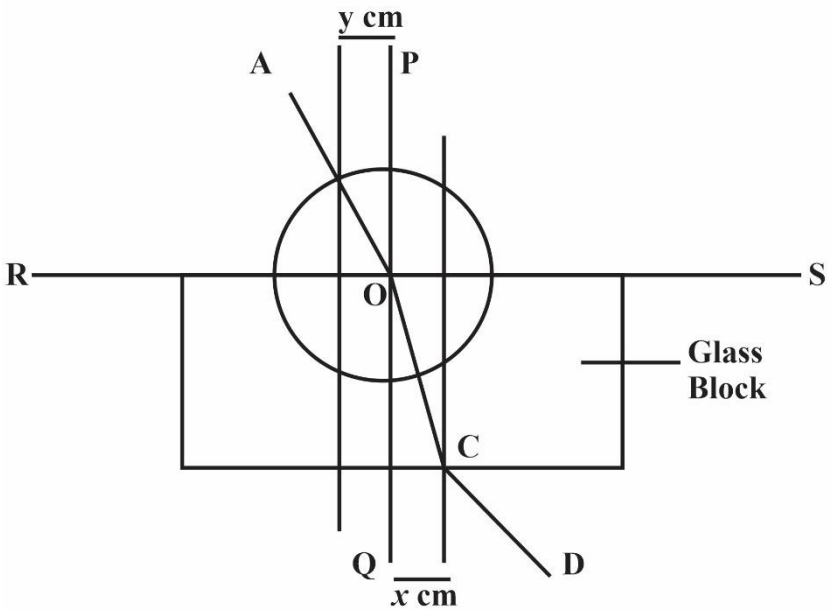
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PART B

a) Measure and record the thickness of the glass block using the meter rule .

t = …….cm (1mk)

b) Fix the sheet of paper onto the soft board using the given drawing pins. Draw two lines, PQ and RS intersecting at right angles at the centre of the paper marked O as shown in the diagram below



c) Draw a circle of radius 3cm having O as its centre.
d) Draw a line AO making an angle of 20^0 with PQ. Stick two optional pins along AO. Place the glass block with the longest edge along RS and trace its outline.
e) Looking through the opposite face of the glass block, stick two other pins along CD so that all the four pins appear to be on a straight line when viewed through the glass block.
f) Remove the glass block and draw lines CD and CO.
g) Draw line MN, perpendicular to RS passing through K as shown in the diagram.

h)Record the corresponding values of x and y. Replace the glass block in exactly the same position as before and repeat the experiment with angle AOP=30^0, 40^0 and 50^0 .

Angle AOP (^{0})	20	30	40	50
X (cm)				
Y (cm)				

(5 marks)

j) Determine the value of n at 30^0 given that n =y/x (2 marks)

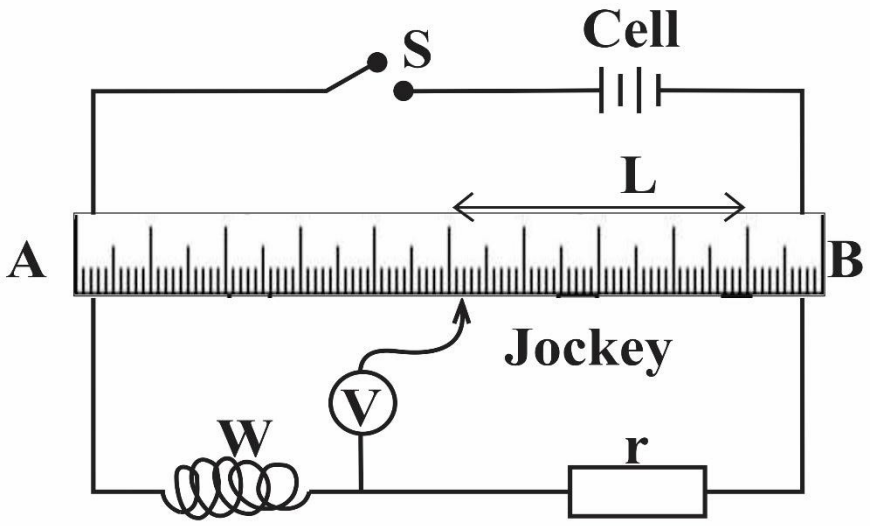
QUESTION 2

You are provided with:

- Switch
- Voltmeter (0- 5v)
- 2 dry cells
- 2.2 ohm resistor labelled r
- 8 connecting wires (4 with crocodile clips)
- A coiled nichrome wire of length 15cm labelled W
- A nichrome wire 1m long mounted on a mm scale labelled AB

PROCEDURE

(i) Set up the apparatus as shown below.



(ii) close the switch and place the jockey at L= 5cm from B and record the voltmeter reading.

(iii) Repeat this for some values of L indicated in table below, record the corresponding values of V.

Length, L (cm)	5	15	25	35	45
Length (m)					
V (volts)					

(3marks)

(b) i) Interchange the voltmeter terminals. Place the jockey at A and make sure the voltmeter pointer deflects to the right.

(ii) Place the jockey on the wire at 95cm from B and record the voltmeter reading in the table below

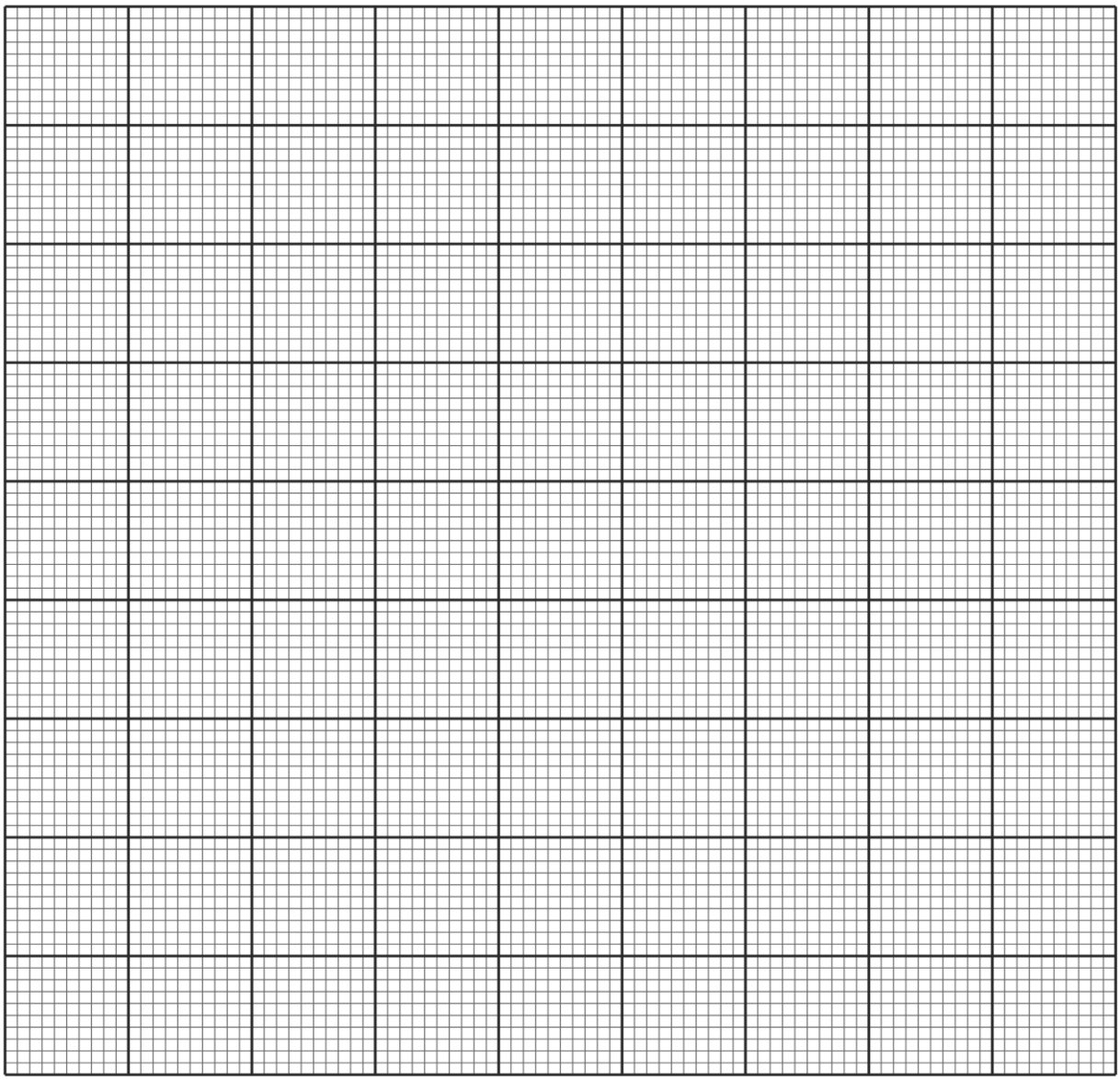
(iii) Repeat this for other values of L in the table below.

Length (cm)	100	95	90	85	80
Length (m)					
V (volts)					

(3 marks)

c) On the same axis plot two graphs of V against L using the values in tables above.

(8marks)



d) From your graph determine:

(i) The value of V when L = 0

……(2 mark)

(ii) The value of L where the two graphs intersect.

L = …… (1mark)

e) Work out the value of the unknown resistance of the wire using the expression.

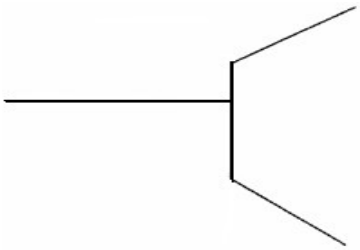
$$R_p = \frac{R_r L}{1-L}$$

where R_r is the resistance of the resistor r. (3 marks)

SERIES 7
PAPER 1

SECTION A: 25marks

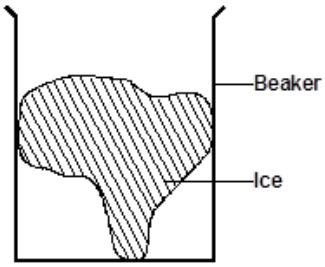
1.The figure below shows part of micrometer screw gauge with 50 divisions on the thimblescale. Complete the diagram to show a reading of 5.73mm.(2 marks)



2.A bottle containing a smelling gas is opened at the front bench of a classroom. State the reason why the gas is detected throughout the room. (1 mark)

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.....3.The figure below shows beaker containing a block of ice.



State and explain the change in stability when the ice melts. (2marks)

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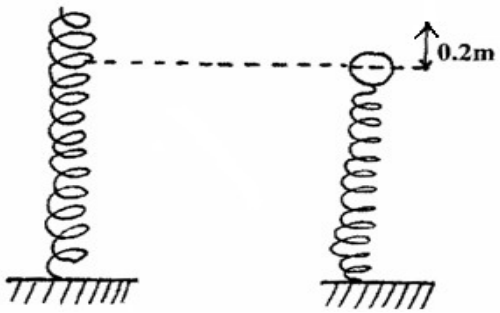
4. An aero plane is moving horizontally through still air at a uniform speed. It is observed that when the speed of the plane is increased, its height above the ground increases. State the reason for this observation.
(2 marks)

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5. A steel ball of mass 0.05kg was placed on top of a spring on a level ground. The spring was then compressed through a distance of 0.2m.

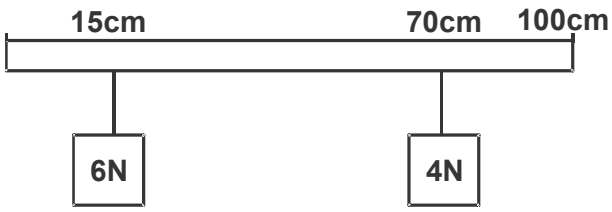


If the spring constant is 15N/m. Calculate the maximum height reached when the spring is released. (3marks)

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6. The figure below shows a uniform metre rule of weight 3N supporting two weights. The metre rule is pivoted somewhere such that it is horizontally balanced. (Pivot not shown)



The 6N weight is at 15cm mark while the 4N weight is at 70cm mark. Determine the position of the pivot from zero cm mark. (3 marks)

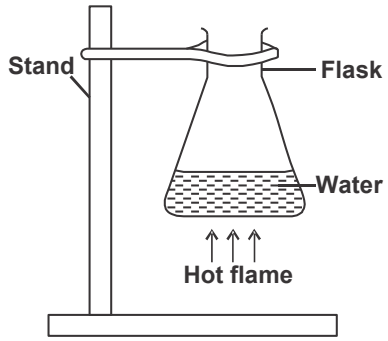
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.....7. State one environmental hazard that may occur when oil spills over a large surface area of the sea. (1 mark)

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8. The figure shows a flat bottomed flask containing some water. It is heated directly with a very hot flame. Explain why the flask is likely to crack. (2marks)

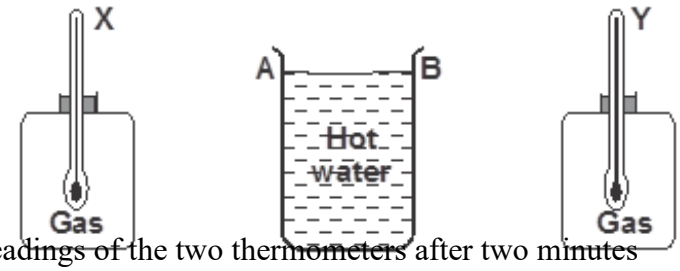


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9.The figure below shows a cylindrical container having hot water at 95°C. End A is shiny while end B is dull black. At equal distances from the container is placed two identical gas jars fitted with thermometers X and Y.



Compare the readings of the two thermometers after two minutes (1 mark)

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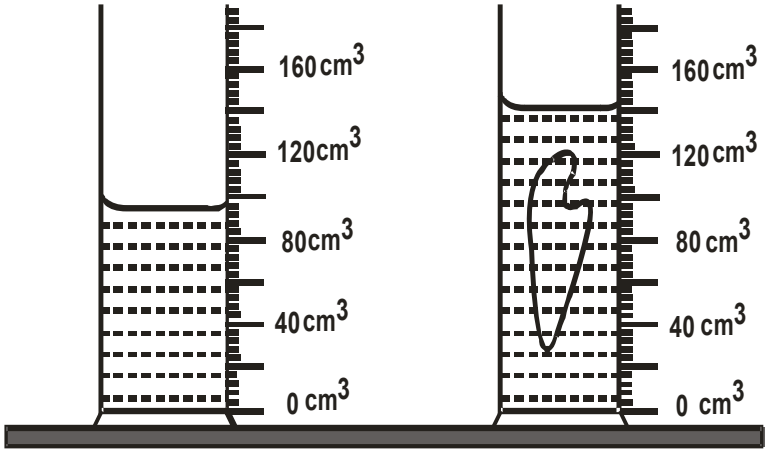
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10. Give a reason for your answer in **question 9** above (1 mark)

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11.The figure below shows the change in volume of water in a measuring cylinder when an irregular solid is immersed in it.



Given that the mass of the solid is 268g, determine the density of the solid in SI units.

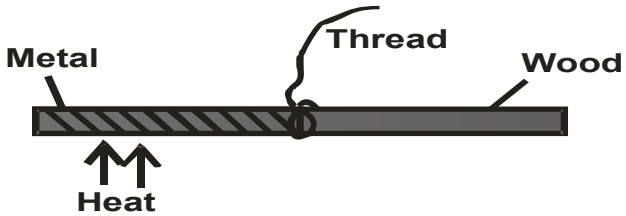
(3 marks)

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12. The following figure shows a rod made of wood on one end and metal on the other end suspended freely with a piece of thread so that it is in equilibrium.



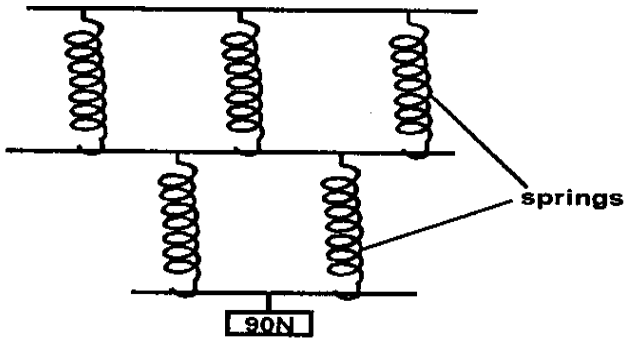
The side made of metal is now heated with a Bunsen flame. State with a reason, the side to which the rod is likely to tilt (2 marks)

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13. The spiral springs shown in the figure below are identical. Each spring has a spring constant, *k = 300N/m*



Determine the total extension of the system. (Take the weight of the cross bars to be negligible) (2 marks)

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SECTION B: 55marks

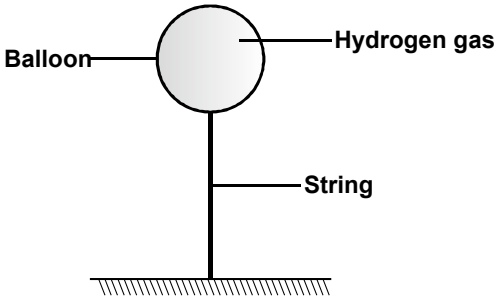
14. (a) State the Archimedes principle. (1 mark)

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b) A rubber envelope of a hydrogen filled balloon having volume of $2m^3$ is held in position by a vertical string as shown below.



The mass of the balloon is 1.3kg. Given that density of hydrogen is $0.1kg/m^3$ density of air is $1.3kg/m^3$. Calculate

(i) the total weight of the balloon including the hydrogen gas. (2 marks)

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(ii) theup thrust. (2 marks)

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(iii) the tension in the string. (2 marks)

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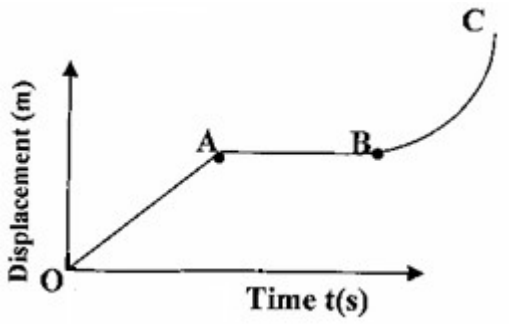
..... (c) A solid weighs 50N in air and 44N when complete immersed in water. Calculate

i) Relative density of the solid. (2 marks)

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(ii) Density of the solid. (2 marks)

15.a) The figure below shows a displacement-time graph of the motion of a particle.



Describe the motion of the particle in the region. (3marks)

OA……..……..…

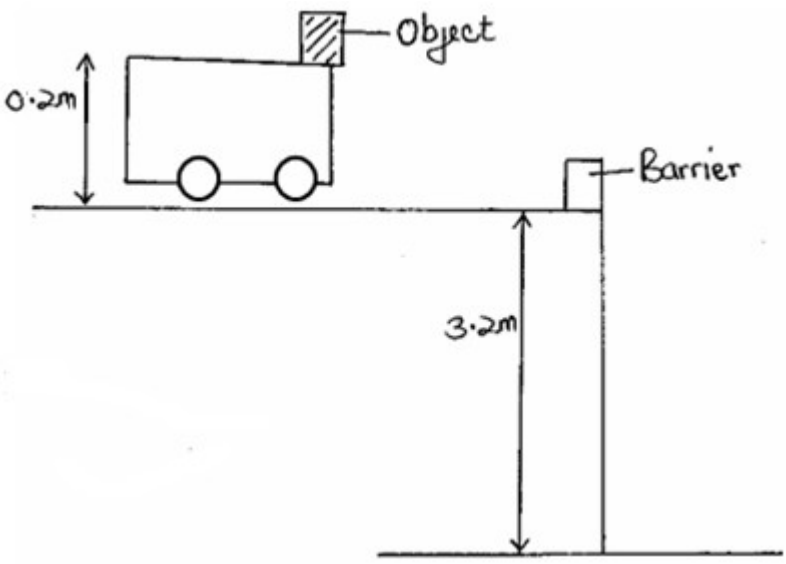
AB…….……..

BC……..……..

(b) State the Newton's first law of motion. (1 mark)

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c) The figure below shows a trolley moving towards a barrier at a constant velocity of 20m/s.Use this information to answer the questions that follows.



i) Sketch the path followed by the object after the impact (1mark)

ii) Give a reason why the object on the trolley flies off on impact. (1 mark)

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iii) Determine the time taken by the object to reach the ground. (2 marks)

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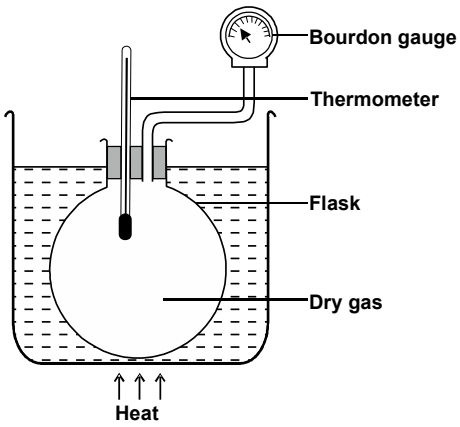
iv) Determine the horizontal distance covered by the object from the point of impact to the point where it reached the ground. (2 marks)

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16. a) What is meant by absolute zero temperature? (1 mark)

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b)The set up below was used by a group of form three students to verify pressure law.



Describe briefly how the set-up can be used to verify pressure law. (4 marks)

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c) A 4.5cm³ bubble released at the bottom of a dam measured 18cm³ at the surface of the dam. Work out the depth of the dam taking atmospheric pressure to be 10^5 Pa and the density of water as 1g/cm³.
(3marks)

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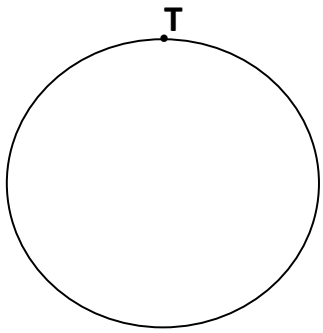
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17(a) One of the factors that affect the centripetal force is the mass of the body. State anotherfactor.
(1mark)

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(b) A mass of 400g is rotated by a string at a constant speed V in a vertical circle of radius 100cm. The tension in the string is 9.2N which is experienced at point T.



i) Determine the velocity V of the mass at point T. (3marks)

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ii) Determine the tension in the string at the bottom of the circle. (2marks)

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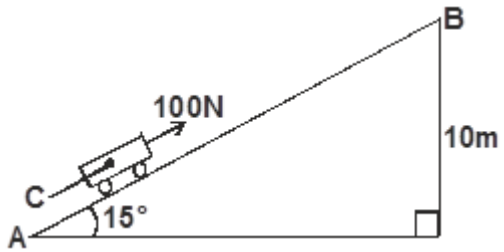
c) State two applications of circular motion (2marks)

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18.The figure below shows an inclined plane, a trolley of mass 30kg is pulled up a slope by a force of 100N parallel to the slope. The trolley moves so that the centre of mass C travels from points A to B.



a) What is the work done on the trolley against the gravitational force in moving from A to B? (2marks)

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b) Determine the work done by the force in moving the trolley from A to B (2 marks)

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c) Determine the efficiency of the system. (3 marks)

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d) Determine the mechanical advantage of the system. (3 marks)

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19. a) Explain why it is advisable to use a pressure cooker for cooking at high altitudes.

(1 mark)

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b) A block of metal of mass 150g at 100°C is dropped into a lagged calorimeter of heat capacity 40J/K containing 100g of water at 25°C. The temperature of the mixture is 34°C. (specific heat capacity of water = 4200J/kg/K).

Determine:

(i) Heat gained by the calorimeter. (2marks)

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(ii)Heat gained by water. (2marks)

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(iii) Specific heat capacity of the metal block. (3marks)

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PAPER 2

SECTION A: 25marks

1. The chart below shows an arrangement of different parts of the electromagnetic spectrum.

Radio wave	A	Infrared rays	B	Ultra-violet	χ-Rays

Name the radiation represented by

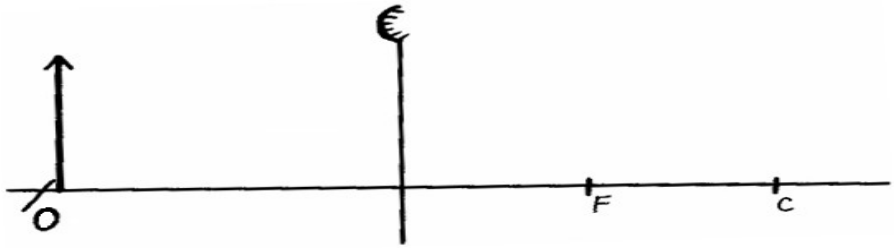
A ……. (1mark)

State one use of radiation represented by B (1mark)

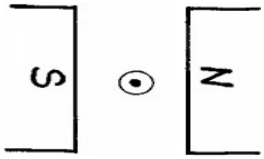
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2. An object O is placed in front of convex mirror as shown in the diagram below. Complete the diagram to locate the position of the image, 1. (3 marks)



3.The figure below shows a wire carrying current whose direction is out of the paper. The wire is placed in a magnetic field.



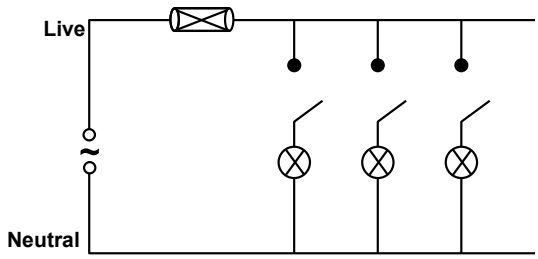
(a)Indicate on the figure the direction of the force F, acting on the wire. (1 mark)

(b)State what would be observed on the wire if the direction of the current is reversed. (1 mark)

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4. The figure below shows part of the lighting circuit of a house.



i) Give a reason why a fuse is included in the circuit. (1 mark)

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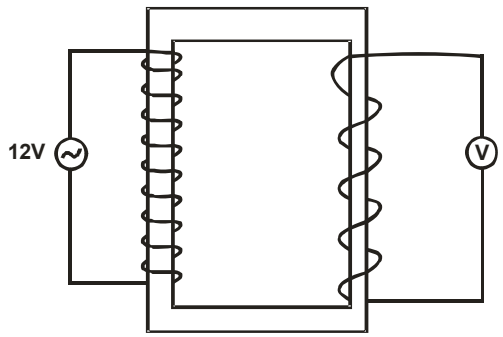
ii) If each lamp has a power of 60W at voltage of 240V. Calculate the current through one lamp when it is switched on.(2 marks)

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5.Figure 5 below shows a simple transformer connected to a 12v a.c source and an a.c voltmeter.

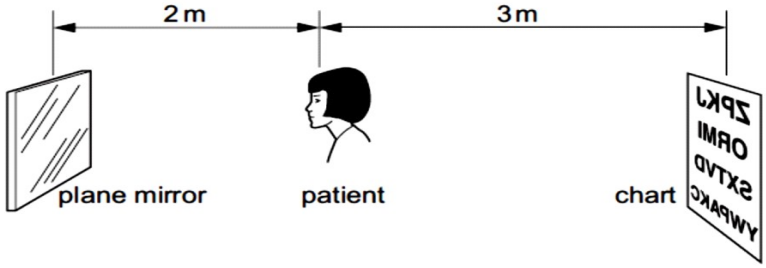


Determine the reading on the voltmeter. (2 marks)

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6. The diagram shows a patient having her eyes tested. A chart with letters on it is placed behind her and she sees the chart reflected in a plane mirror.



Determine how far away from the patient, the image of the chart is seen. (2 marks)

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7. State Snell's law. (1 mark)

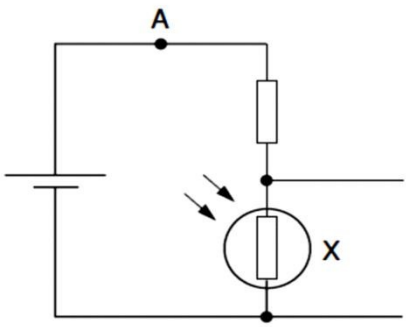
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8. The figure below shows an electric circuit.



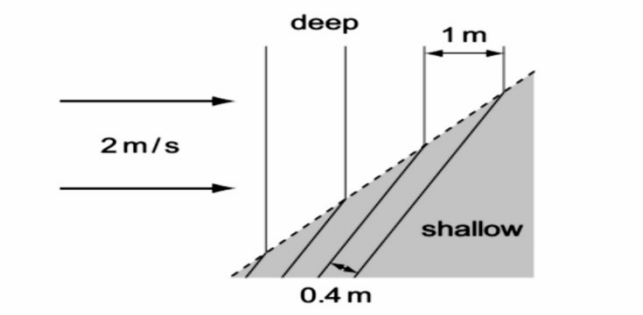
State and explain how the potential difference across X varies as the light shining on it becomes brighter. (2marks)

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9. Waves pass from deep water to shallow water and refraction occurs.



Calculate the speed of the waves in the shallow water (2 marks)

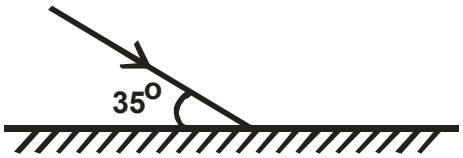
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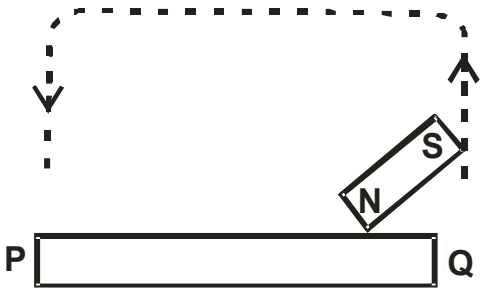
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10.The diagram below shows a ray of light striking the plane at 35° as shown below.

State the angle of reflection. (1 mark)



11.The figure below shows an iron bar being magnetized by stroking it with a magnet.



Indicate on the iron bar the polarity of resulting magnet. (1 mark)

12.An echo sounder of a ship transmits sound waves to the depth of the sea and receives the echo after 2.4seconds. If the speed of sound in water is 1600ms^{-1}, determine the depth of the sea. (3 marks)

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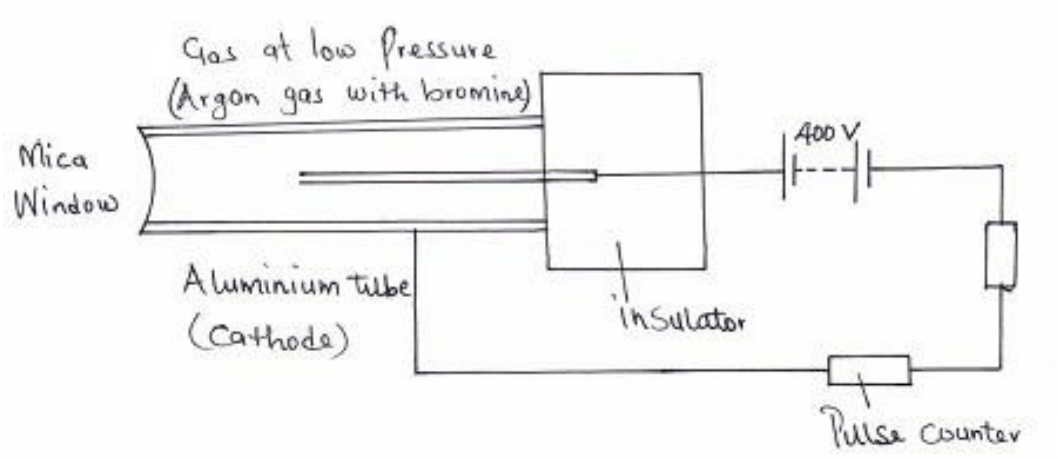
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13.It is observed that when a charged body is brought near the cup of a positively chargedelectroscope, the divergence of the leaf increases.State the type of charge on the body. (1mark)……

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SECTION B (55 marks)

14. (a) The figure below shows a diagram of a Geiger Muller tube connected to a power supply and a pulse counter.



(i)Why should the argon gas be at low pressure? (1mark)

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(ii)State the purpose of the bromine gas in the tube. (1mark)

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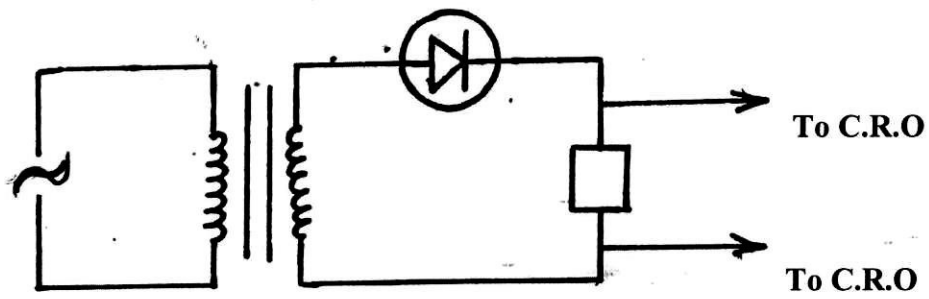
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(iii)Suggest one way of increasing the sensitivity of the tube(1mark)

(iv)Find the value of a and b in the following equation. (2marks)

$$^{234}_{92}U \rightarrow ^{a}_{b}X + 2\,\alpha$$

b)The figure below shows a PN junction diode used in a rectifier.



i)) What is an extrinsic semi conductor? (1mark)

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ii)What type of rectification is shown? (1mark)

……

iii)Describe how the rectification is achieved (2marks)

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iv)In the space provided below, sketch the output signal displayed on the CRO during the rectification process. (2marks)



15.The figure below shows a cathode ray tube

a) State the function of the

i) Heater (1mark)

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ii) Extra High Tension (E.H.T.) (1 mark)

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b) State how the intensity of the fluorescence on the screen can be increased. (1 mark)

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c) State the effect of having air in the tube instead of a vacuum (1 mark)

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d) State one properties of cathode rays (1 mark)

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e) Distinguish cathode rays and X-rays (1 mark)

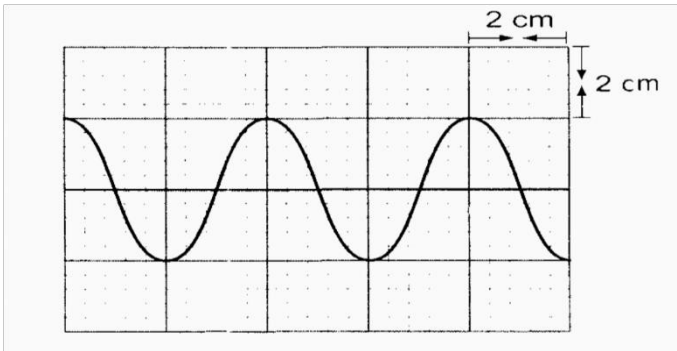
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f) Give one advantages of using a C.R.O instead of a voltmeter in measuring voltages (1 mark)

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g) The figure below shows an a.c. voltage. If the Y-gain control reads 10V/cm and the time base reads 5 milliseconds/cm



Calculate:

i) The frequency of the alternating voltage (2 marks)

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ii) Peak to peak voltage of the alternating voltage (2 marks)

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16 (a)(i) It is observed that when ultra- violet radiation is directed onto a clean zinc plate connected to the cap of a negatively charged leaf electroscope, the leaf falls .Explain this observation
(2 marks)

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(ii) State why this observation does not occur if the electroscope is positively charged (1 mark)

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(iii) ,Explain why the leaf of the electroscope does not fall when infra- red radiation is directed onto the zinc plate (1 mark)

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b)State the effect on the electrons emitted by the photoelectric effect when:

(i) The intensity of incident radiation is increased (1 mark)

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(ii) The frequency of the incident radiation is increased (1 mark)

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c) Light of wavelength 4.3 x 10 $^{-7}$m is incident on two different metal surfaces, nickel and potassium. (Take speed of light as 3.0 x 10^{8} ms^{-1} and planks constant h as

6.63 x $l0^{-34}$Js).

(i) Determine the energy of the incident radiation. (3 marks)

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(ii) If the work function of nickel is 8.0 x 10 $^{-19}$J and that of potassium is 3.68 x 10 $^{-19}$J, state with a reason from which of the two metals the given light will eject electrons. (2 marks)

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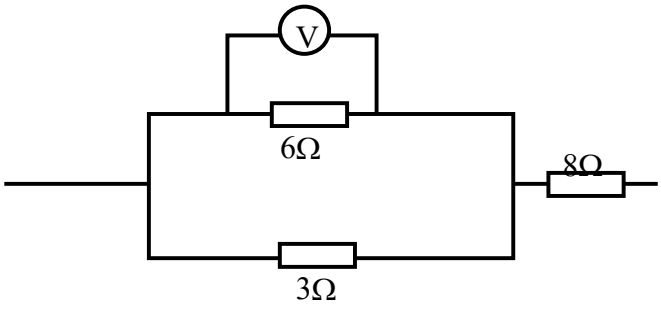
(iii) Determine the velocity of the emitted electrons from the metal surface in b(ii).

(Take the mass of an electron as 9.1 x 10^{-31} kg). (2 marks)

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17(a) The figure below shows three resistors as shown.



If the voltmeter reads 4V, find the

(i) Effective resistance (3marks)

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(ii) Current through the 3Ω resistor (2 marks)

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(iii) Potential difference across the 8Ω resistor if the voltage total voltage in the circuit is 10V
(1 mark)

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(c) (i) What is meant by the term "terminal voltage" as used in current elecricity?

(1 mark)

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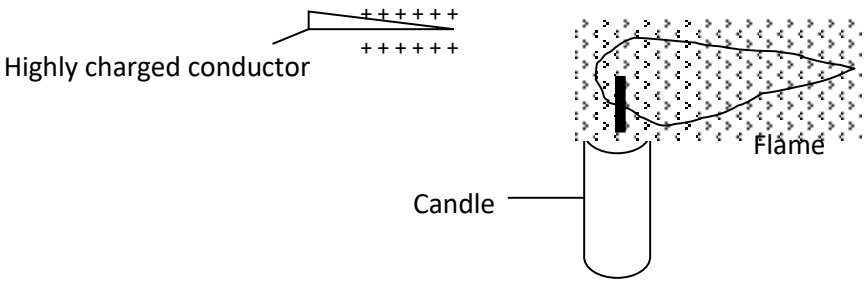
(ii) A cell supplies a current of 2.0A when connected to a 0.4Ω resistor and 1.5A when the same cell is connected to a 0.9Ω resistor.Find the e.m.f and the internal resistance of the cell.

(3marks)

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18((a) Give a reason why a candle flame is blown when a highly charged conductor is brought close to it as shown below. (1mark)



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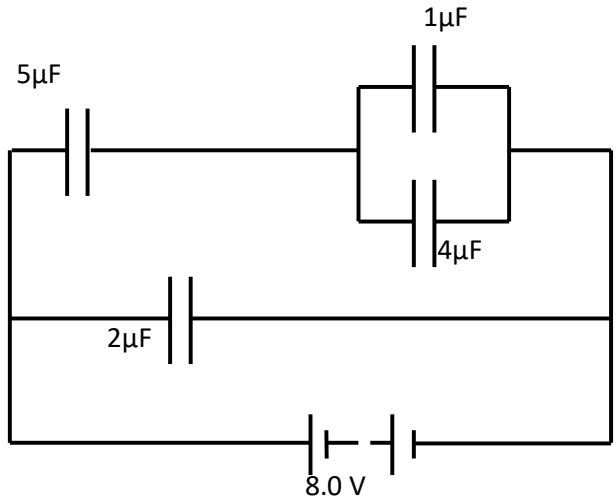
b) State two factors that affect capacitance of a capacitor (2 marks)

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c)The figure below shows 1μF, 2μF, 4μF and 5μF capacitors connected to a battery.



Determine:

i)The total capacitance. (3marks)

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ii)The total energy stored by the capacitors. (2marks)

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iii) Voltage across the 4μF capacitor. (2marks)

PAPER 3 QUESTION 1 (PART A)
You are provided with the following apparatus:

- A rectangular glass block.
- Four optical pins.
- A soft board.
- A protractor.
- 30cm ruler.
- 2 white plain papers.
- A plane mirror.
- A vernier calipers (to be shared)

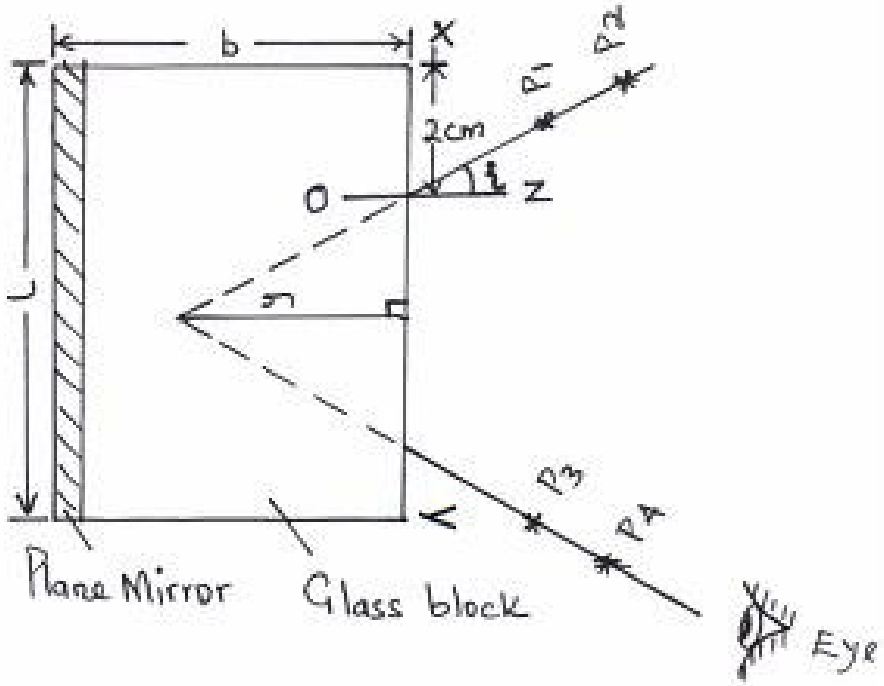
PROCEDURE

(a) Trace the outline of the glass block on the white paper.

(b) Draw a normal ON, 2cm from point X on side XY.

(c) Measure an angle (i) 10º from the normal.

(d) Place back the glass block on the outline and fix a plane mirror vertically along the length of the glass block on the opposite side of XY using a cello tape as shown in the figure below.



(e) Fix two pins P_1 and P_2 as shown in the figure.

(f) By observing image of P_1 and P_2, locate two pins P_3 and P_4 such that they appear to be in line with images of P_1 and P_2.

(g) Remove the pins and the block. Join P_3P_4 and produce the line to meet line P_1P_2 produced

(h) Measure the perpendicular distance y.

(i) Repeat the same for angles of 15º, 20º, 25º, 30º, 35º and 40º and record the results in table 2 below.

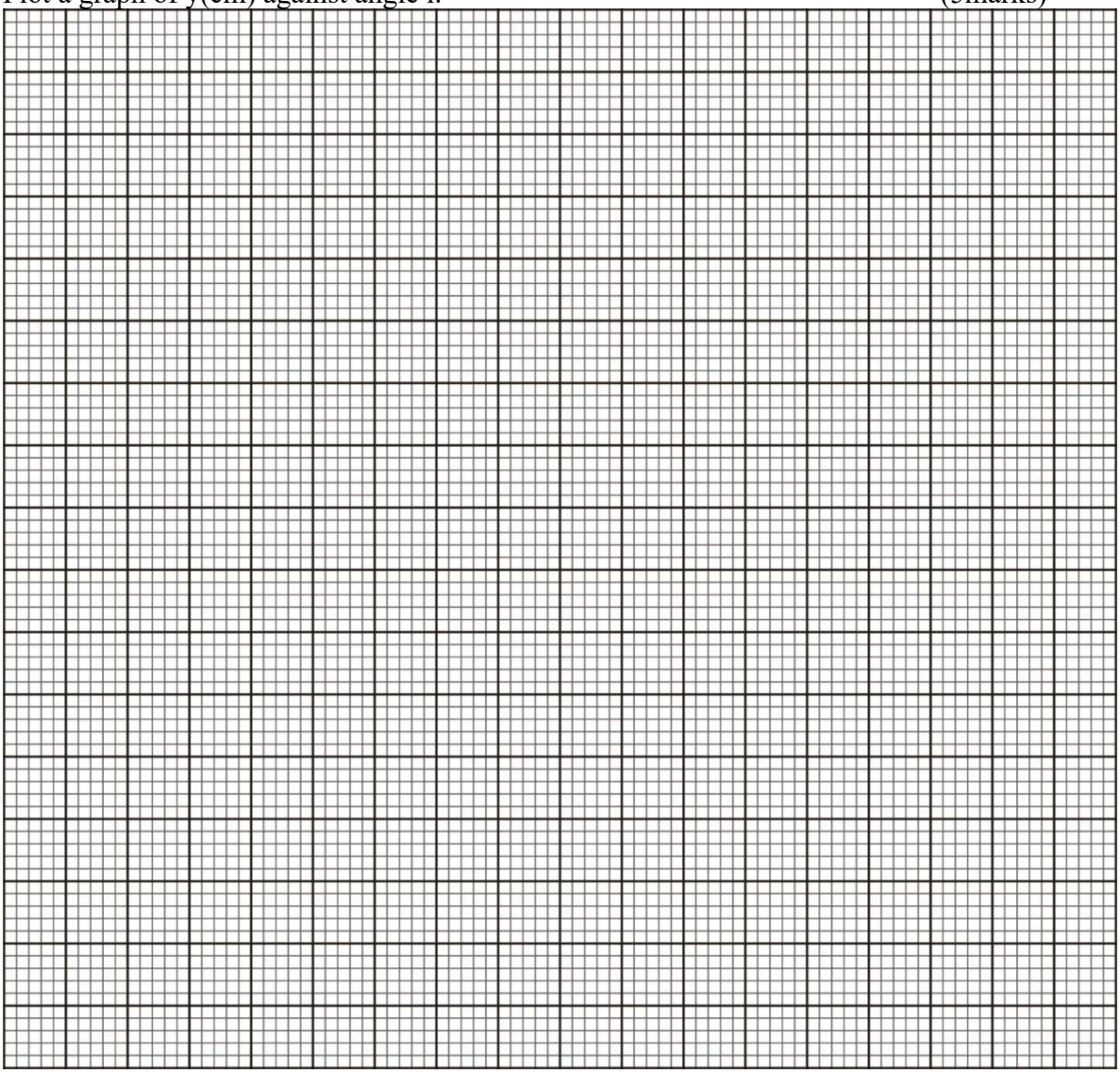
(NB: The paper work must be submitted together with the question paper).

Table 2

Angle i	10º	15º	20º	25º	30º	35º	40º
y(cm)							

(7marks)

(j) Plot a graph of y(cm) against angle i. (5marks)



i) Use the graph to determine y_o the value of y when i = 0º

y_o = …… cm (1mark)

ii) Measure and record the breadth (b) of the glass block

b = ……. Cm (1mark)

(ii) Determine the value of η given that

$$\eta = \frac{b}{y_O}$$ (2marks)

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PART B

You are provided with the following:-

- A boiling tube.
- Some dry sand.
- A liquid in a measuring cylinder labelled L.
- Half metre rule.
- A vernier calipers (to be shared).
- A weighing machine (to be shared).
- Tissue paper.
- A measuring cylinder.

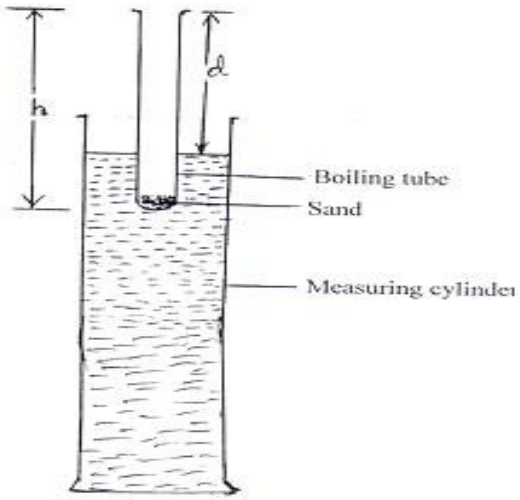
Proceed as follows:

a) Measure the length of the boiling tube.

h = ……. cm (1mark)

b) Put a little amount of sand in the boiling tube and place it in the measuring cylinder which is almost filled with liquid L. Add sand, little by little until the tube floats upright as shown in figure below.

Fig.1



Measure the length, d, of the boiling tube which is above the liquid using half metre rule

d = …… cm (1mark)

c).Determine the length, t, of the boiling tube which is immersed in the liquid using half metre rule

t = …….. cm (1mark)

d) Remove the boiling tube from the measuring cylinder, wipe it dry (on the outside) and measure its mass, m, including the sand inside.

m = …….. g (1mark)

e) Measure the external diameter, D, of the boiling tube.

D = …….. cm (1mark)

f) Determine the external radius, R.

R = …… cm (1mark)

g) Using the formula $m = 12\rho\pi R^2$, determine ρ for the liquid. (2marks)

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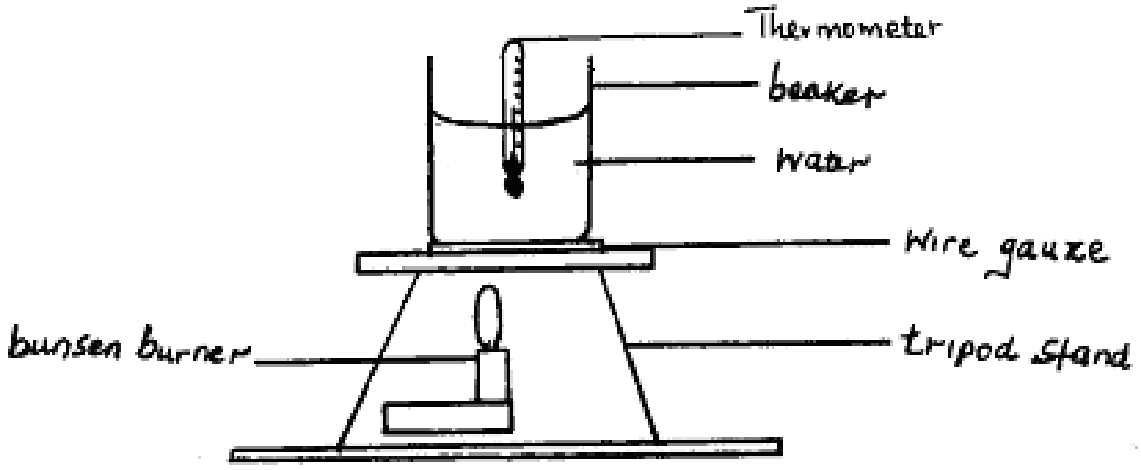
Question 2

You are provided with the following:-

- A 250ml glass beaker.
- A Bunsen burner.
- A thermometer.
- A stopwatch.
- A Tripod stand and a wire qauze.
- A measuring cylinder 100ml.
- Water.

Procedure

Set the apparatus as shown in figure below.



(a) Measure 100cm³ of water and pour it into the beaker. Take the initial temperature of the water.

T_o =…… ºC. (1mark)

Now heat the water to a temperature of 75ºC. Switch off the gas tap and place a thermometer into the beaker and start the stopwatch when the temperature is 65ºC. Take the temperature TºC of water every two minutes. Record your results in the table 3 below. (7marks)

Table 3

Time, t(minutes)	2	4	6	8	10	12	14
Temperature, T(ºC)							
$(T - T_o)$ (ºC)							
Log $(T - T_o)$							

(b) Plot a graph of Log $(T - T_o)$ against Time (t). (4marks)

(c) From the graph find the value of Q given that Q = log $(T - T_o)$ when t = 0. (1mark)

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(d) Determine P, where P is the antilog of Q. (1mark)

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(e) Calculate the temperature of the surrounding T_S using expression P = 65 - T_S. (2marks)

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SERIES 8
PAPER 1

SECTION A (25 MARKS)

1. With a reason identify in which state isdiffusion faster between gasand liquid. (2marks)

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2. The length of the spring is 20.0cm. It becomes 24.0cm when a weight of 8.0N hangs on it. Calculate the length of the spring when supporting a weight of 200N. (2marks)

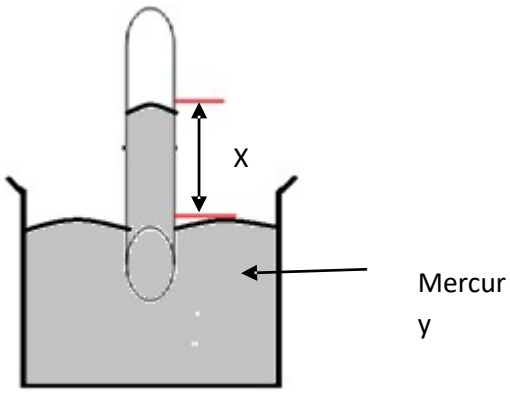
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3. The figure below shows the instrument used to measure pressure



a. Name the instrument (1mark)

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b. What would be observed if the test tube is tilted assuming the instrument is functioning normally (1mark)

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4. The rate of heat flow in thermal conductivity increases with increase in cross-section area. Explain this observation (1mark)

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5. Explain why a small car travelling at a very high speed is likely to be dragged into a long track travelling in the opposite direction (2marks)

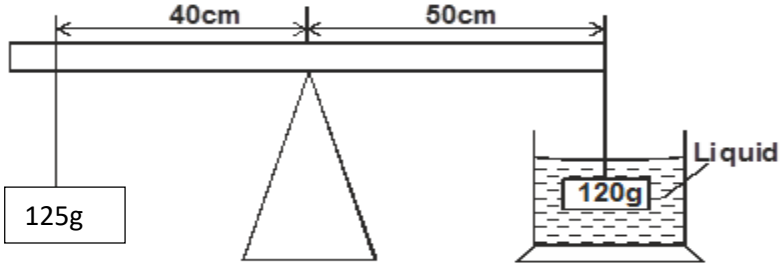
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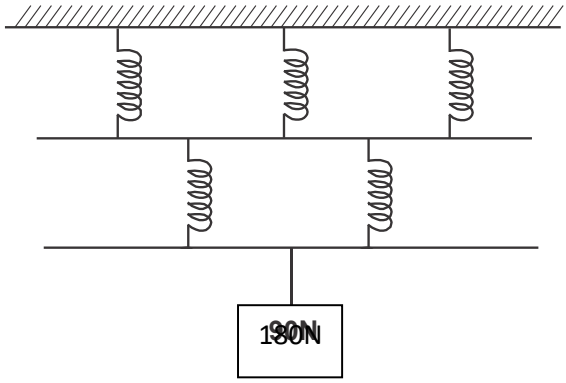
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6. A uniform meter rule is balanced by two masses as shown in the figure below.



By displacement method, the immersed object is found to occupy 13.5cm ^{3}. Determine the density of the liquid in SI units. (3 marks)

7. The springs shown in the arrangement in figure 4 below are identical.



Given that the 180N weight causes a total extension of 30cm, determine the spring constant of each spring. (The weight of each spring is negligible)

(3 marks)

8. i) Distinguish between elastic collision and inelastic collision. (1 mark)

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ii) State the energy transformation during inelastic collision. (2 marks)

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9. State the branch of physics that deal with kinetic energy of matter. (1 mark)

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10. The water in a burette is 30.6cm^3, 50 drops of water each of volume V are added to the water in the burette. The final reading of the burette was 20.6cm^3. Calculate the radius of the drop of water
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(3 marks)

11. State two factors that affect the stability of an object (2 marks)

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12. State a reason why a burn from steam at 100^0cis more severe than a burn from boiling water at the same temperature (1 mark)

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SECTION B: (55 MARKS)

13. a) An astronaut in orbit round the earth may feel weightless even when the earth's gravitational field still acts on him. Explain (2 marks)

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b) Distinguish between angular velocity and linear velocity (1 mark)

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c) a stone is whirled with uniform speed in a horizontal circle of radius 15 cm. it takes the stone 10 seconds to describe an arc of length 4cm. calculate

i) Angular velocity (3 marks)

ii) Linear velocity of the stone (2 marks)

iii) Periodic time (2 marks)

14. a) State the Bernoulli's principle of fluids (2 marks)

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b) In derivation of equation of continuity in fluids, state two assumptions to be made. (2marks)

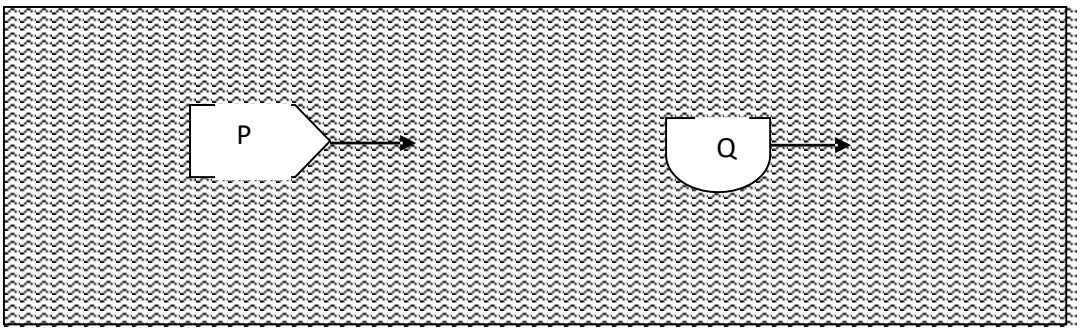
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b) The figure below shows cross-section of two submerged bodies P and Q in an ocean. The bodies were then pulled by a ship in the direction shown.



i) State with a reason, which body is easier to pull if they have equal volume and density (2 marks)

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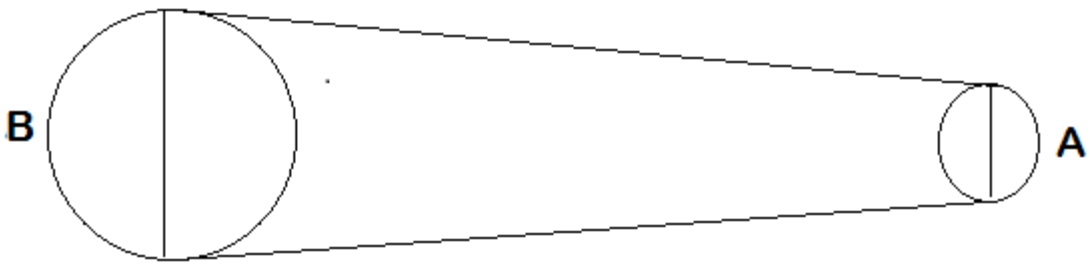
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ii) On the same diagram, show the path followed by each body and their streamlines (2 marks)

c) Water flows steadily a pipe as shown in the figure below. The diameter of A and B are 3cm and 5cm. if the volume flux at A is 45cm^3/s. find the speed of water at B.(3 marks)



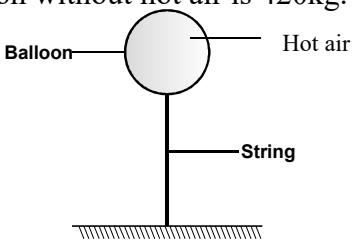
15. a) State the law of floatation (1 mark)

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b) The diagram below shows a hot air balloon tethered to the ground on a calm day. The balloon contains 1300cm^3 of hot air of density 0.82 kg/m3. The mass of the material making the balloon without hot air is 420kg. The density of the surrounding air is 1.35 kg/m^3. Determine



i) The total weight of hot air balloon (3 marks)

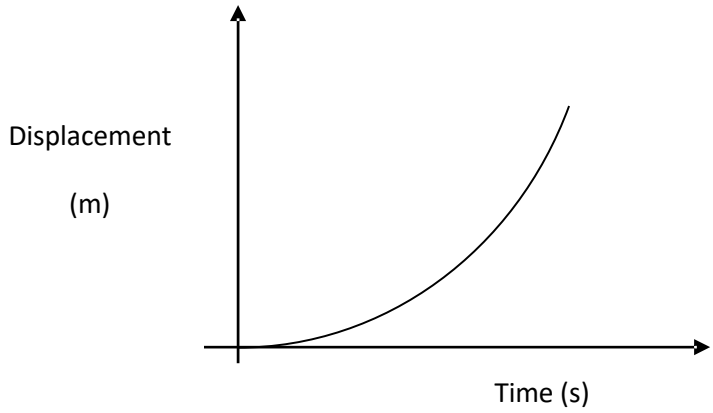
ii) The weight of air displaced by the balloon (2 marks)

iii) Upthrust force on the balloon (1 mark)

iv) the tension in the rope holding the balloon in the ground. (2 marks)

v) the acceleration with which the balloon begins to raise when released.(3marks)

16. a) the graph below represents a body moving with variable speed



on the same graph sketch the results of the same body moving at a lower velocity.(1 marks)

b) A paper tape was attached at a moving trolley and allowed to run throw a ticker timer. If the frequency of the tape is 100Hz. Determine

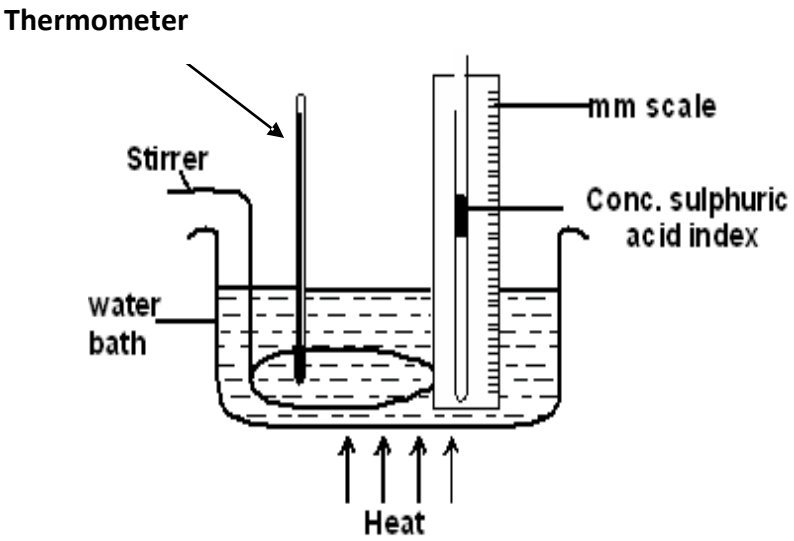


i)The period of the ticker timer (2 marks)

ii)Velocity AB and CD (4 marks)

ii)The average acceleration (3 marks)

17. **a)**Figure 9 shows a set up to investigate one of the gas laws. All equipment are standardized.



i) Name the gas law being investigated. (1 mark)

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ii) Give two reasons for using the concentrated sulphuric acid index. (2 marks)

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iii) What is the purpose of the water bath? (1 mark)

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iv) State two measurements that should be taken in this experiment. (2 marks)

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v) Explain how the measurements taken in (iv) above may be used to verify the law. (3 marks)

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b) A gas has a volume of 30cm^3 at 18^{o}C and normal atmospheric pressure. Calculate the new volume of the gas if it is heated to 54^{o}C at the same pressure. (3 marks)

PAPER 2

SECTION A

1 . What property of light is suggested by the formation of shadows? (1mks)

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2. You are provided with the following; A cell and holder, a switch, a rheostat, an Ammeter, a voltmeter and connecting wires. Draw a diagram for a circuit that could be used to investigate the variation of the potential difference across the cell with the current drawn from the cell. (2mks)

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3. An un-magnetized steel rod is clamped facing North-South direction and then hammered repeatedly for some time. When tested, it is found to be magnetized. Explain this observation. (2mks)

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4. A lady holds a large concave mirror of focal length 1 m, 80 cm from her face, state two characteristicsof her image in the mirror. (2mks)

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5. A girl brought a positively charged rod close to the cap of a gold leaf electroscope; she observed that the gold leaf diverged further. Explain this observation. (2mks)

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6. In an experiment using a ripple tank the frequency, f, of the electric pulse generator was reduced to one third of its value. How does the new wavelength compare with the initial wavelength?

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7. Figure 1 shows a ray of light incident on the face of a water prism

FIG.1

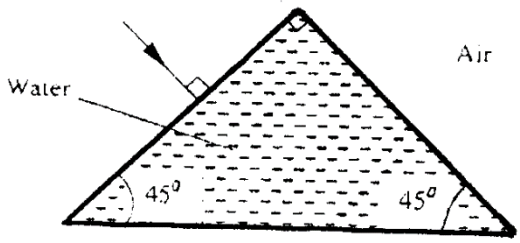


FIG.1

Sketch the path of the ray as it passes though the prism. Critical angle for water is 49^0 (1mk)

8. A heating coil is rated 100W, 240V. At what rate would it dissipate energy if it is connected to a 220V supply? (3mk)

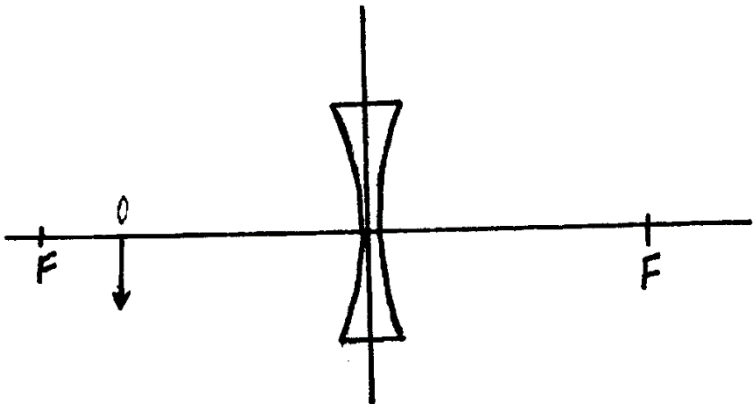
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9. Figure 2 shows an object 0 placed in front of a concave lens with principal foci F and F Construct a raydiagram to locate the position of the image (1mk)



10. State the difference between X-rays and Gamma rays in the way in which they are produced. (1mk)

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11. A 60W bulb is used continuously for 36 hours. Determine the energy consumed. Give your answer inkilowatt hour (kwh). (2mks)

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12 A narrow beam of electrons in a cathode ray oscilloscope (CR0) strike the screen producing a spot.State what is observed on the screen if a low frequency a.c source is connected across the y-input of the CRO (1mk)

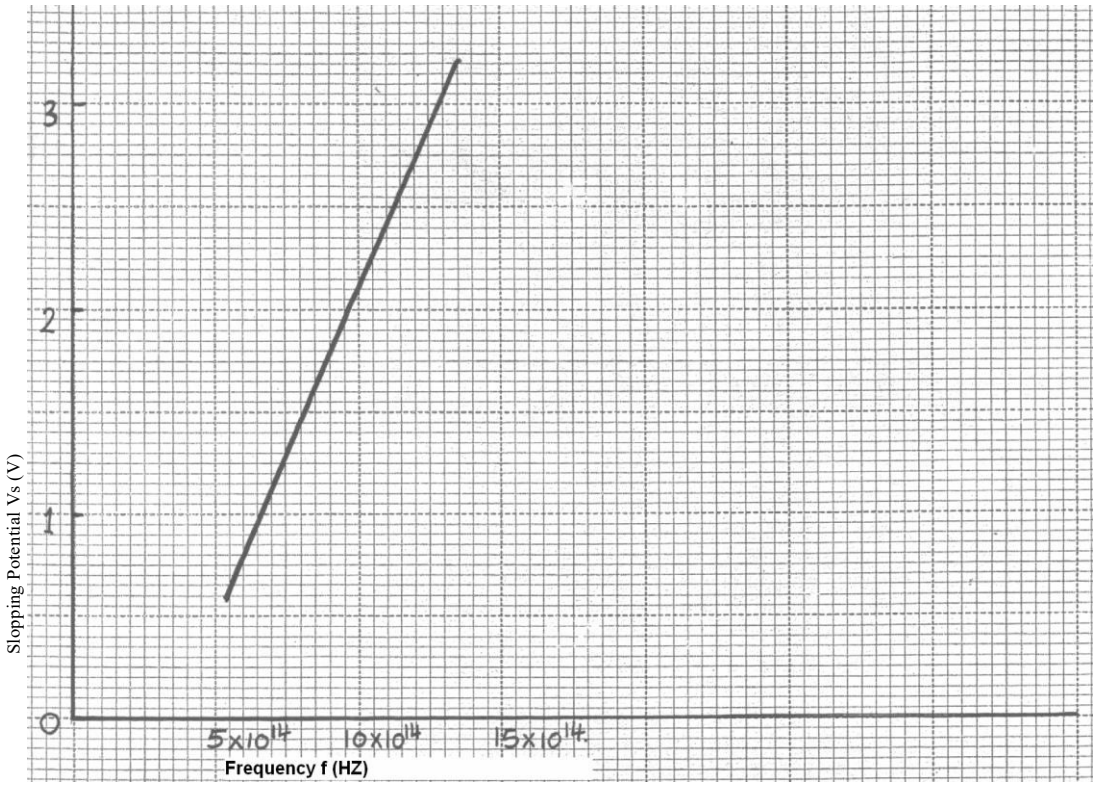
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In an experiment on photo- electricity using metal X, the graph shown in figure 3 was obtained Use the graph to answer questions 13.



13. Determine the minimum frequency Fo below which no photoelectric emission occurs. (1mk)

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14 . You are provided with 12V a.c source, four diodes and resistor. Draw a circuit diagram for a full waverectifier and show the points at which the output is taken. (2mk)

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15. (a) Given a bar magnet, an iron bar and a string

(i) Describe a simple experiment to distinguish between the magnet and the iron bar

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(ii) State with reasons the observation that would be made in the experiment. (2mks)

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(b) In an experiment to magnetize two substances P and Q using electric current, two curves (graphs) were obtained as shown in figure4

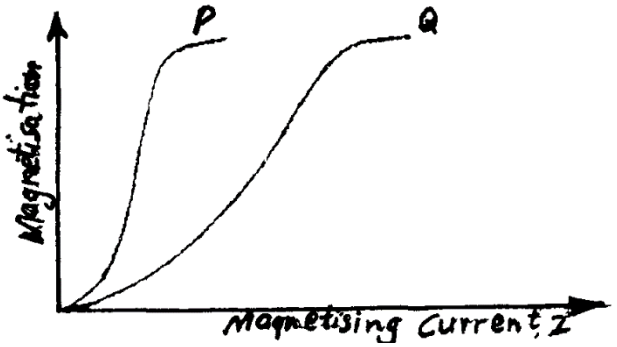


FIG.4

Using the information in fig. 4 explain the differences between substances P and Q with references to the domain theory (6mks)

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(c) In the set up in figure 5, the suspended metre rule is in equilibrium balanced by the magnet and the weight shown. The iron core is fixed to the bench.

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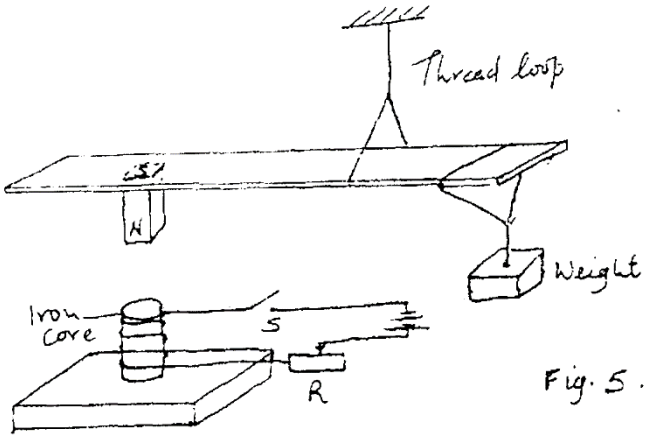


Fig. 5.

(i) State the effect on metre rule when the switch S is closed. (1mk)

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(ii) What would be the effect of reversing the battery terminals? (1mk)

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(iii) Suggest how the set up in figure 5 can be adapted to measure the current flowing in the current circuit. (3mk)

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16. (a) (i) What is the difference between longitudinal and transverse waves? (1mk)

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(ii) State two distinctions between the way sound waves and electromagnetic waves are transmitted (2mk)

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(b) A mineworker stands between two vertical cliffs 400m from the nearest cliff. The cliffs are Xdistance apart. Every time he strikes the rock once, he hears two echoes, the first one after 2.55, while the second follows 2s later. From this information; calculation:

(i) The speed of the sound in air (2mk)

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(ii) The value of X (3mk)

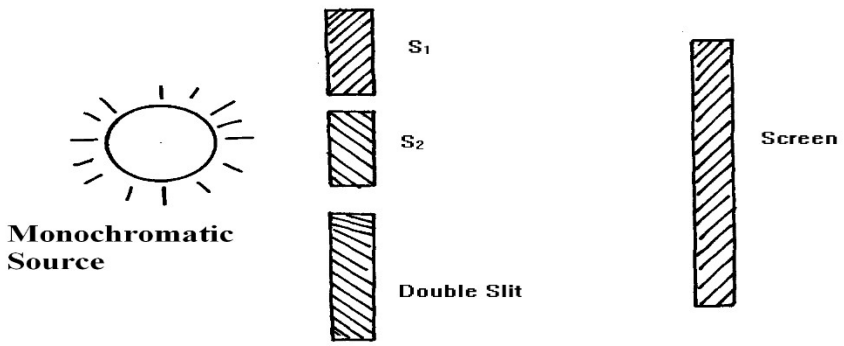
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(c) In an experiment to observe interference of light waves a double slit is placed close to the source. See figure 5



(i) State the function of the double slit (1mk)

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(ii) Describe what is observed on the screen (2 mks)

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(iii) State what is observed on the screen when

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i). The slit separation S1S2 is reduced (1mk)

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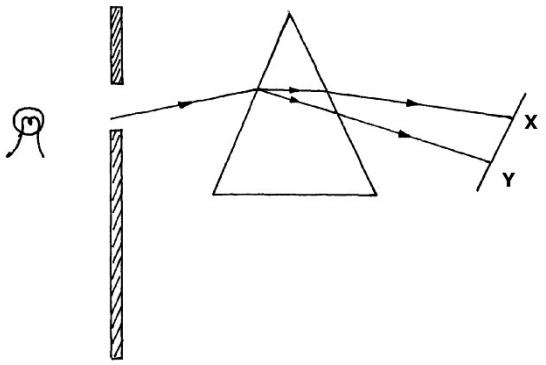
ii) White light source is used in place of monochromatic source (1mk)

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17. a) The diagram in figure 6 below shows a narrow beam of white light onto a glass Prism.



(i) What is the name of the phenomenon represented in the diagram? (1mks)

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(ii) Name the colour at x and Y. (2mk)

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(iii) Give a reason for your answer in part (ii) above. (1mk)

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(iv) What is the purpose of the slit? (1mk)

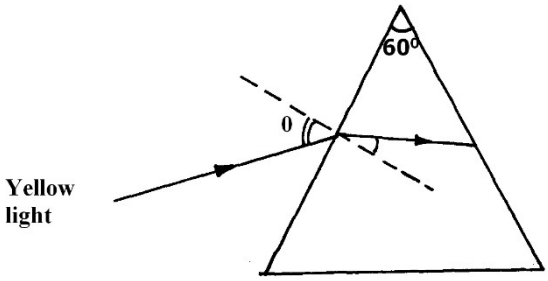
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b) Figure 7 below shows the path of ray of yellow light through a glass prism. The speed of yellow light in the prism is 1.8×10^8 m/s.



i) Determine the refractive index of the prism material (Speed of light in vacuum, C = 3.0×10^8 m/s) (3mks)

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(ii) Show on the same diagram, the critical angle c and hence determine its value. (3mks)

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(iii) Given that r = 31.2^0, determine the angle 0. (3mks)

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18. (a) X- rays are used for detecting cracks inside meta' beams (i)State the type of the X- rays used.

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(ii) Give a reason for your answer in (i) above.

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(b) Figure 1 shows the features of an X- ray tube

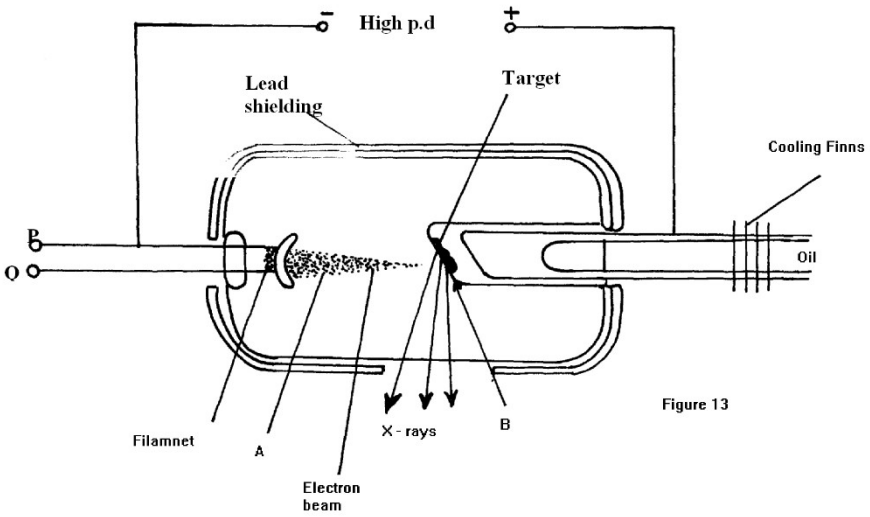


Figure 13

i) Name the parts labelled A and B. (2mks)

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(ii) Explain how a change in the potential across P changes the intensity of the X-rays produced in thetube. (2 mks)

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(iii) During the operation of the tube, the target becomes very hot. Explain how this heat is caused. (2 mks)

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(iv) What property of lead makes it suitable for use as shielding material? (1mk)

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(c) ln a certain X- ray tube, the electrons are accelerated by a Pd of 12000V. Assuming all the energy goes to produce X- rays, determine the frequency of the X- rays produced. (Plank's constant h= 6.62×10^{-34} is and charge on an electron, e = 1.6×10^{-19}C). (3mks)

END

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PAPER 3 QUESTION ONE

You are provided with the following apparatus

- Two new dry cell
- Cell holder to hold two cells
- Nichrome wire on a mm scale
- Voltmeter
- 8 connecting wires with at least five with crocodile clips on one end.
- 5 resistors connected together in series labelled R
- A switch
- A micrometer screw gauge
- A resistor labelled P

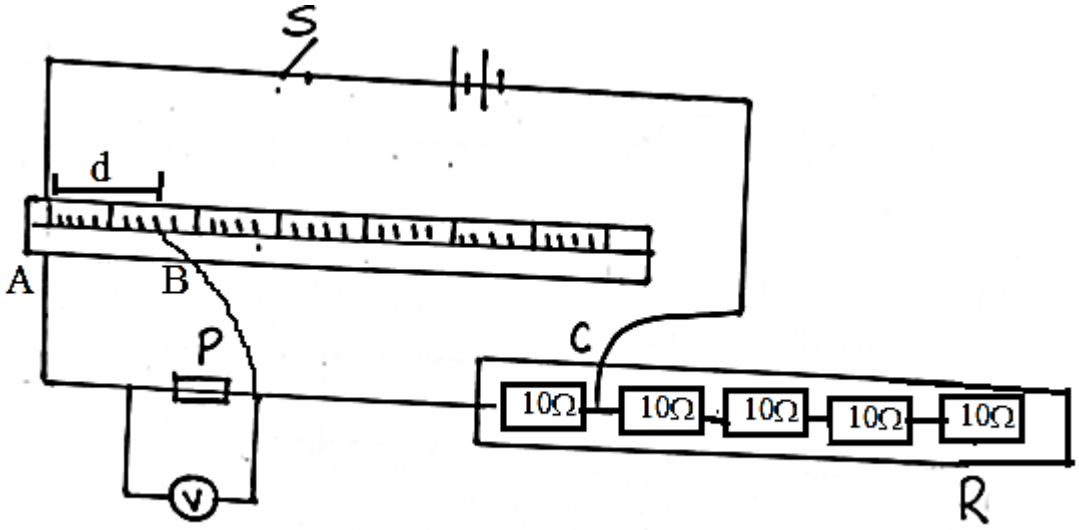
a) Proceed as follows.

i) Use a micrometer screw gauge to measure the diameter of the wire.

D = …….. m (1mark)

ii) Calculate the cross sectional area of the wire in SI units. (2marks)

iii) Connect the circuit below.



iv) Let length AB = d = 25cm. Keep this length constant throughout the experiment. Set point c so that the resistance R is 10 Ω .

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v) Close the switch S and read the voltmeter reading.

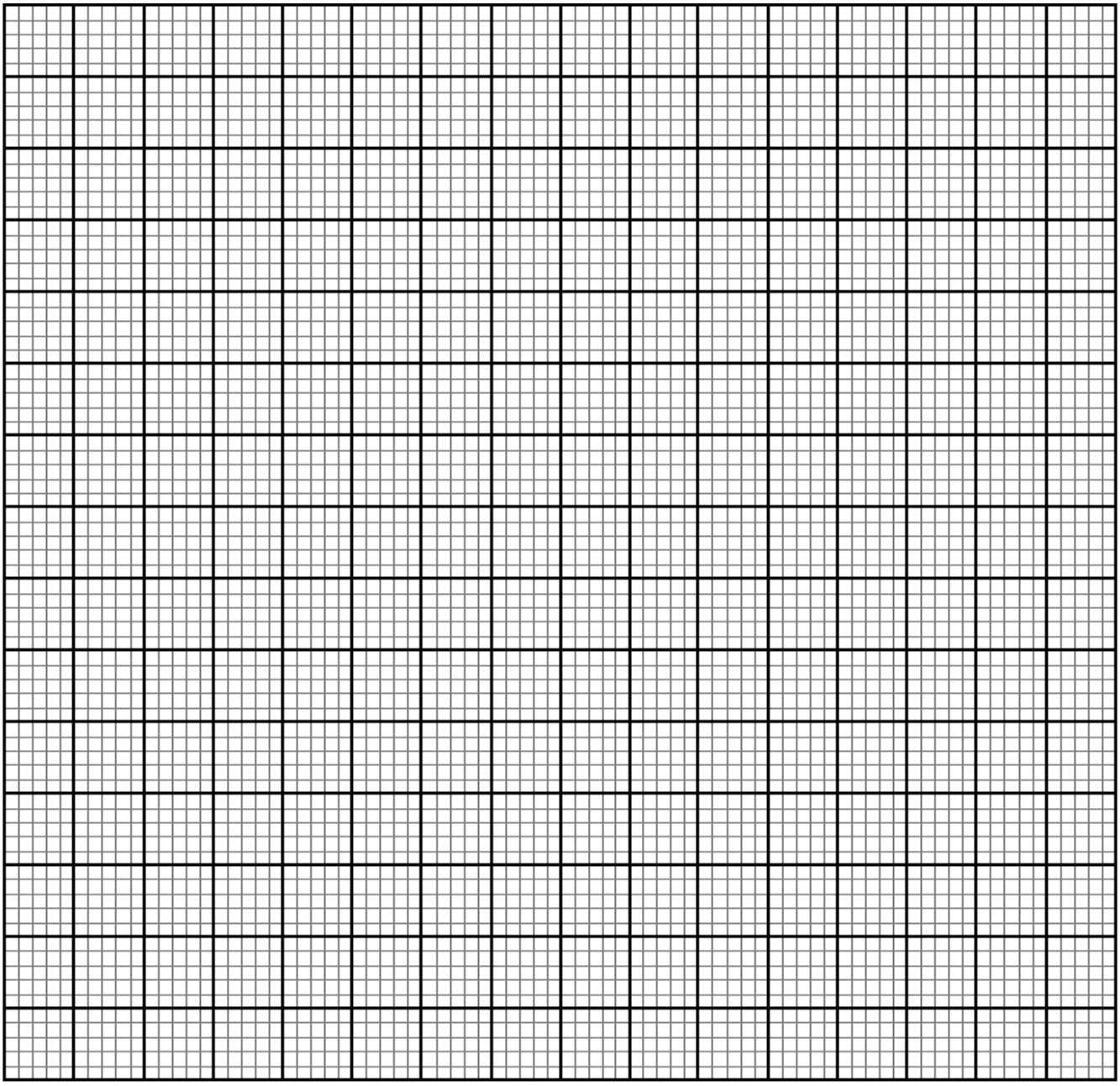
V_1 = …… (1mark)

vi) Open the switch and set point C so that the value of resistor R is $20\,\Omega$, $30\,\Omega$, $40\,\Omega$, $50\,\Omega$ as in the table below. Read and record the values of the voltage corresponding to the resistance R.

(5marks)

Resistance R Ω	10	20	30	40	50
Voltage V(V)					
$\frac{V}{R}$ (A)					

vii) Plot a graph of $\frac{V}{R}(A)$ against V (V). (5marks)



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viii) Determine the slope s of the graph at $V = 0.65V_1$ (3marks)

ix) Given that $Z = \frac{A}{5d}$, find the value of z in SI units. (2marks)

x) What physical quantity does Z represent? (1mark)

QUESTION TWO

PART A

- A screen and a candle
- Metre rule
- Beaker (glass) 250ml
- Measuring cylinder
- Water

a) Add a volume of 200ml of water into the beaker.

b) Measure the value h height of water in the beaker.

h = …….. cm (1mark)

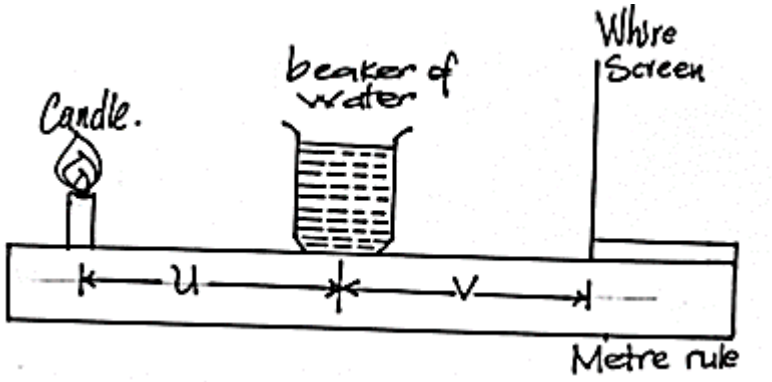
c) Using the formula $K = \sqrt{\frac{V}{\pi h}}$, determine the value of K.

i) K = …….. (2marks)

ii) What does K represents? (1mark)

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d) Set your apparatus as shown below.



e) Position the candle which acts as an object above the meter rule at a distance u= 8K cm away from the centre of the water lens, then adjust the screen to obtain a sharp image of the candle. Record the value of V in the table below.

f) Repeat the procedure in (e) for u = 10k cm. complete the table below. (3marks)

u	u in (cm)	V (cm)	$M = \frac{v}{u}$
8K			
10K			

g) Given that the focal length f of the lens satisfies the equation f $\frac{V}{1+M}$. Determine the average value of the focal length. (2marks)

PART B

You are provided with the following.

- Retort stand, clam and bass
- 500ml beaker ¾ full of water
- Metre rule
- 100g mass
- 50g mass
- Three pieces of thread

Proceed as follows

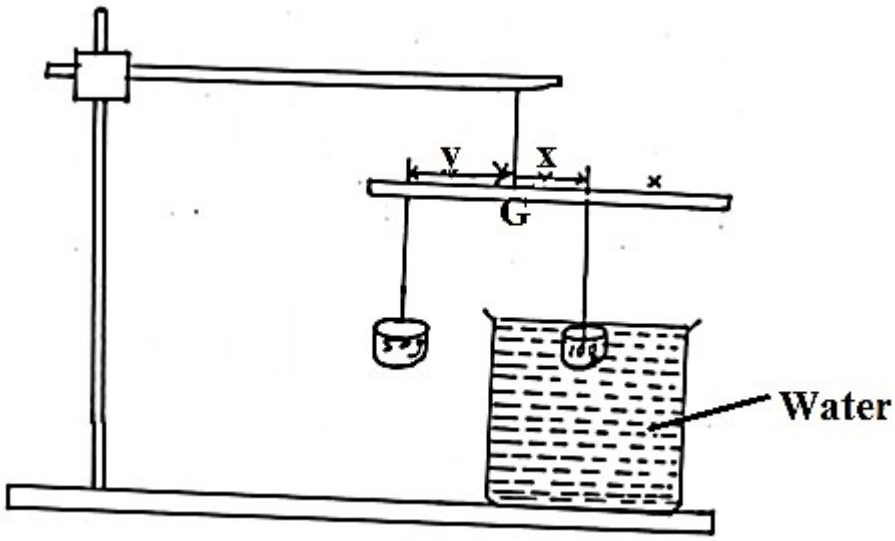
a) Balance the meter rule horizontally by suspending it from the stand and clamp with one of the threads.

Record the balance point G.

G = …… cm (1mark)

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b(i) Suspend the 100g mass from the meter rule at a point X such that X = 10cm from point G. With 100g mass completely immersed in water in the beaker, hang the 50g mass from the meter rule and adjust its position until the system is in equilibrium as shown in the diagram below.



ii) Find the value of y.

y = …….. (1mark)

iii) Using the information above calculate the upthrust on the 100g mass. (3marks)

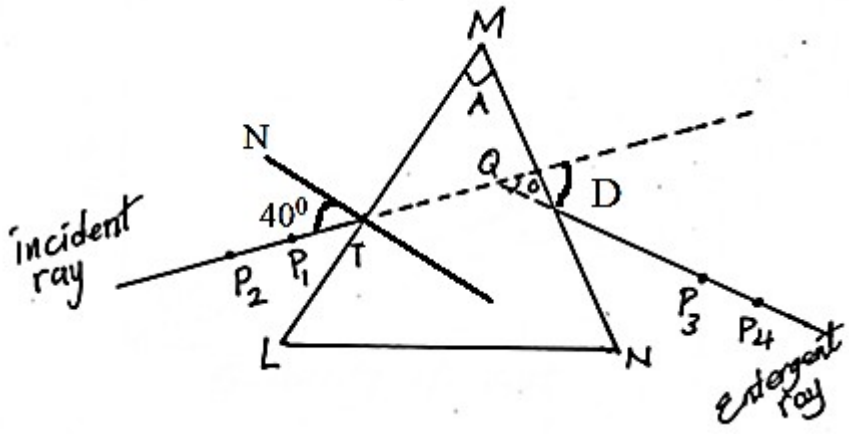
PART C

You are provided with the following apparatus.

- Prism
- 4 optical pins
- Plain paper
- Protractor
- Soft board

i) Set up the apparatus as shown below.

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ii) Measure angle A of the prism using a protractor.

A = …….. (1mark)

iii) Place the prism on a plain paper and trace its outline with a pencil. Indicate the prism angle A. Draw an incident ray to strike the prism at 40^0. Replace the prism and stick pins P_1 and P_2 to define the incident ray.
View pins P_1 and P_2 from the opposite face (MN). Insert pins P_3 and P_4 so that they appear to be in line with images of P_1 and P_2. Remove the prism and join P_3 and P_4 to give emergent ray. Extrapolate the emergent ray into the prism so as to meet the extrapolated incident ray at Q.

iv) Measure angle D. (2marks)

D = ……

b) Calculate the value of η, given that (2marks)

$$\eta = \frac{\cos\left\{90^0 - \left(\frac{A+D}{2}\right)\right\}}{\sin\left(\frac{A}{2}\right)}$$

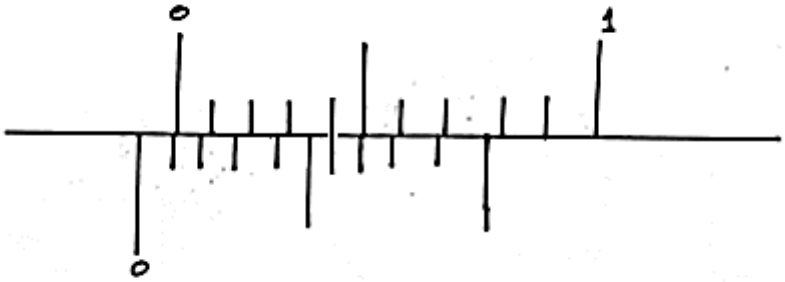
c) What is the significance of η (1mark)

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SERIES 9
PAPER 1

SECTION 1: 25 MARKS

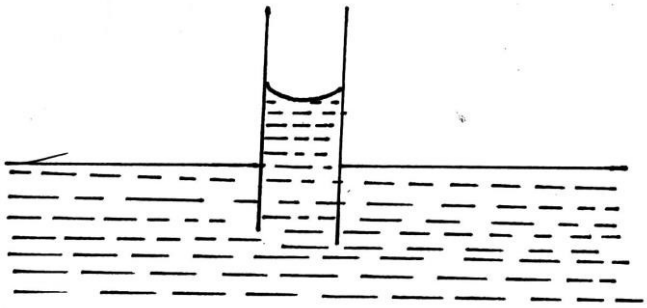
1. The figure below shows part of the scale of a vernier calliper whose are completely closed. State the zero error. (2marks)



2. Explain why a body going round a circular track at constant speed is said to be accelerating. (1mark)

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3. The figure below shows a glass capillary tube dipped in a liquid at room temperature.



a) Indicate on the diagram the level of the liquid in the capillary tube when the liquid is heated slightly. (1mark)

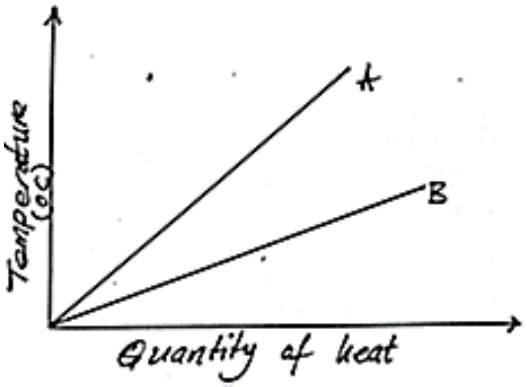
b) Explain your answer in part "a" above. (1mark)

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4. A balloon is filled with a helium which is lighter than air. It is observed to rise in air up to a height of 40m. State the reason why the balloon stops rising. (1mark)

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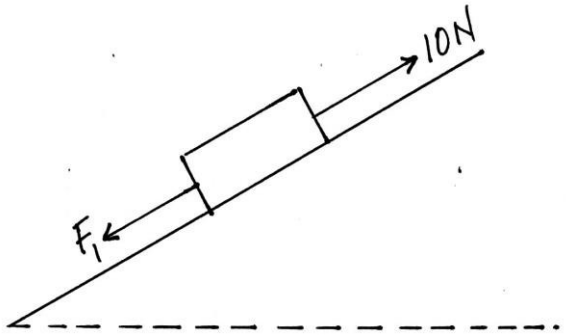
5. The figure below shows the temperature changes against quantity of heat supplied to one kilogram each of liquids A and B.



Which of the two liquids has a higher specific heat capacity? Give reason. (2marks)

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6. A box on an inclined plane is under two forces as shown.

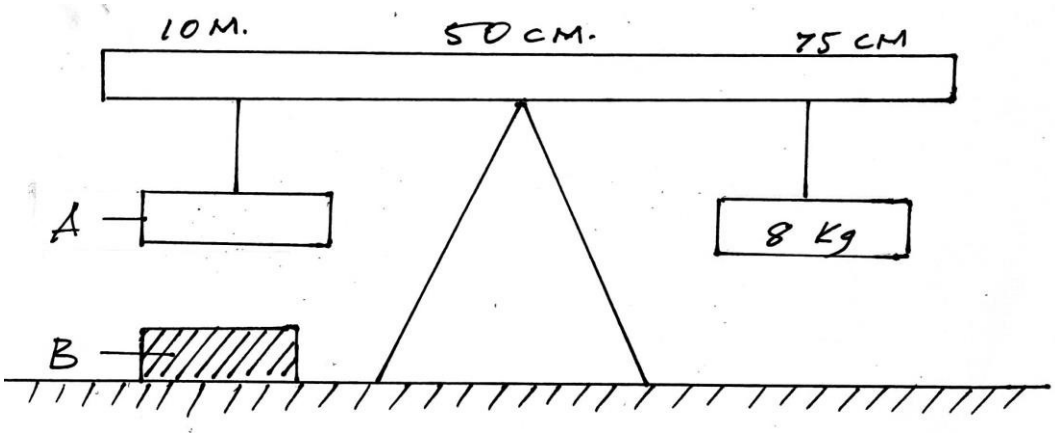


The toy moves upwards with a constant velocity. State the value of F_1 and give a reason for your answer. (2marks)

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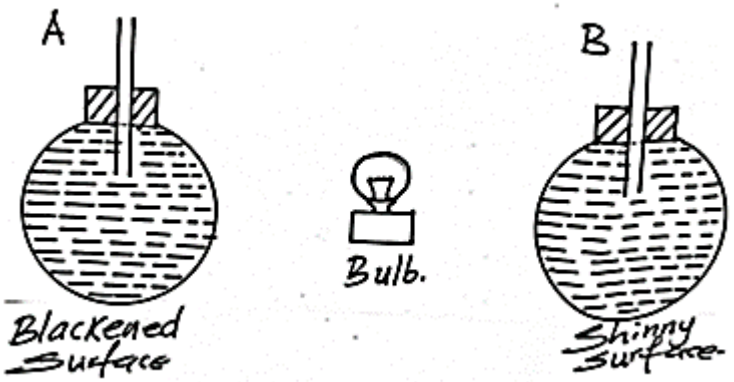
7. A water tank with height 3.6m is full of water. A thin metal plate rests flat at the bottom of the tank. If the plate has an area of $2cm^2$. Determine the force exerted on the thin metal plate if the density of water is $1000kg/m^3$ and the atmospheric pressure is 104,000Pa. (3marks)

8. The figure below shows a uniform ruler balanced at the centre due to action of some forces as shown below. A is a magnet of weight 30N and B is a permanent magnet fixed onto the bench.



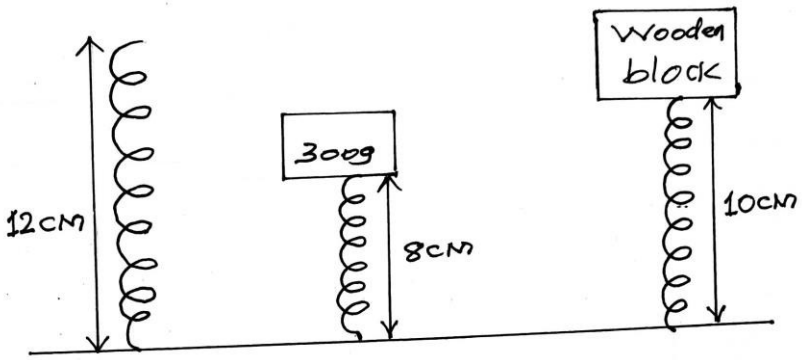
Determine the force between A and B. (3marks)

9. The figure below shows two identical flasks A and B filled with water. Show the level of water one minute after the bulb placed in between the flasks is switched on. Explain your observation. (2marks)



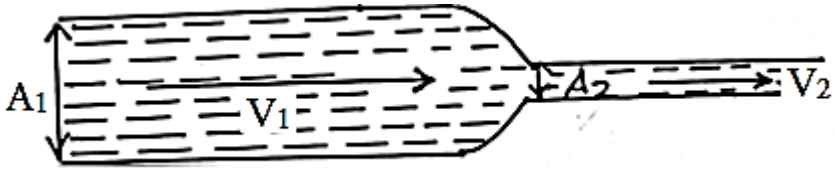
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10. The figure below shows an unloaded spring when supporting a load of 300g and a wooden block.



Calculate the mass of the wooden block. (4marks)

11. The figure below shows an incompressible fluid flowing through a pipe, A_1 and A_2 are the cross-sectional areas of the pipes in the larger section and smaller section of the pipe respectively, while V_1 and V_2 are speeds of the fluid at the two sections of the pipe.



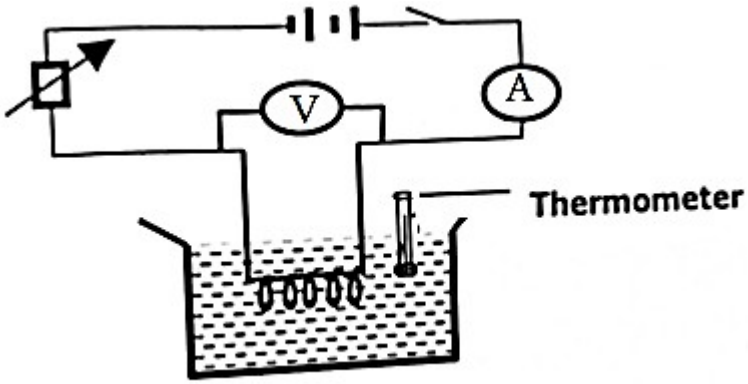
Derive an expression for the ratio of the speeds $\frac{V_2}{V_1}$ in terms of A_1 and A_2. (2marks)

12. Apart from the base area, state any other factor that affects stability. (1mark)

……
……

SECTION B: 55 MARKS

13. Figure below shows a set up in an experiment to determine specific heat capacity of water.



The data below was obtained from the experiment.

- Voltage V across the heater = 12V
- Current 1 in the circuit = 1.4A
- Time t heating = 600s
- Mass m of water = 0.4kg
- Change in temperature = 6^0C

i) Define specific heat capacity. (1mark)

……
……

ii) State two improvements that would be made in the set up to obtain accurate results. (2marks)

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iii) Use the above results to determine he specific heat capacity of water. (3marks)

b) Explain why the cooling unit (freezer) inside a refrigerator is placed near the top but an elastic immersion heater in water tank should be near the bottom. (2marks)

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c) State two factors that will lead to increase in the rate of evaporation of a liquid. (2marks)

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14.(a) A bullet of mass 24g travelling in a horizontal path with a velocity of 450m/s strikes a wooden block of mass 976g resting on a rough horizontal surface. After impact, the bullet and the block move together for a distance of 9m before coming rest.

i) Name the type of collision which takes place above. (1mark)

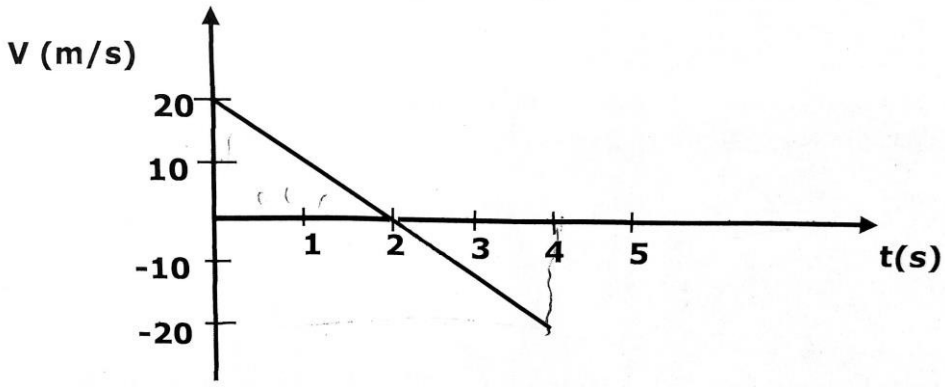
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ii) Determine the velocity of the two bodies when they start sliding. (2marks)

iii) Determine the force which brings the two bodies to rest. (3marks)

b) A missile is fired horizontally from the top of a cliff **320m** high to a target **56m** away. If the missile hits the target, determine the horizontal velocity of the missile. (3marks)

c) The graph below shows how the velocity varies with time for a body thrown vertically upwards.



Determine the total distance moved by the body. (3marks)

15(a) Define the term efficiency as used in machine (1mark)

……
……

b) A hydraulic lift is used to raise a load of 100kg through a height of 20m. The radius of the effort piston is 1.6cm while the load piston has a radius of 8.0cm. if the machine is 75% efficient, calculate;

i) Its velocity ratio. (2marks)

ii) Its mechanical advantage. (2marks)

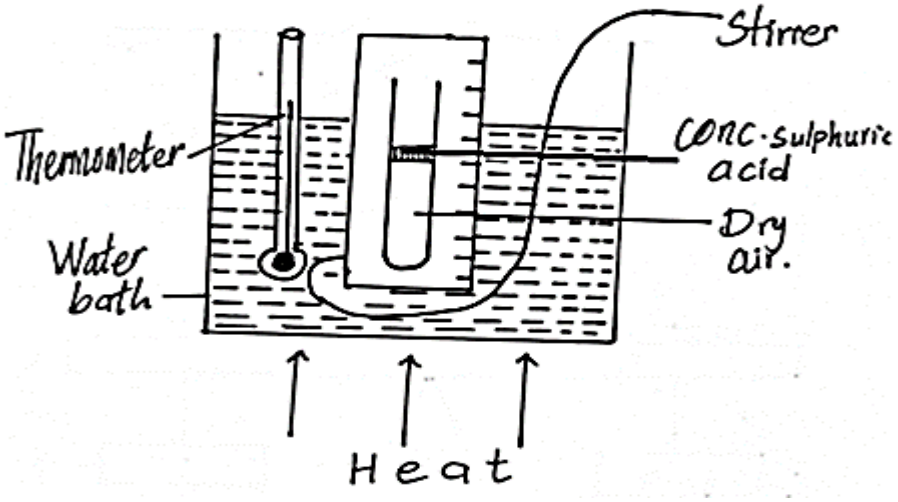
iii) Effort required. (2marks)

iv) Energy wasted in using the machine. (2marks)

c) A block and tackle pulley system is used to lift a mass of 200kg. If the machine has a velocity ratio of 5, and efficiency of 80%.

Sketch in the space provided below the possible arrangement of the system, if provided with two block and tackle pulleys each with two pulleys. (2marks)

16(a) The diagram in figure below shows an experiment to investigate the relationship between volume and temperature of a fixed mass of gas at constant pressure.



i) Which measurement are taken in the above experiment. (2marks)

ii) State the law being investigated in the above experiment. (1mark)

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iii) Describe how the experiment above is used to verify the law. (4marks)

iv) State one assumption made in this experiment. (1mark)

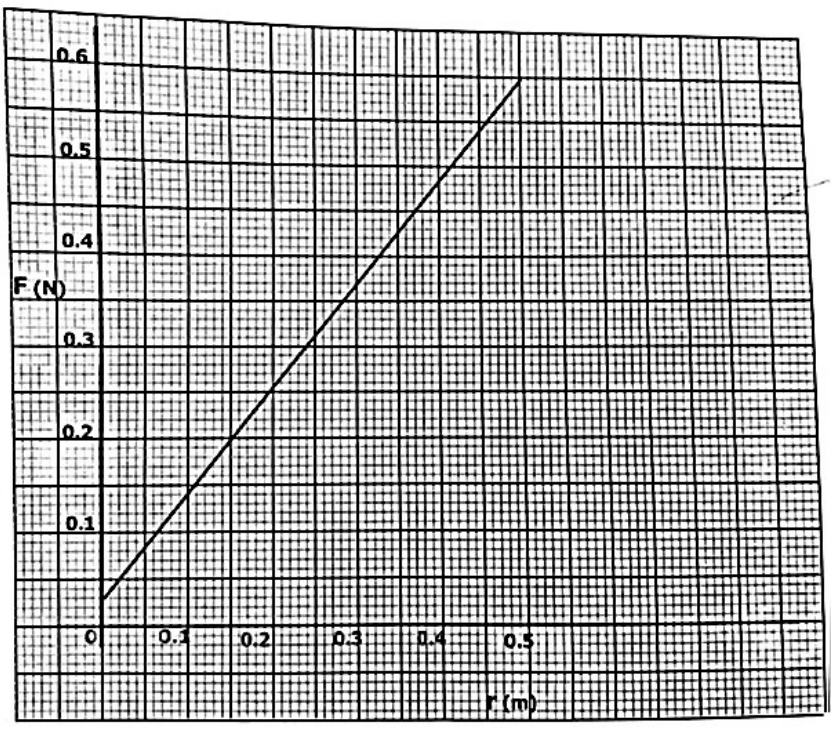
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b(i) State the condition necessary for a body to float. (1mark)

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ii) A certain solid of volume $50cm^3$ displaces $10cm^3$ of kerosene (density $800kgh/m^3$) when floating. Determine the density of the solid. (3marks)

17(a) The graph below was obtained when an experiment to investigate the variation of the centripetal force, F with the radius, r of the circle on which a body rotates was performed.



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From the graph, determine the angular velocity, w of the body given that m = 100g and $F = mw^2r + c$ where c is constant. (4marks)

b) A stone of mass 0.2kg tied to a string is whirled in a horizontal circle of radius 1.0m at a constant speed of 3.0m/s.

Determine;

i) The angular velocity of the stone. (2marks)

ii) The tension in the string. (2marks)

iii) The number of revolutions the stone makes in one minute. (2marks)

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PAPER 2

SECTION A: 25 MARKS

Attempt all the questions in this section.

1. State the property of light associated with formation of shadows. (1mark)

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2. State two quantities that are used to determine whether an accumulator requires recharging or not. (2marks)

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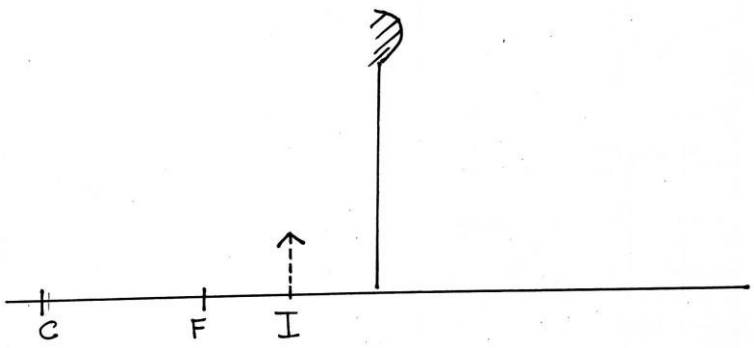
3. Explain why soft iron keepers are suitable for storing magnets. (2marks)

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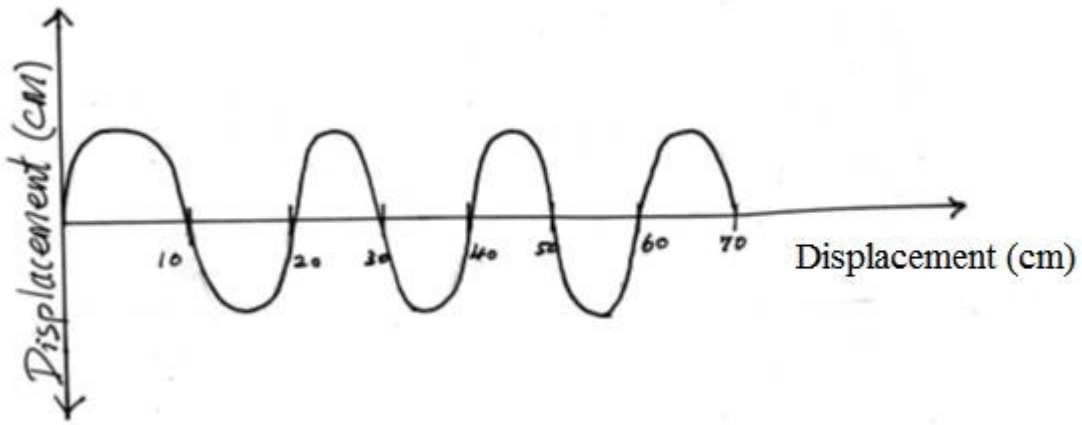
4. The figure below shows a conductor carrying current placed in the magnetic field of two magnets. Complete the diagram by showing the field pattern and the direction of force F that acts on the conductor. (2marks)



5. The figure below shows the image I formed in a convex mirror. Complete the ray diagram to show the position of the object. (2marks)



6. The figure below shows a displacement- time graph for a wave with a period of 0.5 seconds.



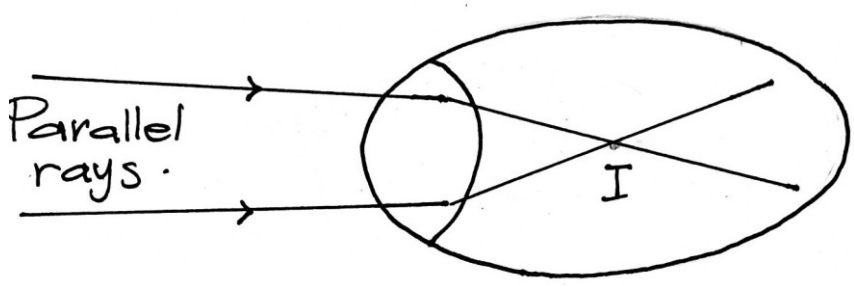
Determine the velocity of the wave. (2marks)

7. State one factor that affects the speed of sound in water. (1mark)

……
……

8. An electric bulb rated 75W is operating on a 240V main supply. Determine the resistance of the heating element. (2marks)

9. The figure below shows how a distance object is focused in defective eye.



a) State the nature of the defect. (1mark)

……
……

b) Suggest a suitable lens to correct this defect. (1mark)

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10. The chart below shows an experiment of different parts of the electro-magnetic spectrum.

Radio waves	A	Infrared	Visible light	B	X – rays	Gamma rays

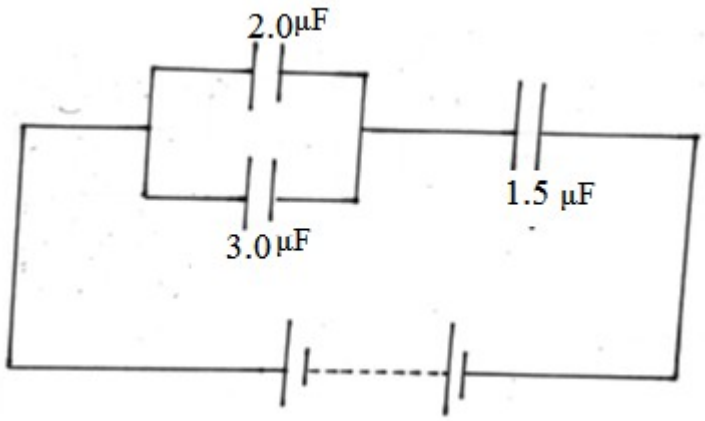
a) Name the radiation represented by B. (1mark)

……
……

b) Name a device that can be used to detect radiation A. (1mark)

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11. The figure below shows a capacitor network set up.



Determine the charge stored by the 1.5μF capacitor (3marks)

12. Below is a nuclear reaction.

$$^{232}_{90}A \xrightarrow{K} {}^{228}_{88}B \xrightarrow{R} C^{y}_{88}$$

a) Identify radiation K. (1mark)

……
……

b) Determine the value of y. (1mark)

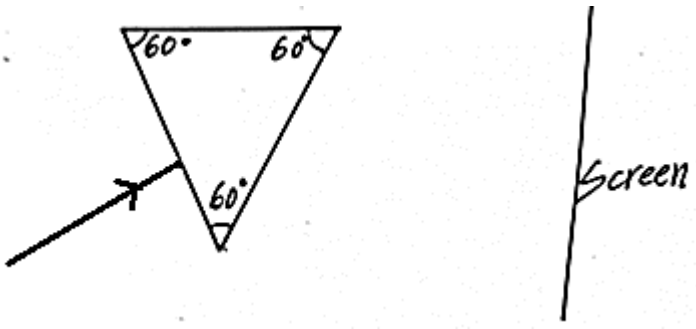
13.a) Draw a circuit diagram to show a p – n junction diode in the forward biased mode.(1mark)

b) State one application of diodes. (1mark)

……
……

SECTION B (55 MARKS)

14.a) The figure below shows a ray of white light incident on the surface of a glass prism.



i) Complete the path of the ray until it reaches the stream. (2marks)

ii) What colour will be observed on the screen if white light was replaced by yellow light?

(1mark)

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b(i) The figure below shows refraction of light at air – water interface.

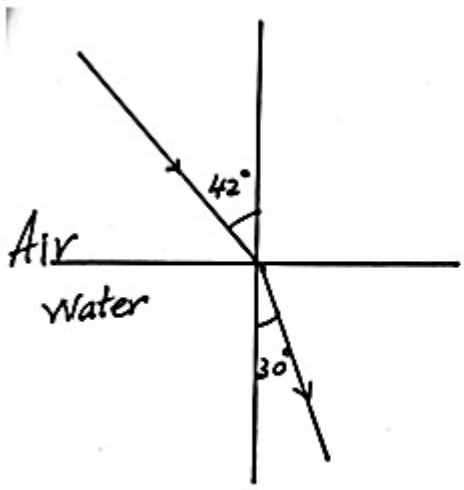


Fig 1.

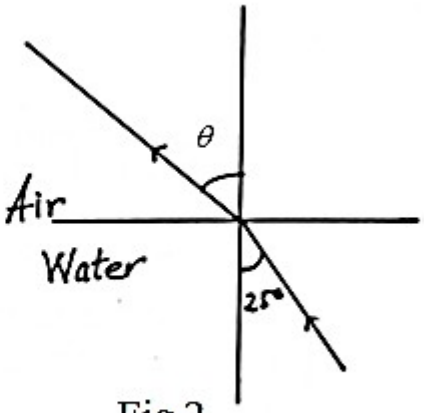


Fig 2.

Determine the angle θ in figure 2. (3marks)

ii) State one law of refraction of light. (1mark)

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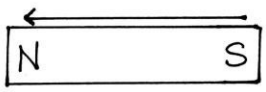
iii) State one condition necessary for total internal reflection to occur in prism. (1mark)

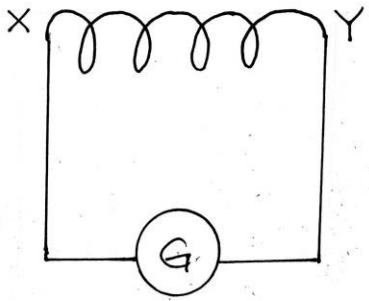
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15(a) State Lenz's Law of electromagnetic induction. (1mark)

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……

b(i) Indicate the direction of the current in the coil shown below.





ii) Label the polarity at the points marked X and Y. (2marks)

X …….

Y …….

c(i) A transformer is connected to a d.c power source. The secondary coil is connected to a centre – zero galvanometer.

I. State the observation when the switch is closed. (1mark)

……
……

II. Explain the observation in (I) above. (1mark)

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……

ii) The primary coil of a transformer has 800 turns and secondary coil has 100 turns, the primary coil is connected to a 240V a.c main supply.

I. What type of a transformer is used. (1mark)

……
……

II. Determine the secondary voltage. (3marks)

III. Determine the secondary current given that the primary current is 0.20A. (2marks)

IV. Determine the efficiency of the transformer. (2marks)

16.a(i) State ohm's law. (1mark)

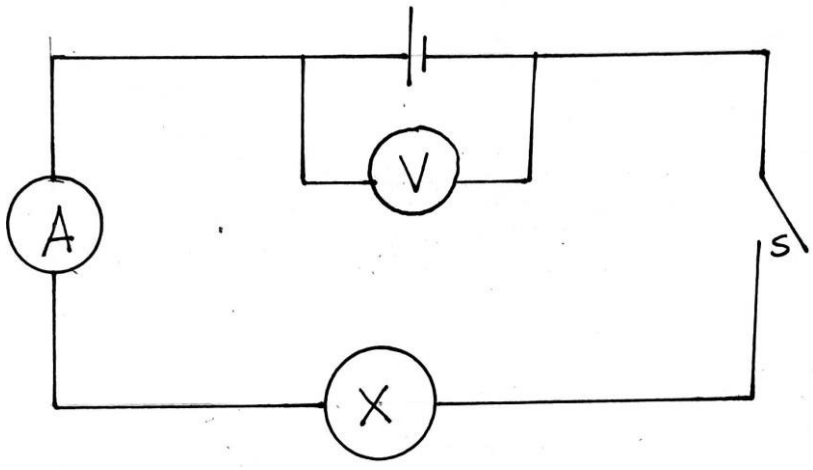
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ii) Apart from temperature state other two factors which affect electrical resistance of a conductor. (2marks)

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b(i) A wire 0.8m long has a cross-sectional area of 7.0×10^{-3} m^2. Determine its resistivity if a current of 0.50A flows through the wire when a p.d of 0.5V is applied at its end. (3marks)

ii) In the figure below the voltmeter reads 2.0V when the switch is open, and 1.5V when the switch is closed. The ammeter reads 0.2A when the switch is closed.



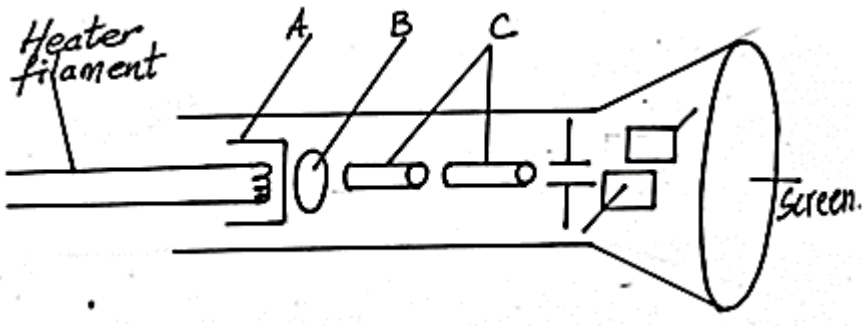
Determine:

I. The e.m.f of the cell. (1mark)

II. The resistance R of the bulb. (2marks)

III. The internal resistance, r of the cell. (2marks)

17.a) The figure represents a cathode ray oscilloscope.



i) Name the parts labelled A and B (2marks)

A ……

B ……

ii) Name one function of the part labelled C. (1mark)

……
……

iii) Explain how cathode rays are produced in a C.R.O (2marks)

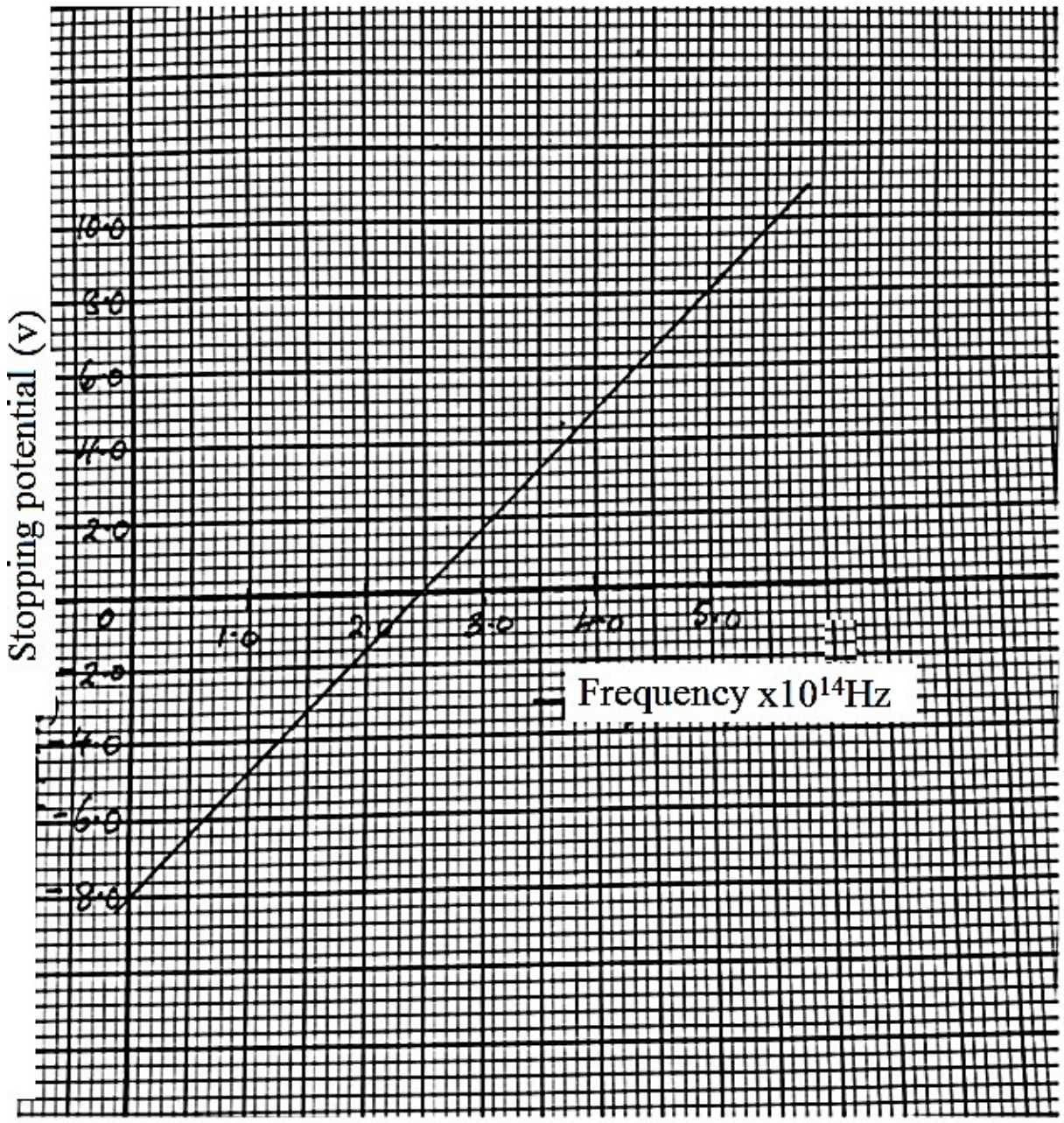
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iv) Give a reason why the tube is evacuated. (1mark)

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18.a) In an experiment to determine the relationship between frequency of radiation of light and kinetic energy of photo electrons in a photoelectric device, the following graph was obtained.



Use the graph to answer the following questions.

a(i) Threshold frequency. (1mark)

ii) Find the plank's constant, h. (change of an electron is 1.6×10^{-19}) (3marks)

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(iii) Hence or otherwise calculate the work function of the metal in Joules (2 marks)

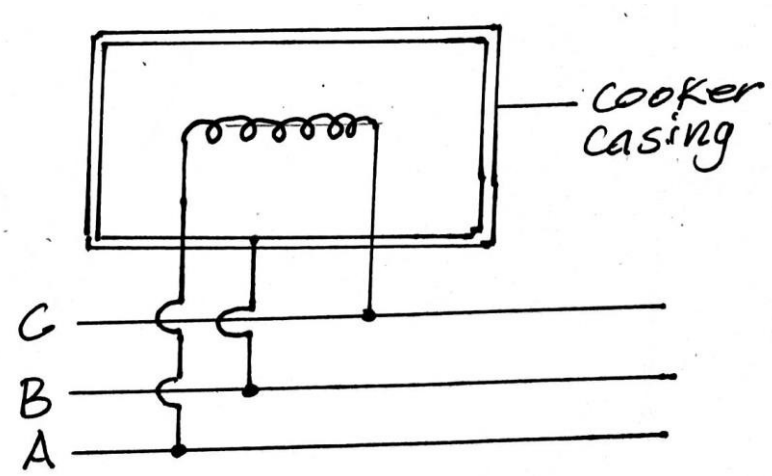
b) A surface whose work function is 6.4×10^{-19} is illuminated with light of frequency 3.0×10^{15} Hz. Determine the maximum kinetic energy of the emitted photoelectrons. ($h = 6.63 \times 10^{-34}$ Js)($M_e = 9.11 \times 10^{-31}$ Kg) (3marks)

19a(i) State why alternating current (a.c) is used for transmitting electricity over long distances. (1marks)

……
……

ii) A house has one 50W bulb, three 100W bulb and one 60W bulb. Determine the cost of having all the bulbs switched on for a day (24hrs) given that the cost of electricity is Ksh 10 per kilowatt hour. (3marks)

b) The figure below shows an electric cooler connected to the main supply. A, B and C are the cables.



i) Identify cable B. (1mark)

……
……

ii) Give a reason for your answer in b(i) above. (1mark)

……
……

c) State the advantage of a circuit breaker over a fuse in domestic wiring system. (1mark)

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……

d) State the function of the ring main circuit in a domestic wiring system. (1mark)

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PAPER 3

QUESTION ONE

You are provided with the following apparatus

- A meter rule
- A copper wire
- A retort stand
- A stop watch
- A micrometer screw gauge
- An overflow can
- A 100ml beaker
- A 50ml measuring cylinder
- A piece of thread
- Water in a 250ml beaker
- Two pieces of wood
- Mass labeled m

Proceed as follows

a)

i. Fill an overflow can with water. Wait until water stops coming out of the spout.

ii. Immerse the mass m into the can. Collect the overflow water into a beaker as shown figure 1 below.

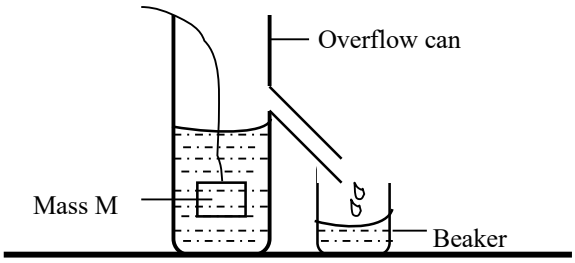


Figure 1

iii. Using the measuring cylinder provided, determine the volume V of the water collected in the beaker

$V =$ ..... ($^1/_2$ mark)

$V =$ ..... m^3 ($^1/_2$ mark)

iv. Calculate I given that $I = \frac{0.2\ m}{V}$ $where\ m = 0.50kg$ (2 marks)

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b) Set up the apparatus as shown below. Ensure that the wire is free of kinks and the end tied to the hook is firm and the hook does not move.

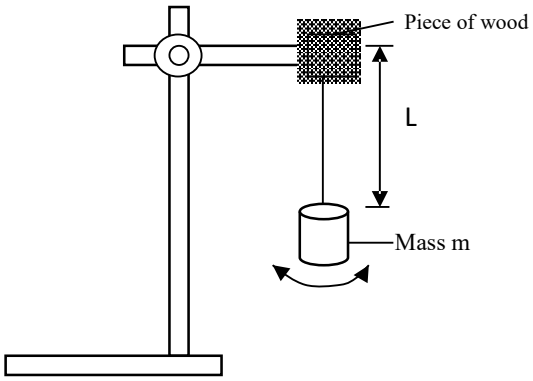


Figure 2

c) Adjust the length L of the wire so that $L = 80cm$. Give the mass m a slight twist so that when released, it oscillates about the vertical axis as shown in figure 2. Measure the time t for twenty oscillations and record in the table below.

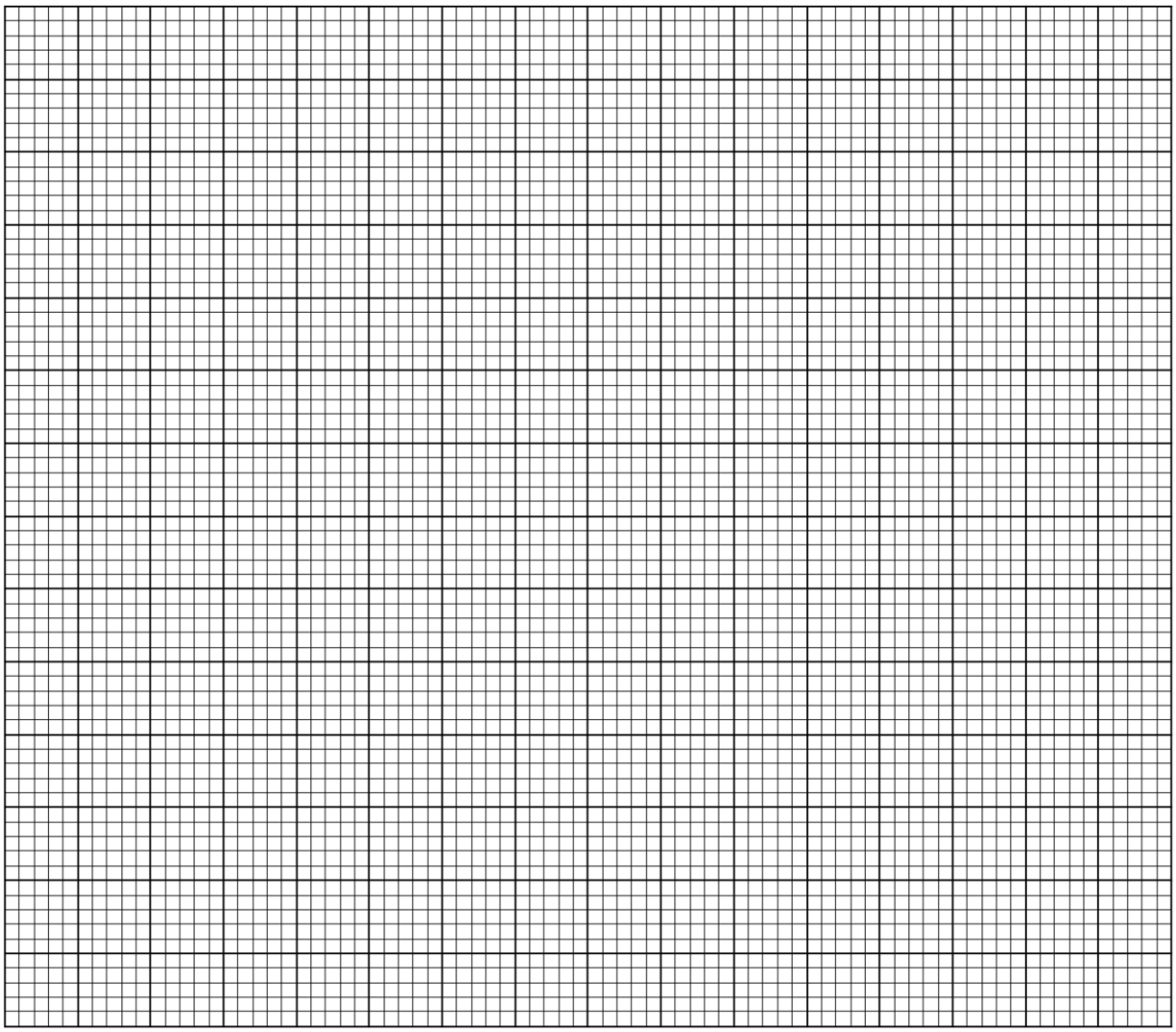
d) Repeat the procedure above for other values of L as shown and complete table 1.

Table 1

Length L (cm)	80	70	60	50	40	30
Length L(m)						
L^2 (m^2)						
Time for 10 oscillation						
Period T(s)						
$T^2(s^2)$						

(6 marks)

e) (i) On the grid provided plot a graph of $T^2(s^2)$ against $L^2(m^2)$ (5 marks)



(ii) Determine the slope of the graph (3 marks)

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.....

(iii)Measure the diameter of the wire

d = ...m (1 mark)

(iv)Given that $T^2 = \frac{0.00096\ \pi^2}{Gd} L^2 + K$ determine the value of the constant G (2 marks)

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QUESTION TWO

PART A

You are provided with the following:

- A resistor R
- a resistance wire labelled Q mounted on a wooden bar
- One 100cm resistance wire AB mounted on a millimeter scale
- Two size D dry cells and a cell holder
- a Centre zero galvanometer G
- 10 connecting wires at least 6 with crocodile clips at one end
- a jockey
- a switch
- a voltmeter 0 – 3V
- an ammeter 0 – 1A

Proceed as follows:

Connect the circuit as shown in Figure 3 below.

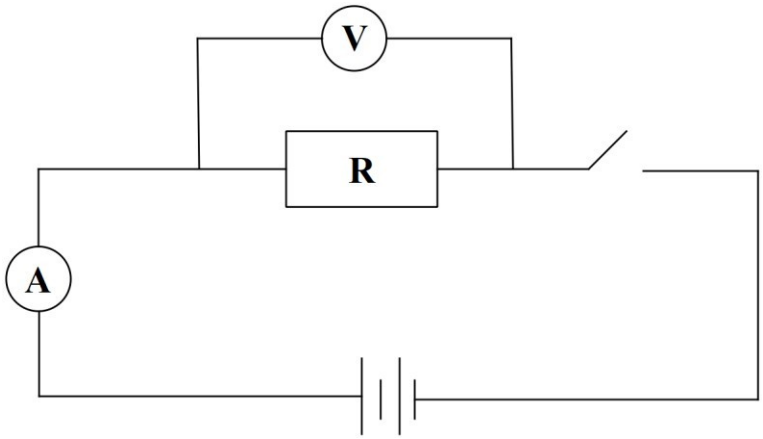


Figure 3

i) Close the switch.

ii) Read and record the reading of

(i) Ammeter, I = ……A (1 mark)

(ii) Voltmeter, V = ……V (1 mark)

iii) Determine the resistance R (2 marks)

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iv) Disconnect the circuit in figure 3 and use the apparatus to connect the circuit in figure 4.

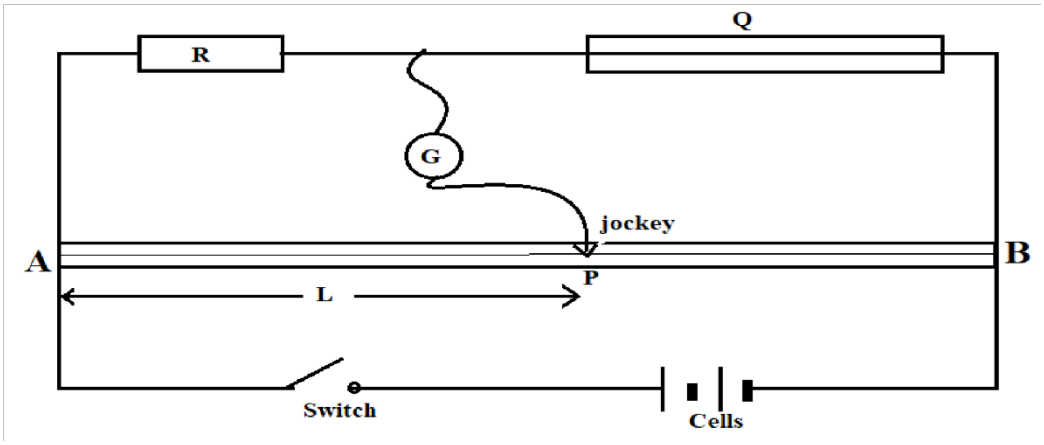


Figure 4

v) Close the switch. Using the jockey tap the wire AB at various points to obtain point P where the galvanometer shows zero deflection.

vi) Record the balance length AP = L.

L=……cm (1 mark)

vii) Determine 100-L (2 marks)

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(h) Calculate the resistance Q. Given that $\frac{Q}{100-L} = \frac{R}{L}$ (3 marks)

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PART B

You are provided with the following;

-A convex lens

-A lens holder

-A candle

-A white screen

-Metre rule

Proceed as follows:

(i) Set up the apparatus as shown in the figure 5 below;

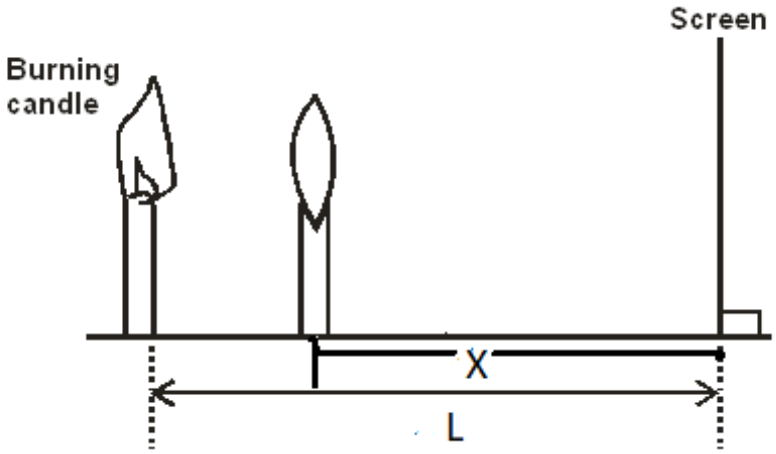


Figure 5

(j) Place the candle at a distance L=50cm from the screen.

Move the lens away from the candle until a sharp diminished image of the candle is seen on the screen. Measure the distance X_1 between the screen and the lens.

X_1……cm (1 mark)

(k) Repeat steps (i) and (ii) above but this time, move the lens towards the candle until a sharp magnified image of the candle is seen on the screen. Measure the distance V2 between the screen and lens.

(l) Given that P = $\frac{L^2-(X_2-X_1)^2}{4L}$, determine P in metres. (3 marks)

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(m) Using an object at infinity, determine the focal length f of the lens.

f =……..m (1 mark)

Compare the value of f to P (1 mark)

……

(n) Given that $K = \frac{1}{P}$, determine K (2 marks)

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(o) State what K represents (1 mark)

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SECTION A (25 marks)

*Answer **all** questions in this section in the spaces provided*

1. A barometer reads 760 mmHg at sea level. Determine its reading at an altitude of 2500 m above sea level. (Density of mercury = 13600 kg/m^3, density of air is 1.25 kg/m^3, g = 10N/kg). (3 marks)

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2. **Figure 1** shows part of the scale of a micrometer screw gauge when it is completely closed.

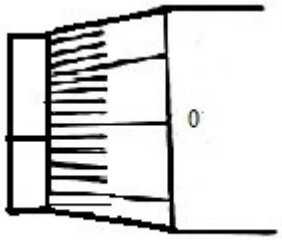


Figure 1

Find the zero error of the device in mm. (1 mark)

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3. **Figure 2** shows an L-shaped cardboard of uniform thickness, balanced on a flat surface.

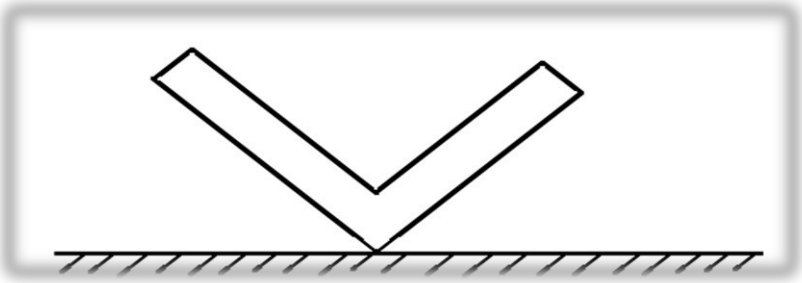


Figure 2

Locate the position of the centre of gravity G. (2 marks)

4. State **two** precautions that must be observed while using a density bottle. (2 marks)

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5. A uniform metre rule of weight 1.5 N is balanced by masses of 50 g and 100 g suspended from its ends. Determine the position of the pivot. (3 marks)

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6. When water at room temperature is added to a piece of ice in a container, some crackling sound is heard. State the reason. (1 mark)

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7. **Figure 3** shows a velocity-time graph of a small metal sphere falling through water in a tall jar.

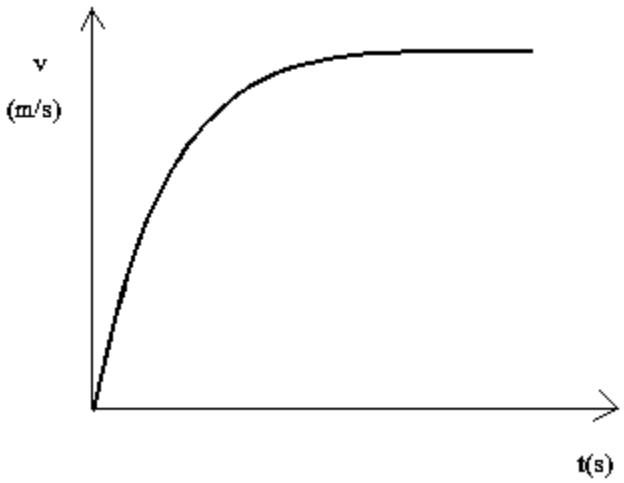


Figure 3

On the same axes, draw a velocity – time graph for the same metal sphere falling through air. (1 mark)

8. A light star leaf is freely suspended near a steady stream of water flowing from a tap as shown in **Figure 4.**

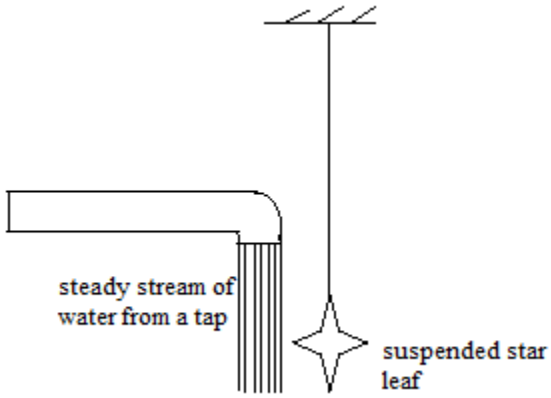


Figure 4

State and explain the motion of the leaf. (2 marks)

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9. You are provided with two identical springs each of spring constant **k**. Sketch a diagram that shows the arrangement of the springs that produces an effective spring constant of **2 k.** (2 marks)

10. An oil drop of diameter 0.5 mm spreads on the surface of water to form an oil patch of diameter 0.2 m. Estimate the thickness of a molecule of oil from the drop. (2 marks)

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11. **Figure 5** shows the tension, T on a pendulum bob suspended from a support.

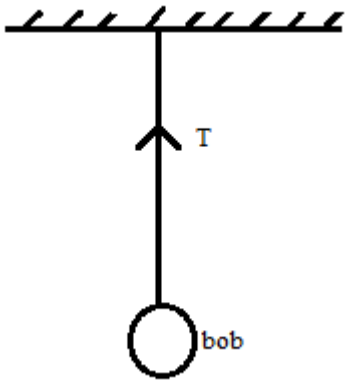


Figure 5

Indicate on the diagram **one** other force acting on the pendulum bob. (1 mark)

12. State **two** advantages of cooking oil over water in cooking. (2 marks)

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13. **Figure 6** shows similar metal cans fit with identical thermometers. The cans had been left outside on a hot day.

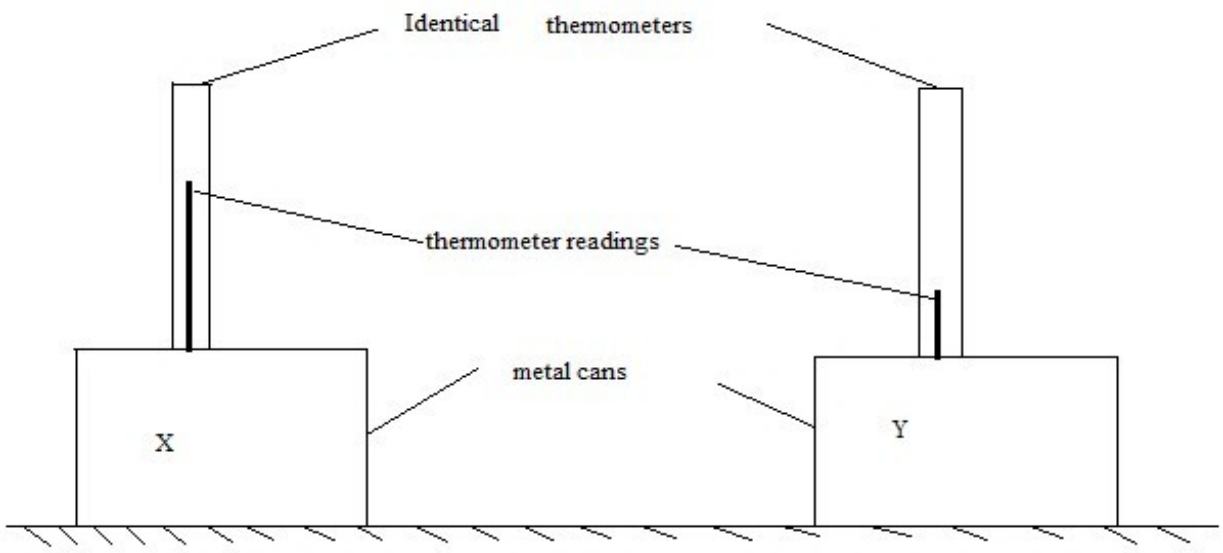


Figure 6

Suggest, with reason(s), one possible difference between the two cans. (2 marks)

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14. State what is meant by the term *particulate nature of matter*. (1 mark)

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SECTION B (55 marks)

*Answer **all** questions in this section in the spaces provided*

15. (a) **Figure 7** shows a spray-can that contains gas particles which are in constant motion.

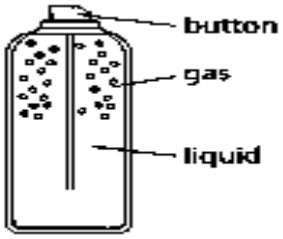


Figure 7

Explain how the gas particles produce a pressure on the walls of the spray-can (1 mark)

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(b) A student presses the button and some liquid leaves the can. The student then concludes that this action leads to decrease in pressure in the can. Explain this conclusion. (2 marks)

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(c) The spray-can is warmed by the sun on a hot day. State what happens to the average speed of the gas molecules. (1 mark)

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(d) **Figure 8** shows a can that produces whipped cream using gas at high pressure.

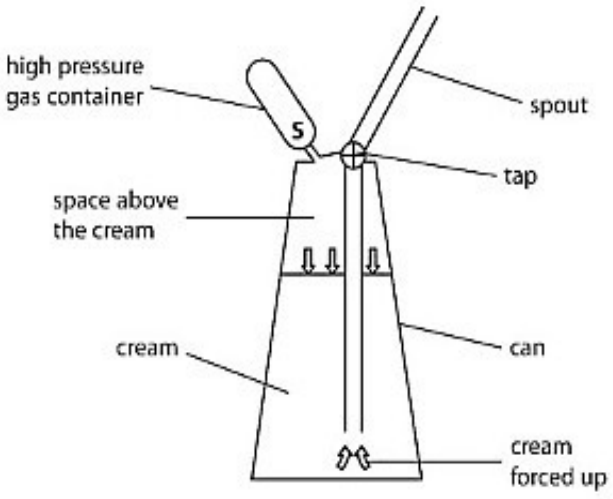


Figure 8

(i) The volume of the high pressure gas container is 10 cm^3. The pressure of the gas is 10,000 kPa. When the seal S is broken, the gas is released into the space above the cream, and expands to a total volume of 270 cm^3. Calculate the new pressure of the gas (3 marks)

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(ii) Some of the gas molecules dissolve in the cream. State and explain how this affects the pressure of the gas in the space above the cream. (2 marks)

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(iii) When the tap is opened, the pressure of the gas forces the cream out of the spout. Explain what happens to the dissolved gas as the cream leaves the can. (2 marks)

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16. (a) i) Define *impulsive force*. (1 mark)

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ii) A car negotiating a corner at a constant speed is said to have a change of momentum. Explain this observation. (2 marks)

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(b) In a penalty kick, a footballer increases the speed of the ball from 0 m/s to 35 m/s. If the ball has a mass of 450 g;

i) Determine the impulse on the ball. (2 marks)

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ii) If the foot was in contact with the ball for 0.12 s, calculate the average force exerted on the ball. (2 marks)

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(c) Parachutists roll as they hit the ground. Explain how this action reduces likelihood of injuries. (2 marks)

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(d) Jemo weighs 70 kg. He boards a lift at KICC designed to accelerate upwards at 3 m/s^2. Determine the reaction of the lift at his feet. Take g=9.8 m/s^2. (2 marks)

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17. (a) **Figure 9** shows a sealed glass syringe that contains smoke particles suspended in air.

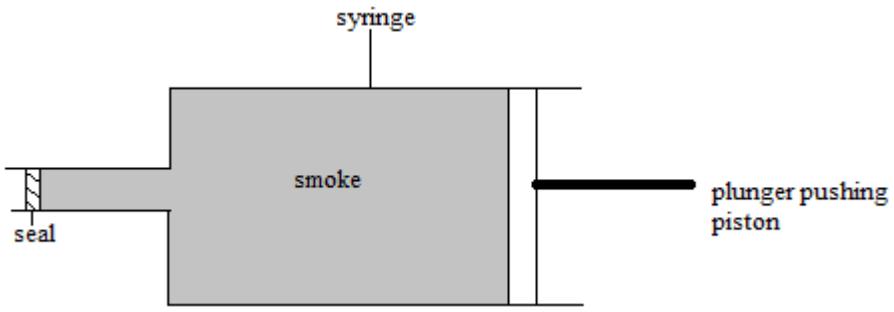


Figure 9

(i) Explain why the smoke particles are suspended in the air and do not settle to the bottom.

(2 marks)

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(ii) The air in the syringe is at a pressure of 2.0×10^5 N/m^2. If the cross-section area of the piston is 4.0 cm^2, determine the force exerted at the piston. (3 marks)

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(iii) A body moving at a velocity of 5 m/s accelerates uniformly within 10 seconds until it attains a velocity of 20 m/s which it maintains in 15 seconds. It then decelerates uniformly to 10 m/s in 5 seconds.

I. Sketch the velocity-time graph for the motion. (2 marks)

II. Sketch a graph of resultant force against time for the motion. (2 marks)

18. (a) Pure ice can be can be converted to water without change in temperature, state another factor that remains constant. (1 mark)

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(b) Explain how possible it is to join two separate bars of ice cubes. (2 marks)

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(c) An immersion heater rated 240 V, 10 A is used to heat 5 kg of water at a temperature of 24 °C. Calculate the temperature of water after 5 minutes. (3 marks)

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(d) **Figure 10** shows a modern refrigerator. Use it to answer the questions that follows.

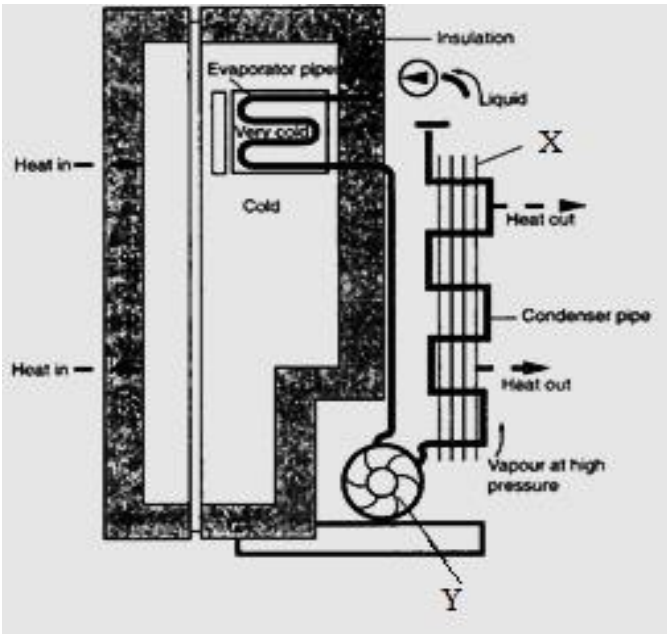


Figure 10

I. State and explain the property of the liquid to be considered as the refrigerant in the device.

(2 marks)

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II. State the importance of these parts of the device shown.

X……. (1 mark)

Y……. (1 mark)

III. Briefly explain how cooling is achieved in the device. (3 marks)

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19. (a) i) State the law of Floatation. (1 mark)

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ii) Explain why a piece of metal placed on water sinks but when the same piece of metal is placed on a block of wood, both are found to float. (2 marks)

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(b) i) A hydrometer floats with 4 cm of its stem out of water. The hydrometer has a mass of 30 g and a cylindrical stem of cross sectional area 0.65 cm^2. Calculate the length of the stem above the liquid surface when it floats in a liquid of density 1.5 g/cm^3. (3 marks)

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ii) State **two** ways to make a hydrometer more accurate. (2 marks)

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(c) A crane is pulling a block of solid Gold from the bottom of the ocean using a metallic cable. If the density of Gold is 19.3 g/cm^3 and the density of sea water is 1.02 g/cm^3. Calculate the volume of the Gold given that the tension in the cable is 3656 N when the Gold is still suspended in the ocean.

(3 marks)

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SECTION A (25 marks)

*Answer **all** questions in this section in the spaces provided*

1. State **two** factors that determines the current carrying capacity of lead acid accumulator. (2 marks)

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2. **a) Figure 1** shows two mirrors inclined at an angle.

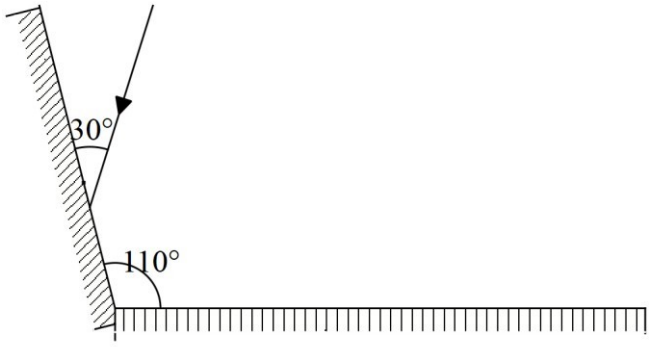


Figure 1

Complete the diagram to show the path of the reflected ray and hence determine the final angle of reflection. (2 marks)

b) **Figure 2** shows the image formed by a biconcave lens.

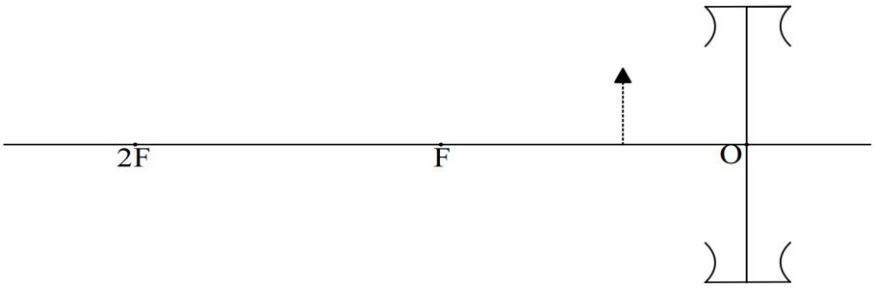


Figure 2

Using ray diagrams locate the position of the object. (2 marks)

3. **Figure 3** shows a bar magnet moved slowly towards a steel bar **A** and iron bar **B** which are equidistant from the north pole, suspended and placed side by side but separated by a wooden block.

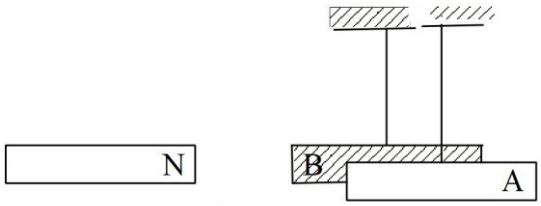


Figure 3

State and explain the observation made. (2 marks)

……

4. State **two** reasons why dentists when examining teeth prefer concave mirrors. (2 marks)

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……

5. Explain why the cathode ray tube is highly evacuated. (2 marks)

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……

6.

a) **Figure 4** shows sound wave passing through air.

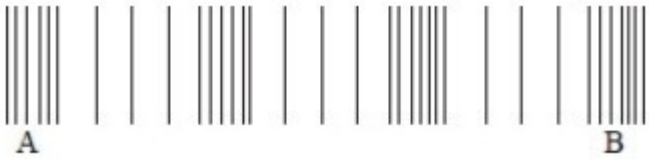


Figure 4

If the wavefront takes 0.2s to travel from A to B. Determine the frequency of the wave. (2 marks)

b) Define by the term *reverberation.* (1 mark)

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7. Explain why in electric circuits, thin resistance wire feels warmer than copper leads in the same circuit. (2 marks)

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8. Define a *standing wave*. (1 mark)

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9. State **one** application of electrostatics. (1 mark)

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10.

a) **Figure 5** shows a set up to investigate magnetic effect of current flowing through conductor.

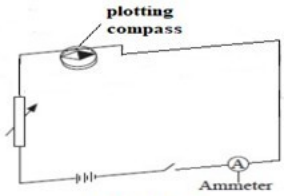


Figure 5

When the switch is closed the pointer of the compass deflects. Explain. (1 mark)

……

……

b) If the compass is under the wire, state the direction (**Clockwise or Anti-clockwise**) of deflection of North pole of the compass. (1 mark)

……...

……

11. State **one** advantage of using a curved magnet in a motor. (1 mark)

……

12.

a) In a microwave cooker, magnetrons produce microwaves at a frequency of about 2500 MHz . Explain how the microwaves help in cooking food. (2 marks)

……

……

b) Table 1 shows electromagnetic waves in order of wavelength.

P	X-rays		Q	Intra red	

Table 1

Identify radiation Q (1 mark)

……

……

SECTION B (55 marks)

*Answer **all** questions in this section in the spaces provided*

13. a) Define a *farad*. (1 mark)

……

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b) **Figure 6** shows three capacitors connected to a voltage of V_T.

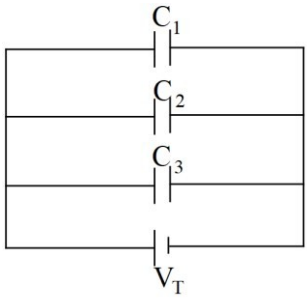


Figure 6

i. Determine the charge in the C_2 capacitor. (1 mark)

……

ii. Determine the total charge Q_T in terms of the quantities given in **Figure 6**. (2 marks)

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……

c) Distinguish between lost voltage and e.m.f. of a cell. (1 mark)

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d) **Figure 7** shows an arrangement of resistors.

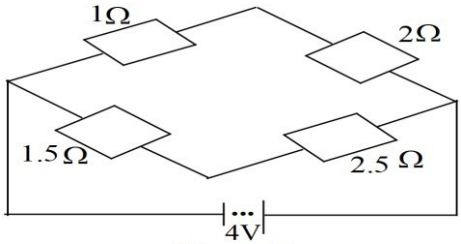


Figure 7

Determine the voltage drop across the 1.5 resistor. (3 marks)

e) **Figure 8** shows a house wiring system.

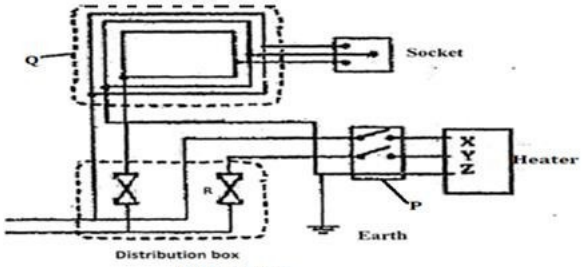


Figure 8

i) Name the part labelled **P**, hence state its function. (2 marks)

……

……

ii) State the colour of **X**. (1 mark)

……

iii) Explain how **Q** reduces the risk overloading. (1 mark)

……

……

iv) State **one** advantage of the device which can be used in place of **R**. (1 mark)

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14.

a)

i) Explain how doping produces a p-type semiconductor. (3 marks)

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ii) Other than rectification, state **two** other uses of a p-n junction diode. (2 marks)

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b) **Figure 9** shows an incomplete circuit for a full- wave rectification.

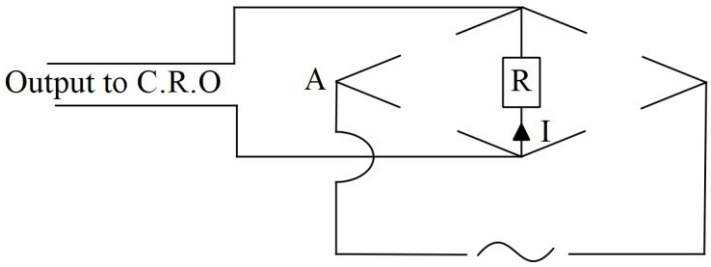


Figure 9

Complete the diagram to show how the diodes should be arranged for the **current I** to flow through **R** in the direction shown when point **A** is positive for the input signal. (1 mark)

c) **Figure 10** shows a device for producing metal foil of constant thickness. Any change in thickness can be detected by the GM tube. The pressure by the roller is then adjusted to keep the thickness constant.

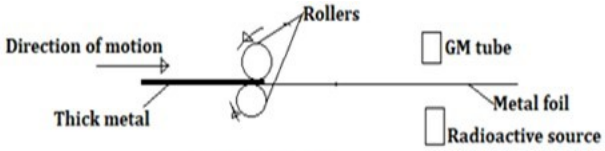


Figure 10

i) State the change in the metal foil that leads to a decrease in the GM tube counter reading. (1 mark)

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……

ii) Give a reason for your answer for your answer in **(i)**. (1 mark)

……

……

iii) Explain why a source emitting alpha particles only would not be suitable for this device. (1 mark)

……

……

d) **Equation 1** shows part of a radioactive decay process.

$$^{234}_{90}\mathbf{T} \xrightarrow{\mathbf{X}} {}^{234}_{91}\mathbf{Pa}$$

Name the radiation **X** and state **one** of its property. (2 marks)

……

……

15.

a) **Figure 11** shows the essential components of an X-Ray tube.

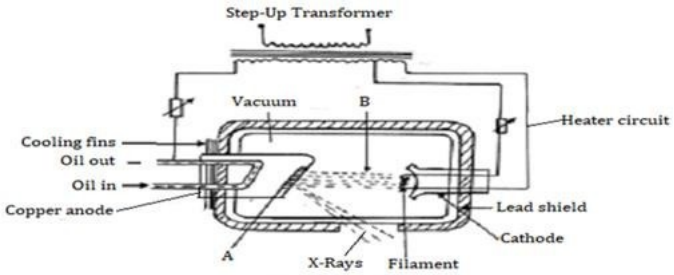


Figure 11

i. Explain how electrons are produced. (2 marks)

……

……

……

ii. During operation of the tube, the target becomes very hot.

I. Explain how this heat is caused. (1 mark)

……

……

II. State **two** ways in which cooling can be achieved in the tube. (2 marks)

……

……

iii. Explain why the cathode is concave shaped. (1 mark)

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……

b) **Figure 12** shows a set up used to demonstrate the photoelectric effect.

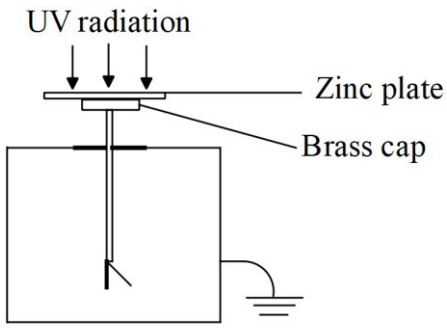


Figure 12

If the electroscope was negatively charged, state the observation made. (1 mark)

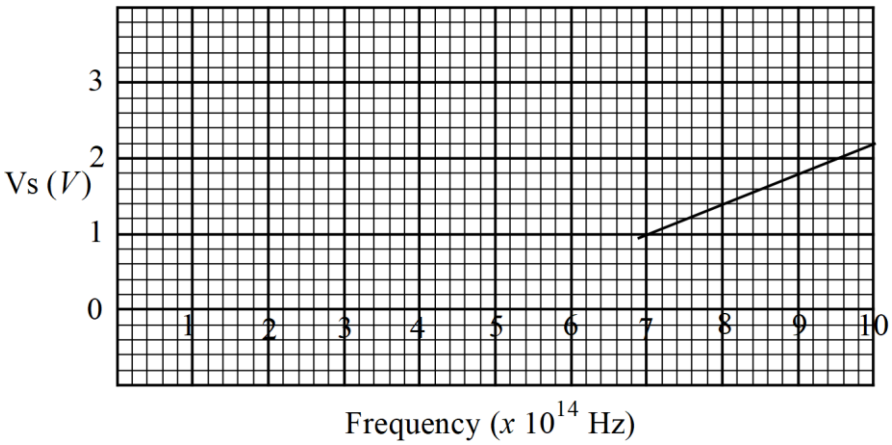
……

c) Define the term *threshold wavelength*. (1 mark)

……

……

d) **Graph 1** shows a plot of stopping potential (V_s) against frequency, (f).



From the graph, determine the;

(i) threshold wavelength. (Take c= 3.0 x 10^8 m/s.) (2 marks)

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(ii) Planck's constant, h. (Take e = 1.6 x 10^{-19} C) (2 marks)

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16.

a) State the *principle of reversibility to light*. (1 mark)

……

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b)

i) Define *centre of curvature* of a concave lens . (1 mark)

……

……

ii) State **one** reason why concave lens is preferred for use in peep hole. (1 mark)

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……

c) **Figure 13** shows refraction of light through multiple layers of transparent media M_1 and M_2.

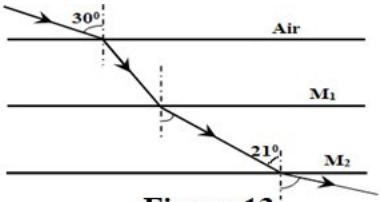


Figure 13

If the refractive index of M_1=1.4. Find the refractive index of M_2 with respect to M_1. (3 marks)

d) **Figure 14** shows a set up used to determine refractive index of law-circular glass block.

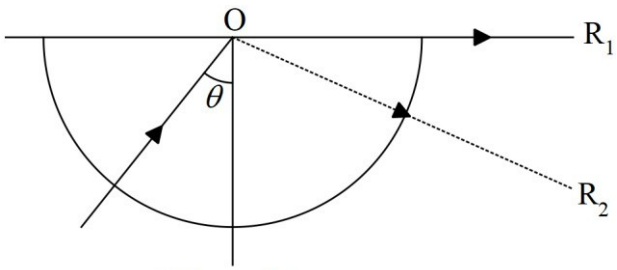


Figure 14

At the angle θ a ray R_1 emerges along the straight edge of the block.State one adjustment for the ray to emerge as R_2. (1 mark)

……

……

e) You are provided with the following apparatus ,

- A lit candle
- Plane mirror
- Metre rule
- Lens mounted on a holder
- Cardboard with cross wires at its center.

Describe an experiment to determine focal length of the lens using the apparatus. (3 marks)

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17.

a) State what is meant by the term *electromagnetic induction*. (1 mark)

……

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b) Explain how energy losses in a transformer are reduced by;

i) Winding both primary and secondary turns on a soft iron ring. (1 mark)

……

……

ii) Having a soft iron core. (1 mark)

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c) **Figure 15** shows a simple microphone in which sound waves from the person taking cause the cardboard diaphragm to vibrate.

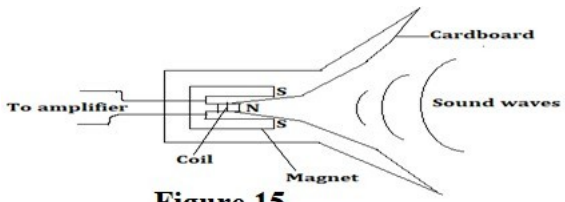


Figure 15

i) Explain how a varying current is induced in the coil when the diaphragm vibrates. (2 marks)

……

……

ii) State **two** ways in which the induced current in **(i)** can be increased. (2 marks)

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d) **Figure 16** shows a bar magnet moved out of a coil.

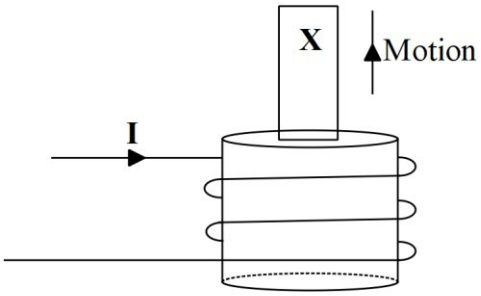


Figure 16

i) If the **current I** is induced in the coil in the direction shown, identify the polarity of end X of the magnet. (1 mark)

……

ii) Explain the source of electrical energy in the circuit. (1 mark)

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SECTION AS: (25 MARKS)

Attempt *ALL* questions in the spaces provided

1. **Figure 1** shows a ball bearing of mass 2.5 g placed between the jaws of Vernier calipers. The magnified section is also shown. The reading of the gauge when the jaws were fully closed without the marble was 0.01cm.

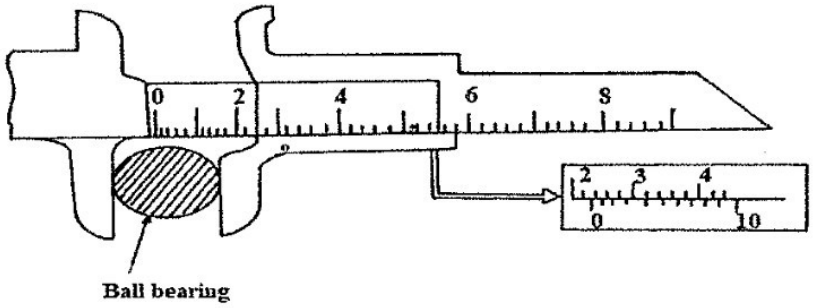


Fig. 1

Determine:

a) The actual diameter of the ball bearing (1mk)

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.....

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b) The density of the ball bearing (2mks)

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2. A rider on a motorbike putting a cap instead of a helmet realized that at a high speed the cap flew off his head. Explain this observation. (2mks)

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.....

3. A drop of olive oil of volume 0.1 mm^3 is placed on the surface of clean water. It spreads out completely into a patch of area 100 cm^2. Use this information to answer questions 3 and 4.

Calculate the thickness of the oil patch. (3mks)

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4. **Figure 2** represents a u-shaped glass tube sealed at one end and containing mercury

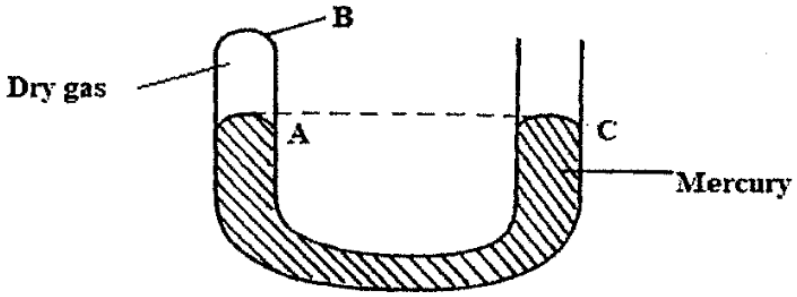


Fig. 2

(i) What is the pressure of the gas as shown in the diagram above? (1mk)

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(ii) Explain why the gas should be dry if it is to be used to verify a gas law (1mk)

.....

.....

6. Explain why water boiling in a container stops boiling momentarily when the lid of the container is removed. (2mks)

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7. A turntable of record player makes 33 revolutions per minute. Determine the linear velocity of a point 0.12m from the center. (3mks)

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8. A uniform mixture consists of water and ethanol in the ratio of 3:4 respectively. Given that the volume of water is 20 cm^3. If the densities of water and ethanol are **1 g/cm^3** and **0.85 g/cm^3** respectively. Calculate the density of the mixture. (3mks).

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9. **Figure 3** shows five identical spring were arranged as shown below and the single spring extends by 10 cm when supporting a load of 50 N.

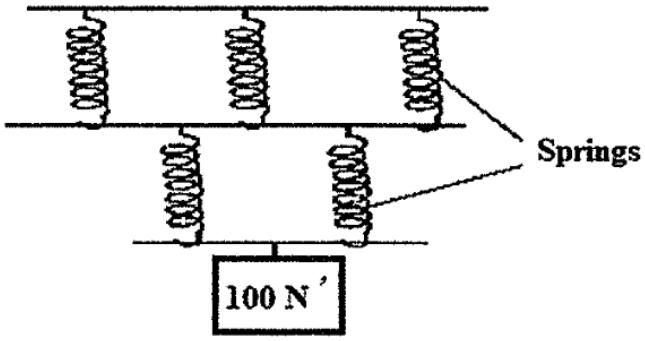


Fig. 3

Determine the total extension of the system (take the weight of the cross bars to be negligible) (3mks)

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10. **Figure 3** shows a manometer closed at one end and the other end connected to gas cylinder.

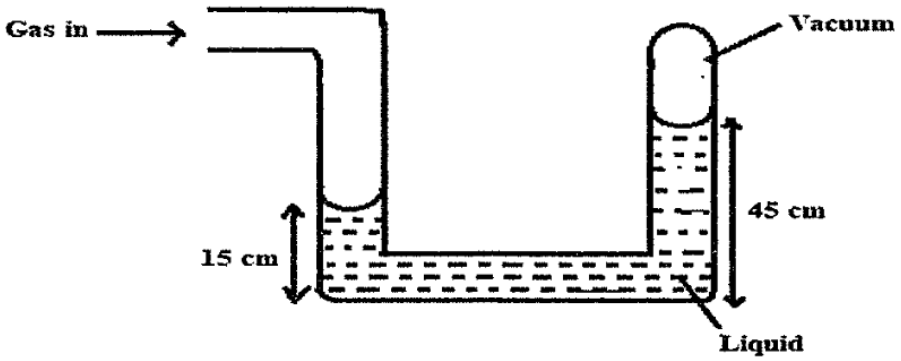


Fig. 3

Given that the liquid has a density of 1.2 g/cm^3.Calculate the pressure due to the gas. (3mks)

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11. The stability of an object can be increased by lowering the c.o.g of an object. State one way in which this can be achieved. (1mk)

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SECTION B (55 MARKS)
Attempt ALL questions in the spaces provided

12. (a) State Pascal's Principle. (1mk)

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(b) **Figure 4** shows hydraulic brake system.

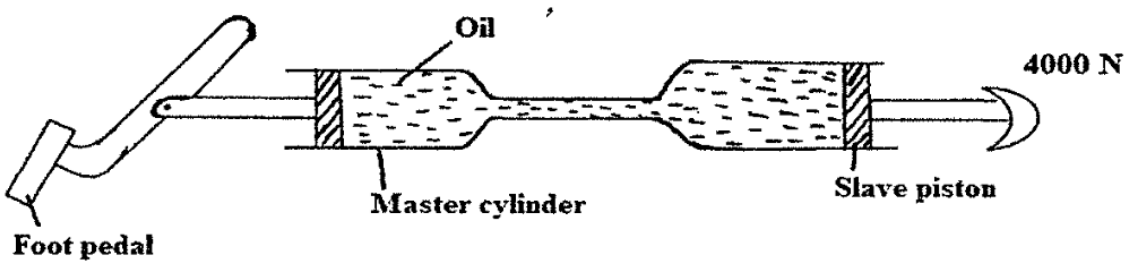


Fig. 4

A force of 20N is applied on the foot pedal to a piston of area $50cm^2$ and this causes a stopping force of 4000N.

Determine;

(i) Pressure in the master cylinder. (3mks)

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(ii) Area of the slave piston. (3mks)

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(iii) State any two properties of the fluid used in the hydraulic brake system other than its compressibility (2mks)

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13. (a) Define the term **velocity ratio** as applied to machines. (1mk)

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(b) **Figure 5** is a graph showing how load varies with effort in an experiment using a single stringpulley system of velocity ratio 5. Use the graph to answer the questions that follow.

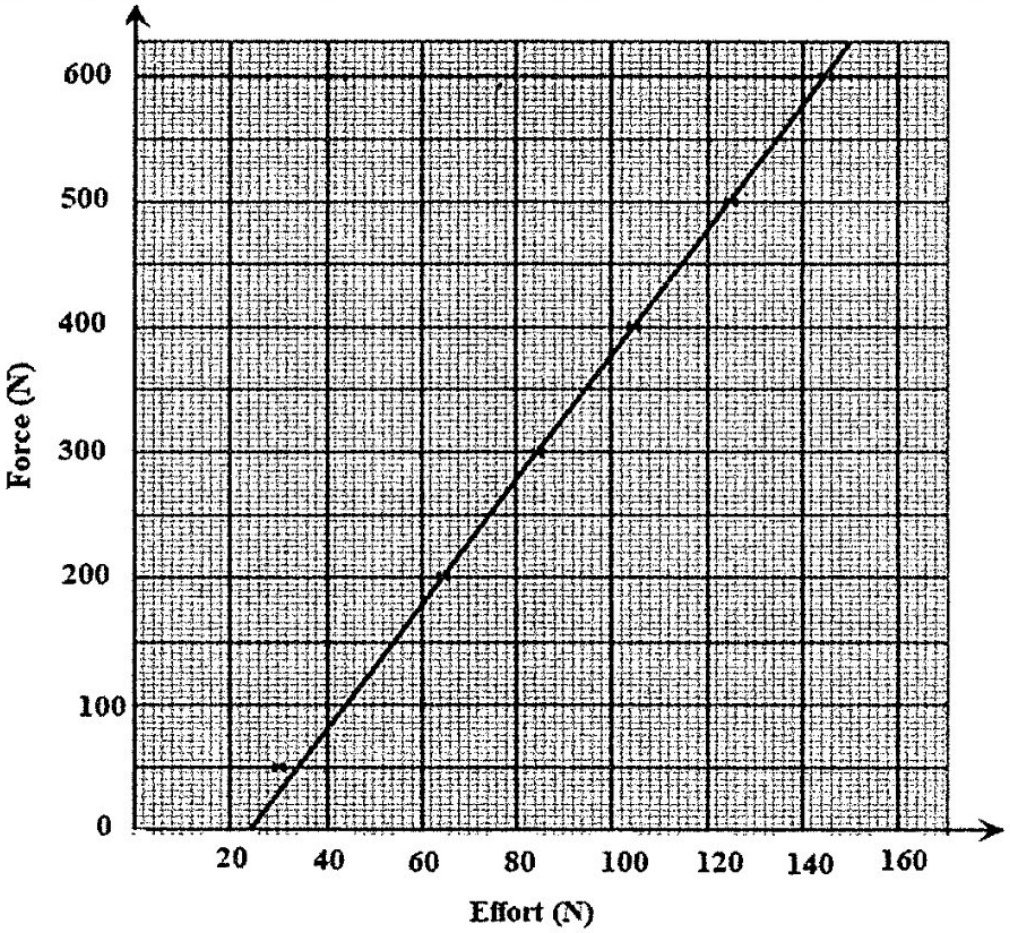


Fig. 5

For a load of 450 N, find the;

(i) Effort. (1mk)

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(ii) Mechanical advantage. (1mk)

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(iii) Efficiency. (3mks)

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(c) A block and tackle pulley system has two pulleys in the lower block and three in the upper block. Sketch the diagram of this pulley system (2mks)

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(d) Sketch a graph showing the variation of mechanical advantage with load. (2mks)

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(e) Explain why the efficiency of such a pulley system is less than 100%. (2mks)

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14. (a) Define specific latent heat of vaporization (1mk)

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(b) A calorimeter of 35.0 g and specific heat capacity 840 J kg^{-1} K^{-1} contains 143.0 g of water at 7 ^{0}C. Dry steam a 100 ^{0}C is bubbled through the water in the calorimeter until the temperatureof the water rises to 29 ^{0}C. If the mass of steam which condenses is 5.6 g.

(i) Calculate the heat gained by the water (2mks)

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(ii) Calculate the heat gained by the calorimeter. (2mks)

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(iii) Determine an expression for the heat lost by the steam in condensing at 100 ^{0}C and in cooling to 30 ^{0}C. (3mks)

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(iv) Find the specific latent heat of vaporization of water. (3mks)

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(c) The cooling system of a refrigerator extracts 0.7 kW of heat. How long will it take to convert 500 gof water at 20 ^{0}C into ice. (3mks)

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15. (a) State the law of floatation (1mk)

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b) A balloon of negligible weight and capacity 90m^3 is filled with helium of density 0.18kg m^{-3}. Calculate the lifting force of the balloon given that the density of air = 1.2 kgm^{-3} (3mks)

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c) A piece of glass has a mass of 52g in air, 32g when completely immersed in water and 18g when completely immersed in an acid. (Take: density of water = 1g/cm^3)
Calculate:

i) Density of glass (3mks)

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ii) Density of the acid (3mks)

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d) **Figure 6** shows a hydrometer

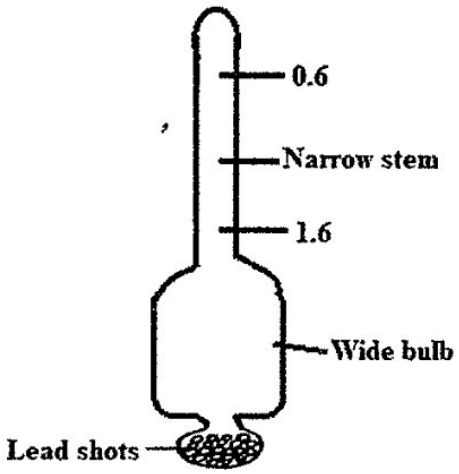


Fig. 6

Explain:

i) Why the stem is made narrow (1mk)

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ii) Why the bulb is made wide (1mk)

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iii) Why the lead-shots are placed at the bottom (1mk)

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16. **Figure 7** shows the structure of a force pump.

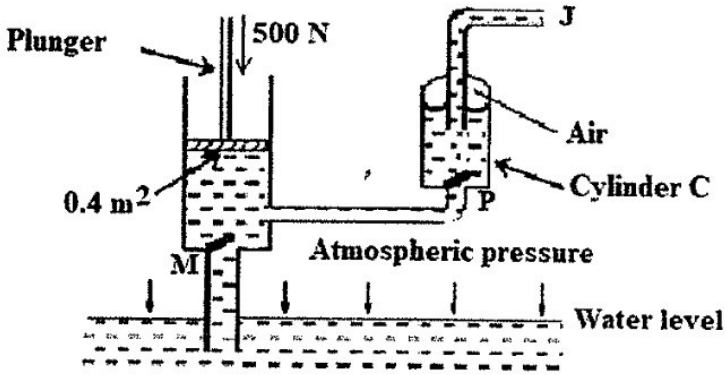


Fig. 7

(i) Describe the action of the pump. (4mks)

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(ii) If the downward force of 500 N is exerted on the plunger whose surface area is 0.4 m^2, calculate the pressure which forces water into cylinder C. (3mks)

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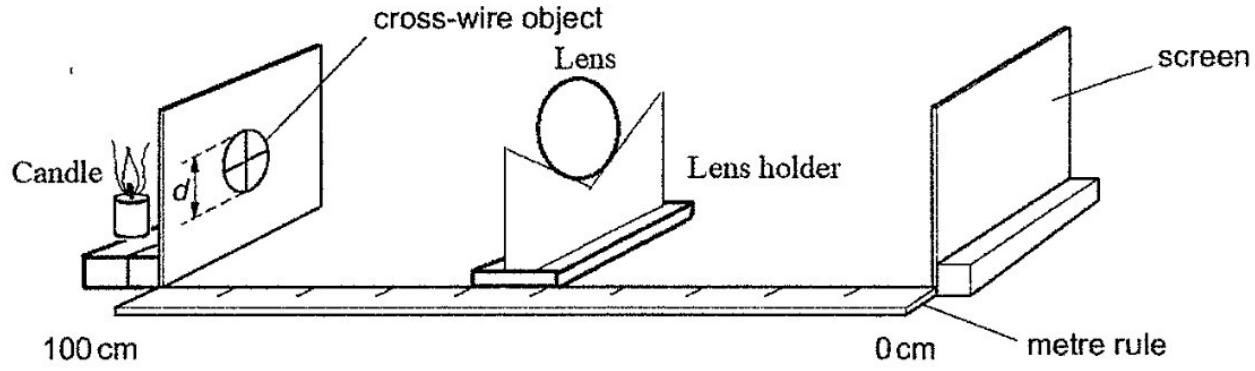
PAPER 3

Question One

In this question, you are provided with:

- a lens mounted on a slotted mass
- additional slotted masses to change the height of the lens
- an illuminated cross-wire object
- a light source (candle)
- a metre rule
- a 30 cm ruler
- a screen.

(a) The supervisor has set up the apparatus as shown in Fig. 4.1. The screen is at the 0 cm end of the rule. The cross-wire object is at the 100.0 cm end of the rule.



(b) Adjust the position of the lens so that a sharply focused and enlarged image of the cross-wire objects seen on the screen.

(c) Measure and record the position of the centre of the lens on the rule and the distance x of the centre of the lens from the screen on the answe

position of the centre of the lens =..... .... (½ mark)

x = ... (½ mark)

(d) Measure:

(i) the length d of the vertical wire of the cross-wire object as shown in Fig. 4.1

d =..... (1 mark)

(ii) the length D of the magnified image of this wire on the screen.

D = ... (1 mark)

(iii) Magnification M

M = ... (1 mark)

(e) Move the screen to the 8.0 cm mark on the rule. The cross-wire object must stay at the 100.0 cm mark throughout.

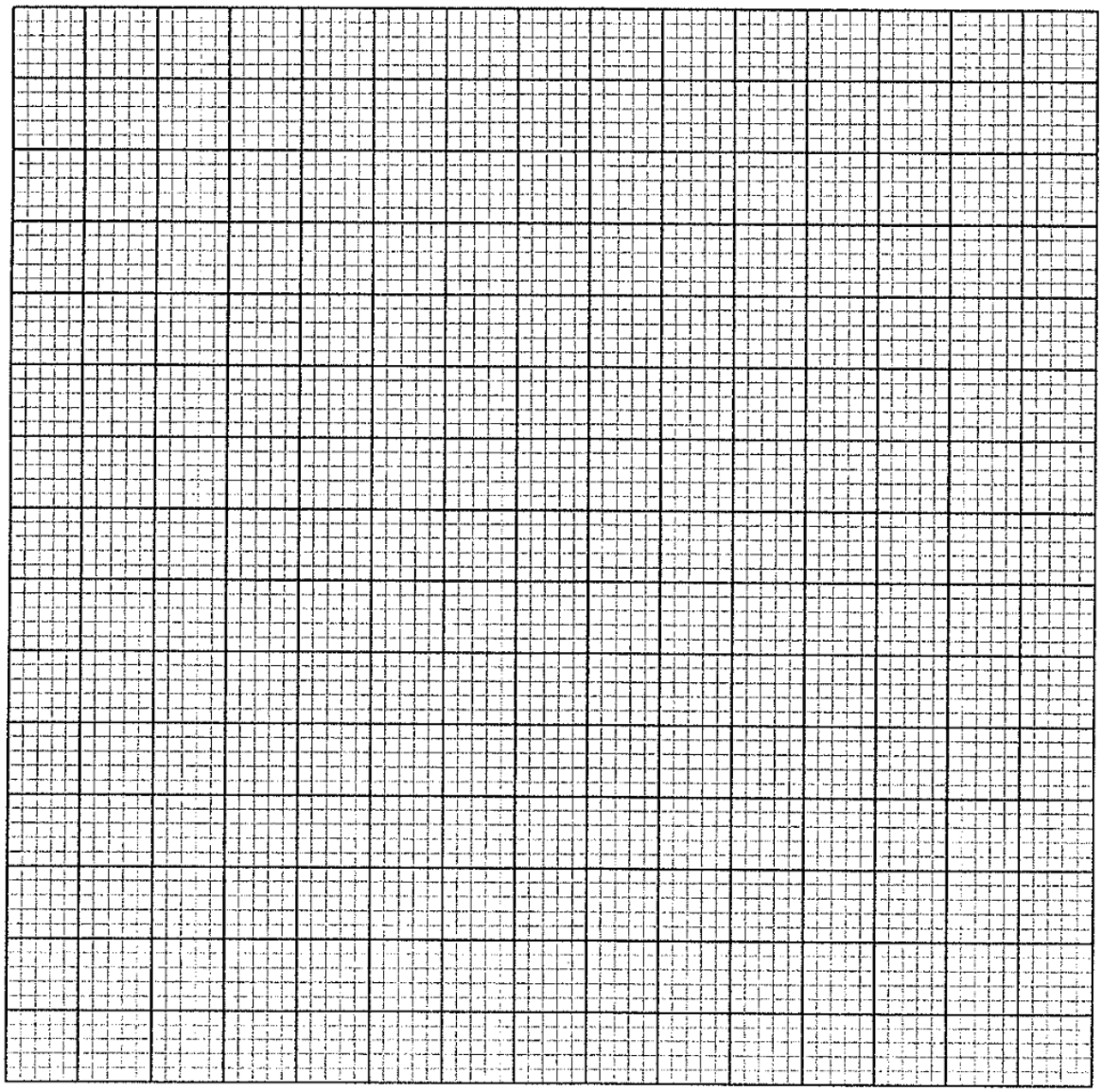
(f) Adjust the position of the lens so that the image of the cross-wire on the screen is sharply focused. Measure and record the new position of the lens, the new x and the new D.

(g) Repeat (b) and (c) to obtain further values for the position of the lens, x and D for screen positions shown in the table below (6 marks)

screen position on rule (cm)	x(cm)	D (cm)	Magnification, M
0			
8.0			
16.0			
24.0			
32.0			
40.0			

Use the value of d *you recorded in (d) above.*

(h) On the grid provided, plot a graph of m on the y-axis against x on the x-axis (5 marks)



(i) Calculate the slope of the graph above (3 marks)

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(j) Given that $x = mq + q$, calculate the value of q: (2 marks)

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Question 2

Part (a)

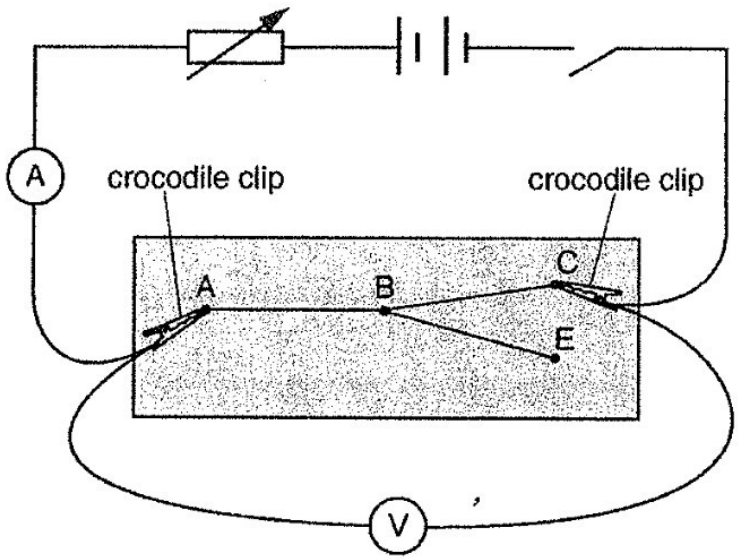
In this question you have been provided with

- a wooden strip with wires attached.
- Some connecting wires
- Crocodile clips
- Voltmeter
- Ammeter
- Micrometre screw gauge

(a) Without detaching the wire from the board, use the micrometre screw gauge provided to measure the Diameter D of wire attached between A and B.

D ..... (1 mark)

(b) Set up the circuit shown in as shown below.



(c) Connect the crocodile clips to A and C and adjust the rheostat to approximately the middle of its range and then close the switch.

(d) Read and record the ammeter and voltmeter reading.

(i) Ammeter reading..... (1 mark)

(ii) Voltmeter reading ..... (1 mark)

(e) Use the micrometre screw gauge to measure and record the diameter d of the wire connected between B and C

d =..... (1 mark)

(f) Given that $G = \frac{D^2+d^2}{D^2d^2}$, Calculate the value of ***G***. (2 marks)

.....

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.....

(g) Disconnect the crocodile clip from C and connect it to E. Close the switch and adjust the rheostat so that the ammeter reading is as close as possible to the reading in (d).

Record the voltmeter reading *V*

V= ..... (1 mark)

(h) Open the switch and measure the diameter d of the wire attached between B and E.

d =..... (1 mark)

(i) Calculate the new value of G, using $G = \frac{D^2+d^2}{D^2d^2}$, (2 marks)

.....

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(j) It is suggested that the relationship between V and G is $\boldsymbol{V = kG}$ where k is a constant. Using your data, calculate two values of k.

(i) First value of k (2 mark)

.....

.....

(ii) Second value of k (2 marks)

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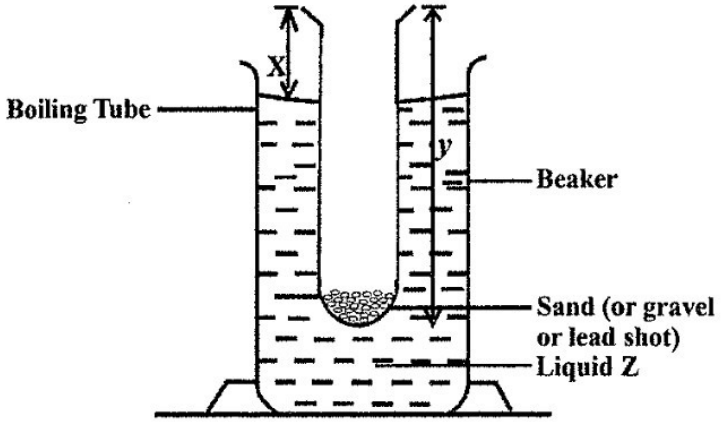
Part (b)

You are provided with:

- Boiling tube
- Some sand
- Transparent cylindrical container
- Water
- Vernier callipers (to be shared)
- Weighing balance (to be shared)
- Meter rule

Proceed as follows:

(a) Place the boiling tube in the Liquid L and keep it upright. Add some sand a little at a time until the tube floats freely upright in the liquid as shown below



(b) Measure the length x of the tube above the liquid level. Remove the tube from the liquid and measure its total length y as indicated in the diagram below.

(i) X=.....m (1 mark)

(ii) Y= .....m (1 mark)

(c) Wipe off the liquid from the outside of the tube and measure the mass of the tube and its content.

mass .....g (½ mark)

m ..... kg (½ mark)

(d) Using the Vernier callipers, measure the outer diameter of the tube at about the middle of the tube.

diameter = ... cm (½ mark)

d =.....m (½ mark)

Given that $K == \frac{m}{\pi\left(\frac{d}{2}\right)^2 (y-x)}$ determine the value of K. (2 marks)

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.....

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(e) State what quantity k represents? (1mark)

.....

SERIES 12

PAPER 1

Section A (25 marks)

Answer all the questions in the spaces provide

1. A partially inflated balloon at sea level becomes fully inflated at higher altitudes. Explain this observation (2 marks)

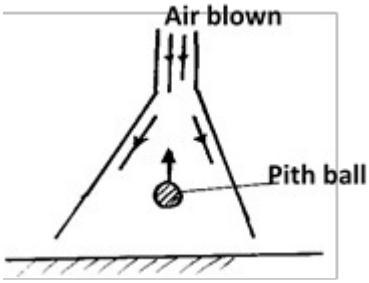
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2. The figure below shows a pith ball being lifted into the funnel by blowing air into the funnel Explain this observation (2 marks)



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3. State **two** reasons why gases diffuses at a higher rate than liquids. (2 marks)

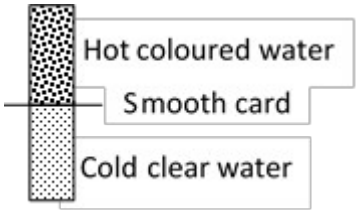
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4. A student set up an experiment as shown below using two gas jars, one with hot coloured water, the other with cold clear water separated by a smooth card. The upper jar is upside down. Explain the observation made when the card is removed. (2 marks)

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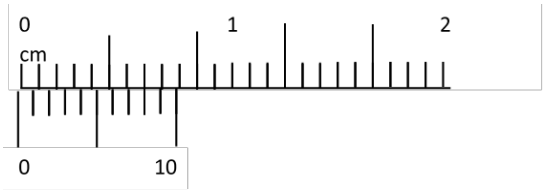
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5. The figure below shows the scale of a Vernier calipers which is closed fully. State the Zero error of the instrument (1 mark)

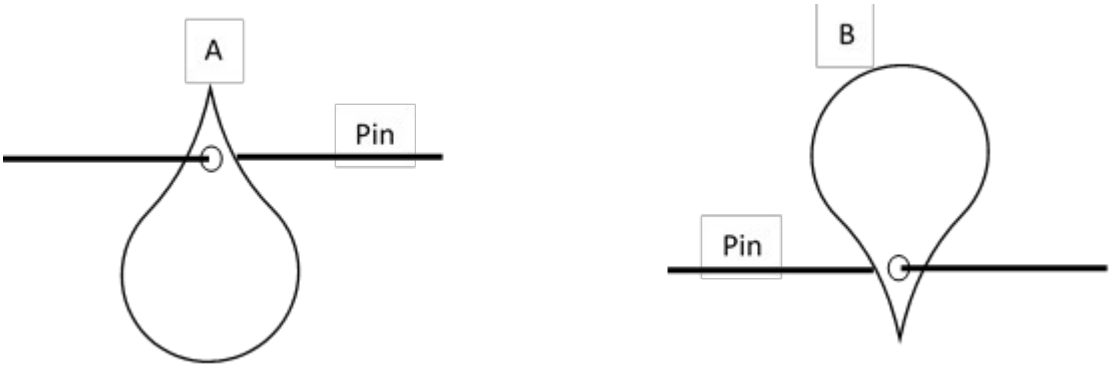


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6. The figure below shows a uniform body suspended freely through a hole on an optical pin. State with reason the case where the body is more stable (2 marks)



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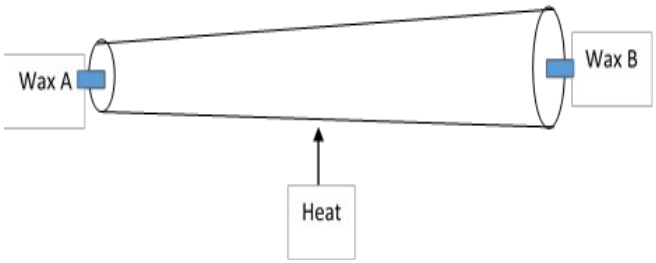
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7. The figure below shows a metal being heater at the middle. Giving the reason state the wax that will fall off first (2 marks)



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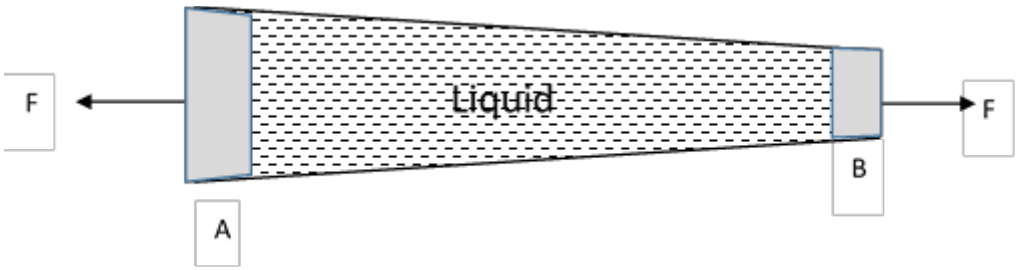
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8. The figure below shows a system with a liquid enclosed by two pistons. Equal force F is applied on the system as shown. Giving reason show with an arrow the direction of movement of the liquid

(2 marks)



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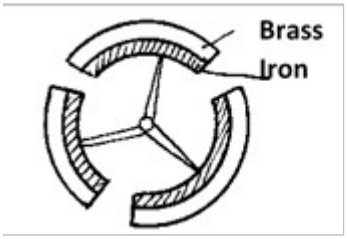
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9. The figure below shows a bimetallic wheel whose diameter is not affected by changes in

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temperature. Briefly explain how the diameter of the wheel remain unchanged as the temperature increases. (2 marks)



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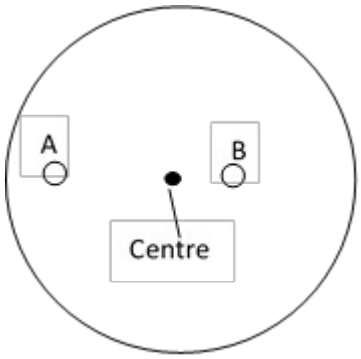
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10. Two identical springs have a combined spring constant of 3.5N/cm when in series Determine combined spring constant when the springs are in parallel. (2 marks)

11. Two coins A and B of the same mass and material are placed on a turntable as show below. The turntable is then rotated at a high speed. With reason name the coin that skids first (2 marks)



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12. A substance of volume Xcm^3 and density $800kgm^{-3}$ is mixed with $100cm^3$ of water of density $1000kgm^{-3}$. The density of the mixture is $960kgm^{-3}$. Determine the value of X. (2 marks)

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13. A bullet of mass 10g travelling at a speed of $400ms^{-1}$ hits a tree trunk. It penetrates the tree trunk and stops inside the trunk after 4 cm. Calculate the average resistance force offered by the trunk to the bullet. (2 marks)

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Section B (55 marks)
Answer all the questions in the spaces provide

14. (a) A body accelerates from rest. Its velocity after 5 seconds is 26m/s and after 9 seconds its velocity is 42m/s. calculate

i) Distance moved during the motion (3 marks)

ii) Average speed of the journey (2 marks)

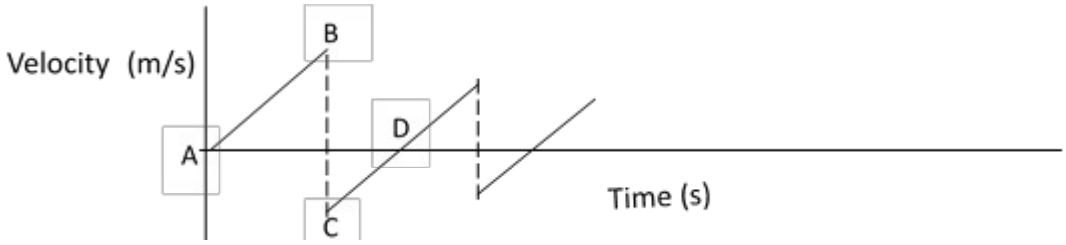
(b) A car can be brought to rest from a speed of 20m/s in a time of 2s when brakes are applies.

i. Find the average deceleration (1 mark)

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ii. The car is stopped by a policeman when moving at a speed of 20m/s. If the driver's reaction time is 0.2s determine the shortest stopping distance. (2 marks)

(c) The figure below shows the graph of a tennis ball bouncing severally on a table



Describe the motion between

i. AB (1 mark)

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ii. BC (1 mark)

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iii. CD (1 mark)

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15. (a) State the Pascal principle (1 mark)

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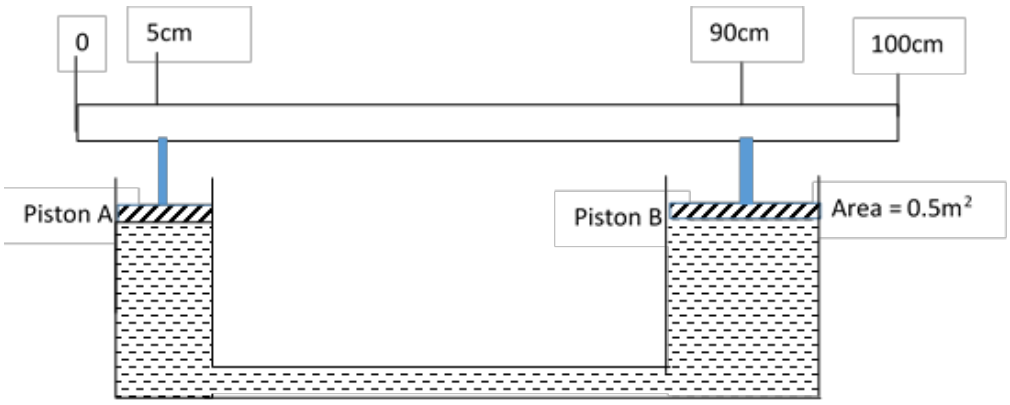
(b) State the principal of moments (1 mark)

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(c) The figure below shows a 100cm uniform bar of weight 50N balanced horizontally on two pistons.



Correct to 2 decimal places determine

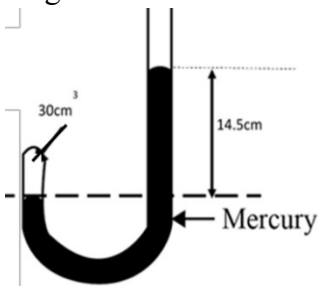
i. Force exerted on piston A (3 marks)

ii. Force exerted on Piston B (3 marks)

iii. Cross section area of piston A (3 marks)

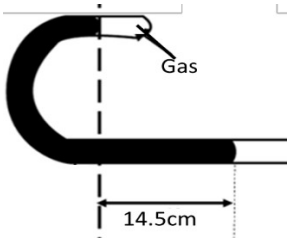
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16. a. The figure below shows $30cm^3$ of gas trapped in a tube containing mercury to a height of 14.5cm. The prevailing atmospheric pressure is 760mmHg. Determine the pressure acting on the gas in Pascals (3 marks)

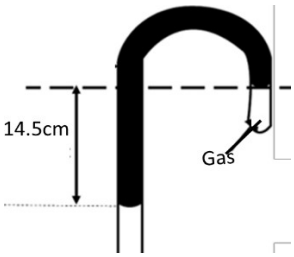


b. Determine the volume of the gas when the tube is held as shown below

i. (3 marks)



ii. (3 marks)



17. a) State the law of floatation. (1 mark)

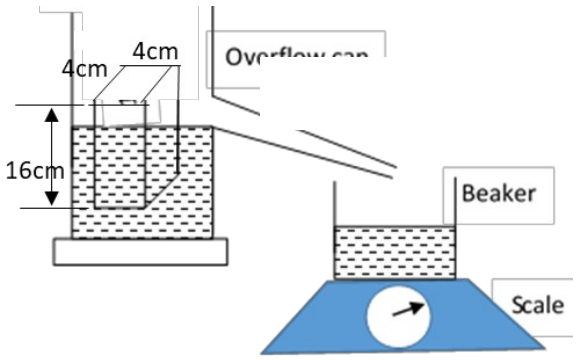
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b) The figure below shows a block cuboid of dimensions 4cm by 4cm by 16cm floating in a liquid in an overflow can with $\frac{3}{4}$ of its height submerged.

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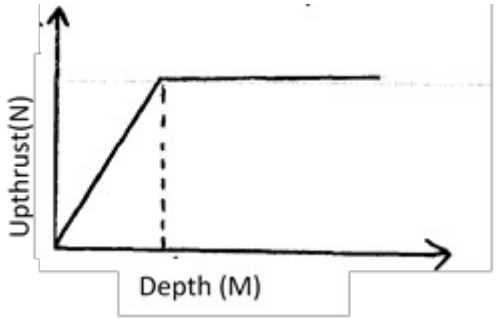


Given that the mass of the beaker when empty is 85g and the reading on the scale in the set up above is 245g, calculate:

(i) The density of the block. (3 marks)

(ii) The density of the liquid. (2 marks)

(c) A metal block is suspended from a spring balance and held inside a beaker without touching the beaker. Water is added gradually into the beaker. The graph below shows the variation of up thrust on the block with depth of water.



Explain the shape of the graph. (2 marks)

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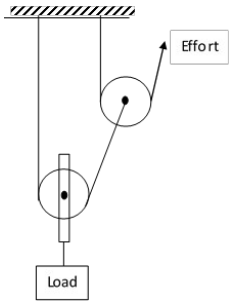
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(d) The figure below shows a pulley system being used to raise a load.

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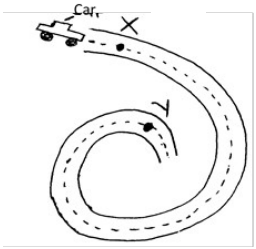


(i) Indicate the direction of the strings (1 mark)

(ii) If an effort of 35N raises a load of 105N, determine the efficiency of the system.

(3 marks)

18. (a) The figure below shows a car of mass (m) moving along a curved part of the road with a constant speed.



(i) Explain why the car is more likely to skid at Y than at X. (2 marks)

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(ii) If the radius of the road at V is 250m and the car has a mass of 600kg, determine the maximum speed at which the car can be driven while at V without skidding. Force of friction between the road and the tyres is 18000N. (3 marks)

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(b) A string of length 70cm is used to whirl a stone in a circle in a vertical plane at 5 rev/s.

Determine:

(i) The period (1 mark)

(ii) The angular velocity. (2 marks)

(iii) The speed of the stone (2 marks)

(c) A body moving in a circle with constant speed is said to have an acceleration. Explain. (1 mark)

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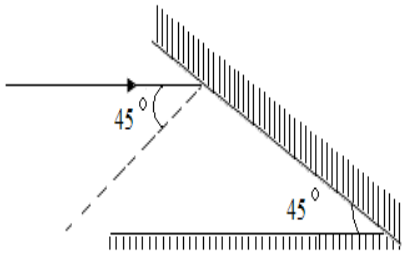
PAPER 2

SECTION A (25MKS)

Attempt all questions in this section

1. The figure below shows a ray of light incident on a mirror at an angle of 45. Another mirror is placed at an angle of 45° to the first one as shown. Sketch the path of the ray until it emerges.

(2mks)



2. A circuit consists of a battery, metal wire, ammeter and a switch connected in series. The switch is closed and the ammeter reading noted. The metal wire is now heated.

a) State the observations made on the ammeter reading. (1mk)

……

……

……

b) Give one reason for the above observation made (1mk)

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3. The table in **figure 6** below shows part of the electromagnetic spectrum in order of decreasing wavelength.

A	B	INFRA RED RADIATION	VISIBLE LIGHT	C	D

Figure 6

(a) Mention any source of waves C. (1mk)

……

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(b) State one use of the wave D (1mk)

……

4. A ray of light incident on the surface of a glass prism is observed as represented in the figure below.

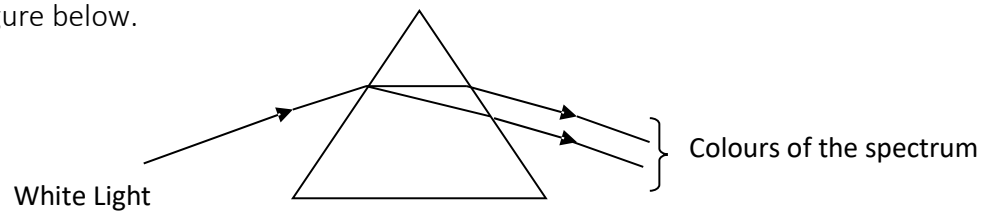


Figure 4.

Explain this observation. (2mks)

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5. (a) State the law of electrostatic charges. (1 mk)

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(b) Figure 5 shows a highly negatively charged rod being brought slowly near the cap of a positively charged leaf electroscope. It is observed that the leaf initially falls and the rises.

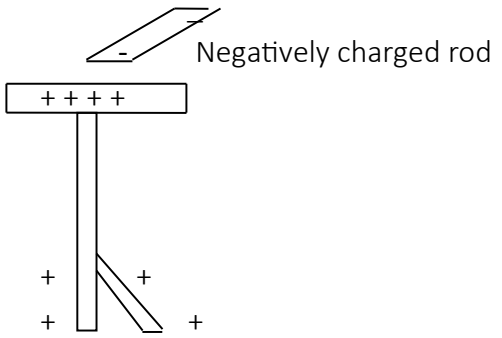


Figure 5

Explain this observation. (2mks)

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6. Distinguish between thermionic emission and photoelectric emission. (2mks)

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7. The expression below is an equation for a radioactive element P. Element Q and R are the daughter nuclides. P, Q and R are not the actual symbols of any of the elements.

$$\frac{235}{92}P \rightarrow \frac{231}{90}Q + \frac{x}{y}R$$

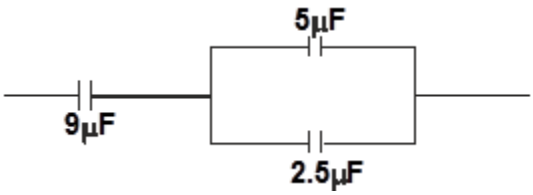
Identify the element R and state any of its characteristics.

R…… (1mk)

Characteristics……

…….. ..(1mk)

8. The figure below shows part of an electric circuit. The charge stored in the 9µF capacitor is 1.4 micro coulombs (µC)



Determine the p.d across the 5µF capacitor. (3mks)

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9. A person standing behind a wall hears a bell ringing although he cannot see the bell. Mention this property of sound. (1mk)

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10. Complete the ray diagram in figure 10 below so as to form an image. (2mks)

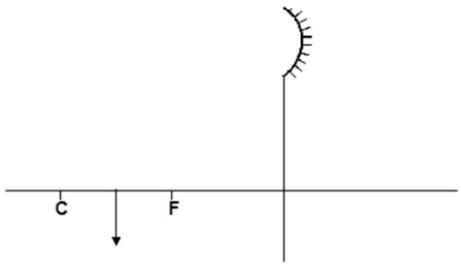


Fig 10

11. Explain the meaning of the following term as used in waves: (1mk)

Amplitude

……

……

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12. **Figure 10** shows an object and its image formed on a screen by a thin lens.

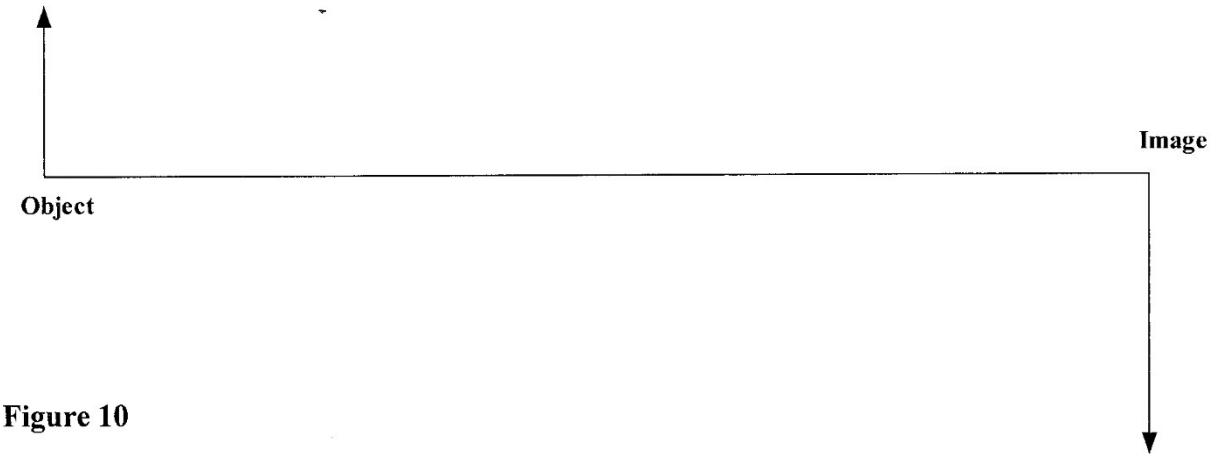


Figure 10

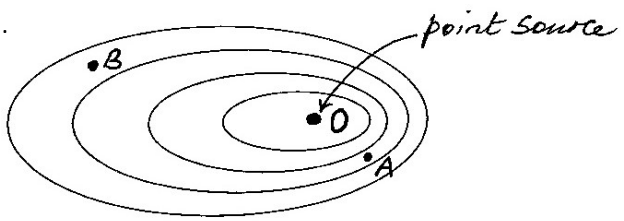
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By using appropriate rays complete the diagram to show the position of:

(i) the lens. (1mk)

(ii) the two principal foci. (1mk)

13. The figure shown below illustrates crests of circular water wave-fronts radiating from a point source O in a pond.



State how the depth of the pond at A compares with that at B. (1mk)

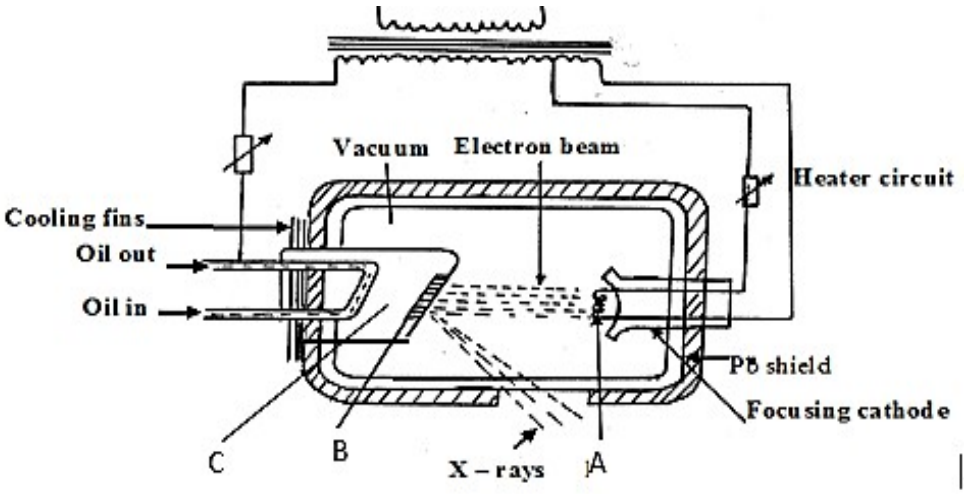
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SECTIOIN B (55MKS)

Attempt all questions in this section

14. (a) Using the diagram below;



(i) Name the part labelled C (1mk)

……

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(ii) State the property of the material labelled B on the diagram which makes it suitable for use in the X-ray tube. (1mk)

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……

(iii) Why is C inclined at an angle of 45°? (1mk)

……

……

(iv) State the adjustment that can be made to vary

I. The quality of X-rays (1mk)

……

……

II. The quantity of the X-rays. (1mk)

……

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v) In an X-ray tube, the accelerating voltage is 100KV Calculate the kinetic energy of the electrons arriving at the target (take e = 1.6 x 10^{-19}C)

(2mks)

……

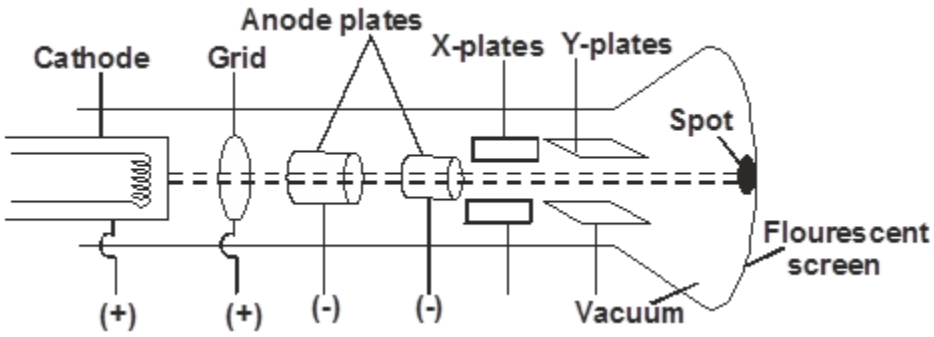
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b) The figure below shows a cathode ray oscilloscope (CRO) drawn by a student.



i) Identify two mistakes in the diagram. (2mks)

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ii) In a correctly drawn C.R.O, what adjustment can be made to obtain a very bright spot. (1mk)

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iii) State the reason why the fluorescent screen should be earthed. (1mk)

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iv) State one difference between a C.R.O and T.V tube. (1mk)

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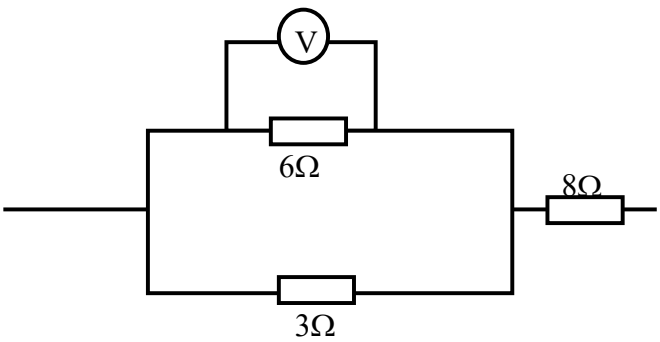
15. a) State one condition under which ohm's law is obeyed in a metal conductor. (1mk)

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b) You are provided with three resistors R_1, R_2 and R_3 connected in parallel. If the p.d across them is V, show that an expression for the effective resistance of the three resistors is given by. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ (3mks)

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c) The figure below shows three resistors as shown.



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If the voltmeter reads 4V, find the

(i) Effective resistance (2mks)

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(ii) Current through the 3Ω resistor (2mks)

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(iii) Potential difference across the 8Ω resistor if the voltage total voltage in the circuit is 10V (1 mk)

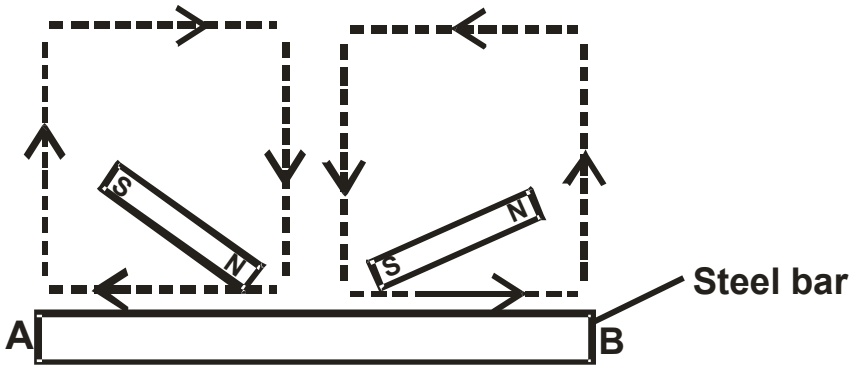
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d) Draw a circuit diagram showing three bulbs A, B and C, an ammeter and a 12v supply connected in such a way that they operate at same potential and all light with equal brightness. (2mks)

16. a) The figure below shows a method of magnetization used in making magnets.



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i) Name the method. (1mk)

……..

ii) Identify the polarities A and B of the magnet produced. (2mks)

A……

B……

b) In demagnetization by electrical method:

i) State the type of current used. (1mk)

……

……

ii) Explain your answer in (i) above. (1mk)

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c) Explain why when demagnetizing a magnet, the magnet should be held in the East-West direction. (1mk)

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d) I. An electric kettle is rated at 1.8 kW, 240 V. Explain the choice of the safest fuse for the kettle. (the available fuses are 5 A, 10 A, and 20 A) (3mks)

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II. Explain one factor which affect heating by an electric current. (2mks)

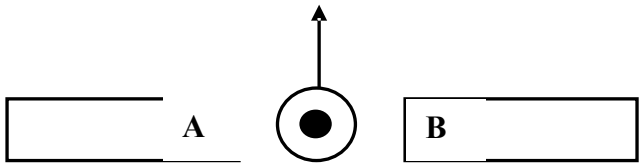
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17. a) The figure below shows a section a flexible wire carrying current perpendicularly out of the paper.



The wire moves in the direction shown as current passes through it.

i) Label the polarities of the magnets A and B. (1mk)

ii) Explain the behaviour of the flexible wire. (2mks)

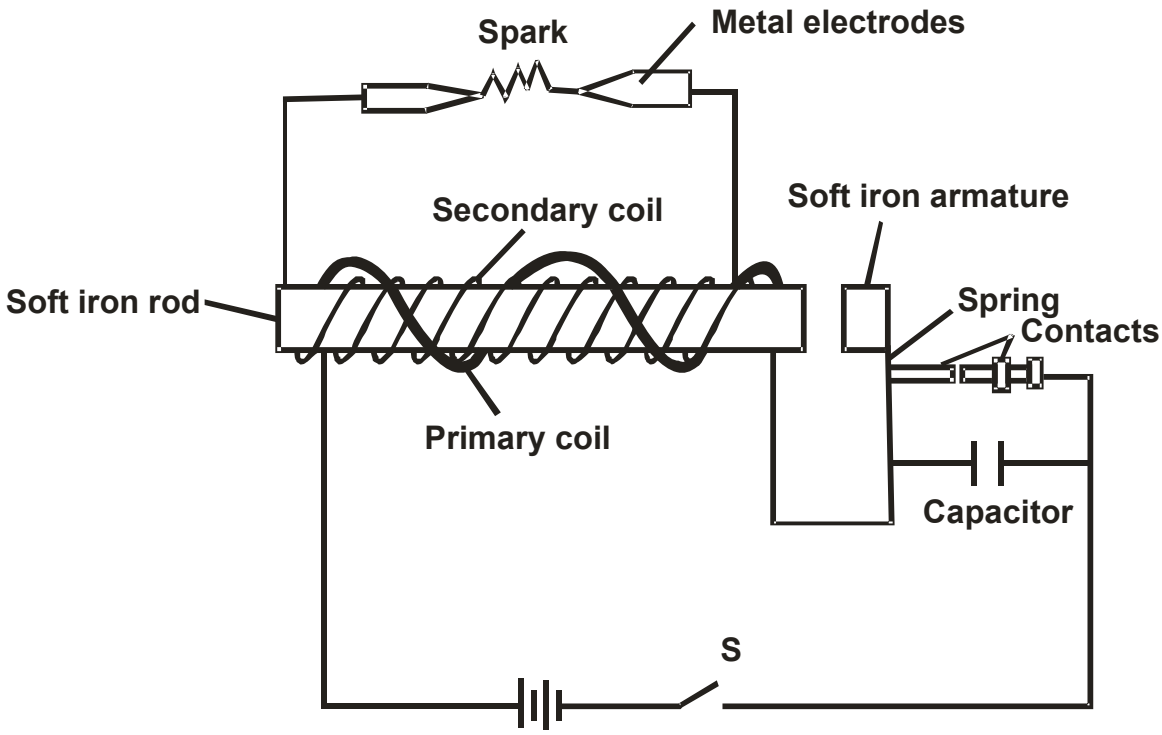
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b) The figure below shows an induction coil used to step-up voltage.



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i) State the difference between the induction coil and a step-up transformer. (1mk)

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ii) Explain how voltage is stepped up by the induction coil. (3mks)

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iii) The voltage is stepped up from 12V to 15kV. Determine the ratio of the secondary to primary coils in the induction coil. (1mk)

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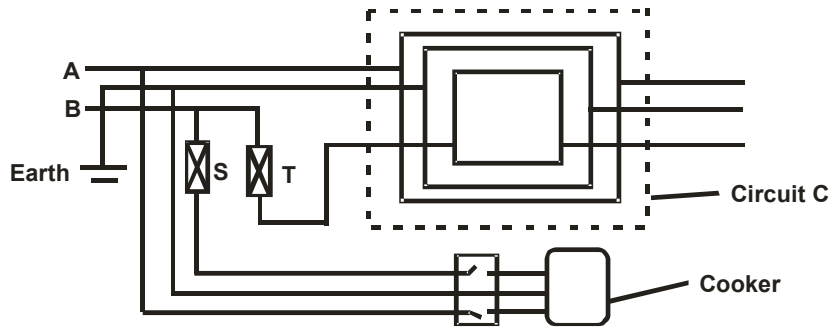
iv) State how the capacitor eliminates sparking (1mk)

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v) Explain one form in which a transformer loses energy. (2mks)

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18. The diagram below shows part of a section of a house wiring system.



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i) Name the circuit marked circuit C (1mk)

……

ii) Identify the cables marked A and B (2mks)

……

……

iii) Explain the function of the device marked S and T. (3mks)

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iv) A house has three rooms each with two 240V, 60W bulbs. If the bulbs are switched on from 7.00p.m to 10.00pm daily.

a) Calculate the power consumed per day in kilowatt-hours. (2 marks)

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b) Find the cost per week for lighting these rooms at sh.6.30 per kilowatt hour. (2 marks)

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PAPER 3

QUESTION ONE

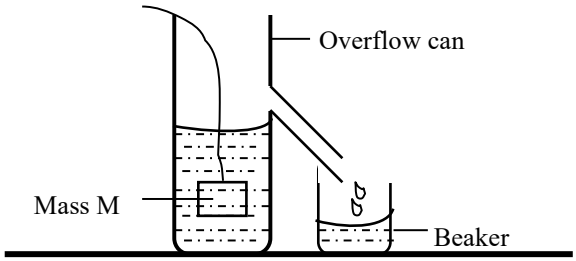
1. You are provided with the following apparatus
   A meter rule
   A wire of length 100cm
   A retort stand
   A stop watch
   A micrometer screw gauge
   An overflow can
   A 100ml beaker
   A 10ml measuring cylinder
   A piece of thread
   Water in a 250ml beaker
   Two pieces of wood
   Mass labeled M

PROCEDURE

a)

i. Fill an overflow can with water to overflowing and then let it drain.

ii. Gently immerse the mass m into the can. Collect the overflow water into a beaker as shown below.



iii. Using the measuring cylinder provided, determine the volume V of the water collected in the beaker

V=..... m^3 (1mark)

iv. Calculate I given that $I = \frac{10^6 M}{V}$ $where\ M = 0.05kg$ $(2mks)$

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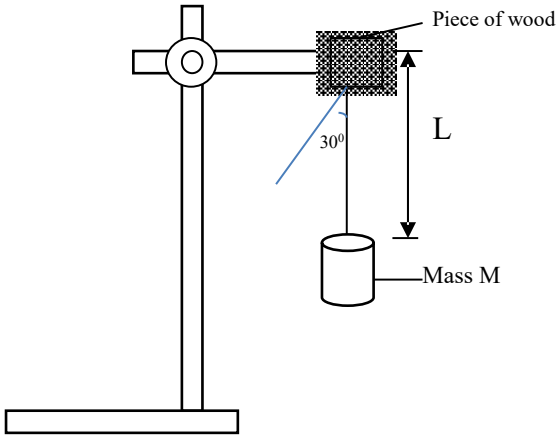
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v) What quantity does l represent? (1 mk)

b) Clamp a copper wire as shown in the set up below. Ensure that the wire is free of kinks and the end tied to the hook is firm and the hook does not move.



c) Adjust the length L of the wire so that L=70cm. Give the mass M a slight twist of about $30^0$from the point of inclination so that when released, it oscillates about the vertical as shown above. Measure the time t for twenty oscillations and record in the table below.

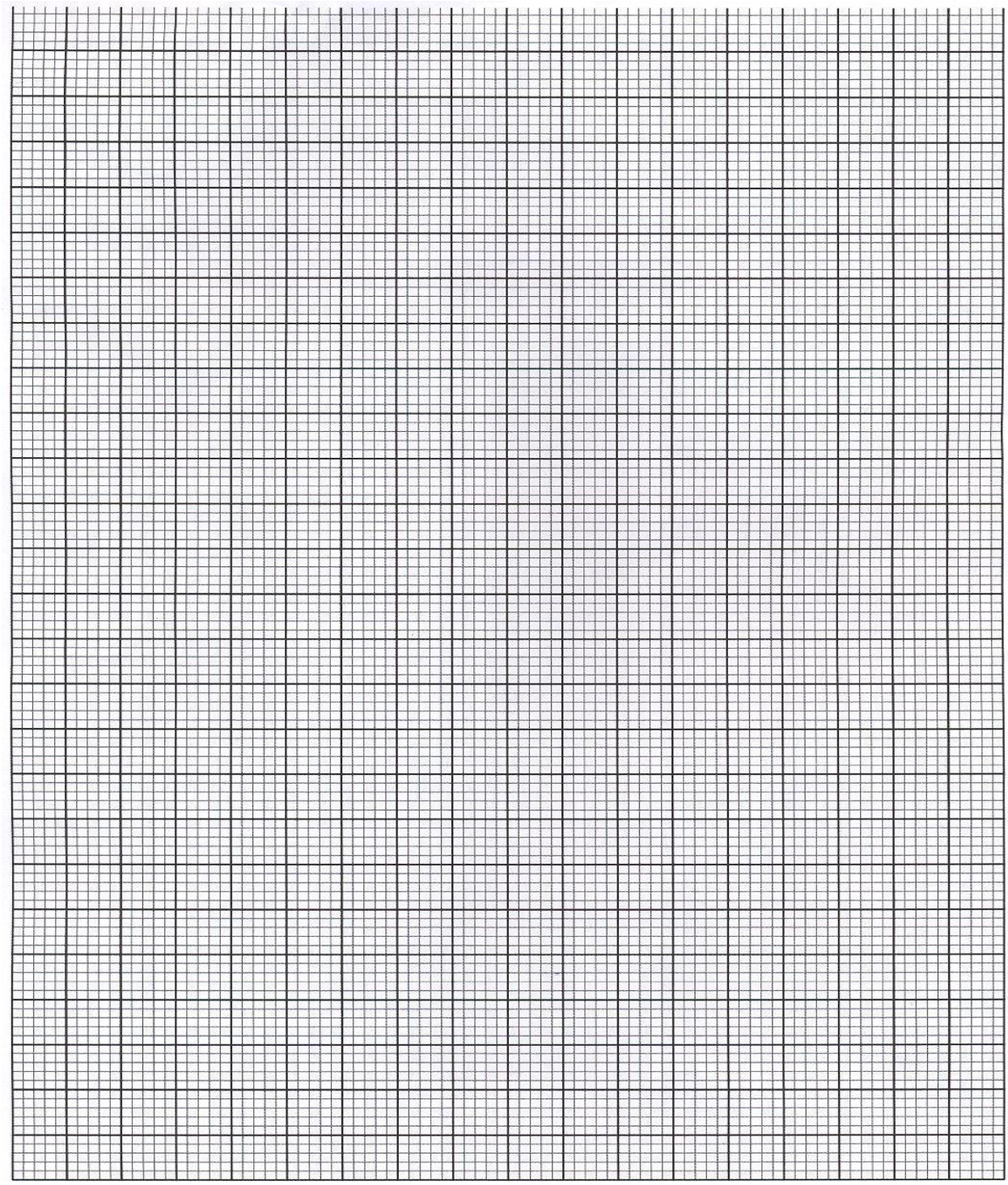
d) Repeat the procedure above for other values of L as shown and complete the table. (5mark)

Length L (cm)	70	60	50	40	30	20
Length L(m)						
Time for 20 oscillation						
Period T(s)						
$T^2(s^2)$						

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e) On the grid provided plot a graph of $T^2(s^2)$ $y-axis$ against L(m) (5marks)

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f) Measure the diameter of the wire
d=.....metre (1mark)

i. Determine the slope of the graph (2marks)

.....

.....

.....

.....

.....

ii. Given that $T^2 = \frac{32\pi^2 l}{Gd}$ determine the value of the constant G (3mark)

.....

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QUESTION TWO

Part A

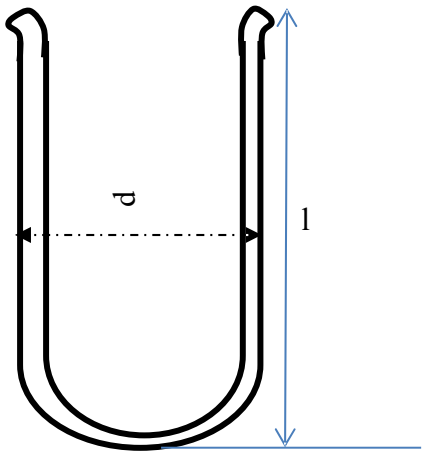
You are provided with the following apparatus.

Metre rule.
Electronic beam balance (shared)
vernier callipers (shared)
100ml measuring cylinder
Boiling tube.

Proceed as follows;

(a) Measure the length l of the boiling tube provided using a metre rule

l = …… cm (1mark)



(b) Measure the external diameter d of the boiling tube at the middle using Vernier callipers.

d=……cm (1mark)

(c) Calculate the external volume of the boiling tube. $V_1 = \frac{11d^2l}{14}$ (1mark)

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……

……

(d) Completely fill the boiling tube with water. Pour the water into the measuring cylinder Read and record the volume V_2 of the water.

V_2 = …….. …… cm^3 (1mark)

(e) Calculate the volume V_3 of the glass used to make the boiling tube. (1mark)

……

(f) Using the electronic balance measure the mass of the dry empty boiling tube

Mass =……kg (1mark)

(e) Determine the density of the glass. (1mark)

……

……

……..

PART B

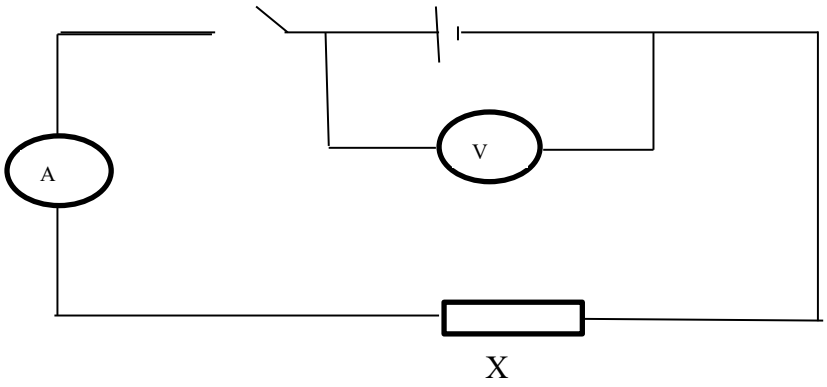
You are provide with the following

A wire mounted on a millimetre scale labelled AB
A galvanometer.
Jockey or a crocodile clip
A carbon resistor labelled X .
8 Connecting wires, 4 with crocodile clips at both ends.
A resistance wire labelled R mounted on a half meter rule
Ammeter
Voltmeter
One size D dry cell in a cell holder
Micrometer screw gauge

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Proceed as follows:

(a) Set up the circuit as shown below.



(a) Record the voltmeter reading when the switch is open.

E = …… (1mark)

(ii) Close the switch and record the voltmeter and ammeter readings V and I.

V = …… (1mark)

I = …… (1mark)

(iii) Explain why V is less than E . (1mark)

……

……

……

(iv) Now connect the voltmeter across the carbon resistor X and record voltmeter reading V_1

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when the switch is on.

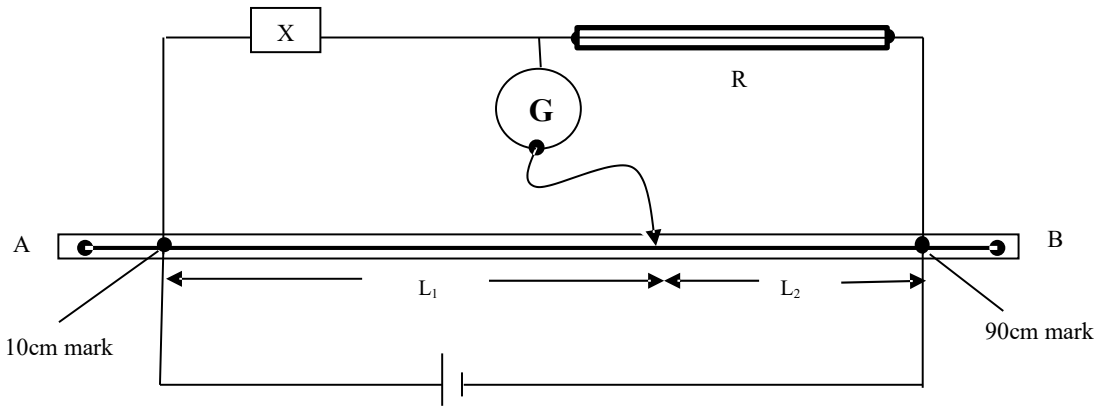
V_1 = ……. (1mark)

(v) Determine X given that $X = \frac{V_1}{I}$ (1mark)

(b) Using the micrometre screw gauge, measure and record the diameter D of the resistance wire R provided

D =……m (1mark)

(c) Now connect another circuit as shown in the figure below.



Touch the 10cm mark and the 90 cm mark and see that the galvanometer deflects in opposite direction in each case.

(i)Move the sliding jockey along the resistance wire AB and note the length L_1 and L_2 where the galvanometer pointer points at the zero mark. Record the values of L_1 and L_2.

L_1 =……m (1mark)

L_2 =…… m (1mark)

(ii) Determine the resistance of the resistance wire R using the relationship: (2marks)

$$\frac{R}{L_1} = \frac{X}{L_2}$$

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(iii)Determine the resistance of the wire R per metre. (1 mark)

……

……

(iv)Given that, $R = \frac{0.1114S}{D^2}$ determine the value of S, where R is the resistance per metre. (1mark)

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SERIES 13
PAPER 1
SECTION A (25 Marks)

1. The diagram below shows a graph of anomalous expansion of water.

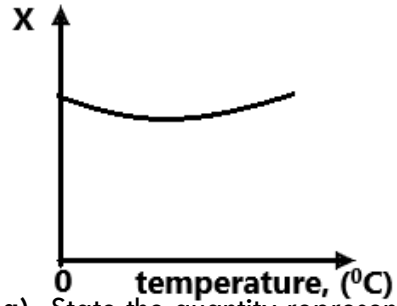


Figure 1

a) State the quantity represented by X **(1 mark)**

b) Explain the shape of the graph **(2 marks)**

2. A form one student attempted to measure the diameter of a spherical marble as shown in figure2 below.

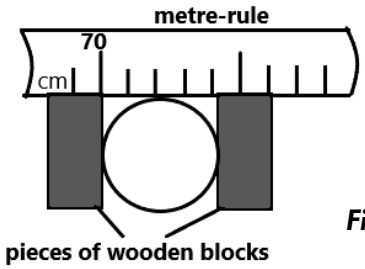


Figure 2

On the space alongside, determine the volume of the marble in SI units and expressed to two significant figure. **(2 marks)**

3. Two glass tubes of varying cross-section area dipped into water in a beaker as shown below. Show the level of water in the narrower tube. **(1 mark)**

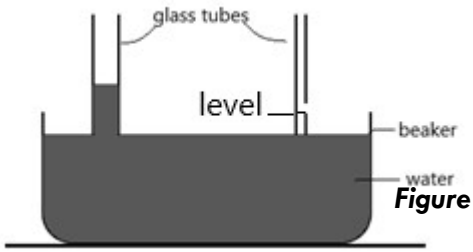


Figure 3

4. In an experiment to demonstrate Brownian motion, smoke was placed in an air cell and observed under a microscope, Smoke particles were observed to move randomly in the cell.

i. Explain the observation **(1mark)**

ii. What would be the most likely observation if the temperature in the smoke cell was raised? **(1mark)**

5. The diagram shown in figure 4 below is an arrangement of three pulley wheels used to help in lifting loads.



Figure 4

i. Complete the diagram to show how the rope goes round the wheels, position of the load and the effort. **(2 marks)**

ii. State the velocity ratio of the pulley system **(1 mark)**

6.

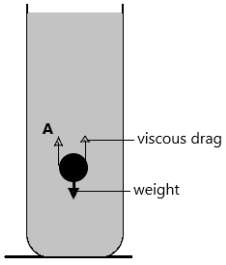
a) Explain how ghee is separated from milk using a centrifuge **(2 marks)**

b) Besides the centrifuge, state any other application of uniform circular motion **(1 mark)**

7. Differentiate between inelastic and elastic collisions. **(1 mark)**

8. The diagram in Figure 5 below shows some of the forces acting on a sphere moving in a viscous liquid in a tall measuring cylinder.

Figure 5



i. Identify the force labelled A **(1 mark)**

ii. State the relationship among the forces when the acceleration of the sphere down the fluid is zero **(1 mark)**

9. A mass of 1kg is attached to a cord of length 50cm. It is whirled in a circle in a vertical plane at 10 revolutions per second as shown in the figure below.

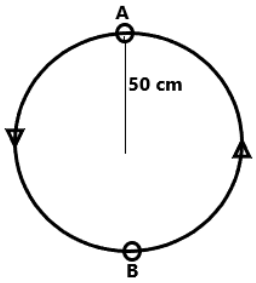


Figure 6

Find the tensions in the cord when the mass is at the lowest point at **B** **(3 marks)**

10. State **any two** changes that can be made to a fluid flowing in a streamline flow to make it turbulent flow. **(2 marks)**

11. A ship carrying load moves from a fresh water to a salty water. Will the depth of floating increase or decrease? Explain your answer. **(2marks)**

12. State **one** way of reducing surface tension in a liquid **(1 mark)**

SECTION B (55 Marks)

13.

a) Define '***specific heat capacity***' **(1 mark)**

b) In an experiment to determine the specific heat capacity of aluminium metal, the set up below was used.

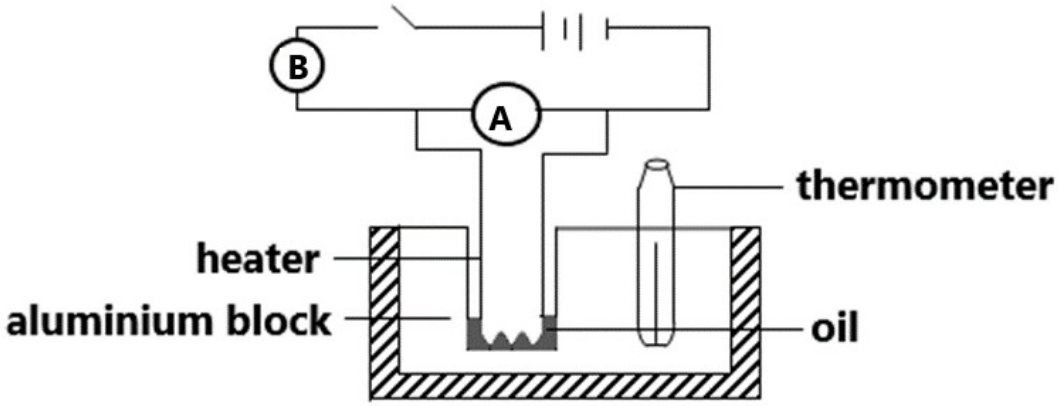


Figure 7

i) Name the measuring instruments labeled A and B **(2marks)**

A:

B:

ii) In the experiment the following data was recorded:

Voltmeter reading	= 2.9V
Ammeter reading	= 1.8A
Mass of the block	= 1.12kg
Initial temperature of block	= 22^0C
Final temperature of block	= 35^0C
Time for heating	= 250 seconds

Use the information above to calculate the specific heat capacity of the aluminium block **(3 marks)**

iii) Suggest a function of the oil in the above experiment **(1 mark)**

c) Food cooks faster along the coastline than at high altitude areas. Explain **(2 marks)**

d) Explain why water is a better coolant than other liquids **(1 mark)**

14.

a) State the law of flotation. **(1 mark)**

b) You are provided with the following apparatus:

- A block of wood.
- A spring balance
- A thin thread.
- Overflow can
- A small measuring cylinder.
- Some water in a beaker.

With the aid of labelled diagrams describe an experiment to verify the law of flotation.
(4 marks)

c) A block of length 80cm, cross sectional area, 3.0cm^2 and density 1300kg/m^3 is completely immersed in a liquid of density 1030kg/m^3. Determine the weight of the block in the liquid.
(3 marks)

d) Explain why a hollow glass sphere just floats on water at 4^{0}C but sinks when water is slightly heated. **(2marks)**

e) The system below is at equilibrium. Dry ice pellets are carefully added to the water until the temperature of water falls to below room temperature. State and explain the observations made.
(2 marks)

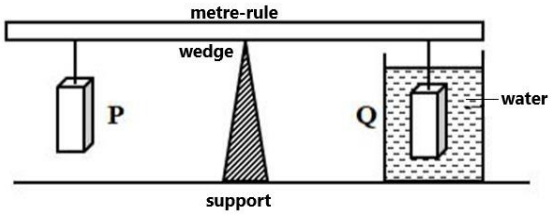


Figure 8

15.

a) Define '***angular velocity***' **(1 mark)**

b) Give an example of object travelling at constant speed and accelerating at the same time.
(1mark)

c) A marked point on the turntable plate has a linear velocity of 23.4 m/s. If the plate has a radius of 20 cm. Calculate the angular velocity of the point on the plate. **(2 marks)**

d) A stone is whirled in a vertical circle as shown in the diagram. The direction of rotation is shown by the arrow. On the axes provided, sketch a graph of tension against time as the stone moves through P, Q, R and S. Indicate on the graph, the positions of P, Q, R and S. **(2marks)**

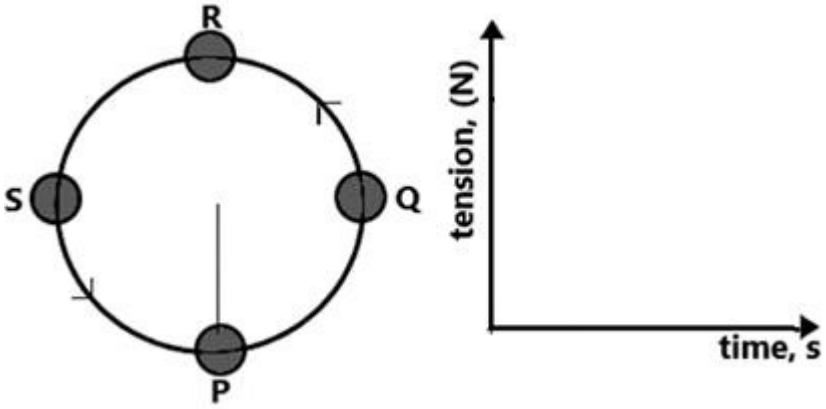


Figure 9

e) A 200g mass is tied to a string and rotated in a horizontal circle at constant angular velocity. The graph below shows the force required to keep the mass in the horizontal circle at different lengths (radius).

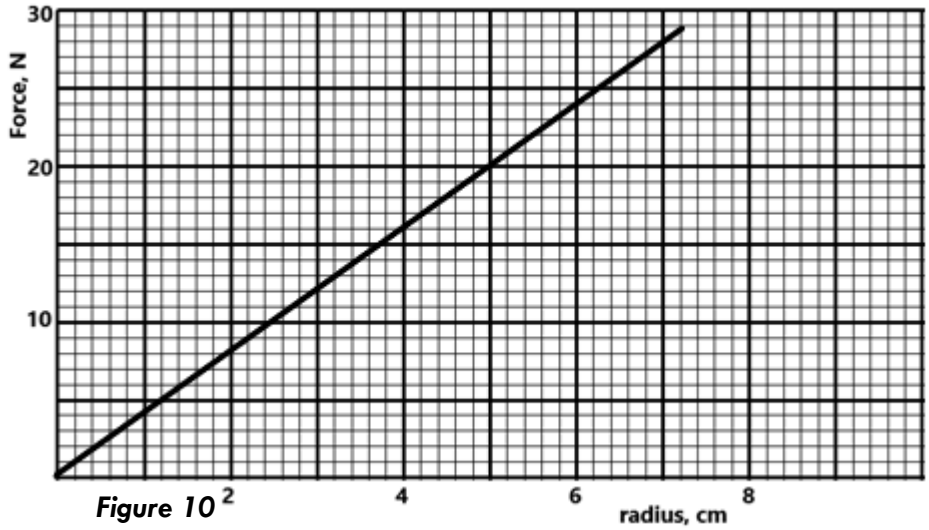


Figure 10

Determine, from the graph, the angular velocity of the mass. **(4 marks)**

16.

a) Define term 'atmospheric pressure' **(1 mark)**

b) Figure below shows an accurate simple mercury barometer.

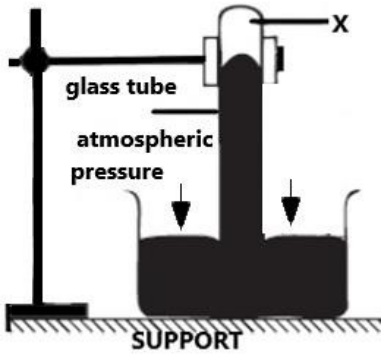


Figure 11

i. Identify the part labelled X **(1 mark)**

ii. Explain how you would test for the X **(2 marks)**

c) The figure below shows a U-tube filled with water, mercury and another liquid:

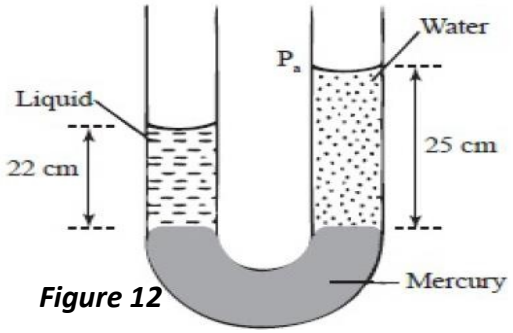


Figure 12

i. Determine the density of the liquid. **(3 marks)**

ii. State possible reasons why mercury is used. **(2 marks)**

d) It is dangerous to stand close to a railway line on which a fast moving train is passing. Explain **(2 marks)**

e) Differentiate between the: **Bernoulli's effect** and **Bernoulli's principle** **(2 marks)**

17.

a) Explain the meaning of the following as used in machines:

i. Mechanical advantage **(1 mark)**

ii. Efficiency **(1 mark)**

b) The figure below shows part of a hydraulic press. The plunger is the position where the effort is applied while the Ram piston is the position where the load is applied. The plunger has cross-section area, 10 cm^2 while the Ram piston has cross-section area, 50 cm^2.

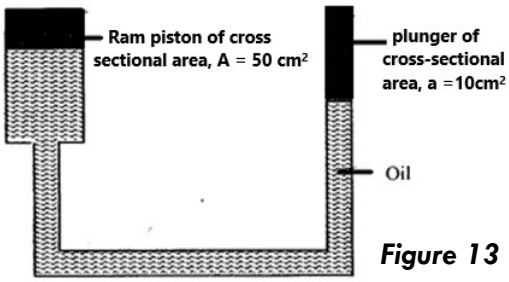


Figure 13

When the plunger moves down a distance, d the Ram piston moves up a distance, D.

i. State any two properties of the oil used in the hydraulic press **(2 marks)**

ii. Determine the velocity ratio of the press in terms **(2 marks)**

c) A block of mass 5 kg is pulled up an inclined plane shown below by a force of 50 N.

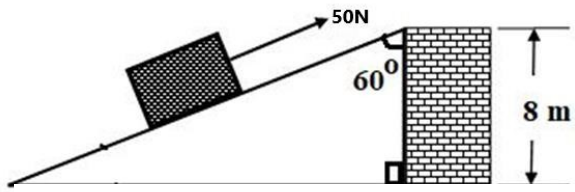


Figure 14

Calculate the efficiency of the plane. **(3 marks)**

d) Explain why the efficiency of the inclined plane is not 100% **(1 mark)**

PAPER 2

SECTION A (25 marks)

*Answer **all** the questions in this section in the spaces provided*

1. (a) The figure 1 below shows the inner parts of a three-pin plug.

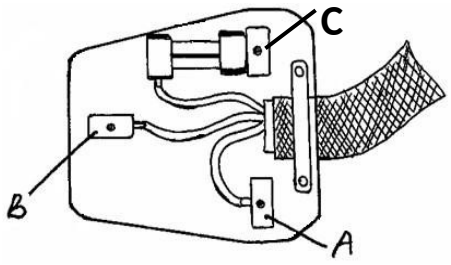


Figure 1

(i) Identify the pins **A** and **B**.

A. (1mk)

.....

B. (1mk)

.....

(ii) State the reason why the pin **B** is normally longer than the other two pins **A** and **C.**

.....

.....

2. The figure 2 below shows an iron bar suspended near a coil connected in a circuit containing abattery of cells and switch.

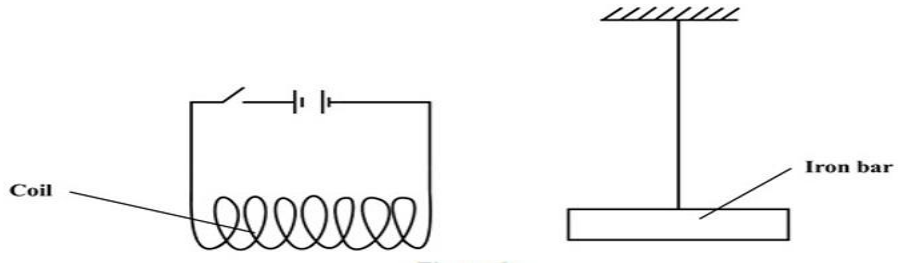


Figure 2

State and explain what is observed when the switch closed. (2 marks)

……
……
……

3. The figure 3 below shows a charged parallel plate capacitor connected to a voltmeter.
   The separation of the plates is adjustable

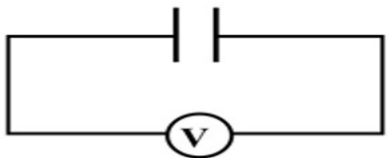


Figure 3

State and explain the change in the voltmeter reading when the plates are moved further apart.
(3 marks)

……
……
……
……

4. Give a reason why brass cap of a gold leaf electroscope is perfectly circular (1mk)

.....

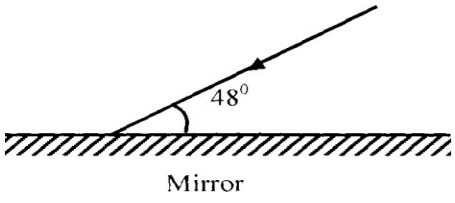


Figure 4

.....

5. The figure 4 below shows a ray of light incident on a mirror. (2 mks)
   Determine the angle of reflection

.....
.....

.....

6. Explain why lecture theatre halls are covered with soft perforated materials. (2mks)

.....

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7. The figure 5 below shows magnetic field around a current carrying conductor.

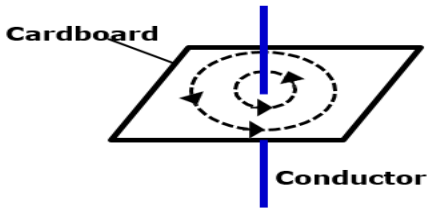


Figure 5

State the rule of physics that helps Indicate on the diagram the direction of the current. (1mk)

.....

8. The Figure 6 below shows how the displacement varies with time for a certain wave.

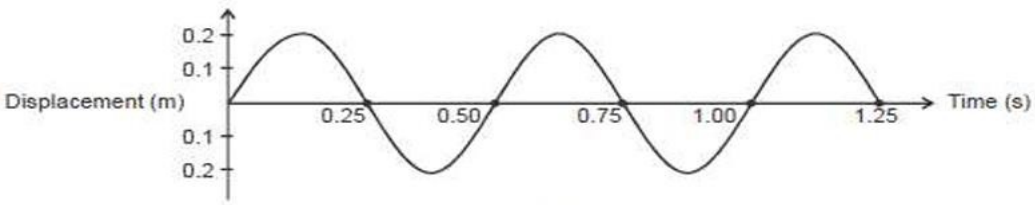


Figure 6

Determine the frequency of the curve. (3 marks)

……

……

……

9. The table below shows the arrangement of electromagnetic waves in the order of increasing energy of radiation.

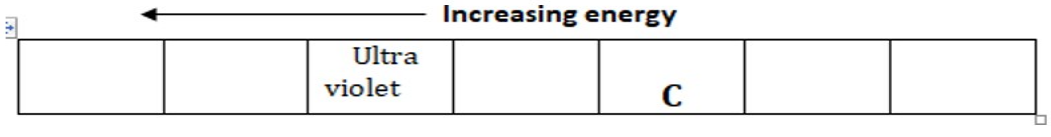


Figure 7

a. Identify wave C (1mk)

.....

b. State **one** use of the wave marked C (1 mk)

.....

10. Explain how x-rays of high quality can be produced from an x-ray tube .
(2mks)

.....
.....
.....

11. State two factors that determine the heat produced by electric circuits.
(2mks)

.....
.....

12. State two similarities of images formed by a plane mirror and a convex mirror. (2 marks)

……
……
……

SECTION B (55 marks)

*Answer **all** the questions in this section in the spaces provided*

13. a) An electric cooker has three electrical elements each rated 600 W. It is connected to a power supply of 240 V for 45 minutes.

I. Determine the value of the suitable fuse required for this cooker. (2mks)

.....
.....
.....

II. Determine the cost of operating the cooker for the given duration given that the cost of electricity is sh. 11.25 per unit.
(2mks)

.....
.....
.....

b) **Figure 8** shows a simple diagram of a step-down transformer. The input voltage of the transformer is 12 kV and output voltage 240V. Current in the primary coil is 0.01 A.

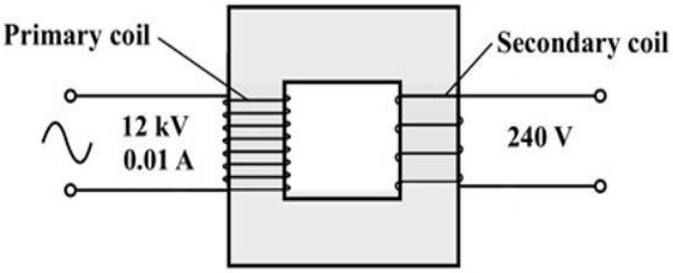


Figure 8

i. Explain how an e.m.f is induced in the secondary coil. (2 marks)

……
……
……
……

ii. The transformer is used to supply electric power to a village 2 km away. The transmission lines have a total resistance of 10.0Ω per kilometer. If the transformer is 100 % efficient, determine the:

I. current in the secondary coil of the transformer, (3 marks)

……
……
……

II. electric power delivered to the village. (3 marks)

……
……
……
……

14. a) An object is placed 15cm from a diverging lens and the image is formed 6cm from the lens.

i. Define the term principal focus in relation to diverging lens. (1mk)

.....
.....
.....

ii. Calculate the focal length of the lens. (3mks)

.....
.....
.....
.....

b) State two differences between the human eye and the camera. (2mks)

.....
.....
.....

.c) i. Define refractive index. (1 mark)

.....
.....
.....

ii. Figure 9 shows an object **O** and its image **I** as seen through a glass block of length **r**. The block is made of glass of refractive index **n** and **d** is the displacement of the image from the object.

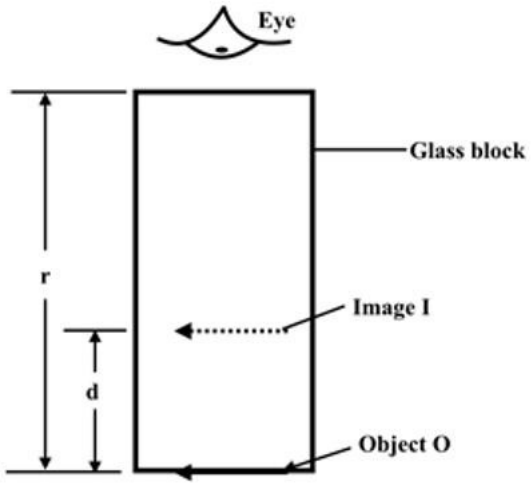


Figure 9

Show that the displacement, **d** is given by $d = r(1 - \frac{1}{n})$

……
……
……

iii. A stream has water of depth 240.0 cm. Determine the apparent depth of the water in stream

when viewed from above. (Take refractive index of water $= {}^{4}/_{3}$). (3marks)

……
……
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……

d) Figure 10 shows a diagram of a polar bear and its inverted image in the sky.

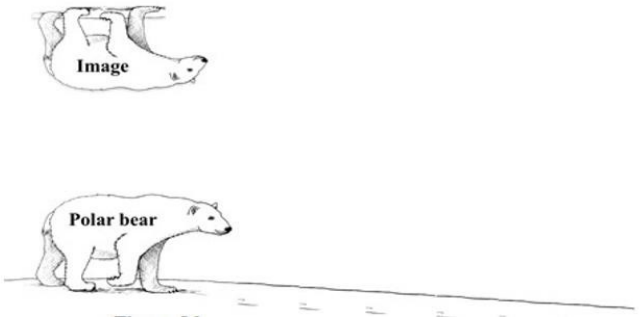


Figure 10

State and explain the phenomenon shown in this diagram. (2 marks)

……
……
……

15. (a) State what is meant by:

a. electromotive force of a cell. (1 mark)

……
……

b. internal resistance of a cell. (1 mark)

……
……

(b) A battery of e.m.f, **E** of 12.0 V and internal resistance, **r** =2.0 **Ω** is connected to a resistor R of resistance 20.0 **Ω** and a resistance wire P, as shown in **Figure 11**.

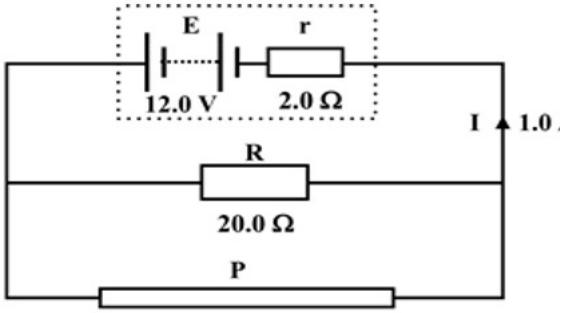


Figure 11

A current I = 1.0 A flows in the circuit.

(i) Determine the:

(I) terminal potential difference V of the battery, (3 marks)

……
……
……

(II) resistance of the resistance wire P. (3 marks)

……
……
……

(III) A new resistance wire Q of the same material as P has more resistance than wire P. State **two** possible differences between wire P and wire Q that would cause Q to have more resistance than P. (2 marks)

……..……
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(IV) Wire P is replaced with wire Q in the circuit in **Figure 11**. State and explain the effect of this change on the power output of the battery. (2 marks)

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16. The figure 12 below shows a circuit diagram for a photocell.

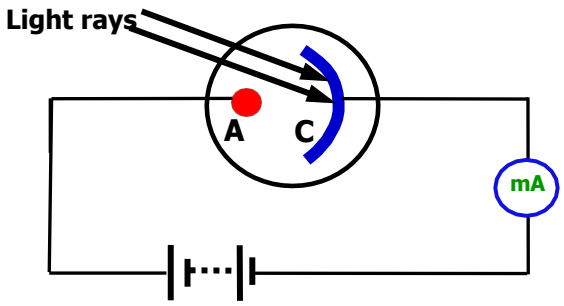


Figure 12

i) The milli-ammeter shows a deflection when ultraviolet light is shown on the photocell. Explain (2mks)

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……
……

ii) Explain how the milliameter reading is affected when the intensity of light is increased. (2mks)

……
……
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……

(iii)The figure 13 shows the trace on the screen of a C.R.O when an a.c signal is connected to the Y plates. Time base control is set at 10ms/division and y-gain sensitivity at 120v/division.

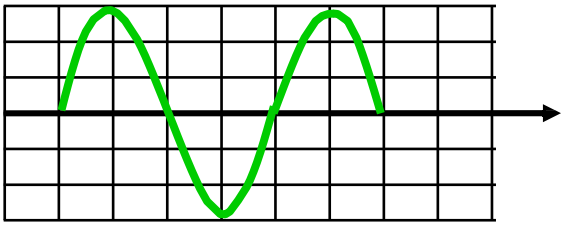


Figure 13

Determine the frequency of the a.c signal. (2mks)

.....

.....

.....

iv. The graph in **Figure 18** shows the variation of stopping potential V_S with frequency *f* of the incident light for two photosensitive surfaces, **A** and **B**.

a. State, with a reason, which surface has a longer threshold wavelength. (2 marks)

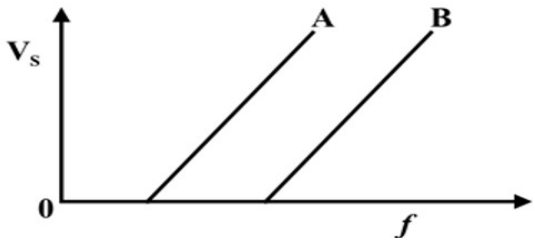


Figure 14

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b. Light of frequency$5.5 \times 10^{14} Hz$ is made to strike a surface whose work function is 2.5eV. Determine whether photoelectric effect will take place or not. (h=$6.63 \times 10^{-34} js$,1eV=1.6×10^{-19} J)
(3mks)

……

……

……

……

17. a.(i)The half – life of cobalt – 60 is 5years.How long will a sample take for the activity to decrease to $^{1}/_{16}$ of its original value. (3mks)

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ii) The graph below shows radioactive decay of iodine.

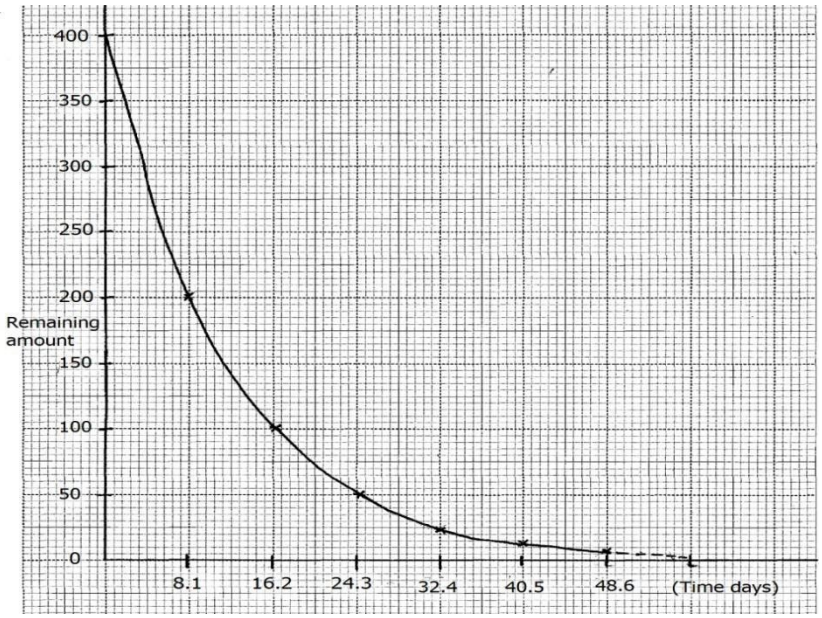


Figure 15

Use the graph to determine the:-

(I) Fraction of the amount remaining after 16.2 days. (2mks)

.....
.....
.....

(II) Determine the half – life of iodine. (1mk)

.....
.....

iii. The following is a decay series of Uranium 238.

$$^{238}_{x}\mathrm{U} \xrightarrow{\alpha - Particle} \mathrm{Th} \xrightarrow{\beta - Particle} {}^{y}_{91}\mathrm{Pa}$$

Determine the values of *x* and *y*. (2 marks)

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PAPER 3
QUESTION ONE

You are provided with the following apparatus:

- ✓ A soft-board,
- ✓ an equilateral glass prism,
- ✓ 4 optical pins and 4 drawing pins,
- ✓ plain white paper

Proceed as follows:

a) On a plain white paper draw a line XY and mark its midpoint Q. At Q draw a normal NQM at right angles to XY. Draw a line PQ such that the angle of incidence, i, (PQN) is 25^0 (figure below). Fix the paper on the soft-board with the drawing pins.

b) Place the triangular prism vertically with the triangular base down, on the paper such that the midpoint of the edge CA of the prism coincides with the midpoint, Q, of the line XY, as shown. Draw the outline CAB of the prism.

(The plain paper to be collected with the answer sheet) **(3 marks)**

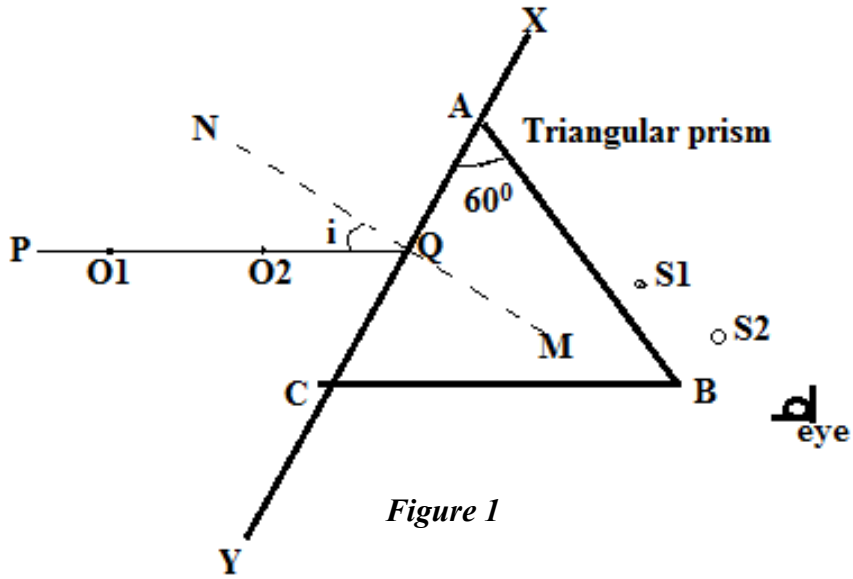


Figure 1

c) Stick two pins, O1 and O2 (object pins), on the line PQ vertically into the soft-board, about 5cm apart. View from the side AB of the prism and look for the images of the pins O1 and O2, as shown in the figure. Keeping the eye along the plane of the paper, fix two pins S1 and S2 (search pins), one after the other between your eye and the prism so that S1 and S2 and the images of O1 and O2, seen through the prism, appear one behind the other in a straight line. Mark the positions of the four pins and remove the pins, the prism and the paper.

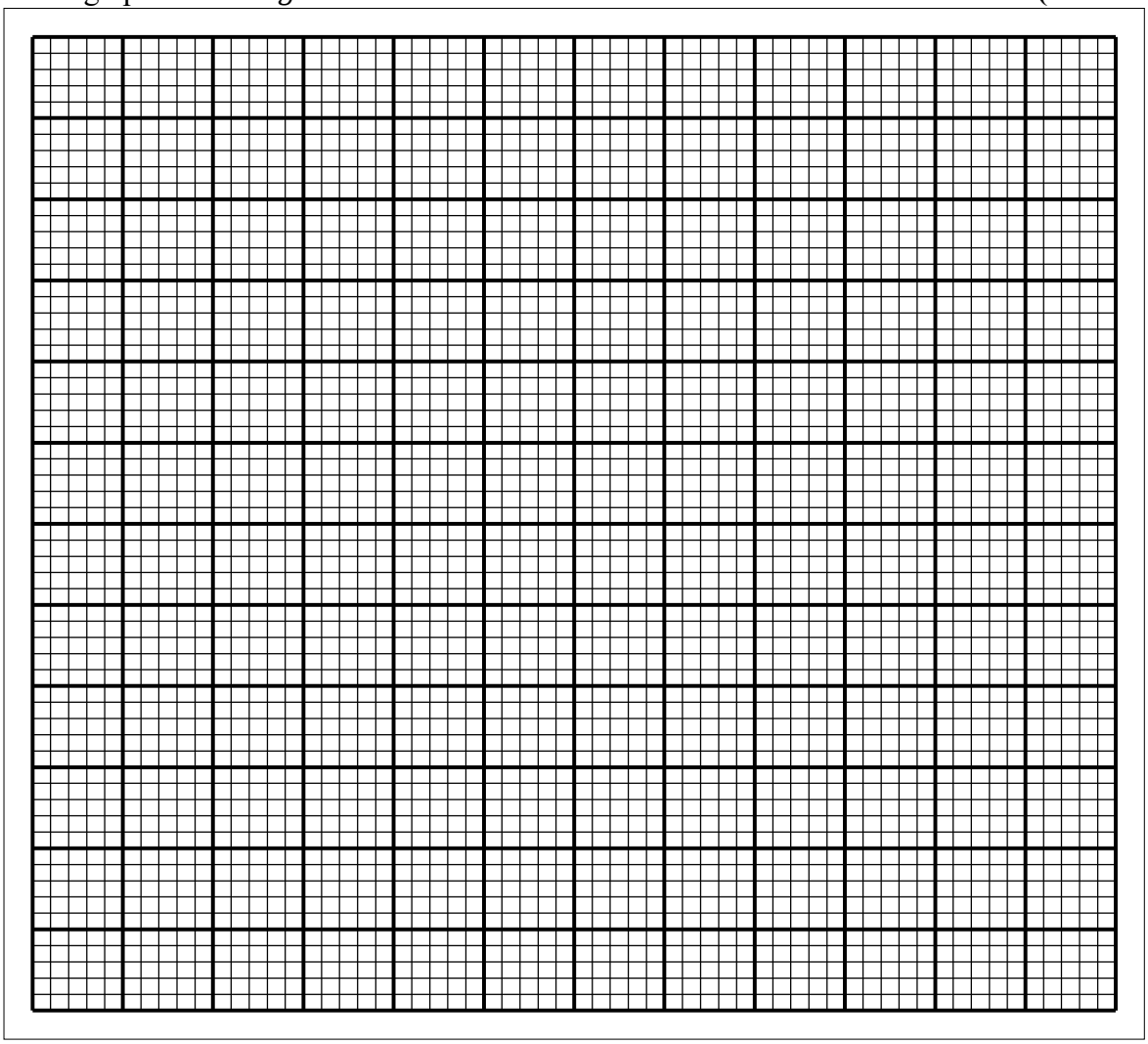
d) Draw a line joining the points S1 and S2 to meet the line AB at R. Draw the line QR. Measure the angle of refraction, r (MQR). Record the values of the angles i and r in the table below.

e) Repeat the experiment for the other values of i and entre your results in the table 2 below. Complete the table. **(6 marks)**

i (^{0})	**r (^{0})**	**Sin i**	**Sin r**	$\frac{\sin i}{\sin r}$
25				
30				
35				
40				
45				

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f) Plot a graph of sin i *against* sin r **(5 marks)**



g) Determine the slope of the graph **(3 marks)**

h) Determine, k the average value of: $\frac{\sin i}{\sin r}$ **(1 mark)**

i) Compare your slope with the ratio: $\frac{\sin i}{\sin r}$ and state the significance of the slope **(2 marks)**

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QUESTION TWO

PART A

You are provided with the following apparatus:

- A volt-meter (0-5V)
- An ammeter
- Two dry cells and holder
- Mounted wire
- Connecting wires (at least 2 with crocodile clips)
- Torch bulb in a holder
- Micrometer screw-gauge

Proceed as follows:

a) Arrange the apparatus as shown below:

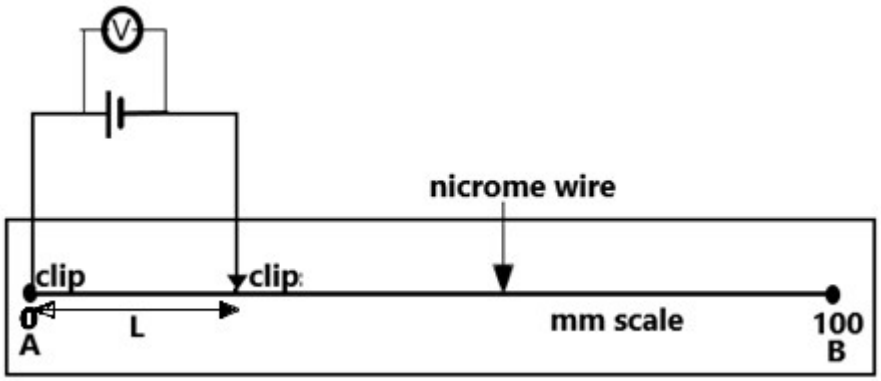


Figure 2

b) When L = 100 cm, record the voltmeter reading, V_0.

V_0 = …… **(1 mark)**

c) Take more readings from the voltmeter for values of L shown in the table 2. Complete the table. **(5 marks)**

Table 1:

L (m)	**0.9**	**0.8**	**0.4**	**0.2**	**0.1**
p.d (V)					
$\frac{V}{L}$ **(Vm^{-1})**					

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d) Determine I_k the average value of $\frac{v}{L}$ in table 2 above **(1 mark)**

e) Now dismantle the apparatus and arrange them as shown in figure 4 below:

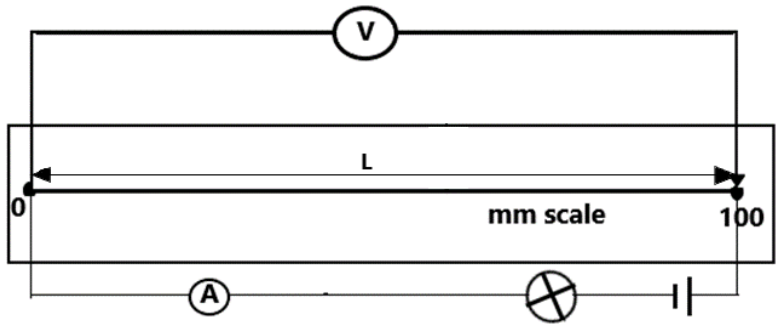


Figure 3

f) Record the ammeter reading, I_0 and voltmeter reading, V_1

i. I_0 = …… V_1 =……. **(2 marks)**

ii. Determine, k where: $k = \frac{V_1}{I_0}$ **(1 mark)**

iii. Explain the meaning of k above **(1 mark)**

g) Using the micrometer screw gauge, measure the diameter, **d** of the mounted wire

$\boldsymbol{d}$ = ……..m **(1 mark)**

h) Calculate the quantity, Q such that: $Q = \frac{8}{10}.k.(\frac{d^2}{L})$ **(2 marks)**

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PART B

You are provided with the following apparatus:

- 400 ml plastic beaker labelled B
- Source of boiling water
- Thermometer (range: -10^0c – 110^0c)
- Stop-watch
- 100 ml of water in a beaker labelled A

Proceed as follows:

i) Measure the temperature, $\mathbf{T_0}$ of cold water in the beaker labelled A

$\mathbf{T_0}$ = ……. K **(1 mark)**

j) Transfer 200ml of boiling water into the beaker labelled B and wait for the temperature to drop to 65^0c then switch on the stop watch. Take and record the temperature, T ^{0}c of the water after every two minutes. Record your results in table 3 below: **(5 marks)**

Table 2:

Time (minutes)	**2**	**4**	**6**	**8**	**10**
Temperature, T_1 (^{0}C)					
Temperature, T_2 (K)					
(T_2 - T_0) K					

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SERIES 14

PAPER 1

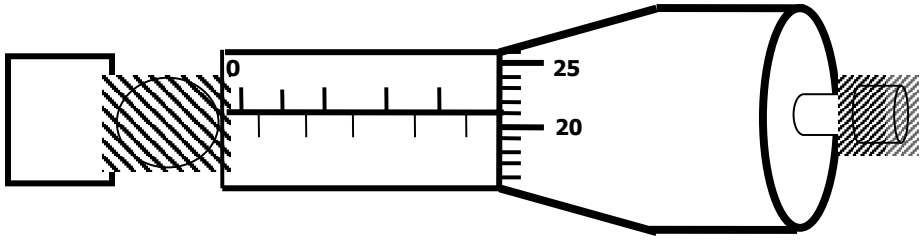
SECTION A (25 MARKS)

(Answer all the questions in the spaces provided)

1. State one effect of force on a moving body. (1mark)

   ……

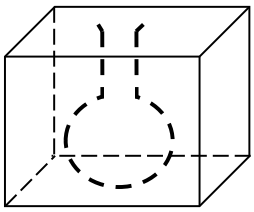
2. The figure below shows a reading of micrometer screw gauge with a positive zero error of 0.06mm. state the actual reading of the micrometer screw gauge. (2marks)



3. It is not correct to quote weight of object in kilogram. Explain. (1mark)

   ……

4. The figure below shows a rectangular block of wood with a hollow section (inside) at the position shown. The block is resting on a horizontal bench.



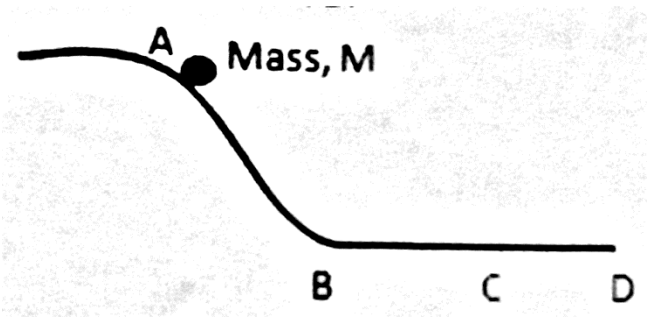
   State and explain the effect on the stability of the block when the hollow section is filled with water. (2marks)

   ……

   ……

   ……

5. Figure below shows a section of a curved surface ABCD. Point A is higher than point B while BCD is horizontal. Part ABC is smooth while CD is rough. A mass M is released from rest at A and moves towards D. state the change in velocity between.



   i. BC (1mark)

   ……..

ii. CD (1mark)

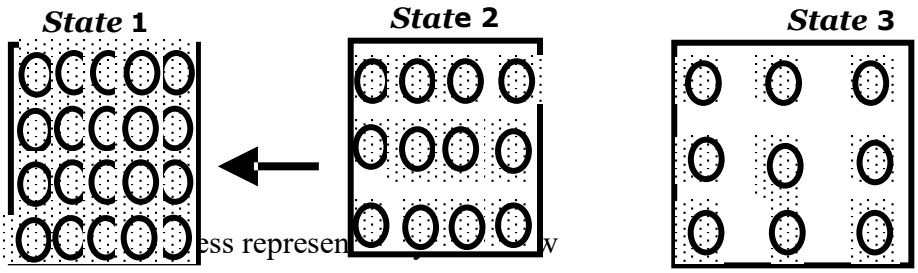
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6. A student wearing sharp pointed heeled shoes is likely to damage soft wooden floor. Explain. (1mark)

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7. Figure below shows the arrangement of molecules in the three states of matter.



i. [illegible] ess represen [illegible] w (1mark)

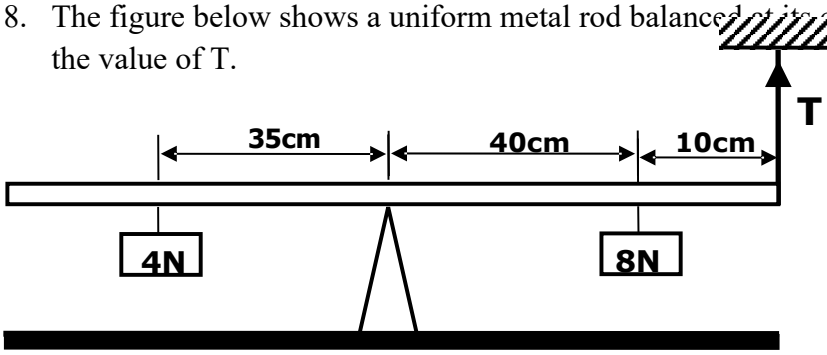
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ii. State the reason for the arrangement of molecules in state 3 (1mark)

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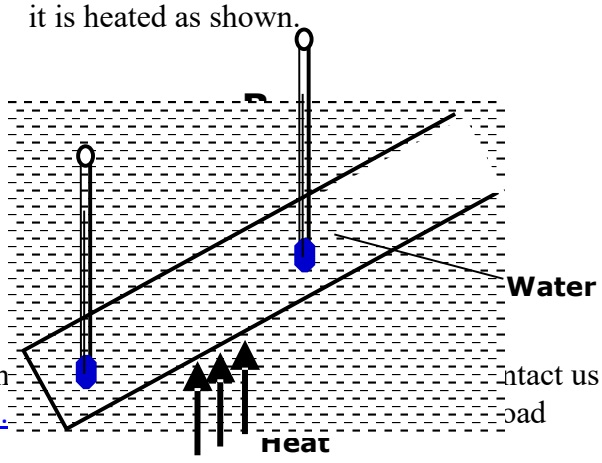
8. The figure below shows a uniform metal rod balanced at its centre by different forces. Determine the value of T. (3marks)



9. A person carrying a luggage using one hand leans her body away from the luggage. Give a reason for this observation. (1mark)

……..

10. Figure below shows a glass tube with water and is fitted with two identical thermometers A and B. it is heated as shown.



State with a reason which of the two thermometers shows a higher reading after some time. (2marks)

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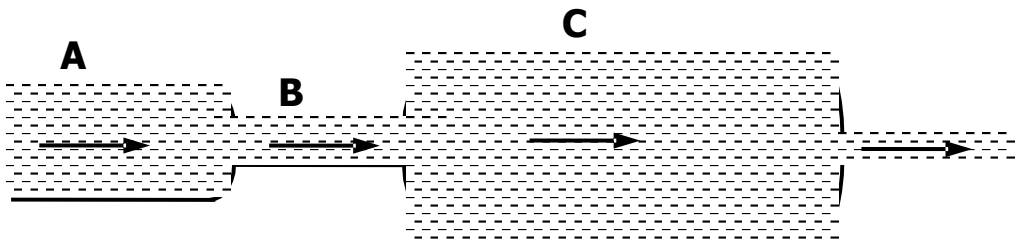
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11. Thermodynamics is one of the branches of physics. State what it deals with. (1mark)

……..

12. A body of volume $6 \times 10^{-5} m^3$ floats on a paraffin of density $800 kgm^{-3}$ with $\frac{2}{3}$ of its volume submerged. Calculate the weight of the body. (2marks)

13. Figure below shows parts A, B and C of a none uniform glass tube. State with a reason the part of the tube where the pressure will be lowest when liquid is made to flow in the tube from A to C. (2marks)



……

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14. In an experiment to determine the density of a liquid R, a student obtain the following data;

Mass of empty density bottle = 55.0g

Mass of the density bottle + water = 80.0g

Mass of the density bottle + liquid R =70.0g

Determine the density of liquid R. (density of water is $1000 kgm^{-3}$) (3marks)

Section B 55marks.

(Answer all the question in this section.)

15.

a) Define the absolute zero of the kelvin scale. (1mark)

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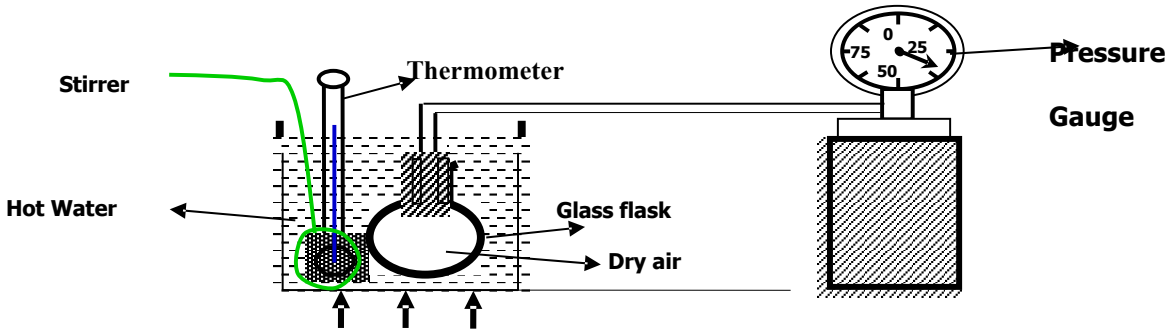
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b) It is not possible to obtain zero pressure of a gas in real gas situation. Explain (2marks)

……

……

c) The diagram below shows an experiment that can be used to verify a certain gas law, use it to answer the following questions.



i. State the gas law that can be verified using the set up above. (1mark)

……

……

ii. State two measurements that can be obtained from the set up above. (2marks)

……

……

iii. Explain how the measurements in (ii) above can be used to verify the gas law in (i) above. (3marks)

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d) A fixed mass of a gas occupies $1.5 \times 10^{-3} m^3$ at a pressure of 760mmHg and temperature of 273K. determine the volume the gas will occupy at a temperature of 290K and preesure720mmHg. (3marks)

e) State two assumptions made in explaining gas laws using kinetic theory. (2marks)

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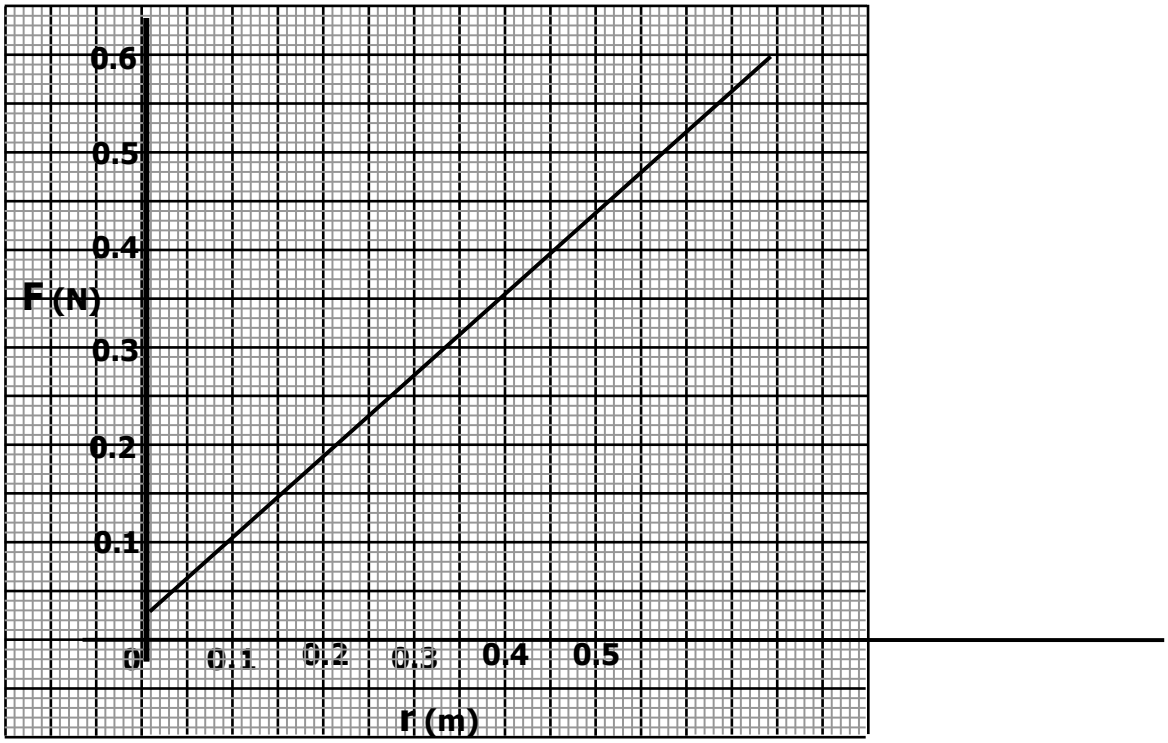
16.

a) Define the term angular velocity. (1mark)

……

……

b) The graph below was obtained from an experiment to investigate the variation of the centripetal force, F with radius, r of a circle which a body in circular motion describes.



From the graph, determine the angular velocity, ω of the body given that $m = 100g$ and $F = m\omega^2 r + c$ where c is a constant. (3marks)

c) A stone of mass 40g is tied to the end of a string 50cm long and whirled in a vertical circle at 2 revelations per second. Calculate the maximum tension on the string. (3marks)

d) A car negotiating a bend on a leveled ground experiences centripetal force towards the centre of the bend.

i. State what provides the centripetal force. (1mark)

……

ii. State two factors that determine the maximum speed by which the car safely negotiates the bend. (2marks)

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17.

a) State two differences between boiling and evaporation. (2marks)

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……
……
……

b) Explain why temperature is constant during change in state. (1mark)

……
……

c) In an experiment, 50g of dry steam at 100^0c was passed through some crushed ice at 0^0c. (*latent heat of vaporization of water is* $2.26 \times 10^{6J}\, kg^{-1}$, *latent heat of fusion of ice is* $3.4 \times 10^5 J/kg$ *and specific heat capacity of water is 4200J/kgK)*

Determine the;

i. Quantity of heat lost by the steam to change to water at 100^0c. (2marks)

ii. Quantity of heat lost by water formed to cool to 0^0c. (2marks)

iii. Mass of ice melted at 0^0c. (2marks)

d) State one assumption made in the experiment in question (c) above. (1mark)

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……..

18.

a)

i. State two factors that affect the spring constant of a helical spring. (2marks)

……

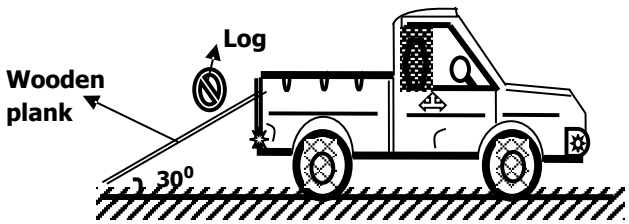
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ii. A spring of length 8cm is loaded with a mass 200g and its length becomes 13cm.

I. Calculate the spring constant of the spring. (2marks)

II. Determine the elastic potential energy stored in the spring. (3marks)

b) A man used a plank of wood to lift a log of wood from the ground to a stationary pick up on a flat ground as shown in the figure below.



The wooden plunk was inclined at an angle 30^0 to the ground. Calculate the;

i. velocity ration of the set up. (2marks)

ii. mechanical advantage of the set up if its efficiency is 60% (2marks)

19.

a) Define an acceleration as used in linear motion. (1mark)

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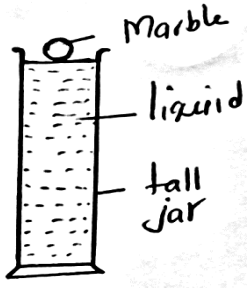
b) A tape attached to an accelerating trolley passes through a ticker timer that makes dots on it at a frequency of 50Hz. The ticker timer makes 10 dots on a 10cm long tape such that; the distance, a, between the first two dots is 0.5cm and the distance, b, between the last two dots is 1.5cm. Determine the;

i. Initial velocity of the trolly. (2marks)

ii. Final velocity of the trolly. (2marks)

iii. Acceleration of the trolly. (2marks)

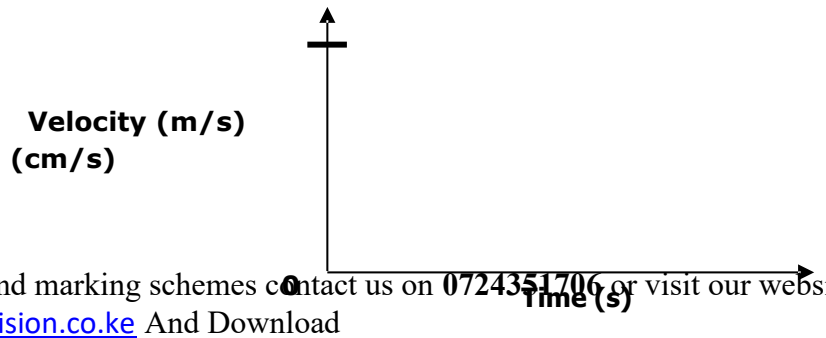
c) The figure below shows a marble dropping through a liquid. Use it to answer the following questions that follows.



i. Other than the weight of the marble state two other forces acting on the marble. (2marks)

……
……

ii. Sketch a velocity time graph for the marble in the grid provided below. (1mark)

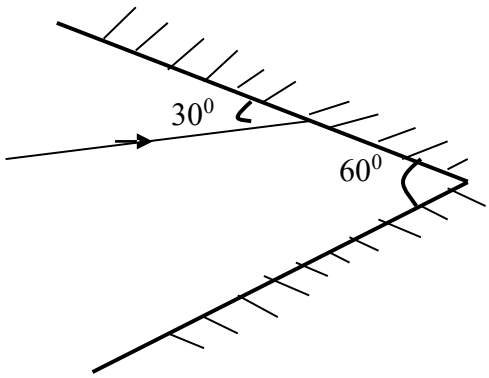


PAPER 2

SECTION A: (25 MARKS)

Answer all questions in this section in the spaces provided

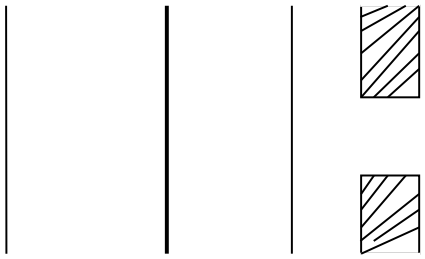
1. Figure 1 shows two mirrors inclined at an angle of 60^0 to each other. A ray of light is incident on one mirror as shown.



Sketch the path of the ray to show its reflection on the two mirrors. (2 marks)

2. State any **two** ways of increasing the size of an image formed by a pinhole camera.(2 marks)

3. The figure 2 below shows water waves moving towards barrier.



(i) State the property of wave under investigation. (1 mark)

(ii) Show the emergence of the reflected wave after passing the opening. (1mark)

(iii)State why passing of light through marrow opening is a very rare phenomenon.

(1 mark)

4. The figure 3 shows part of an electromagnetic spectrum.

A	B	Visible light	UV	C

(i) Identify radiation A and C (2 marks)

A.....

C.....

(ii) State **one** use of radiation C (1 mark)

.....

.....

5. An electric bulb is rated 100W 20v. Determine the resistance of its filament at its operating temperature. (2 marks)

.....

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6. (a) State the basic law of magnetism. (1 mark)

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(b) Figure 4 shows a bar of soft iron placed near a magnet.



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On the same diagram, sketch the magnetic field pattern due to the set up (2 marks)

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7. State **two** uses of a charged gold leaf electroscope. (2 marks)

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8. State **two** physical quantities that can be measured to determine whether a secondary chemical accumulator requires to be charged. (2 marks)

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9. (a) Explain why the walls of studios are padded with woolen materials. (1 mark)

.....

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.....

(b) A student stands between two classroom walls and claps. After 0.6 seconds, she hears the first echo and hears the second echo after 0.2 seconds later. Determine the distance from the student to the further wall. Take the speed of sound in air to be 320 m/s. (3 marks)

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10. Three resistors of 3Ω, 6Ω and 9Ω are connected in parallel. Determine the total resistance. (2 marks)

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SECTION B: (55 MARKS)

Answer all questions in this section

11. (a) Differentiate between progressive wave and standing waves. (2 marks)

.....

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(b) Sketch a graph of displaced against time for a transverse wave of frequency 50Hz with at least two cycles with amplitude of 2 cm. (2 marks)

(c) The figure 5 shows an experiment to observe interference of light waves. Waves are incident to double slits placed closed to a source of monochromatic light.

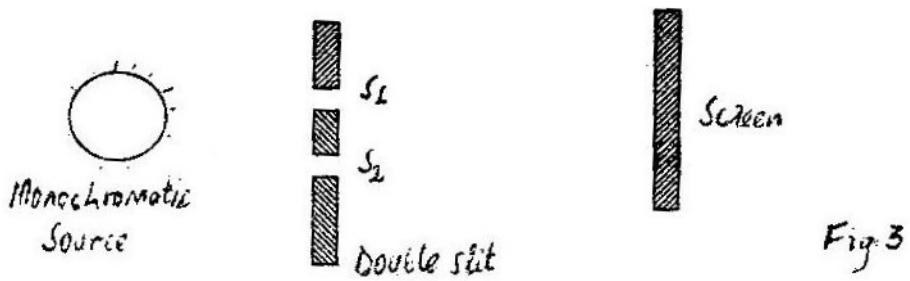


Fig 3

(i) State what is meant by a monochromatic source of light (1 mark)

.....

.....

(ii) State the function of the double slit. (1mark)

.....

.....

.....

.....

(iii)State and explain what is observed on the screen. (3marks)

.....

.....

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.....

(iv)State what is observed on the screen when the slit separation S_1 S_2 is reduced.

(1 mark)

.....

.....

.....

(v) While light source is used in place of monochromatic source. (1 mark)

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12. (a) State the meaning of the term principal focus as applied in converging lens. (1 mark)

.....

.....

(b) A real object of height 1 cm placed 50mm from a converging lens forms virtual image 100mm from the lens. Determine the following:

(i) Focal length of the lens (3 marks)

.....

.....

.....

(ii) The magnification. (2 marks)

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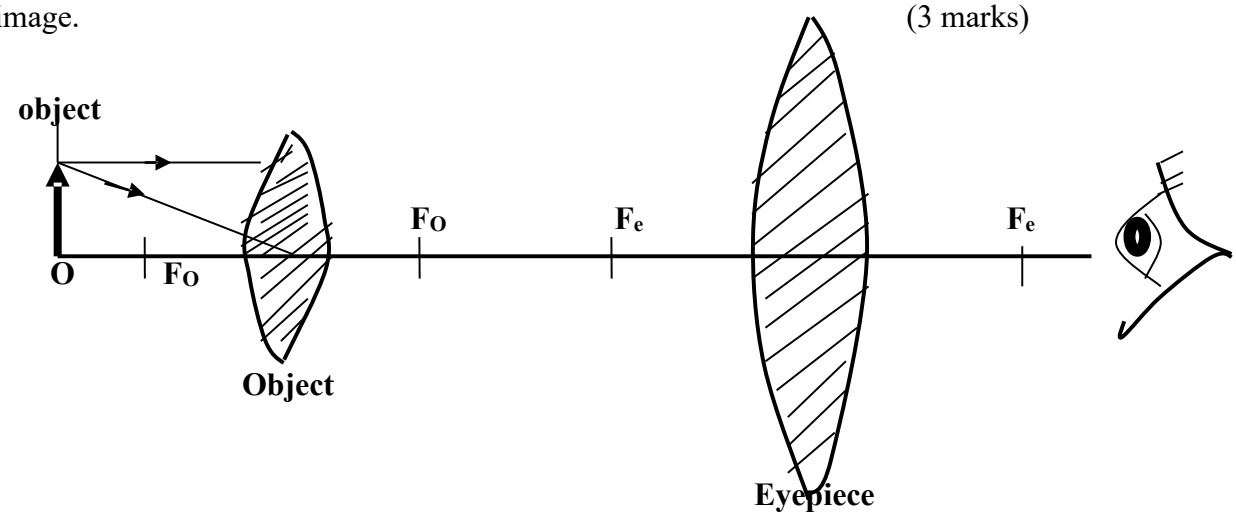
(c) State **two** optical instruments that produce a magnified real image using a convex lens. (2 marks)

.....

.....

.....

(d) The figure 6 shows a compound microscope with objective and eyepiece of principal foci F_O and Fe respectively. Complete the ray diagram to illustrate how the eye sees the final image. (3 marks)



(e) State **two** differences between human eye and camera (2 marks)

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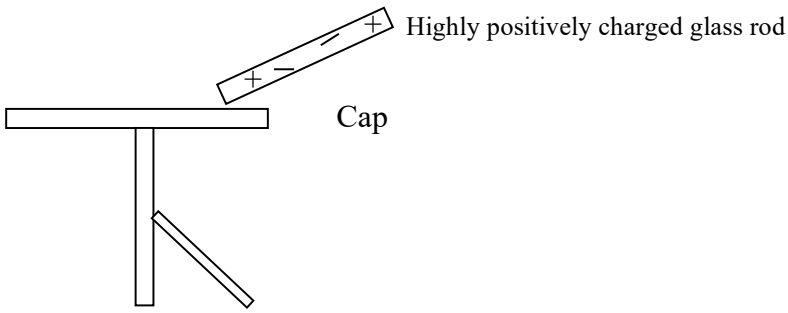
.....

13. (a) State the law of electrostatic charges. (1 mark)

.....

.....

(b) The figure 7 shows a highly positively charged glass rod being brought slowly near the cap of a negative charged gold leaf electroscope. It is observed that the leaf initially falls and then rises.



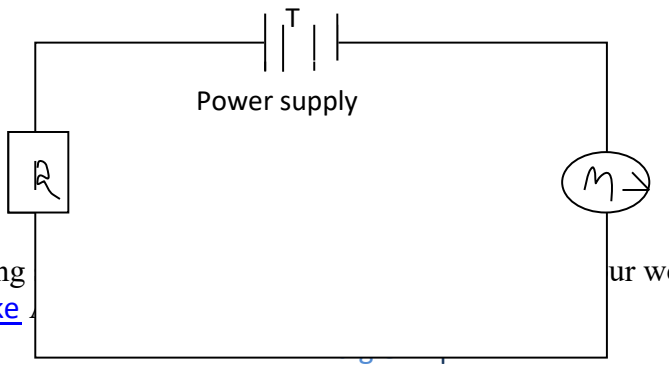
Explain this observation. (1 mark)

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.....

.....

(c)(i) The figure 8 shows an electric circuit used to charge a capacitor C. when switch is closed, it is observed that, the millimeter records some current which gradually reduces to zero with time.



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(i) Explain the observation (1 mark)

.....

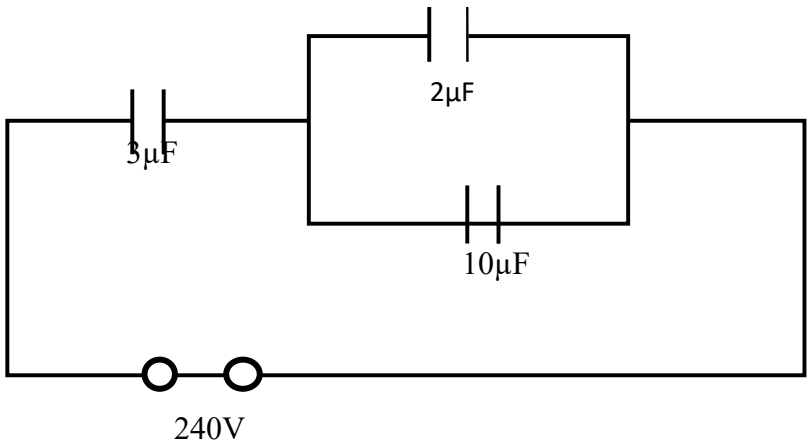
.....

(ii) State **one** factor that reduces the capacitance of a parallel plate capacitor. (1 mark)

.....

.....

(d) The figure 9 shows an electrical circuit with three capacitors of 10μF, 2μF and 3μF capacitance connected to a 240V supply.



Determine

(i) The effective capacitance of the capacitor combination. (2 marks)

.....

.....

.....

(ii) The charged stored in the circuit. (2 marks)

.....

.....

.....

(iii)The potential difference across the 2μF capacitor. (2 marks)

.....

.....

.....

.....

14. (a) A spoon partly submerged in a glass of water appears bent. Explain. (1 mark)

.....

.....

.....

(b) A coin placed at the bottom of a tall gas jar. When the jar is filled with paraffin to a depth of 32.4 cm, the coin is apparently seen displaced 9.9 cm from the bottom. What is the refractive index of paraffin? (3 marks)

.....

.....

.....

.....

(c) State **two** conditions necessary for total internal reflection. (2 marks)

.....

.....

.....

.....

(d) The speed of light in air is 3.0×10^8 m/s. what is the speed of light in glass?

(Take refractive index of glass = 1.5) (3 marks)

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(e) State Snells' law. (1 mark)

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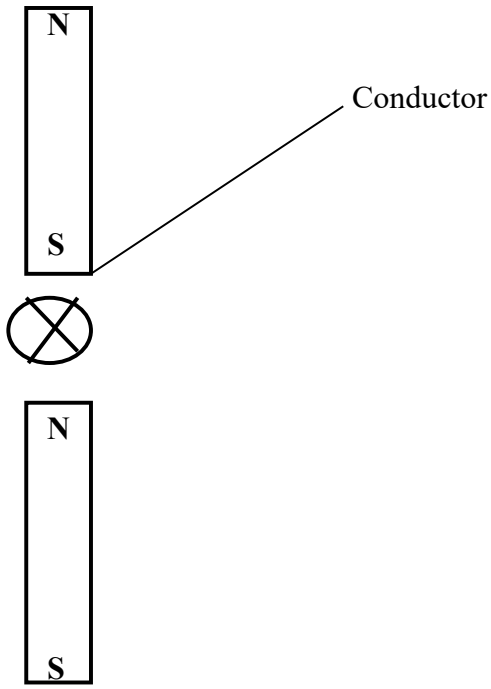
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15. (a)(i) State Flemings left hand rule. (1 mark)

.....

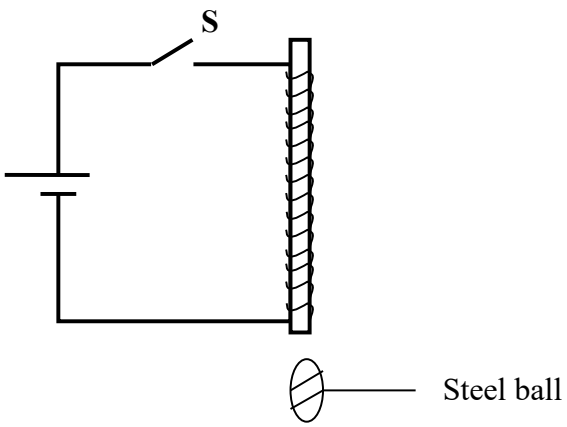
.....

(ii) The figure 10 shows the cross-section of two bar magnets and a current carrying conductor held between them.



Draw the field pattern, hence indicate an arrow the direction of force experience by the conductor (2 marks)

(b) A small electromagnet for lifting and releasing a small steel ball is made in the laboratory as shown in figure 11 below.



(i) Explain why soft iron is better material to be used for the core than steel.(1 mark)

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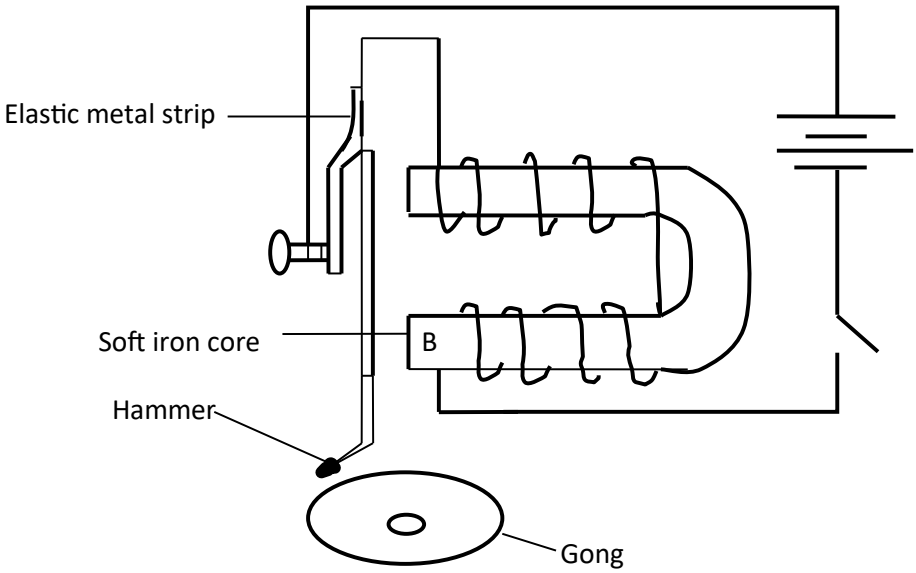
(ii) In order to lift a slightly larger ball, it is necessary to make a stronger electromagnet.

State two ways in which electromagnet can be made more powerful.(2 marks)

.....

.....

(c) The figure 12 below illustrates a circuit diagram of an electric bell.



Explain how the bell works. (4 marks)

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PAPER 3

1.

You are provided with the following.

- An ammeter. (0-1A)
- A voltmeter. (0-3 or 0-5V)
- A wire mounted on mm scale labeled XY
- A switch.
- Two new dry cells (size D) and a cell holder.
- A micrometer screw gauge (may be shared).
- 6 connecting wires with crocodile clips at the end.

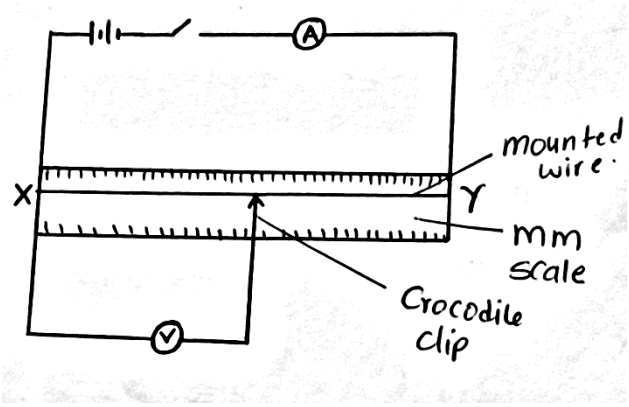
Proceed as follows:

(a) Measure the diameter, d of the mounted wire at three different points.

Average diameter d = _____mm (1mark)

(b) Calculate the cross-sectional area of the wire in SI unit (2marks)

(c) Set up the apparatus as shown in the circuit diagram in the figure **below**.



(d) Close the switch and tap the mounted wire with the crocodile clip at any point as shown in the circuit. Ensure that both meters show positive deflection. Record the ammeter reading I. Open the switch.

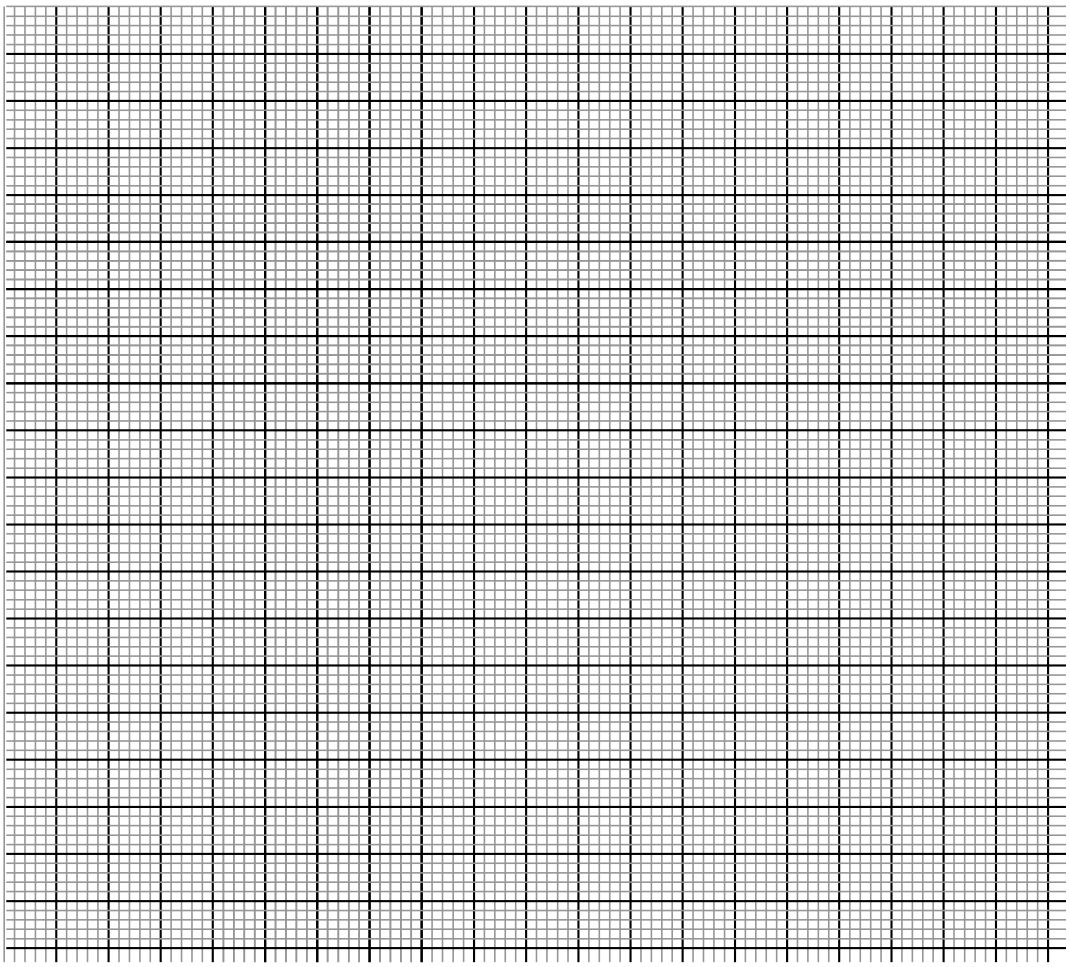
I……A (1mark)

(e) Tap the wire at X. Close the switch, move the crocodile clip towards Y until the voltmeter reads 0.2 V, read and record in the table below the corresponding length L.

(e) Repeat the procedure in (d) above for other values of V, shown in the table below and complete the table. (6marks)

V (Volts)	Length L(m)	IL(Am)
0.2		
0.4		
0.6		
0.8		
1.0		

(f) (i) Plot the graph of V (Y-axis) against IL(m). (5marks)



(ii) Determine the slope of the graph. (3marks)

(iii) Given that $V = \frac{\rho IL}{A}$ were A is the cross-sectional area of the wire and ρ is a constant for the material of the wire; determine the value of the constant ρ. (2marks)

2.

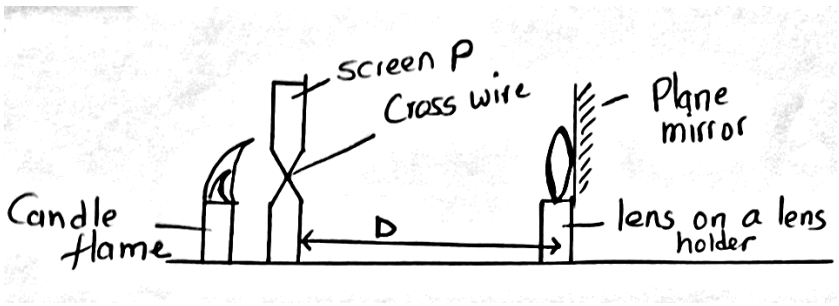
A

You are provided with the following apparatus.

- ✓ Candle
- ✓ A lens on a lens holder
- ✓ Two screens (one with cross wire labeled P and the other one labeled G)
- ✓ Plane mirror
- ✓ Masking tape
- ✓ Metre rule.

Proceed as follows.

a. Fixe the plane mirror at the back of the lens on a lens holder using masking tape provided. Set the candle flame to be in line with the cross wire on the screen P and the lens with the mirror at the back as in the figure below.



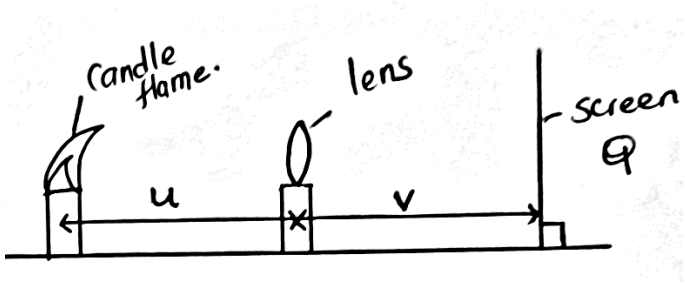
b.

i. Adjust the position of the lens until a sharp image of the cross wire is formed besides the cross wire. Measure the distance D between the screen and lens.

D……m (1mark)

ii. Calculate quantity T, given that $T = \frac{1}{D}$, which property of lens is quantity T? (2marks)

c. Remove the mirror and now arrange the candle flame and screen Q on either side of the lens as in the figure below.



d. Adjust the position of the candle so that its centre is at a distance of $u = 20cm$ from the lens. Adjust the position of the screen until a sharp image of the flame is formed on the screen. Measure and record in the table below, the image distance v, *the distance between the screen and the lens*.

e. Repeat part (d) above for other values of u shown in the table and complete the table.
(5marks)

Distance $u\ (cm)$	20	25	30
Distance $v(cm)$			
$m = \frac{v}{u}$			
$k = \frac{v}{m+1}\ (cm)$			

f. Determine the average value of k.
(1mark)

B

You are provided with the following apparatus.

- ✓ 10ml measuring cylinder (plastic)
- ✓ Stop watch
- ✓ Source of heat (water bath)to be shared
- ✓ Thermometer
- ✓ Boiling tube
- ✓ Test tube holder.
- ✓ Some water in 50ml beaker
- ✓ Electric top pan balance

Proceed as follows.

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g.

i. Measure the mass of a clean dry measuring cylinder. (1mark)

M_1……..……g

ii. Measure 10ml of water. Measure the mass of the measuring cylinder and the 10ml of water in it. (1mark)

M_2……g

iii. Determine the mass M of 10ml of water in kg. (1mark)

M……kg

h. Transfer the 10ml of water into boiling tube, hold the boiling tube using test tube holder and heat the boiling tube with its contents in the water bath until the temperature of the water in side it reaches 80^0c (*heating the boiling tube in boiling water makes the temperature of inside to rise fast*). Remove the boiling tube from the water bath and let the temperature of its content drop to 75^0c. At 75^0c start the stop watch and record the temperature θ_1 after every 30 seconds in the table below and complete the table.(*note; time should continuously run, do not stop until time reaches 90s*) (5marks)

Time t (s)	0	30	60	90
Temperature $\theta_1(\theta_1^0c)$	75			
Change in temperature θ^0c	0			
$R = 4200M\theta$	0			

i. Determine the average value of R from 30 – 90 s
(1mark)

j. Determine the quantity S given that $S = \frac{R}{t}$ where $t = 30s$.
(2marks)

k. State the physical quantity represented by S.
(1mark)
……

SERIES 15

PAPER 1

SECTION A.(25mks)

1. List down one precaution to observe in physics laboratory while handling electrical circuits and equipment. (1mark)

   ……

2. Give a reason why displacement method is unsuitable for determining the volume of irregular shaped solid ice. (1mark)

   ……

3. Give a reason for the random movement of particles suspended in a fluid. (1mark)

   ……

   ……

4. An oil drop of volume 1.0 x $10^{-10}m^3$ is placed on a clean water surface. The oil drop spreads to form a thin film as shown in the **figure 1 below**. The measuring instrument is a metre rule.

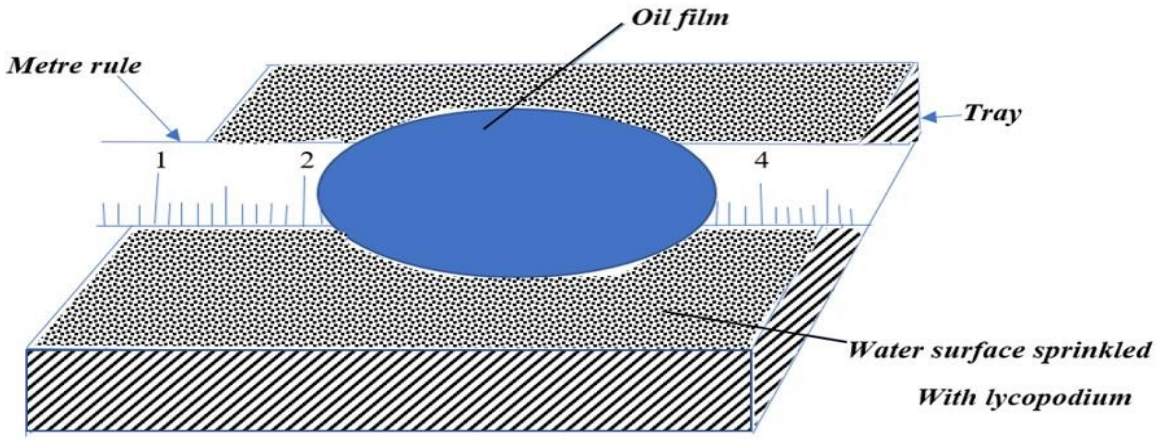


Figure 1

(a) Determine the area of the oil patch. (3marks)

……

……

……

(b) Determine the size of the oil molecule. (2marks)

……

……

5. Explain why a glass container with thick walls is more likely to crack than the one with thin walls when a hot liquid is poured into them. (2marks)

……

……

……

6. A metal pail feels colder than a plastic pail on a cold morning even though both have the same temperature. Explain this observation. (2marks)

……

……

……

7. Water flows along a horizontal pipe of cross-sectional area $48cm^2$ which has a constriction of cross-sectional area $12cm^2$ at one place. If the speed of water at the constriction is 36m/s, Determine the speed in the wider section. (2marks)

……

……

……

……

8. (a) State the **principle of moments**. (1mark)

……

……

……

(b). A uniform metre rule of mass 180g is pivoted freely at 0cm mark. Determine the upward vertical force needed to maintain the metre rule horizontally at 60cm mark. (2marks)

……

……

……

(c) Explain why the handle of the door is usually placed as far as possible from the hinge

……(1mark)

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……

9. (a) Define the **centre of gravity of a body.** (1mark)

……

……

……

(b) Explain why bus-body builders build luggage compartments under the seats rather than on the roof racks. (2marks)

……

……

10. (a) State the **Hooke's law**. (1mark)

……

……

(b). The diagram below shows three identical springs which obey Hooke's law.

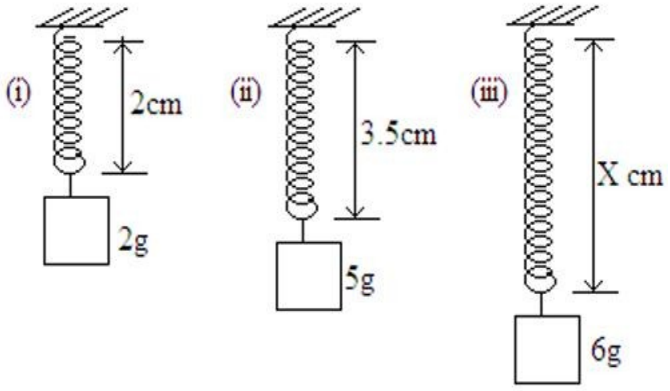


Figure 2

Determine the length **X** using the information from the figure 2 above. (3marks)

……

……

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SECTION B.(55mks)

11. A skydiver jumps out of an aircraft. The **figure 3 below** shows the two forces acting on the skydiver.

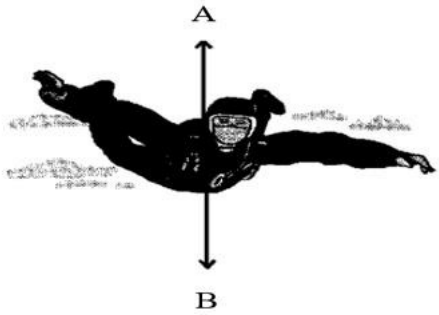


Figure 3

(a) State what cause forces A and B (2marks)

A ……

B…….

(b) The graph shows how her velocity changes before she opens her parachute.

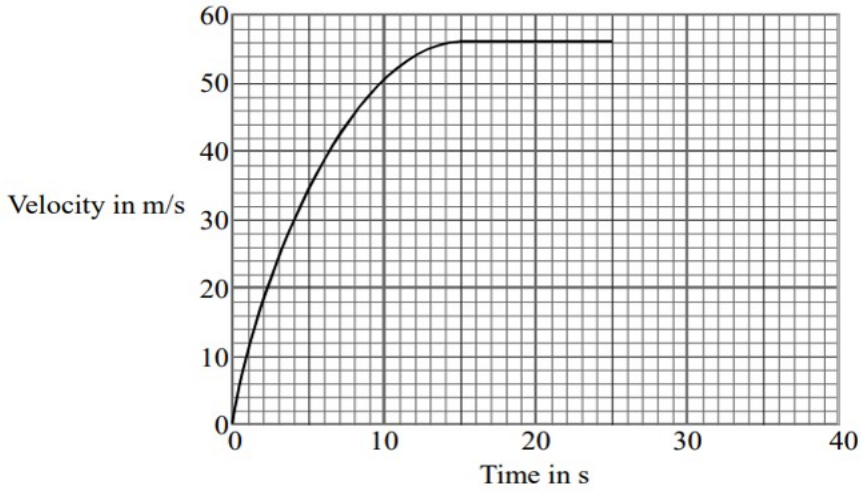


Figure 4

Determine the skydiver's terminal velocity. (1mark)

……

(c) What is the relationship between the two forces on the skydiver, (2marks)

(i) Before she reaches terminal velocity;

……

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(ii) When she is travelling at terminal velocity?

……

(d) A bullet is fired horizontally at a velocity of 400m/s from a cliff which is 50m tall as shown in the **figure 5** below.

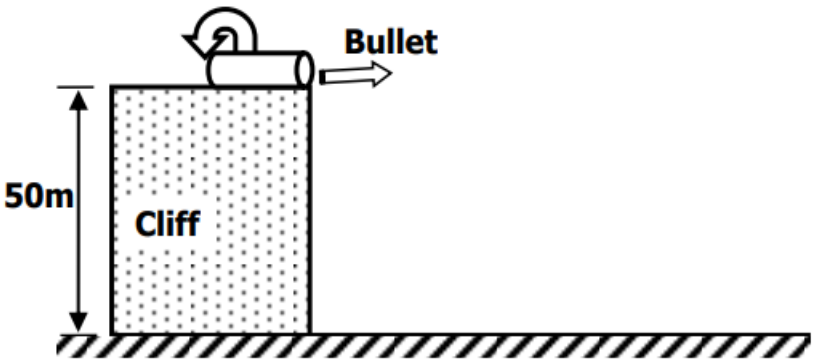


Figure 4

(i) On the same diagram draw the trajectory of the bullet until it comes to rest. (1mark)

(ii) Determine the time taken for the bullet to hit the ground. (2marks)

……

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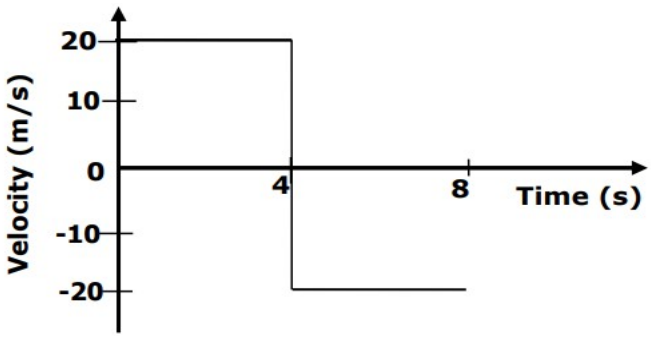
(iii) Determine the range. (2marks)

……

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……..

(iv) The figure below shows the velocity – time graph for the motion of a body.

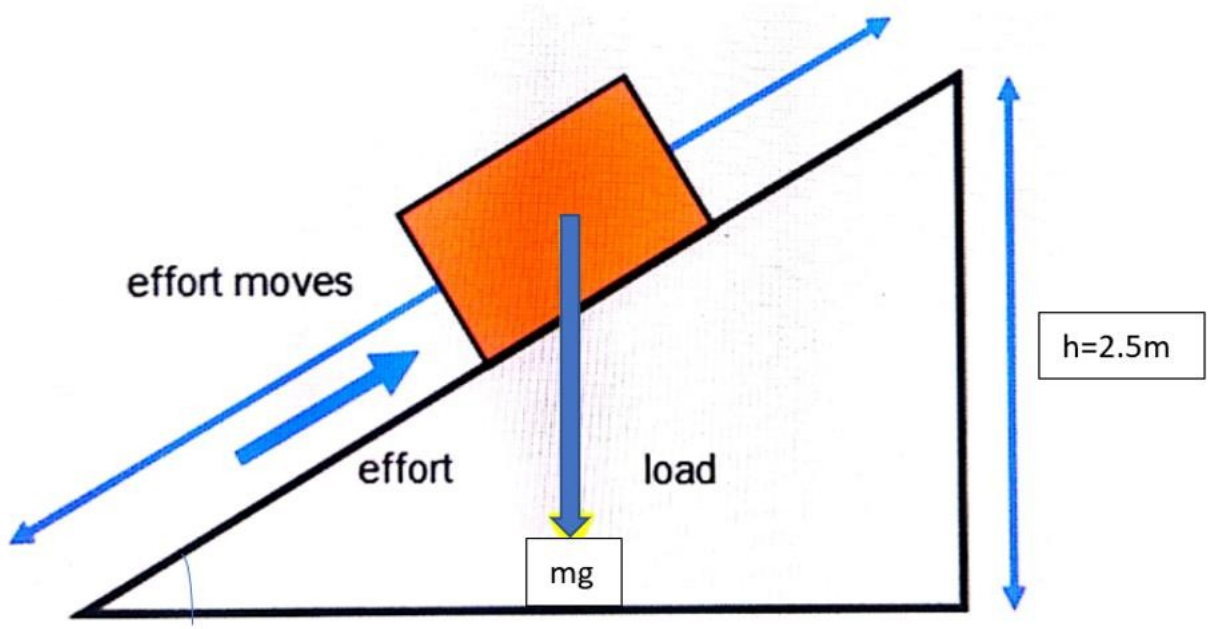


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Figure 5

Sketch the speed time graph for the same motion. (2marks)

12. An object of weight 900N is pushed up along an inclined plane of length 20m as shown below.



If 500 Joules of energy was wasted in this operation, determine;

(i) The work output. (2marks)

……

……

(ii) Efficiency of the machine. (3marks)

……

……

……

(iii) Mechanical advantage. (3marks)

……

……

……

(iv) Effort needed. (2marks)

……

……

……

13. (a). Define the term specific latent heat of fusion of a substance. (1mark)

……

……

(b). The graph below shows a temperature Θ(°C) against time, t(s) of 20g of Naphthalene that was heat to 80°C then cooled to room temperature.

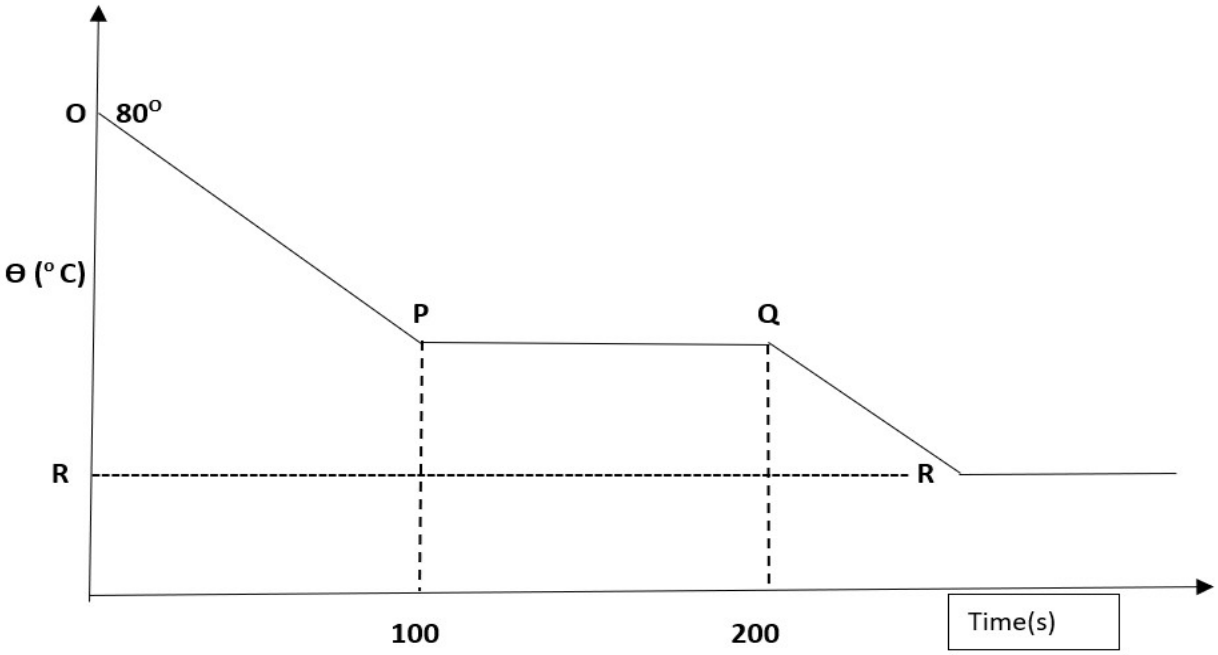


Figure 7

If the rate of heat given out on PQ was at the rate of 30W;

(i) State what happens in part PQ. (1mark)

……

……

(ii) Use the graph to determine the specific latent heat of fusion of Naphthalene.

(3marks)

……

……

……

14. The graph shows a graph that can be used to verify Charles law. Use the information provided to answer the questions below.

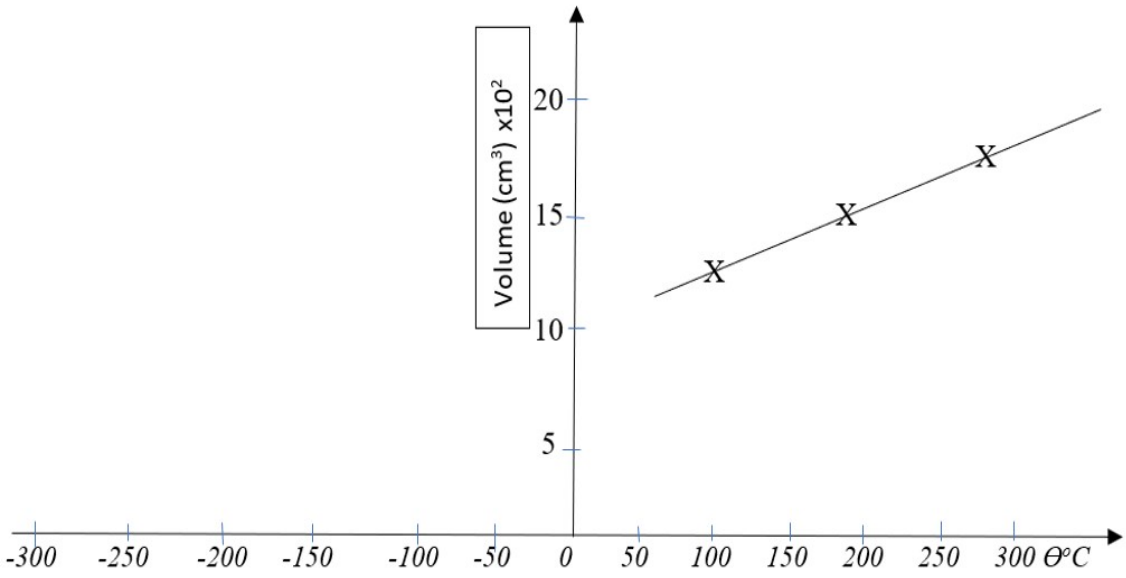


Figure 8

(a) What is the volume of the air at 0°C? (1mark)

……

(b) The value of 0 K in Celsius scale. (1mark)

……

(c) The glass tube in figure 9 below contains air enclosed by a thread of mercury as shown in a horizontal position at a temperature of 27°C.

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Figure 9

The tube is then raised until its positioned vertically upwards with the opened end at the top, determine the length of the enclosed air in mm when in its new position.

…… (3marks)

……

……

15. (a). State Pascal's Principle of Transmission of pressure. (1mark)

……

……

(b) The figure 10 below shows a mercury manometer. Some dry gas is trapped in the closed space in one of the limbs while the other is open. Alongside is mercury barometer

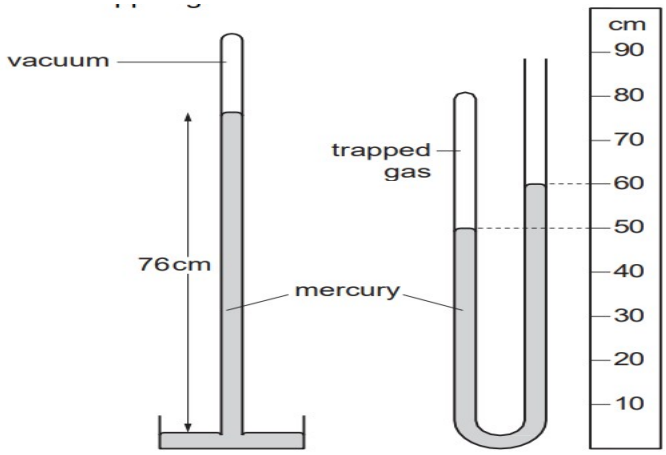


Figure 10

Determine the pressure of the trapped gas given that the density of mercury is 13600kg/m^3 in SI units. (3marks)

……

……

……..

(c) The figure 11 below shows a simple hydraulic used to raise a car.

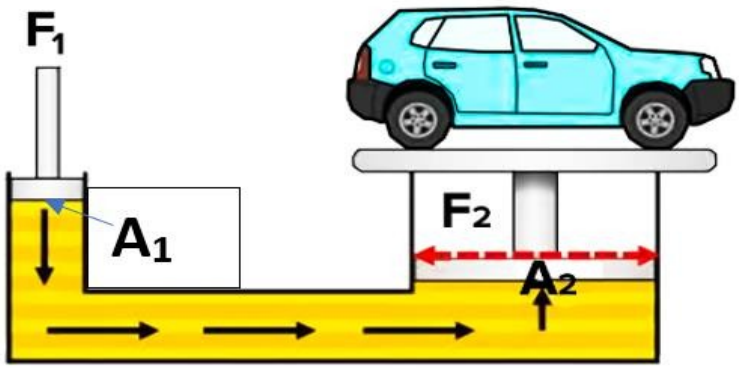


Figure 11

(i) Determine the pressure exerted by the piston given that F_1=120N, A_1= 0.006m^2 and A_2=0.2m^2. (3marks)

……

……

……

……..

(ii) Determine the weight of the car. (3marks)

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……

……

(iii) Give one property which make the oil suitable for use in the above machine.

……..(1mark)

……

16. (a) State what contributes to centripetal force when a bucket full of water is at the top while being rotated in a vertical circle. (1mark)

……

(b). (i) Distinguish between angular velocity and linear velocity. (1mark)

……

……

(c). A particle moves in a semi-circular path of radius 3.5m with a constant speed of 20m/s as shown in the figure 12 below.

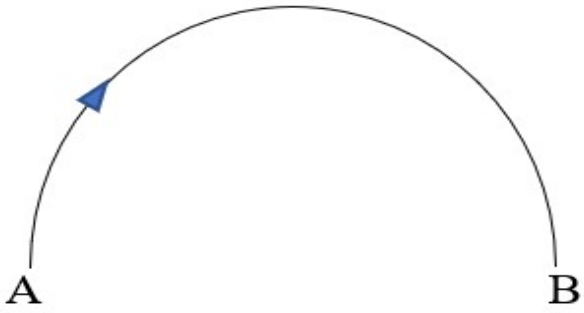


Figure 12

Calculate

(i) Determine the distance moved by the particle from A to B. (2marks)

……

(ii) The time taken to travel from A to B. (2marks)

……

……

……

(iii). The angular velocity of the particle. (3marks)

……

……

(d) State any two applications of uniform circular motion. (2marks)

……

……

PAPER 2

SECTION A

1. a) Figure 1 below shows a point object O placed in front of a plane mirror M. Using a ray diagram, locate the position of the image formed. (3 Marks)

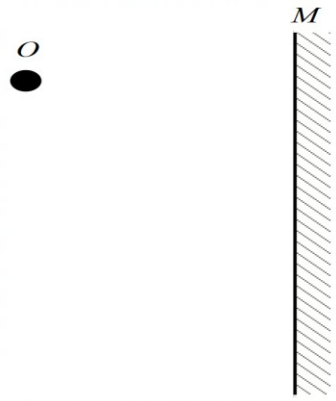


Figure 1

2. A magnetic material is placed in the north-south direction and hammered several times. Using the domain theory, explain the magnetization process. (3 Marks)

……

……

3. Figure 2 below shows a virtual image formed by a concave mirror. Complete the diagram to show the position of the object. (3 Marks)

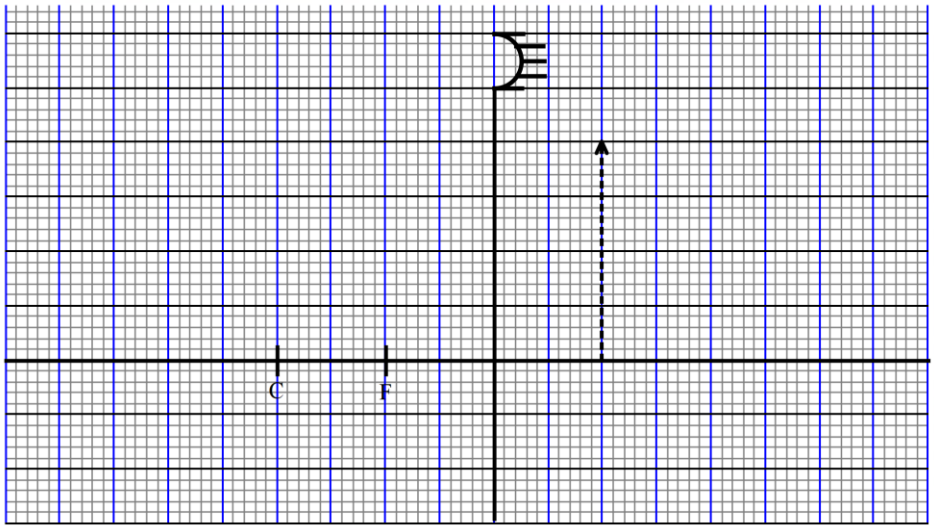


Figure 2

4. Figure 3 below shows a simple electric bell circuit.

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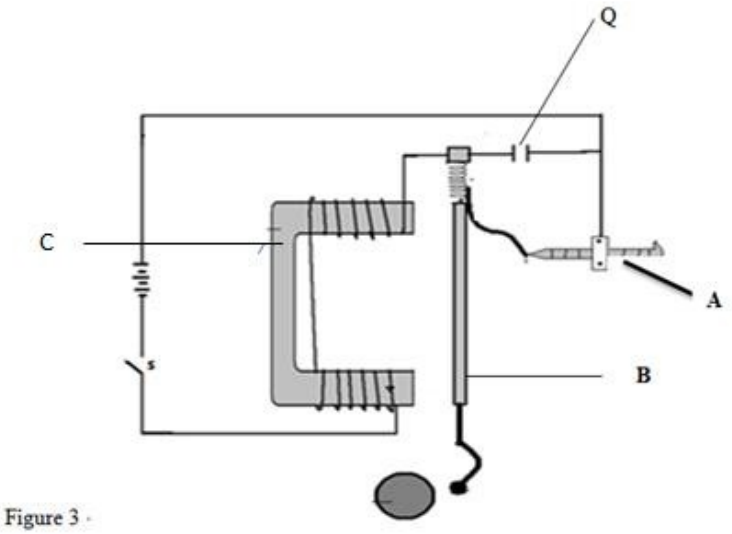


Figure 3

a) Name the parts labelled;

A: ……. (1 Mark)

B: ……. (1 Mark)

b) State the function of the part labelled Q in the circuit. (1 Mark)

……

c) State the effect of the part labelled C being made of steel metal. (1 Mark)

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5. Figure 4 below shows a set up by a student to investigate the properties of sound.

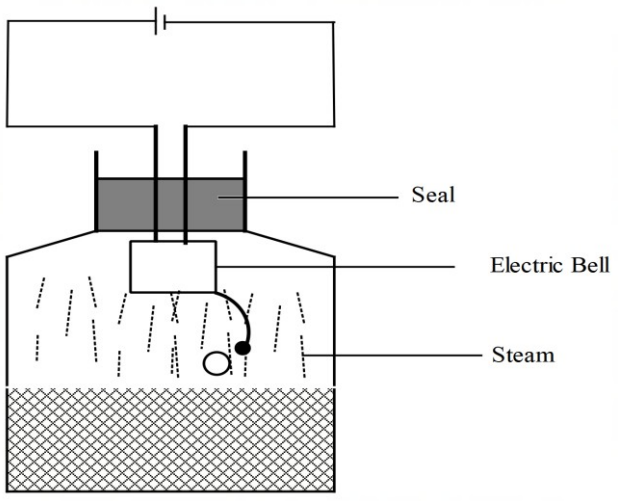


Figure 4

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a) State and explain the observation made on the sound from the bell as the bottle and its contents are cooled to 0°C. (2 Marks)

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b) An ultrasound signal of wavelength 5 cm and frequency of 0.05 MHz is sent by a ship to the seabed. Determine the depth of the sea given that the echo is received after 10 seconds. (2 Marks)

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6. Figure 5 below shows a narrow beam of light incident on the face XY of a glass prism. The refractive index of the glass is 1.5091.

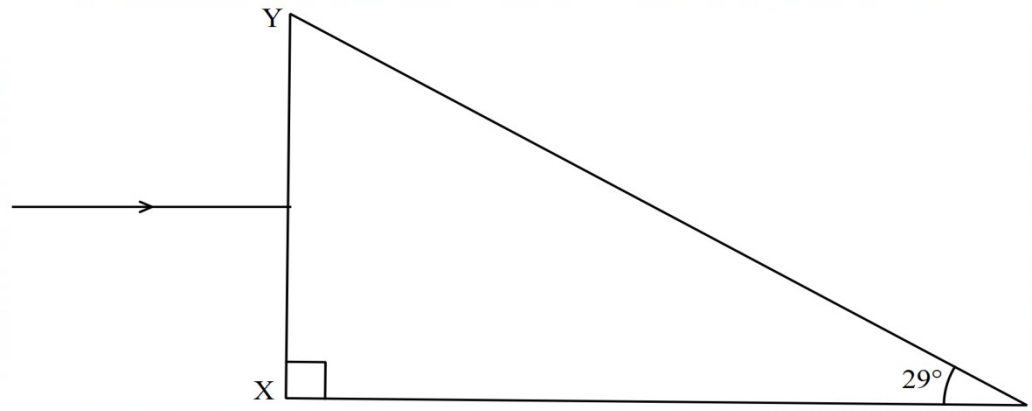


Figure 5

Use the provided information to answer the following questions.

(i) Determined the critical angle of the glass. (2 Marks)

……

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(ii) On the same diagram, show how the ray will emerge from the prism. (1 mark)

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(iii) Determine the angle of refraction of the resultant emergent ray. (2 Marks)

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7. Consider the table below for some electromagnetic waves.

Radiation	Production	Detection	Application
Radio waves	A: ……..…… ……	Aerials	B:…… ……
Infrared	Thermal vibration of atoms of hot bodies	C: ……	D: ……

Fill in the spaces labeled A,B and C. (3 Marks)

SECTION B

8. a) Explain how polarization affects the working of a simple cell. (1 Mark)

……

……

b) Figure 6 below shows an electric circuit with two switches S_1 and S_2 and three identical lamps L_1, L_2 and L_3.

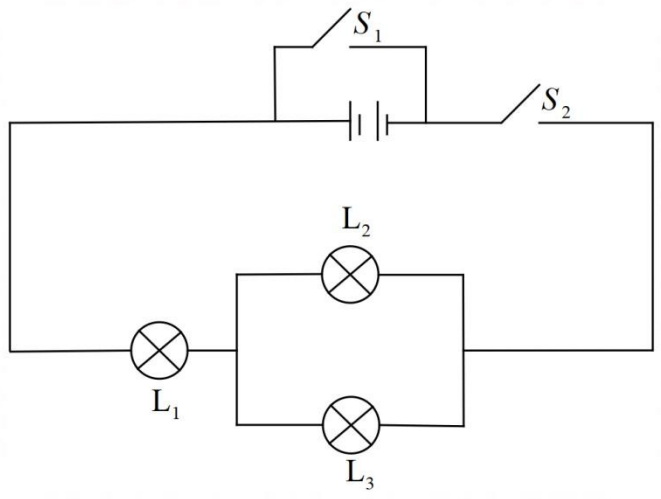


Figure 6

State and explain what will be observed if both switches S_1 and S_2 are closed simultaneously. (2 Marks)

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c) (i) Apart from length, state one other physical factor that should be kept constant in a copper conductor for Ohm's law to hold. (1 Mark)

……

(ii) The Figure 7 below shows a resistor network connected to a power supply of 12V. The resistor R_1= 5Ω, R_2= 2Ω and R_3= 3Ω.

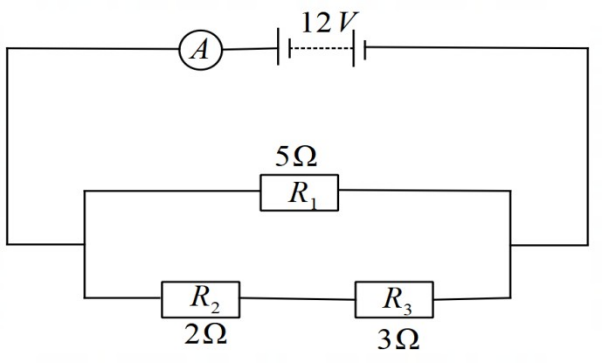


Figure 7

Determine:

I. the equivalent resistance in the circuit (2 Marks)

……

……

……

II. the reading in the ammeter A. (1 Marks)

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III. the potential difference across the resistor R_3. (2 Marks)

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9. (a) Figure 8 below shows a charged electroscope and two aluminum plates A and B.

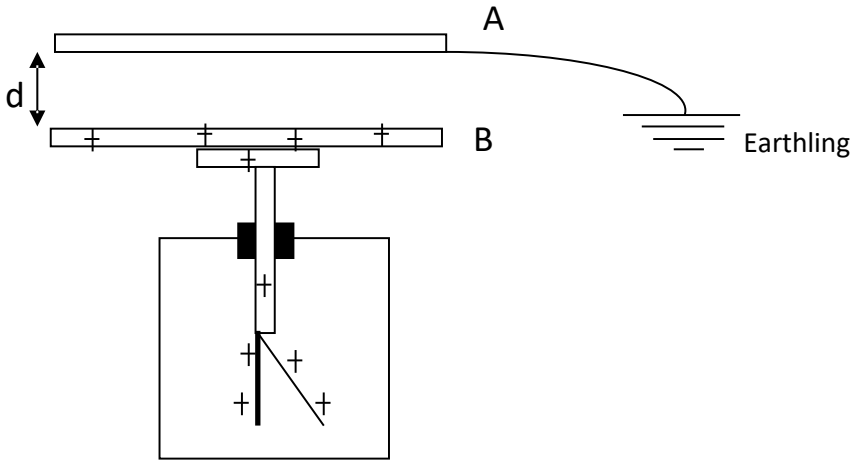


Figure 8

State and explain the observations made on the leaf divergence when plate A is moved closer to B. (2 Marks)

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b) Figure 9 below shows a circuit having the following components: source of E.m.f of 20 V, a voltmeter, three switches S_1, S_2 and S_3 and two capacitors C_1 and C_2 of capacitances 13μF and 8μF respectively.

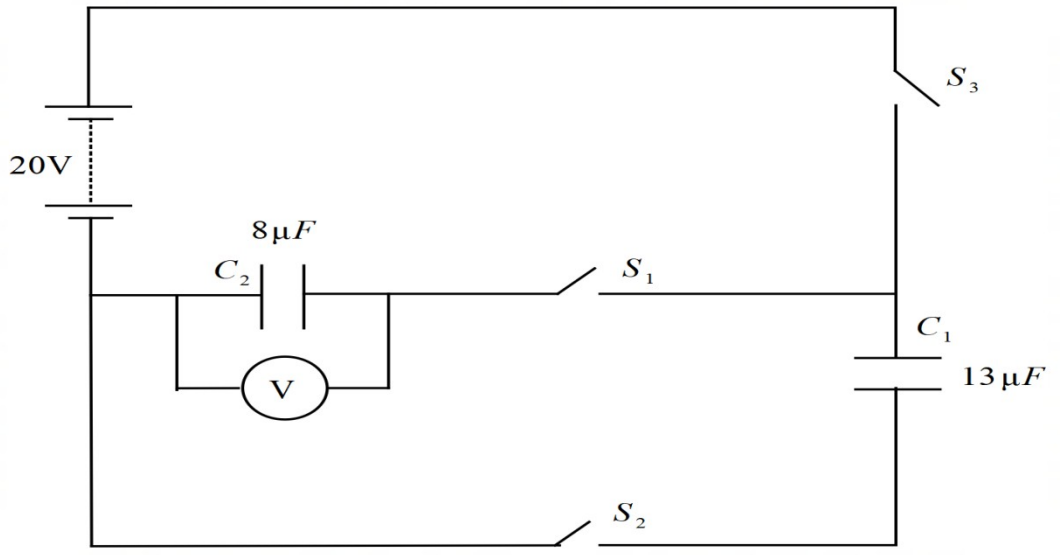


Figure 9

(i) Determine the charge on C_1 when switches S_2 and S_3 are closed while S_1 is open. (2 Marks)

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(ii) After some time, S_3 is opened and both S_1 and S_2 are closed. Find the maximum voltage V recorded by the voltmeter. (2 Marks)

.....

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(iii) Determine the energy stored in C_2. (3 Marks)

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10. a) Figure 10 below illustrates waves emanating from two coherent sources S_1 and S_2.

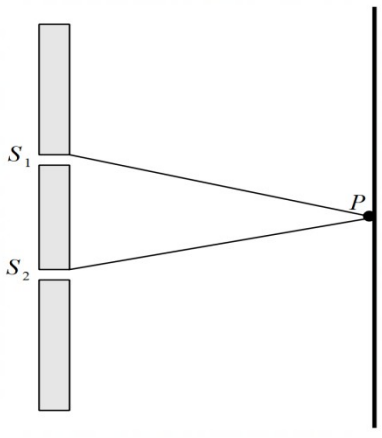


Figure 10

What would be observed at the central point P if the waves are:

(i) Light waves (1 Mark)

……

……

(ii) Sound waves (1 Mark)

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b) Define the term diffraction as applied in waves. (1 Mark)

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c) Figure 11 below shows water waves moving from a deep to a shallow region.

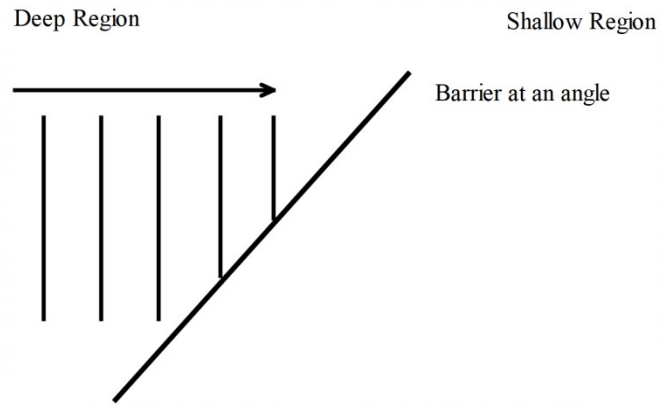


Figure 11

(i) In the same diagram, sketch the wave pattern beyond the barrier. (2 Marks)

(ii) State two changes that will occur to the wave when it moves from the shallow to the deep region if the frequency is kept constant. (2 Marks)

……

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iii) The distance between the antinode and its nearest node of a stationary wave is 0.08 m. Given that the wave has a velocity of $10ms^{-1}$, determine the frequency of the wave. (2 Marks)

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d) State one difference between light waves and sound waves in terms of their propagation. (1 Mark)

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11. (a) (i) State one application of a fuse in an electric circuit. (1 Mark)

……

……

(ii) A kitchen is fitted with a kettle rated 6kW, 240V, select a suitable fuse for use by the appliance if the available fuses are 35A, 25A, 24A, 26A. (2 Marks)

……

……

……

(b) A current of 2A is passed through a circuit connected to an electrical heater. Determine the time taken by the heater to produce 1000 J of heat if the voltage across the heater is 10 V. (2 Marks)

……

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(c) State one reason why fluorescent tubes are preferred to filament lumps in lighting homes. (1 Marks)

……

……

12. a) A scientist wanted to determine the focal length of the convex lens of thickness 0.5 cm using an optical pin and a plane mirror. Figure 12 below shows the set-up of apparatus when there is no parallax between the pin and the image.

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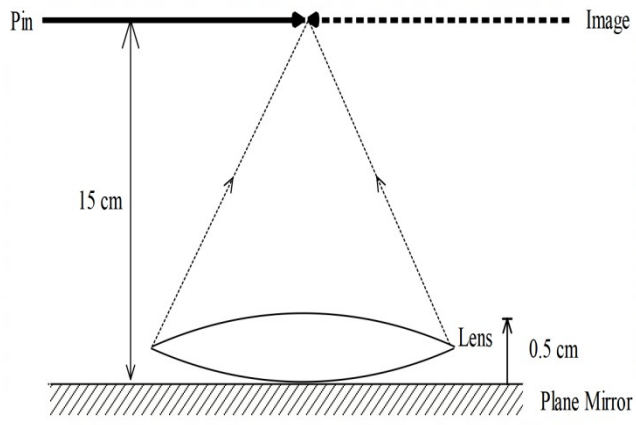


Figure 12

Determine the focal length of the lens. (2 Marks)

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……

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b) A lens forms a focused image on a screen when the distance between the object and the image is 50 cm.

(i) State with a reason the type of the lens used. (2 Marks)

……

(ii) Determine the object distance. (3 Marks)

……

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c) Figure 13 below shows a human eye with a certain defect.

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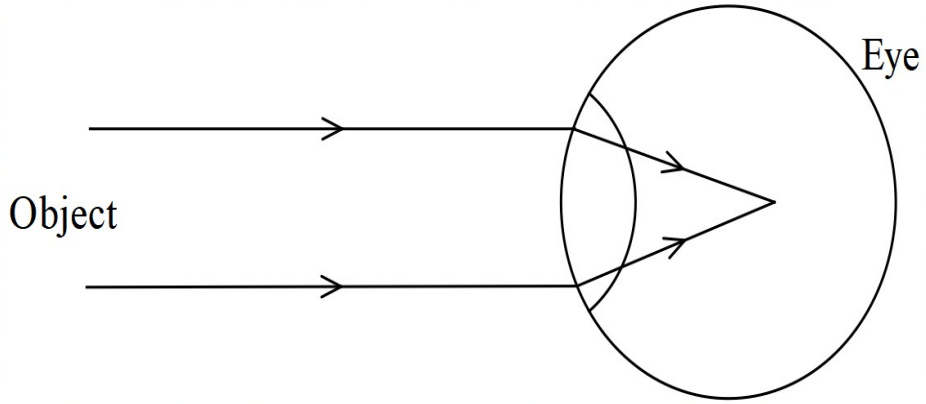


Figure 13

(i) Identify the defect. (1 Mark)

……

(ii) State one cause of the defect. (1 Marks)

……

(d) On the same diagram, sketch the appropriate lens to correct defect and sketch rays to show the effect of the lens. (2 Marks)

13. a) In figure 14 below, a magnet is made to approach a coil as shown.

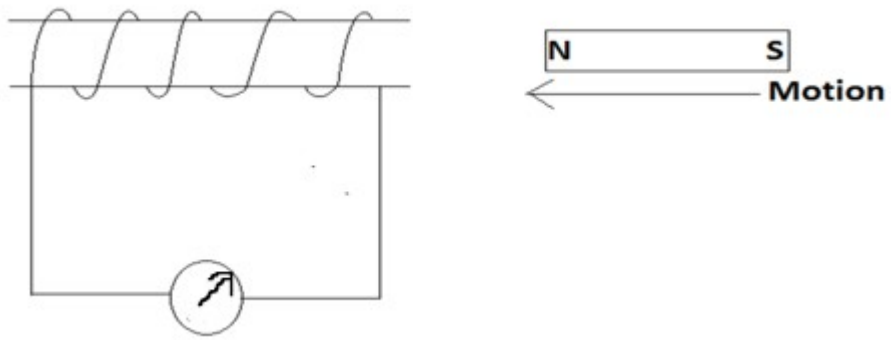


Figure 14

It is observed that the galvanometer deflects to one direction and goes back to zero.

Explain the observation made. (2 Marks)

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(b) Figure 15 below shows a simple illustration of an a.c generator.

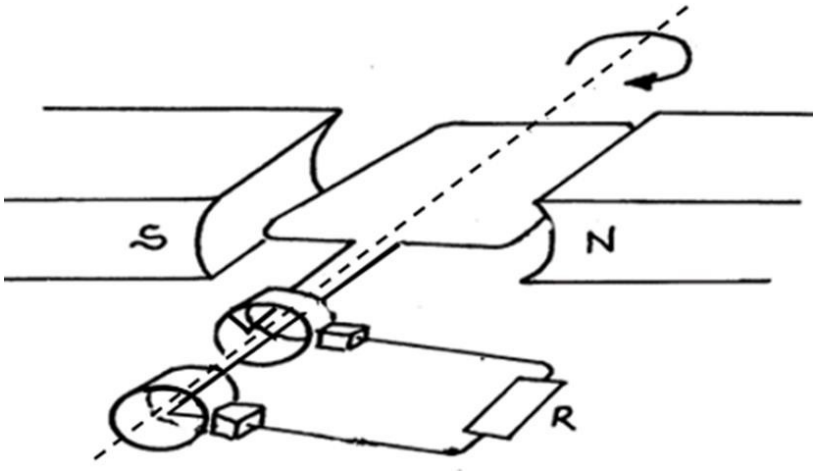


Figure 15

(i) Indicate on the diagram the direction of the induced current through R when the coil is in the horizontal position. (1 Mark)

(ii) Give one way of increasing the amount of induced current in the set up. (1 Mark)

……

(iii) On the axes of Figure 16 below, sketch the output of P.d across R. The coil is initially horizontal. (1 Mark)

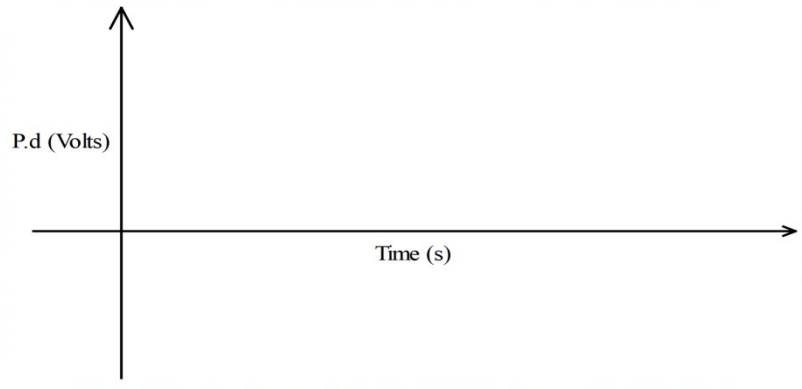


Figure 16

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d) A transformer has 600 turns in the primary coil and 9000 turns in the secondary coil. The secondary coil is connected to a 250V mains and the current in it is 0.15A. Determine:

(i) Power in the primary coil if the transformer is 95% efficient. (2 Marks)

……

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(ii) Current in the primary coil. (3 Marks)

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PAPER 3

1. You are provided with the following:
   - A voltmeter
   - A milliameter
   - A micrometer screw gauge (to be shared)
   - A stop watch
   - A centre zero galvanometer
   - A switch
   - Ten connecting wires (at least five with crocodile clip on one end)
   - A resistance wire mounted on a millimeter scale labeled AB.
   - A resistance wire labeled P
   - A resistance wire labeled Q
   - A capacitor labeled C.
   - A meter rule or half meter rule
   - Two dry cells and a cell holder.
   - A carbon resistor labeled R.

Proceed as follows

PART A

(a) Using the micrometer screw gauge provided, measure the diameter.

(i) D of wire P

D = ……. (1mk)

(ii) d of wire Q

d = …….. (1mk)

(b) Determine C_1 the value of the ratio $\frac{D}{d}$

C_1 = …… (1mk)

(c) (i)Set up the circuit as shown in **figure 1**. (Ensure each of the wires **P** and **Q** is 50cm long)

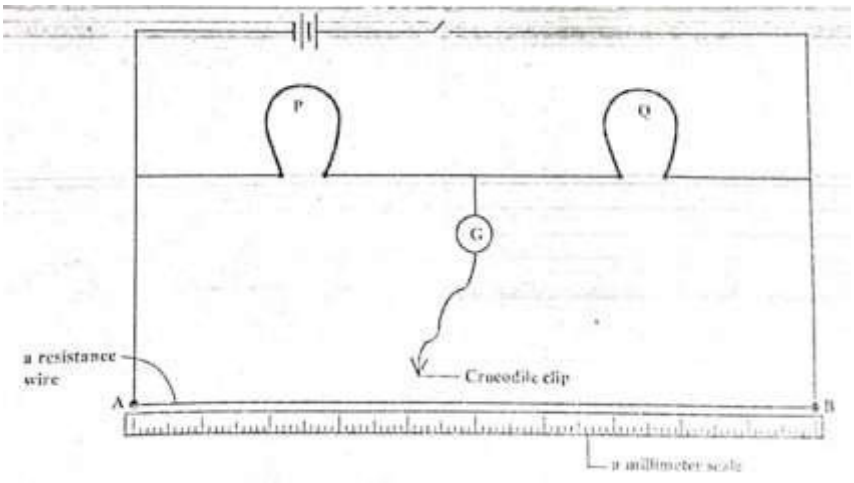


Figure 1

Close the switch. Using the clip at the free end of the wire from the galvanometer, tap wire **AB** near end **A** and observe the deflection in the galvanometer.

(ii)Then tap the wire near end **B** and again observe the deflection in the galvanometer.

(iii)Now tap the wire **AB** at various points between **A** and **B** to obtain a point **K** where there is no deflection in the galvanometer.

(I)Determine the length $\mathbf{L_1}$, the distance from **A** to **K**.

$\mathbf{L_1}$ = _____ (1mk)

(II)Determine the length $\mathbf{L_2}$, the distance from B to K.

$\mathbf{L_2}$ = _____ (1mk)

(d) (i) Given that the resistance $\mathbf{R_Q}$ of **Q** is 9.0 ohms, determine the resistance R_P of **P** using the expression

$$\frac{R_P}{R_Q} = \frac{L_1}{L_2}$$ (2mks)

……

……..

……..

(ii)Determine the value of C_2 given that;

$$C_2 = \sqrt{\frac{R_Q}{R_P}}$$ (2mks)

……

……..

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(iii)Compare the value of C_1 (in part (b) with that of C_2. (1mk)

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PART B

(e) Set up the circuit shown in **Figure 2**. **S** and **T** are crocodile clips.

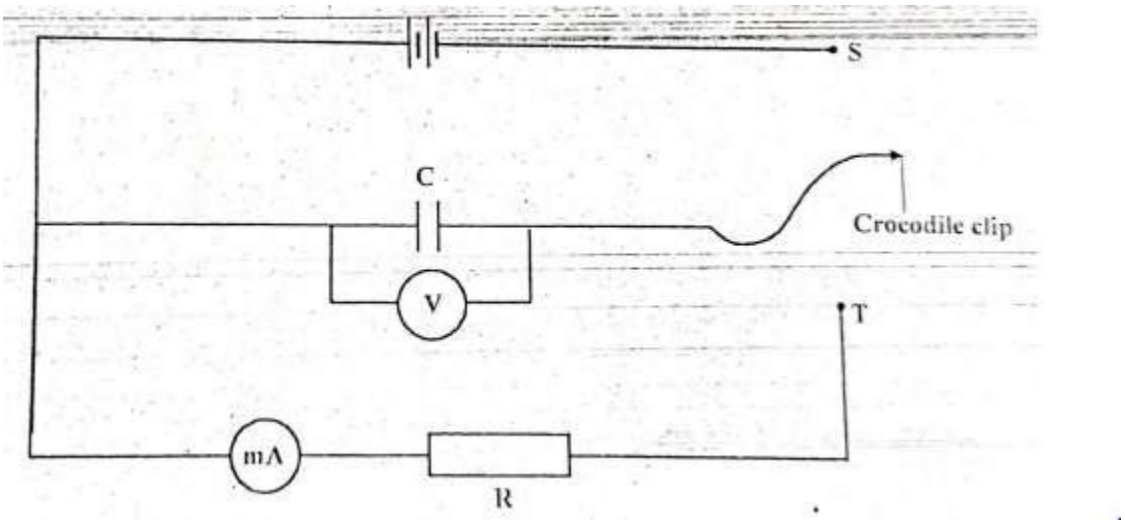


Figure 2

(i) Charge the capacitor **C** by connecting the crocodile clip to **S**. Record the reading of the voltmeter, V

V = ……(1mk)

(ii) Calculate the value of the current I_0 given that $I_0 = \frac{V}{R}$ = (where R = 4.7 x $10^3\Omega$

(3mks)

……

……..

……..

(f) (i) Discharge the capacitor by disconnecting the crocodile clip from **S** and connecting it to **T.** Observe and record the highest reading of the milliameter 1_1 (This is the current at $t_0 = 0$)

(**You may have to repeat the process to obtain an accurate value**).

I_1 = ……. (1mk)

(ii) Recharge the capacitor by connecting the crocodile clips to S.

(iii) Discharge the capacitor and at the same time start the stop watch to measure the time t_1 taken for the current to decrease to half the value of 1_1 i.e. (½ 1_1)

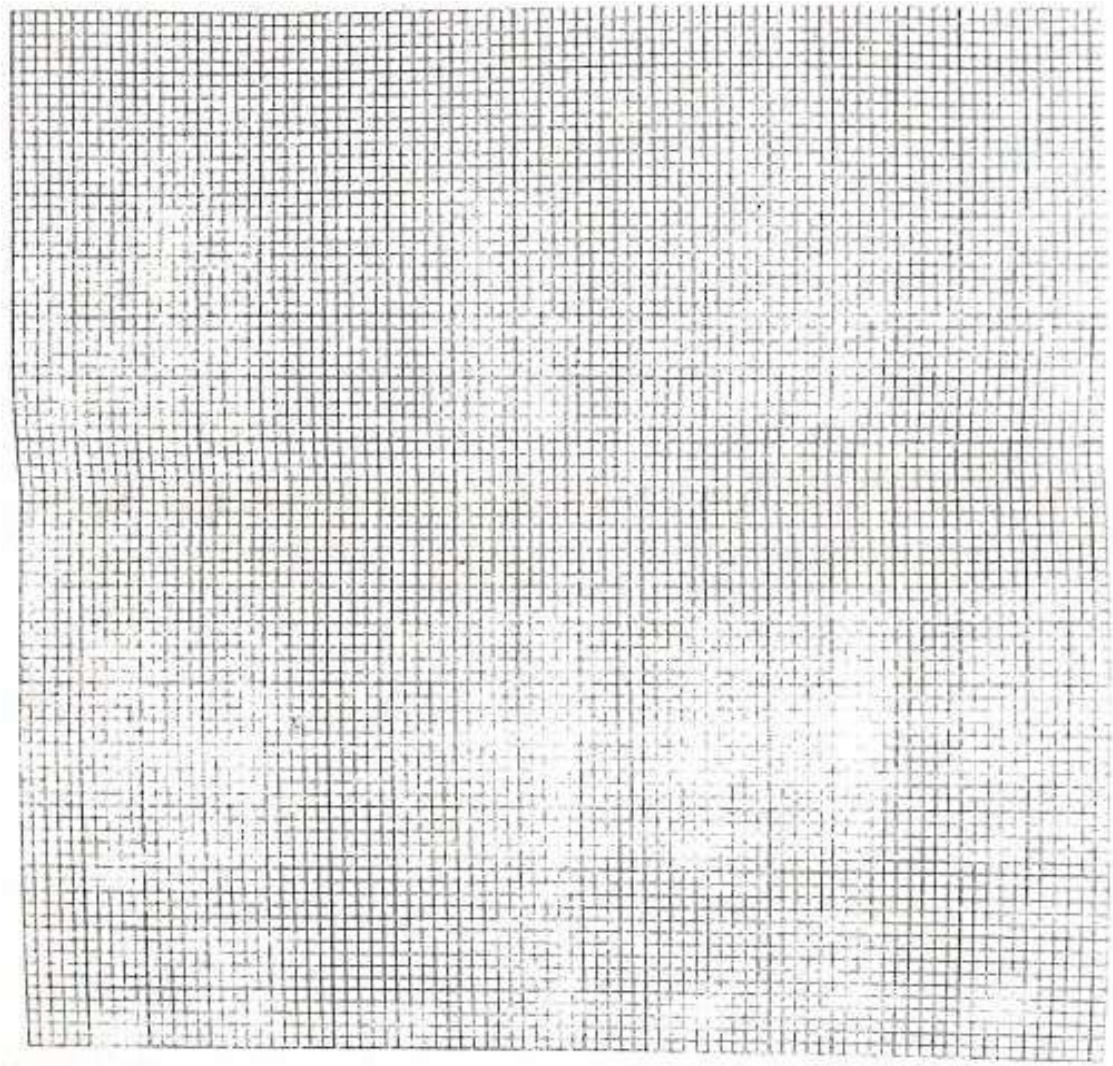
t_1 = ……. (1 mk)

(g) (i)Recharge the capacitor and repeat the procedure in f(iii) to measure the time t_2 taken for the current to decrease to one tenth of the value of I_1 ie $(\frac{1}{10} I_1)$

t_2 = …….. …..(1mk)

(ii)Use the value of the currents I_1, ½ I_1, $^1/_{10}$ I_1 and their corresponding times to draw a graph of current I (y axis) against time on the grid provided.

(3mks)



QUESTION 2

You are provided with the following

- A meter rule
- A stand, boss and clamp
- A piece of string
- A 20g mass
- A 50g mass
- A measuring cylinder containing water
- A concave mirror
- A screen
- Candle
- Pieces of sewing threads
- A mirror holder (Lens holder)

Proceed as follows

PART A:

(a)Using a string, suspend the metre rule on the stand so that it balances horizontally at its centre of gravity. Record the centimetre mark at which the metre rule balances.

Centimeter mark = ……cm (1mk)

(b)With the metre rule balanced at its centre of gravity, suspend a 20g mass at a distance of 30cm from the centre of gravity. Suspend the 50g mass on the other side of the centre of gravity and adjust its position until the rule is balanced. **See figure 3.**

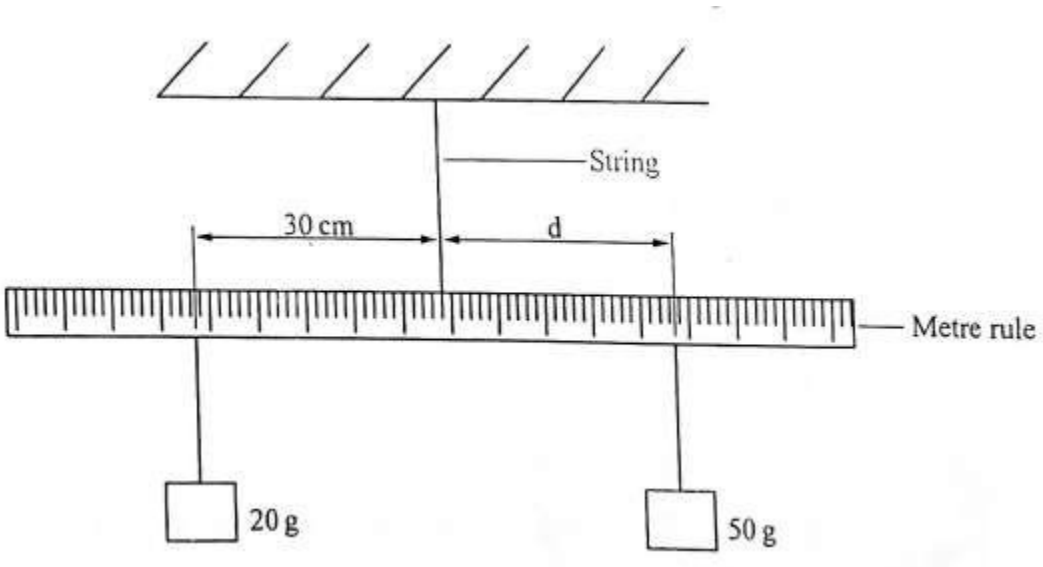


Figure 3

Record the distance d of the 50g mass from the center of gravity.

d = ……cm

d=……m (1mk)

(c) (i) Record the volume of the water in the measuring cylinder provided.

V= ……. (1mk)

(ii) Immerse the 20g mass fully into the water and adjust the position of the 50g mass so that the rule balances horizontally. Record the volume V_1 of the water plus 20g mass and the distance d_1 of the 50g mass from the centre of gravity.

V_1 = …… (1mk)

d_1 = …… (1mk)

(iii) (I) Determine the volume of the water displaced. (1mk)

`……

(II) Determine the weight of the water displaced (3mks)

(***density of water = 1 gcm^{-3}***)

……..

……

……

(d) (i) Using the principle of moments to determine the apparent weight of the 20g mass when fully immersed in water . (g = 10Nkg^{-1}) (2mks)

……..

……

……

(ii) Calculate the weight of the 20g mass in air (g = 10Nkg^{-1}) (1mk)

……..

……

……

(iii) Determine the apparent loss in weight of the 20g mass. (1mk)

……..

PART B

(e) Light the candle and place it at distance u = 20cm in front of the concave mirror. Adjust the position of the screen until a sharp image of the candle flame is obtained. See **figure 4.**

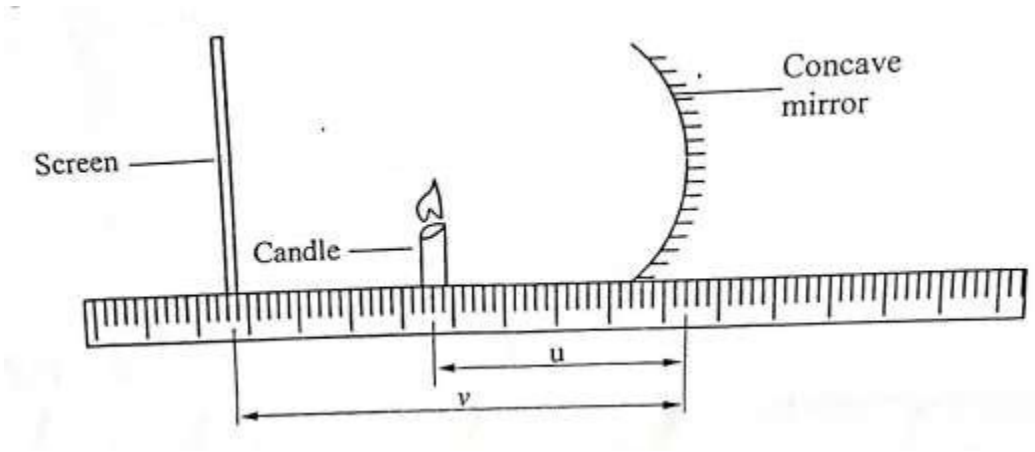


Figure 4

(i)Read and record the distance v between the screen and the mirror.

v=……..(1mk)

(ii)Determine

l. The magnification m of the mirror given that m = $\frac{v}{u}$

……(1mk)

……...

II. The value of f_l given that: $f_l = \frac{mu}{m+1}$

……(1mk)

……

……

(f) Repeat part (e) for distance u_1 = 18cm

(i) Read and record the distance v_1 between the screen and mirror.

v_1 = …….. (1mk)

(ii) Determine the magnification m_1 of the mirror. (1mk)

……..

……

……

(iii)1 Hence determine f_2

……..(1mk)

……

……

(g)Determine the average value of f. (1mk)

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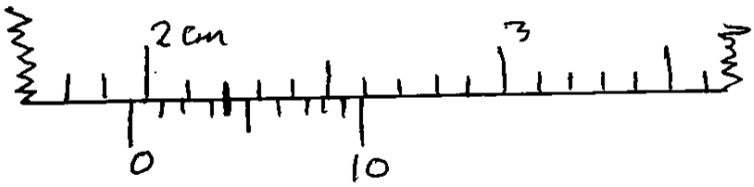
SERIES 16

PAPER 1

SECTION A 25 MARKS (ANSWER ALL QUESTIONS)

1. Water is normally used as a coolant in many internal combustion systems. Explain why (2mks)

2. Give the reading indicated in the section of the Vernier calipers shown below (2mks)



3. One advantage of friction force is that it enables motion. State one disadvantage of friction (1mk)

4. Steel bars are used to reinforce concrete beams. Give a reason why (2mks)

5. A stone of mass 50g is whirled in a vertical circle at a linear speed of 25m/s when attached to a string of length 0.5m. Calculate the tension on the string when the stone is at the bottom of the circular path. ***[g=10N/kg]***(3mks)

6. An inflated balloon is left on the sun for some time. The balloon burst, give a reason why it bursts. (2mks)

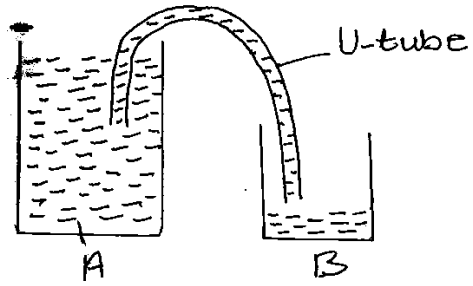
7. Name two factors that determine momentum of a body. (2mks)

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8. It is common practice by motor vehicle body builders to make luggage compartments of buses underneath passengers' seats. How does this enhance safety of those travelling in such buses? (2mks)

9. An empty density bottle has a mass of 20g. When full of water, its mass is 70g and when full of a liquid ***X***, its mass is 55g. Given that density of water is 1000kg/m^3, find the density of liquid ***X***. (3mks)

10. Figure below shows a system used to transfer a liquid from a tank A to tank B on earth's surface.



(a). Give the name of this method (1mk)

(b). When some young astronauts tried the method on the moon's surface, they failed. Give a reason why they were unsuccessful (1mk)

11. What is the SI unit of specific heat capacity (1mk)

12. An object of mass 90kg weighs 360N on the surface of a certain planet. Find the acceleration due to gravity of this planet (3mks)

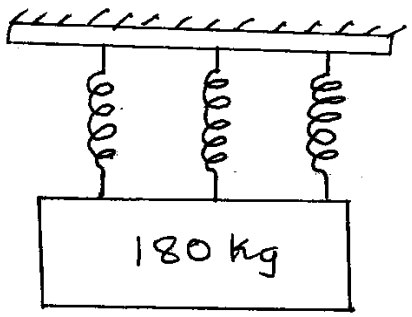
SECTION B (55 MARKS) ANSWER ALL QUESTIONS

13. (a). State Hooke's law (1mk)

(b). State three factors that affect spring constant (3mks)

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©.A spring has a spring constant of 40N/cm. 3 such springs are used to suspend a mass of 180kg as shown in the figure below.



Find the extension of the system (3mks)

(d). A spring of elastic constant 50N/cm is compressed 2cm inside the muzzle of a shotgun. If the gun is to shoot a bullet of mass 20g when trigger is released. Find;

i. The initial velocity of the bullet as it leaves the gun (4mk)

ii. The recoil velocity of the gun if it has a mass of 4kg. (3 decimal places) (3mks)

14. (a). What is an ideal gas (1mk)

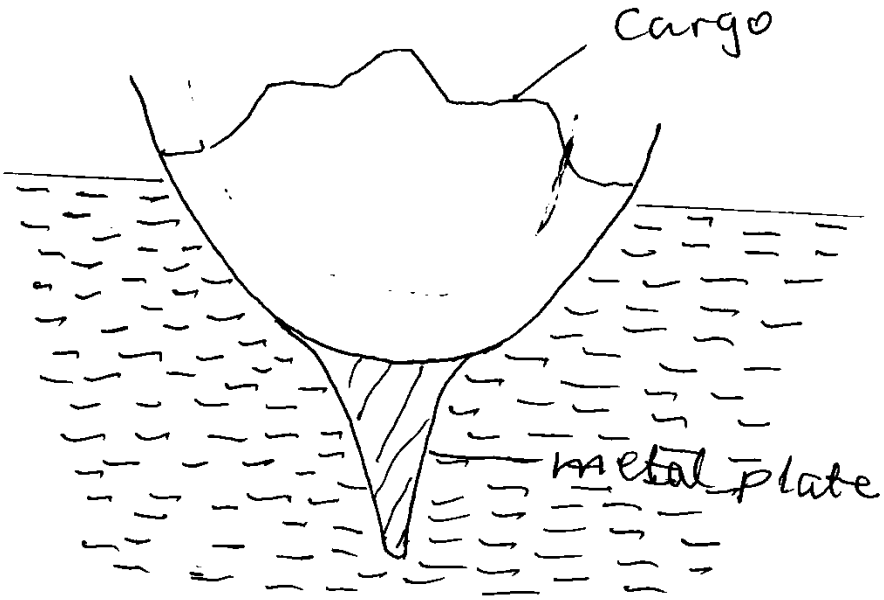
(b). Absolute zero temperature is practically not attainable. Explain why (1mk)

©. A gas has a volume of $2m^3$ at 25˚C. What will be the volume of the gas at a temperature of 77˚C keeping pressure constant (2.d.p) (3mks)

(d). A hot air balloon is sometimes used by merry makers to rise to high heights. Explain how it works (3mks)

(e). Figure below represents a cross-section of a large ship.

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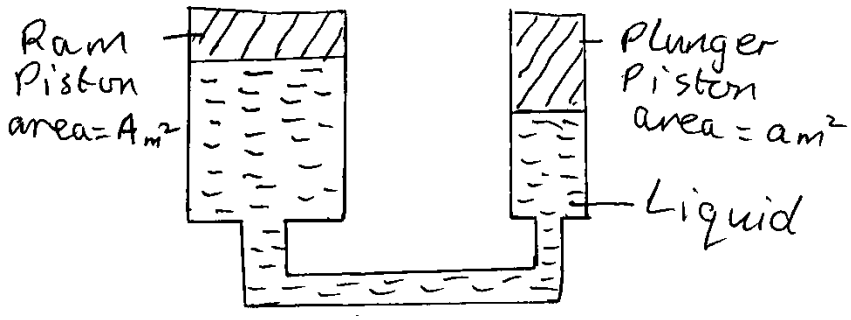
i. What is the use of the large metal plate underneath the ship (2mks)

ii. The ship can carry heavier luggage in sea-water than in fresh water. Explain (2mks)

iii. A loaded ship whose total weight is 4000 tonnes is moving in sea water of density 1030Kg/m^3. Find the volume of ship under the water surface (1.d.p) (3mks)

15. (a). Define the term velocity ratio of a machine (1mk)

(b). Figure below shows part of a hydraulic press. The plunger is the piston where effort is applied while the Ram piston is the piston where the load is applied. The plunger has a cross-sectional area ***a*** m^2while Ram piston has a cross-section area, ***A*** m^2.



When the plunger moves down a distance ***d*** the Ram moves up a distance ***D***. Derive an expression for the velocity ratio (V.R.) in terms of **A** and **a** . (4mks)

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©. A machine of velocity ratio 45 overcomes a load of $\mathbf{4.5 \times 10^3 N}$ when an effort of 135N is applied. Determine

i. The mechanical advantage (M.A) of the machine (2mks)

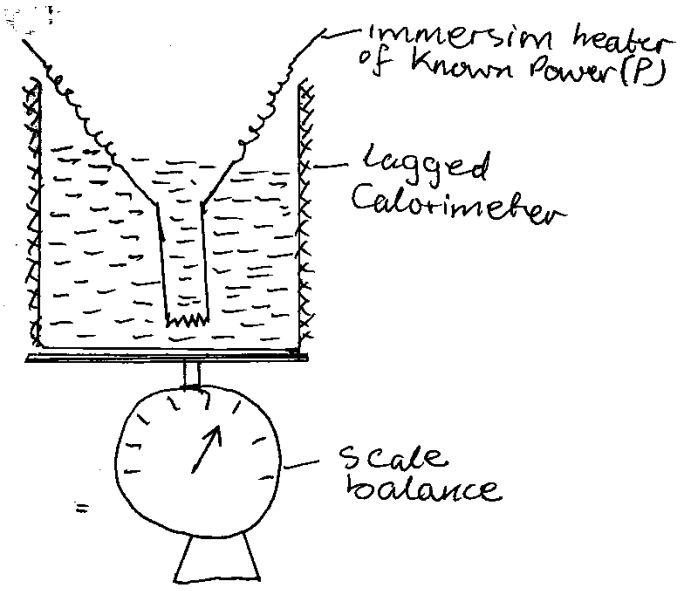
ii. Efficiency of the machine (2mks)

iii. The percentage of work that goes to waste (1mk)

(d). State two properties of fluid suitable for use in such a hydraulic machine (2mks)

16. (a). Define the term specific latent heat of fusion (1mk)

(b). You are provided with the apparatus shown in the figure below. Describe an experiment to determine the specific latent heat of steam **L** using the set up. In your answer clearly explain the measurements to be made and how these measurements could be used to determine **L** (6mks)



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©. A block of metal of mass 150g at 100˚C is dropped into a lagged calorimeter of heat capacity $40JK^{-1}$ containing 100g of water at 25˚C. The temperature of the resulting mixture is 34˚C. (Specific heat capacity of water **=4200JKg^{-1}K^{-1}**). Determine:

i. Heat gained by calorimeter (2mks)

ii. Heat gained by water (2mk)

iii. Heat lost by the metal block (1mk)

iv. Specific heat capacity of the metal block (2mks)

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PAPER 2

SECTION A(25 MKS)

1. State two properties of magnetic field lines around a bar magnet. (2mks)

2. Recharging is one of the practices of maintenance of accumulators; state two measurements which need to be taken to help you decide when the accumulator is ready for recharging. (2mks)

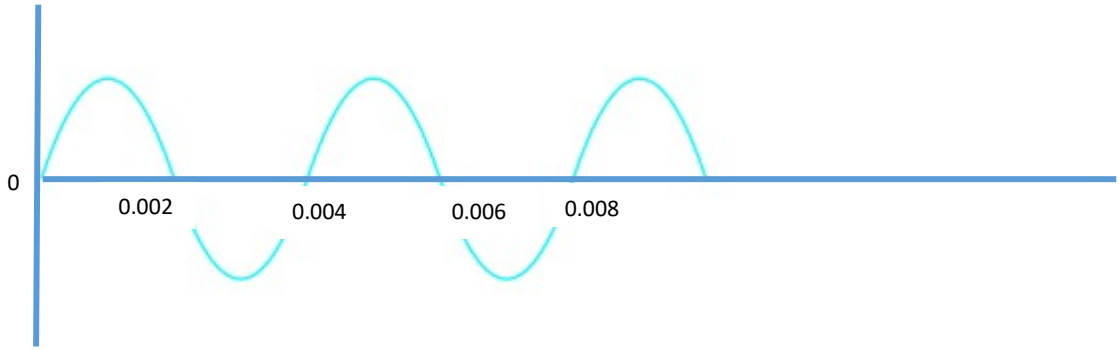
3. Two students stand 300m from a wall. One bangs two pieces of wood together and at the same time the other starts a stop watch. They hear an echo after 1.8 seconds. Determine the speed of sound in air. (3mks)

4. State one use of gold leaf electroscope. (1mk)

5. Arrange the following electromagnetic waves in order of increasing frequencies

   Infrared, X rays ,visible light, Radio waves . (1mk)

6. The figure represents displacement time graph for a wave.

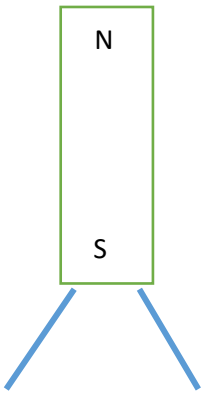


   Determine the frequency of the wave. (3mks)

7. Describe the change on the image formed when the following adjustment are made on a pinhole camera:
   (a) Size of the hole increased (1mk)

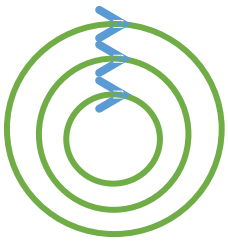
   (b) Length of the pinhole camera increased (1mk)

8. Two pins are hanging from a magnet as shown in the diagram below.



   State and explain why they do not hang vertically downwards (2mks)

9. The figure below shows magnetic field pattern due to current flowing through a conductor



   Using . or a x State the direction of electric current in the conductor. (1mk)

10. (a) What do you understand by the label 100W, 240v indicated on an electric bulb? (1mk)

(b) What property does a fuse wire have that makes it suitable for protecting excessive current in the circuit? (1mk)

(c) What is the operating resistance of an electric lamp rated by manufacturer at 80W , 240 V (3mks)

11. Sound waves cannot travel through vacuum. Explain. (1mk)

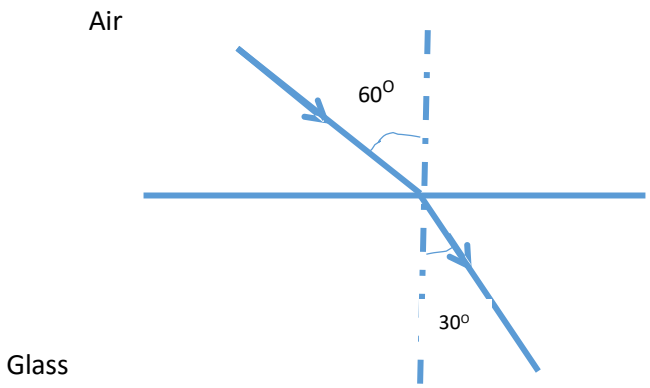
12. Other than the same frequency, state other two conditions for formation of stationary wave. (2mks)

SECTION B (55 MKS)

ANSWER ALL THE QUESTIONS IN THIS SECTION IN THE SPACES PROVIDED

13 (a) State Snell's law. (1mk)

(b) The figure below shows a ray of light incident on air glass interface. Study it and answer the questions that follow.



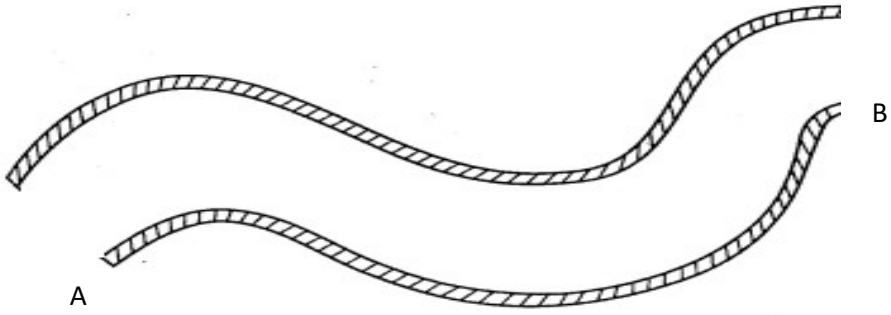
From the diagram determine

(i) The refractive index of the medium (2mks)

(ii) The critical angle of the medium (3mks)

(c) State two conditions under which total internal reflection occurs. (2mks)

(c) The figure below shows an optical fibre. Study it and answer the questions that follow.

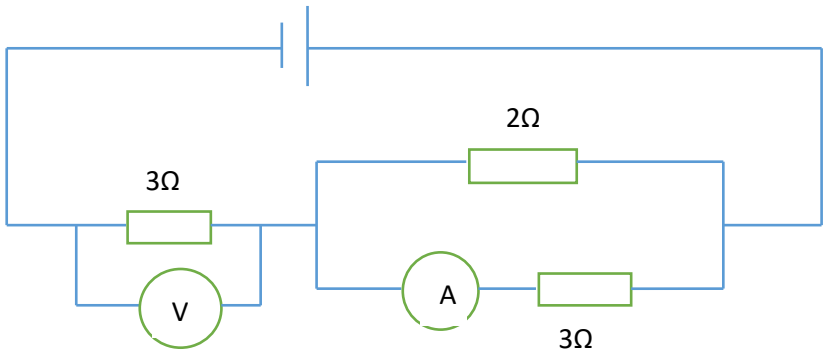


(i) Explain how the ray of light is transmitted from one point of incidence until it emerges at B through the tube. (1mk)

(ii) State two advantages of using optical fibre in communication. (2mk)

14. (a) State two physical quantities that affect the electrical resistance of a conductor at a constant temperature. (2mks)

(b) The cell in the figure below has an emf of 1.8V and negligible internal resistance.



Determine

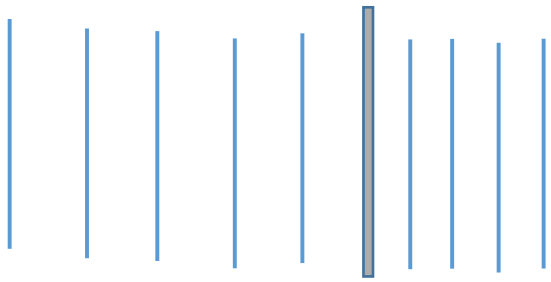
(i) Total resistance in the circuit. (3mks)

(ii) Current in the circuit. (2mks)

(iii) Reading of the voltmeter. (2mks)

(iv) Reading of the ammeter. (3mks)

15 (a) Plane water waves produced in a ripple tank are passed from a region of deep water into a region of shallow water. The figure below shows the top view of the tank .



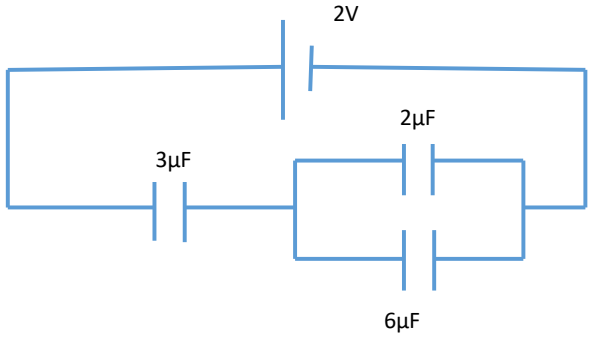
(i) State what happens at the boundary to the frequency of the waves. (1mk)

(ii) The waves have a speed of 24cm/s in the deep water. Consecutive waves crests are 0.08M apart in the deep water. Calculate the frequency of the source producing the waves. (2mks)

(b) Explain how an increase in temperature affects the speed of sound in air. (1mk)

(d) State one application of a capacitor.
(1mk)

(e) The figure below shows three capacitors connected in a circuit



Calculate

(I) The total capacitance of the circuit. (3mks)

(II) The charge stored in the circuit. (2mk)

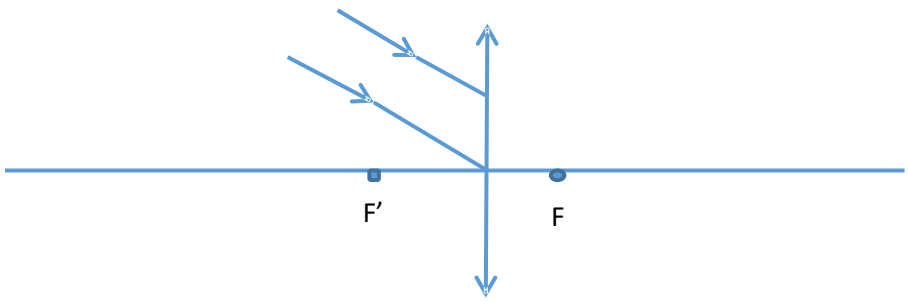
(III) The potential difference across the 2μF capacitor. (3mks)

16. (a) Define the following terms as used in mirrors

(i) Principal axis. (1mk)

(ii) The pole. (1mk)

(b) The figure shows two rays of incident on a converging lens.



Complete the ray diagram to show the rays after passing through the lens. (2mks)

(c) (i) State two differences between the human eye and the camera lens. (2mks)

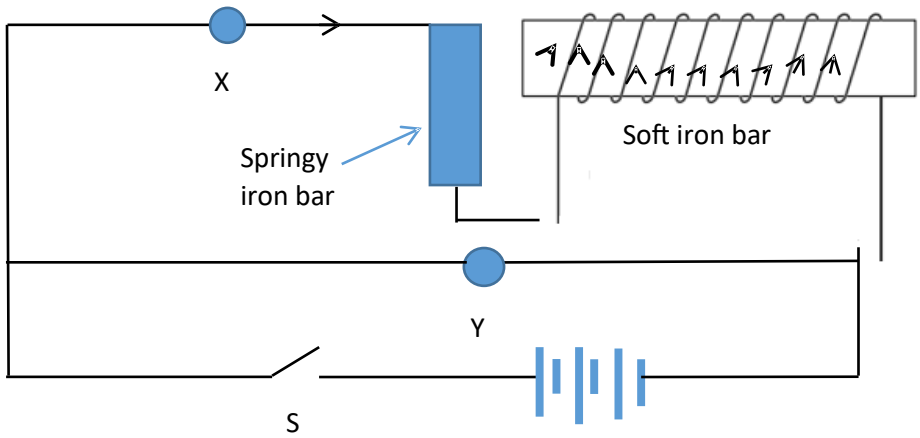
(ii) State the name of the part of the eye that enables the lens to focus images of objects at different distances. (1mk)

(f) An object which is 3cm tall is placed 20cm from a converging lens of focal length 12 cm. Calculate:

(i) The distance of the image from the lens. (3mks)

(ii) Magnification. (2mks)

17 (a) The figure below shows a circuit with two bulbs X and Y study the diagram and answer the question that follow.



Explain the following observations

(i) When the switch S is closed, bulb Y lights continuously. (1mk)

(ii) When the switch S is closed bulb X flickers. (3mks)

(b) You are provided with the following apparatus; a white screen, a metre rule, and a concave mirror and a mirror holder. Using the apparatus describe an appropriate method to determine the focal length of the mirror. (3mks)

PAPER 3

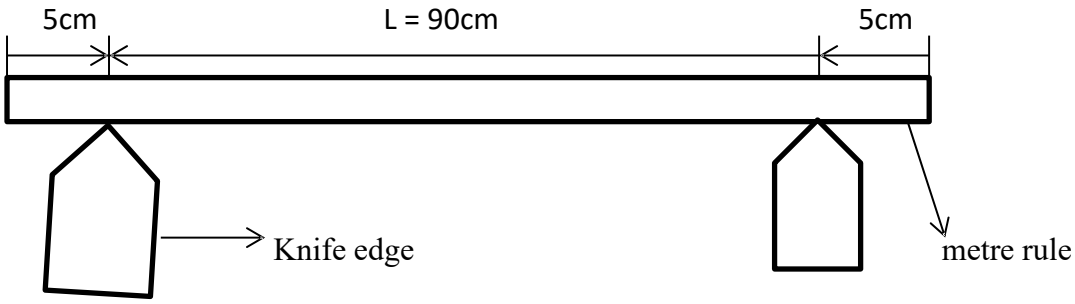
QUESTION 1: PART A

You are provided with the following:

1. Metre rule.
2. Vernier Callipers.
3. 300g mass
4. Two knife edges.
5. Thread

Proceed as follows:

(a) Place the metre rule on the knife edges such that each is 5cm from the end. Ensure the mm scale is facing upwards. Set the distance between the knife edges, L= 900mm as shown below.



(b) Place the vernier callipers vertically against the metre rule at 50cm mark with the depth gauge lowered to touch the bench.

(i) Record the height h_o of the upper edge of the metre rule at the 50cm mark.

h_o =_____cm = ----------mm (1mark)

(ii) Using the thread provided hang the 300g mass at 50cm mark of the metre rule ensuring it does not touch the bench. Measure and record the height h of the upper edge of the metre rule from the bench at the 50cm mark.

h =_____cm= _____mm (1mark)

(iii) With the 300g mass hanging at the 50cm mark, adjust the position of the knife edges so that the distance L is 600mm with the knife edges equidistant from the 50cm mark i.e. at 20cm from each end.
Measure and record the height h of the upper edge of the metre rule at

50cm mark.

h =_____cm= _____mm (1mark)

{iv}

Table1

Length L(mm)	900	600
Height h(mm)		
Depression, d = (h_o-h) (mm)		
Log L		
Log d		

(c) Determine the value of $s = \frac{log\ 900 - log 600}{log d_{900} - log\ d_{600}}$ (3marks)

(2marks)

(d) Evaluate $y = \frac{1}{s}$ (1mk)

e) Given that $G = \frac{log\ K}{y}$ $where\ G = 2.75$,

Determine the value of K. (1mark)

PART B

You are provided with the following:

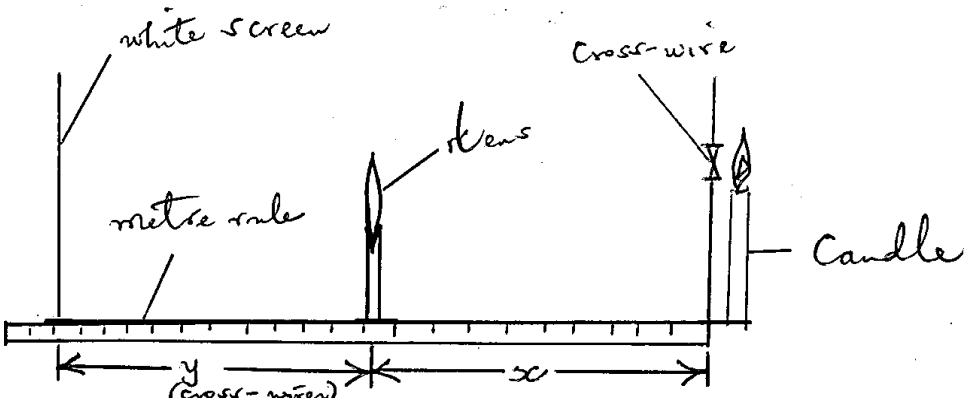
1. A white screen with crosswire
2. A Mounted lens
3. A White screen
4. A Candle
5. A Metre rule

Proceed as follows:

f) Estimate the focal length of the lens by focusing the image of a distant object on the screen provided e.g. distant window.

f_o =_____cm (1mark)

g) Arrange the apparatus as shown.



With the object (cross-wires) illuminated using a candle flame placed at $x = 15cm$, move the screen until a sharp magnified image of the object is formed on the screen. Measure and record the corresponding value of y in the table.

h) Repeat step (g) for the value of $x = 18\ cm$

Table 1 (3 marks)

$x\ (cm)$	15	18
$y\ (cm)$		
$\frac{x+y}{xy}(\text{cm}^{-1})$		

i) Determine the average of $\frac{x+y}{xy}$ (2mks)

j) Compare the average $\frac{x+y}{xy}$ and $\frac{1}{f_0}$ (2mks)

k) Given that $\frac{1}{f_0} = \frac{y}{(\frac{y}{x})+1}$ and x = 25cm. Determine the value of y. (2mks)

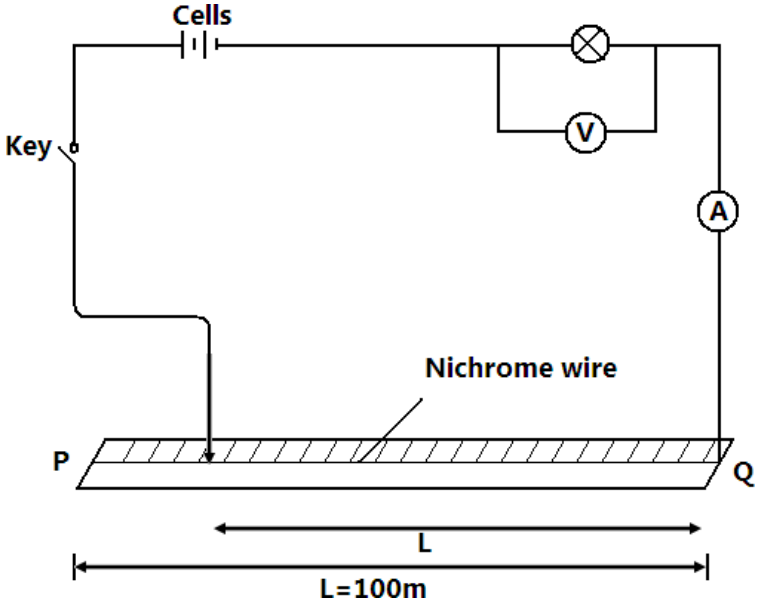
QUESTION 2 (20MKS)

You are provided with the following

- Two dry cell
- One bulb
- Voltmeter (0-3v)
- Ammeter (0-1A)
- Amounted nichrome wire mounted on a millimeter scale.
- Switch
- Seven connecting wire at least two with crocodile clips
- Micrometer screw gauge

Proceed as follows:

a) (i) Set up the circuit as shown in the figure below.



ii) With the crocodile clip at p, take the voltmeter reading and ammeter reading. Record v and 1 repeat the readings for L=80, 60, 40, 20 and 0cm respectively and complete the table below. (5mks)

Table 2

Length, L(cm)	100	80	60	40	20	0
Voltage, V(V)						
Current, I (A)						

iii). What changes do you observe on the bulb as L decreases from P? (1mrk)

iv).Plot a graph of ammeter reading (y-axis) against voltmeter readings. (5mrks)

v). Determine the slope of the graph at V=1 volt. (2mrks)

vi). what physical quantity is represented by the slope of the graph at any given point? (1mrk)

b. (i) given the apparatus in a (i) above, draw a diagram of the circuit you would use to determine the current through the resistant wire and the potential difference across. (1mrk)

ii).Set up the circuit you have drawn. Record the ammeter reading I and the wire reading V when L=100cm

(2mks)

V=……
I=……..

iii). Using a micrometer screw gauge, measure the diameter of the wire.(1mrk)

d_1=……mm

d_2 =……m

iv)Calculate the quantity P given that P = 0.785 $\dfrac{{}^{V}/_{I}}{\dfrac{(d_2)^2}{L}}$

and state its SI units, where L=1m (2marks)

SERIES 17

PAPER 1

SECTION A (25MARKS)

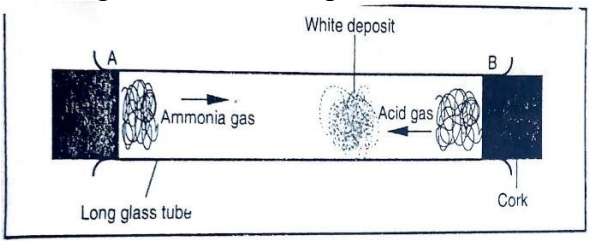
1. Define volume and state its SI unit (2marks)

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2. State a reason as a to why weight of a body varies from place to place on the earth's surface.
(2marks)

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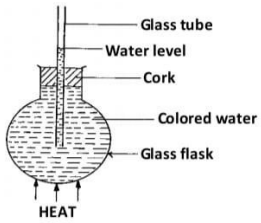
3. In the figure below, ammonia gas and an acid gas diffuse and react to form a white deposit on the walls of the glass tube. The deposit forms nearer end B.



If the experiment was performed at a higher temperature, would you expect it to take longer or shorter time to form the white deposit? Explain (2marks)

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4. The diagram below shows a liquid inside a round bottom glass flask. State and explain what would happen to the level of the liquid, if the temperature of the surrounding increases.
(2marks)



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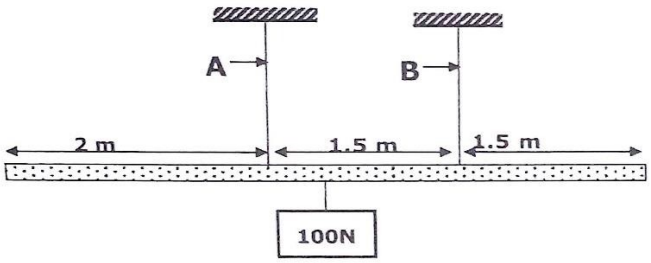
5. A paper windmill in a horizontal axis was placed above a candle as shown in the figure below. When candle was lit the paper windmill begun to rotate. Explain this observation
(2marks)



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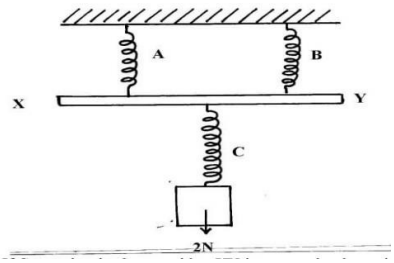
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6. A uniform plunk of wood weighing 50N and of length 5m is suspended by two ropes, A and B. A is at 2m from one end while B is at 1.5m from the other end as shown below. A concrete block of weight 100N is suspended from the center of the plunk. Determine the tension on rope A.
(3marks)



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7. Three identical springs A, B and C of negligible weight are arranged as shown below;



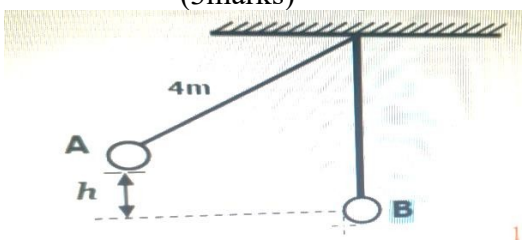
If C stretches by 3cm, and bar XY is assumed to be weightless, determine the extension in A.
(3marks)

……
……
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8. Define the centre of gravity of a body. (1mark)

……
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……

9. A metal ball suspended vertically with a wire is displaced through an angle as shown in the diagram below. The body is released from A and swings back to 'B'. Given that the maximum velocity at the lowest point B is 2.5 m/s. Find the height h from which the ball is released.
(3marks)



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10. a) A cyclist negotiating a bend at a high speed leans inwards in order to successfully pass. Explain how this action enables him to negotiate a bend. (1mark)

……

……

b) State two conditions necessary for a driver to negotiate a bend on a bend on a flat level road at a relatively high speed. (2marks)

……

……

……

11. When a piece of metal is placed on water, it sinks. But when the same piece of metal is placed on a block of wood then placed on water both are found to float. Explain this observation. (2marks)

……

……

……

SECTION B(55 MARKS)

12. a) A car is travelling uniformly at 100km/hr when the driver observes a road block ahead. He takes 0.5s before applying the brakes which brings the car to rest with a uniform deceleration of $4m/s^2$. Determine the distance travelled by the car from the time the driver observed the road block until the car come to rest. (2marks)

(b) A car moves at constant speed of 20m/s for 50s and then accelerates uniformly to a speed of 25m/s over a period of 10s. This speed is maintained for 50s before the car is brought to rest with uniform deceleration in 15s. Draw the graph of velocity (y axis) against time (x axis) (3marks)

c) Determine:

i) The average speed for the whole journey (2marks)

ii) The acceleration when the velocity changes from 20m/s to 25m/s. (2marks)

13. a) State the Bernoulli's principle. (1mark)

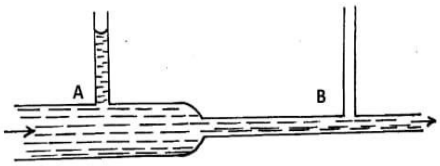
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b) State the two conditions for a fluid to experience streamline flow. (2marks)

c) Figure below shows water flowing through two sections A and B of a pipe having cross-sectional area of $8cm^2$ and $2cm^2$ respectively.

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i) Mark the appropriate level of water in the manometer B. (1mark)

ii) The velocity of water as it flows past the wider section of pipe is 0.6m/s. Calculate the velocity at the narrower section (3marks)

……
……
……
……

d) State one effect of Bernoulli's effect (1mark)

……

14. i) What is another name for the Newton's first law of motion (1mark)

……

ii) Why is it given that name? (2marks)

……

b) Why should we tie seat-belts? (2marks)

……
……

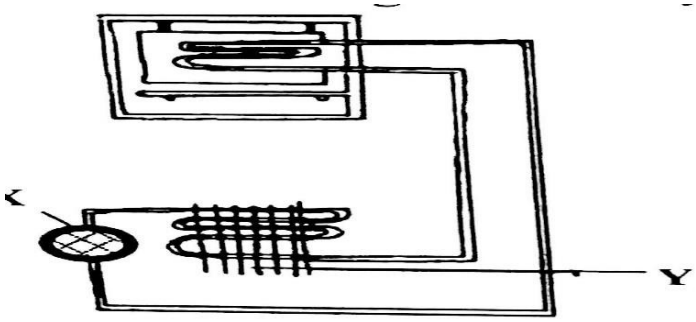
c) Explain how each of each of Newton's Law affects game of tug of war (3marks)

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15. a) Define latent heat of vaporization (1mark)

……
……
……

b) Figure below shows a domestic electric refrigerator



i) Label the parts

X…… (1mark)

Y……(1mark)

ii) What property is considered when selecting the liquid used as refrigerant? (1mark)

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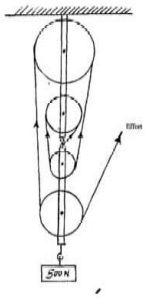
(c) (i) Define the term velocity ratio as used in machines. (1mark)

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……

……

(ii) The figure below shows a block and tackle pulley system lifting a load of 500N.



(a) Determine the velocity ratio of the machine. (2marks)

(b) If an effort of 120 N is required to lift the load using the machines. Determine the efficiency of the pulley system. (3marks)

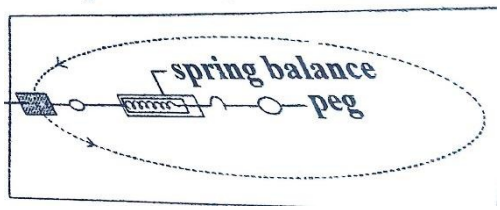
16. a) State two ways in which the centripetal force on a body of mass m can increased. (2marks)

……

……

……

b) Figure below shows an object at the end of a light spring balance connected to a peg using a string. The object is moving in a circular path on a smooth horizontal table with a constant speed.



i) State what provides the centripetal force. (1mark)

……

……

ii) Indicate with an arrow on the figure the direction of the centripetal force (1mark)

……

……..

iii) Given that the mass of the object is 0.5kg and it is moving at a speed of 8m/s at a radius of 2m, determine the reading on the spring balance. (2marks)

……

……

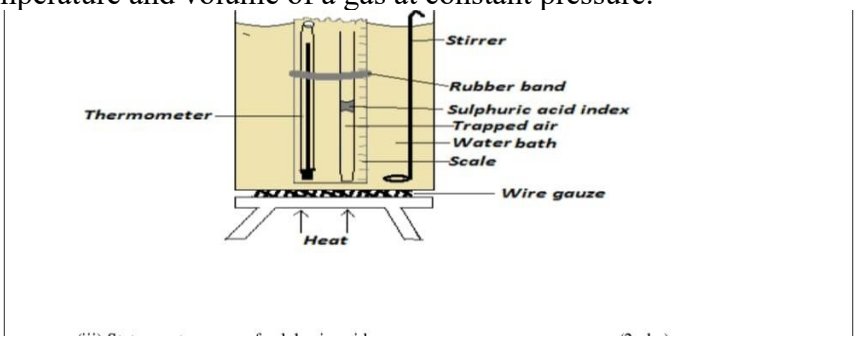
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c) (i) State Charles' law for an ideal gas (1mark)

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……
……
……

(ii) The set up below shows an arrangement that can be used to determine the relationship between temperature and volume of a gas at constant pressure.



(iii) State any two uses of sulphuric acid. (2marks)

……
……

(iv) The volume of a gas enclosed with a movable piston is $300cm^3$ when the temperature is 20^0 Determine the temperature at which the volume of the gas increase to $355\ cm^3$ (Assume pressure does not change). (3marks)

17. a) State Archimedes' principle. (1mark)

……
……

b) A rectangular brick of mass 10kg is suspended from the lower end of a spring balance and gradually lowered into water until its upper end is some distance below the surface.

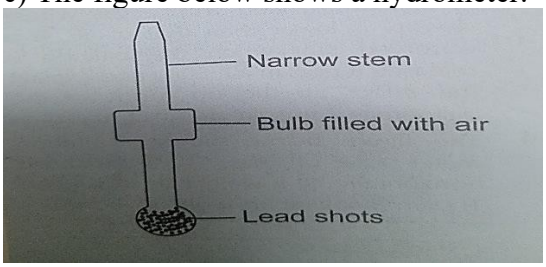
i) State and explain the changes observed in the spring balance during the process. (2marks)

……
……..

ii) If the spring reads 80N when the brick is totally immersed determine the volume of the brick. (Take density of water = $1000kg/m^3$) (2marks)

……
……
……

c) The figure below shows a hydrometer.



Explain:

i) Why the stem is made narrow (1mark)

……

ii) Why the bulb is made wide. (1mark)

……

iii) Why the lead-shots are placed at the bottom. (1mark)

……

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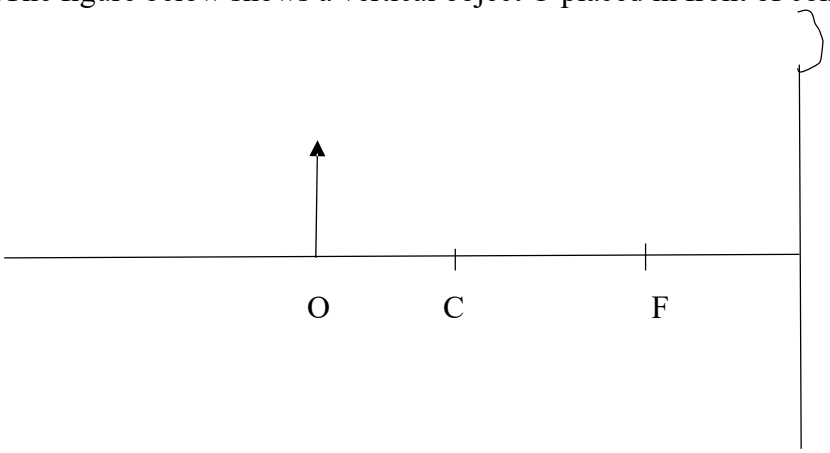
PAPER 2

SECTION A **(25mrk)**

1.Distinguish between real and virtual image (1mrk)

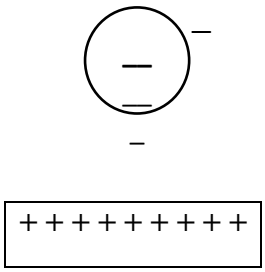
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2.The figure below shows a vertical object O placed in front of concave mirror whose principal focus is at F



Complete a ray diagram above to show how the image is formed (3mrk)

3.The figure below shows a negative point charge close to positively charged rod. Sketch the electric field pattern (2mrk)



4a) State one main reason why the bulb's filament is made of a tungsten. (1mrk)

……..

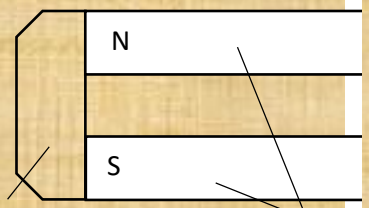
b). A hair drier rated 2700W ,240V is connected to a 240 mains supply through a 10A fuse. Determine whether or not the fuse is suitable (2mrk)

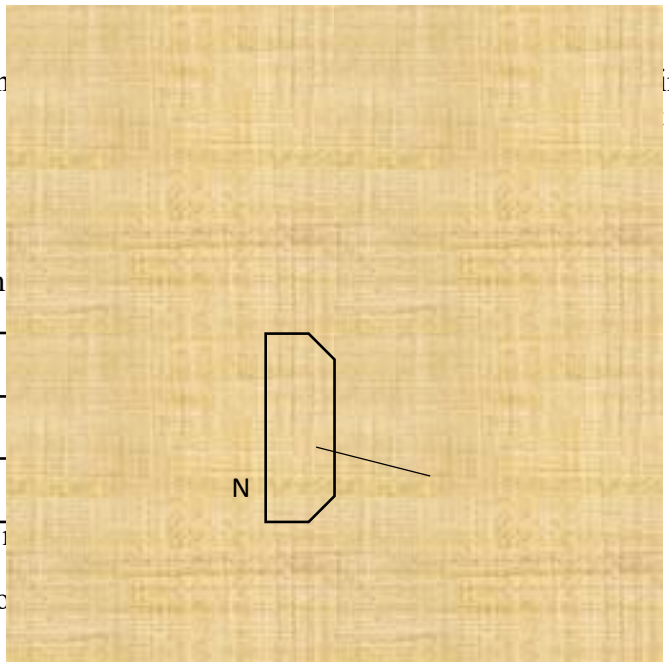
5.It is advisable to top up acid level of an accumulator with a distilled water and not acid. Give a reason for this (1mrk)

……
……..

6.A girl claps her hands on ng. when she is 85m away from the building, she hears the clap. Calculate speed of sound

n





c (2mrk)

……

……

the electromagnetic spectrum.

			R	Infrared waves	S	T

i.Identify the radiation marked (2mrk)

P-- …… …

R—……

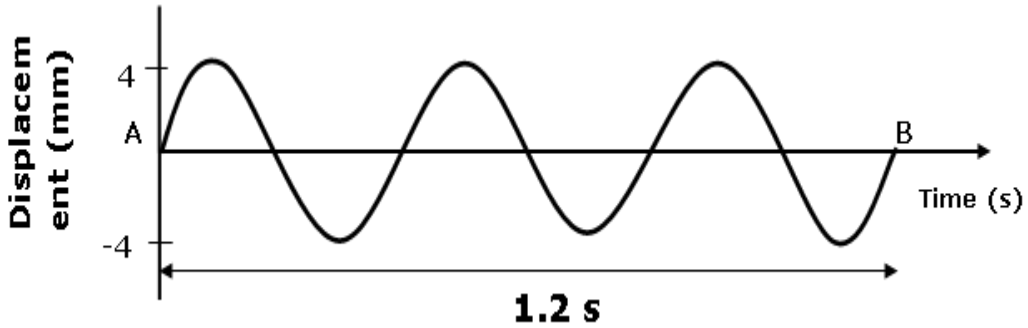
9.Differentiate between electromagnetic wave and mechanical wave (2mrk)

……

……

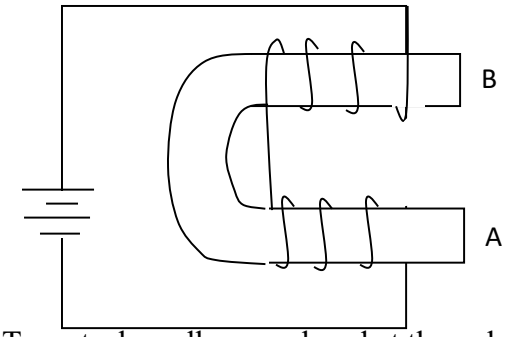
……

10.The sketch is a displacement – time graph of a wave traveling at 320ms-1. The wave takes 1.2 seconds to move from point **A** to **B**.



Determine the wavelength (3mrk)

11. a) The figure below shows a horse shoe electromagnet. Determine the polarity at the ends A and B. (1mrk)



(b) Two steel needles are placed at the poles A and B state and explain what happens to the needles. (2mrk)

……
……
……

c) Give ONE factor that increases the magnitude of an electromagnet (1mrk)

……
……

SECTION B (55 MARKS)

12. (a) Define the term *principal focus of diverging lens* (1mrk)

……
……,…….....

(b) **State** two similarities between the operation of a lens camera and the eyes (2mrk)

……
……

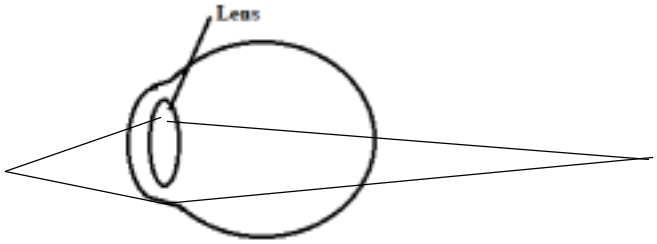
c)(i)State the conditions under which a convex lens forms a virtual image (1mrk)

……

ii)State one practical use **of** concave lens under the conditions you have stated in (i) above (1mrk)

……

d)The figure below shows how rays from a near object are focused behind the retina in human eye with a certain defect



i)**Name** the defect (1mrk)

……

ii)**State** the cause of the defect (1mrk)

……

(iii) State how the defect can be corrected (1mrk)

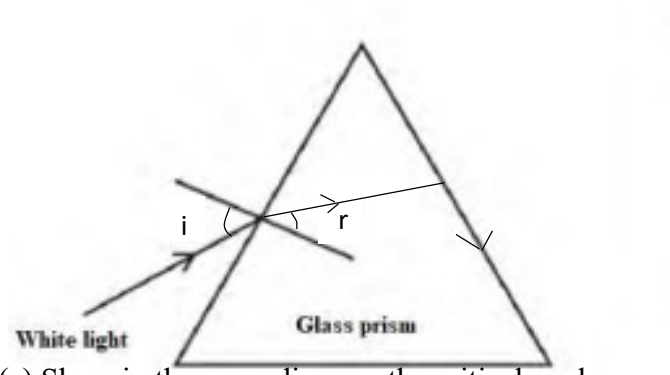
……..

13.(i)In the deviation of light by a glass prism red light is found to be the least deviated while the violet the most deviated. Explain this observation (1mrk)

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……
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ii)The diagram below shows the path of a ray of light through a glass prism whose refractive index is 1.525



(a) Show in the same diagram the critical angle, c and determine its value (3mrk)

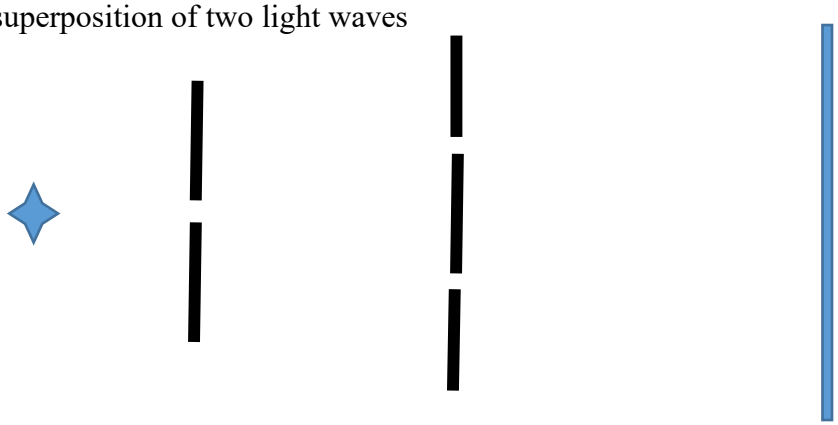
b) Given that angle r is 27°, determine angle i (2mrk)

c) Sketch on the same diagram, the path of the same ray after striking the prism, if the prism were replaced by another of the same size and shape but of a lower refractive index (use a dotted line for this answer) (1mrk)

d) State two reasons for total internal reflection to occur (2mrk)

……
……

14(a)The diagram below shows an arrangement (not to scale) for observing the interference pattern produced by the superposition of two light waves



S1 and S2 are two very narrow slits. The single slit S ensures that the light leaving the slit S1 and S2 is coherent,

i)Define coherent source (1mrk)

……

ii)Explain how dark and bright fridges are formed (2mrk)

……
……
……..

ii)Explain why the slits S1 and S2 need to be very narrow (2mrks)

……
……

(b)An example of longitudinal wave is sound wave. longitudinal waves consist of compressions and refractions as in the medium. Explain with the aid of diagrams the meaning of the following

(i)longitudinal wave (2mrk)

……
……
……
……

(ii)compressions (2mrk)

……
……
……
……

(c)A source produces sound of frequency 550Hz.The speed of sound in air is 330m/s.Calculate the wavelength of the waves produced (3mrk)

15.(a)State ohm's law (1mrk)

……
……
……

(b) Provide with the following apparatus voltmeter ,ammeter ,rheostat dry cell connecting wires and a fixed resistor describe an experiment to verify Ohm's law (4mrk)

……
……
……
……
……
……
……

(c)What current flows through an 80Ω lamp operating on240V supply? (2mrk)

(d)A current of 0.7A flows through awire when a pontential of 0.35V is applied at the ends of the wire.If the wire is 0.5m long and a cross-sectional area of 8.0×10^{-3} m^2.determine its resistivity (3mk)

16.(a)Define the following terms

(i) Electric field (1mrk)

……
……

(ii) Electric field line (1mrk)

……

……

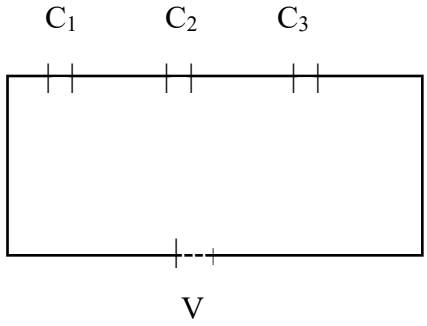
b)State how a highly negatively charged body with a sharp-pointed edge gets discharged by itself (2mrk)

……

……

……

c) Show that when capacitors are connected in series ,the total capacitance is given by:



$\frac{1}{CT} = \frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3}$ (3mrk)

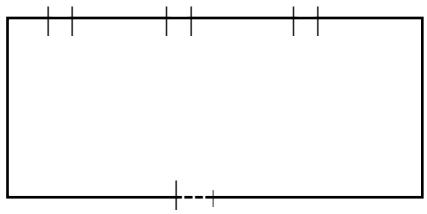
……

……

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(d) 1.5μF 2.0μF 3.0μF



b) In the circuit above, determine:

(i)Total capacitance (3mrk)

(ii)voltage across the 2μF capacitor (3mrk)

(iii)Energy stored by the 3μF capacitor (3mrk)

PAPER 3

Question 1

You are provided with the following

- A meter rule
- A retort stand, clamp and boss
- A 500 ml beaker ¾ full of water
- A 50g mass
- Liquid **L** in a beaker
- 10 cm cello tape
- Three 50cm sewing thread
- Tissue paper

Proceed as follows:

a) Balance the meter rule horizontally by suspending it from the stand and clamp with one of the threads.

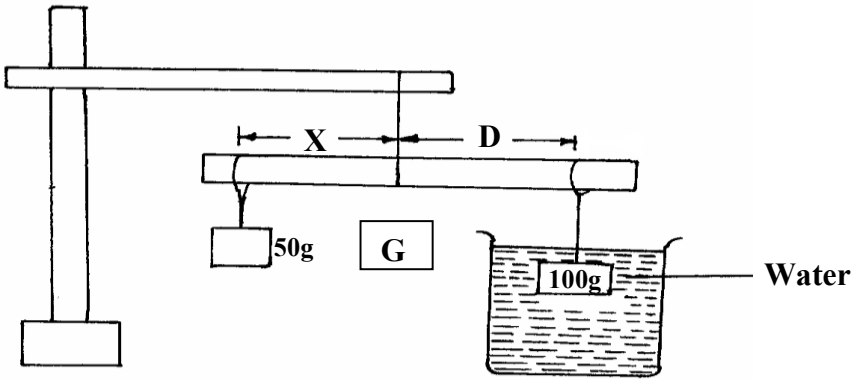
Record the balance point **G.**

G = …… cm mark (1mrk)

Note

For the rest of the experiment the position of the thread through **G** does not change, use cello tape to fix the position of thread.

b) Using a 100g mass and a 50g mass, set up the apparatus as shown below. The thread suspending the masses should be looped such that their positions of support can be adjusted.



Move the position of the 100g mass to and fro until the beam balance horizontally.

Note:

Distance **X** and **D** are measured from **G.**

Read and record the values of **X** and **D**

X=…….. cm 1mrk)

D=…… cm (1mrk)

Work out the weight W_1 of the 100g mass

W_1 = …… (1mrk)

Apply principle of moments to determine the upthrust U_w in water. (1mrk)

U_w_____

Remove the 100g mass from the water and dry it using the tissue paper, then suspended it

a) Now balance the metre rule when the 100g mass is fully submerged in liquid **L**
Record distance **X.**

X =_____cm (1mrk)

Apply principle of moment to work out the upthrust U_L in the liquid (1mrk)

b) Determine the relative density r.d of the Liquid L given that

$$r.d = \frac{U_L}{U_W}$$ (2mrks)

Maintaining the 100g mass in liquid **L** , replace the 50g mass with the other 100g mass and adjust distance **D** to **D** =100mm. Adjust distance **X** until equilibrium is attained and record distance **X**. Adjust **D** to the values indicated in the table below and record corresponding distance **X** that maintain equilibrium when the 100g mass is **fully submerged**. Complete the table(4mrks)

D(mm)	100	150	200	250	300	350	400
X mm							

Plot a graph of **X** (vertical axis) against **D** on the grid provided (5mkrs)

Determine the gradient **S** of the graph (2mrks)

Question 2 PART A

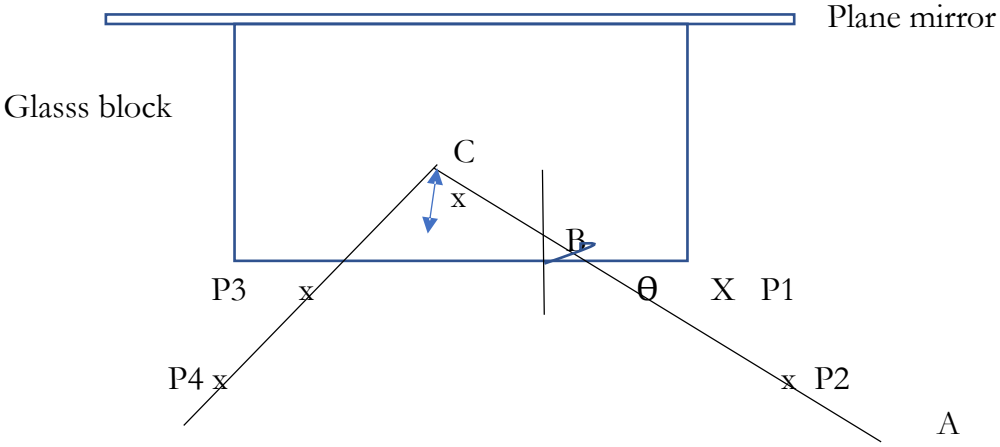
a) You are provided with the following apparatus

- a glass block
- a plane mirror
- 4 optical pins
- a soft board

- A sellotape (about 15cm long)
- 2 white – plain sheets of paper
- a ruler or half metre rule
- a protractor
- 4 office pins

Proceed as follows: -

(i) Using the cello tape provided fix the plane mirror to the glass block alongside as shown in the figure below.



(ii) The reflecting surface to face the glass block.

(iii) With the use of the office pins, secure firmly a white plain paper on the board and place the block together with attached mirror.

(iv) Draw the outline of the glass block together with the mirror

(v) Remove the block and the mirror and draw a normal at B somewhere a quarter- way the length of the outline you drew in (iv) above.

(vi) Draw a rays AB incident at B and extended to C. The incident rays should make an angle of 10° with the normal

(vii) Replace the glass block together with the attached mirror so as exactly fit the outline

(viii) Place two object pins P1 and P2 along the 10° line. Locate the images of pinsP1 and P2 as they appear by non-parallax (the images of the pins appear to be in a straight line when viewed through the glass block). Place pins P3 and P4 so that the images of pins P1 and P2 are not seen.

(ix) Remove the glass block together with the attached mirror from the outline and produce the lines joining P1 to P2 and P3 to P4 so that the they intersect at C. Measure and record the distance x in the table below. (3 Marks)

(x) Repeat procedure (vi) to (ix) for angles of $20^0, 30^0$ and 40^0.

NB. It may be necessary for you to draw another outline so as to avoid congestion of (construction) lines. Submit the outlines.

Angle θ	10°	20°	30°	40°
Distance X (cm)				

(xi) Now measure the breadth b of the glass block.
b=_____(1mark)

(xii) Calculate the average Ax of the values of x in table 3 above Ax
_____ (1mark)

(xiii) Determine the refractive index of the glass block using the formula. Refractive index n of glass $n = b/Ax$
(3 marks)

PART B

You are provided with the following apparatus,

- A voltmeter
- An ammeter
- A resistance wire labeled W
- A wire mounted on a mm scale and labeled T
- A micrometer screw gauge (to be shared)
- Six connecting wire with crocodile clips

Proceed as follows:

a) Using the micrometer screw gauge provided measure the diameter of the wire labeled T

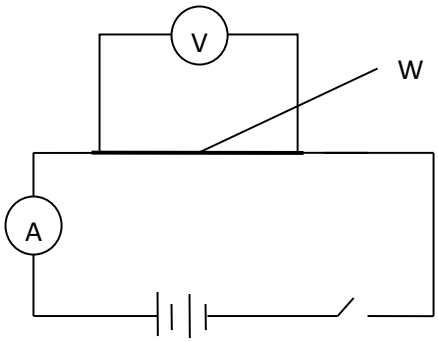
d ……. mm (1mk)

Determine the radius r of the wire

r = …… m (1mk)

b) Set up the apparatus as shown below

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i) Record the voltmeter (V) and ammeter (I) readings

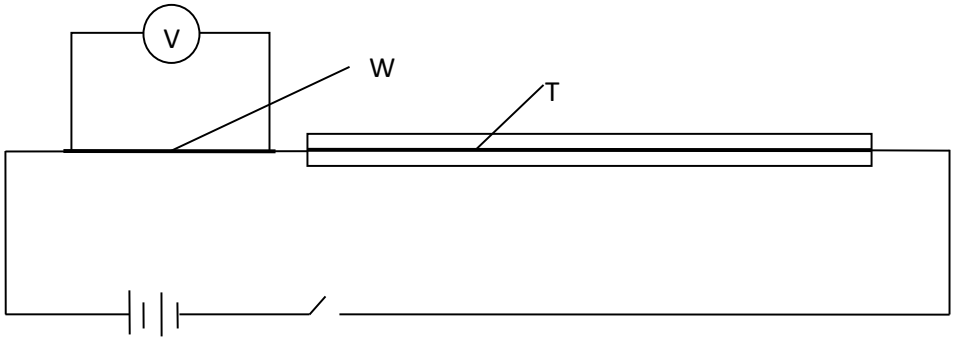
V ……V (1mk)

I …… A (1mk)

ii) Determine the resistance R_w of the wire W (1mk)

R_w = ...

c) Set up your apparatus as shown below



i) Use the voltmeter provided to measure the p.d V_w across W and V_T across T when the switch is closed.

Vw = …… V (1mk)

V_T = …… V (1 mk)

Open the switch.

ii) Use the value of R_w calculated in b (ii) and the value of V_w to calculate the current I flowing through W when the switch was closed.

I = …….. (1 mk)

iii) Determine the constant K and its units given that, (2mk)

$K = \frac{R_W \, .I}{V_T}$

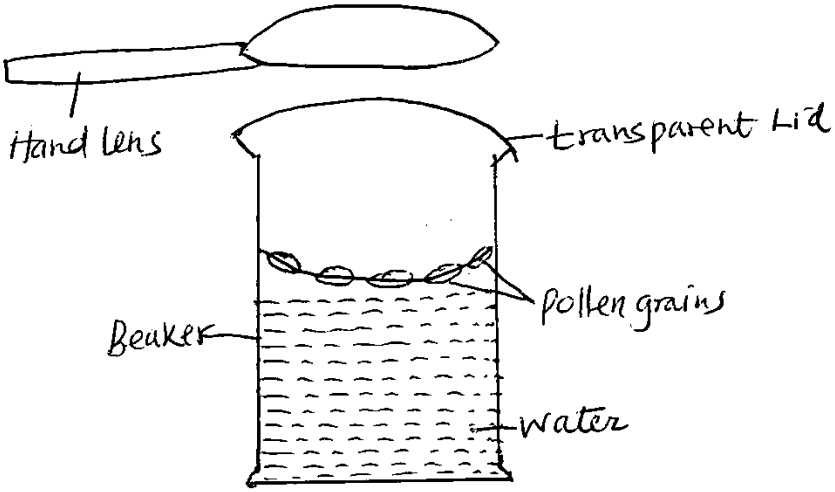
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SERIES 18

PAPER 1

SECTION A (25MKS) Answer all the Questions

1. The figure below shows a setup used to study Brownian motion in liquids

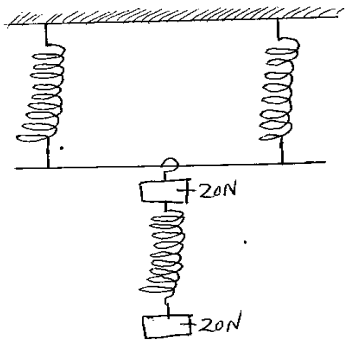


(i) State the functions of the hand lens (1mk)

(ii) State what is observed on the pollen grains (1mk)

2. An object placed on the surface of water in a beaker starts to sink immediately. It is observed that it stops sinking when half of its volume is below the water surface. State the reason for these observations (1mk)

3. The three springs shown in the figure below are identical and have negligible weight. The extension produced on the system of springs is 20cm.

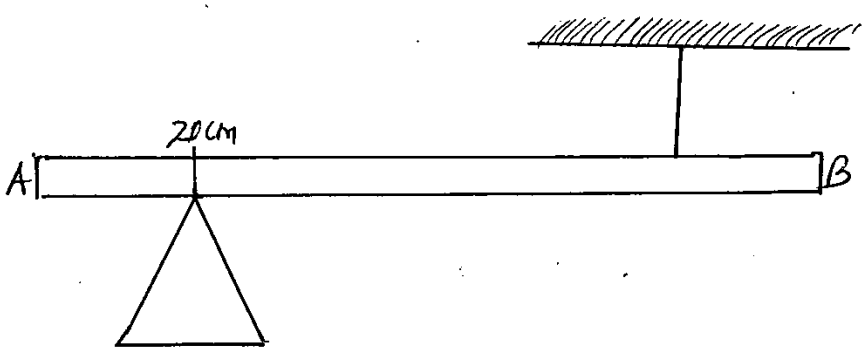


Determine the constant of each spring. (2mks)

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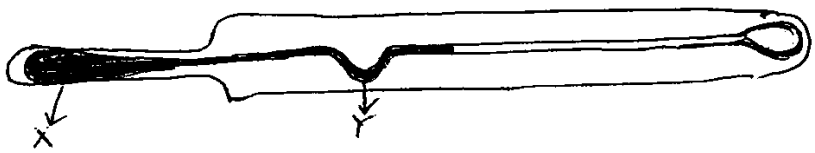
4. A particle starts from rest and accelerates uniformly in a straight line. After 3 seconds it is 9m from the starting point. Determine the acceleration of the particle (3mks)

5. The figure below shows a uniform rod AB of length 1m and weight 8N pivoted at 20cm from one end. It is balanced by supporting it with a string attached to a fixed support. The tension in the string is 4N. Determine the position of the string from end A. (3mks)



6. State the reason why the speed of water at the narrow section of a river is higher than at the wider section (1mk)

7. The figure below shows a clinical thermometer which is not graduated

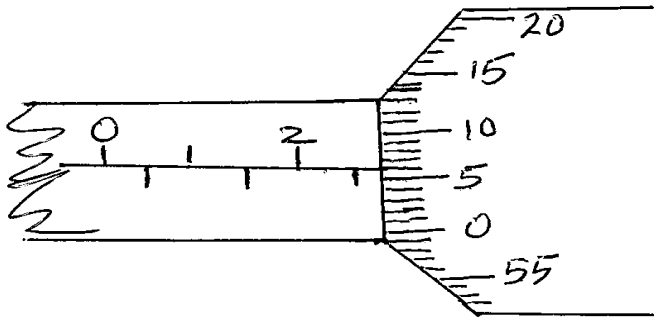


(i) Name the part indicated with letter x (1mk)

(ii) State the function of the part labelled y (1mk)

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8. A micrometer screw gauge is used to measure the thickness of a stack of 10 microscope slide cover slips. The reading with the cover slips in position is as shown below



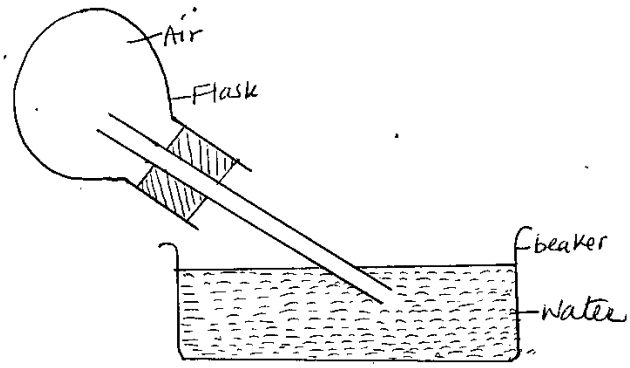
If the micrometer screw gauge has a negative zero error of 0.01mm, determine

(i) The thickness of the slips as shown by the micrometer screw gauge (1mk)

(ii) The actual thickness of the slips (1mk)

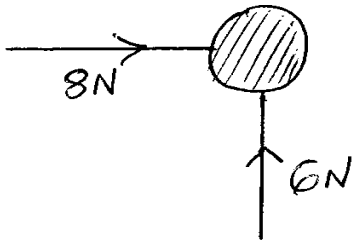
9. State one factor affecting stability of a body (1mk)

10. The figure below shows a glass flask filled with a narrow tube dipped into a beaker containing water at room temperature. State and explain what is observed when ice cold water is poured on the flask (2mk)



11. Given that pressure at the deepest point in a lake is 400,000N/m², determine the depth of this point. (Density of water is 1000kg/m3 (2mks)

12. Two forces 8N and 6N acts on a body at 90° to each other as shown.



Determine the resultant force acting on the body and sketch the direction of the resultant force (1mk)

13. The potential difference across a lamp is 12v. Determine the electrical energy changed to heat and light when a current of 12A flows through the lamp for 10 seconds. (2mks)

14. What is the purpose of the vacuum in thermos flask (vacuum flask) (1mk)

SECTION B 55 MARKS

15. (a) State the law of conservation of linear momentum. (1mk)

(b) Distinguish between elastic and inelastic collision (1mk)

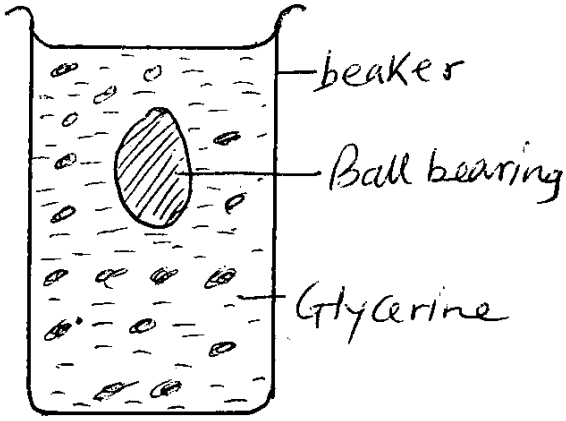
(c) A lorry of mass 2000kg travelling at 20m/s collides with a car of mass 800kg travelling at 30m/s in the opposite direction. The impact takes 2 seconds before the two bodies move with a common velocity.
Determine

(i) The common velocity (3mks)

(ii) The impulsive force (2mks)

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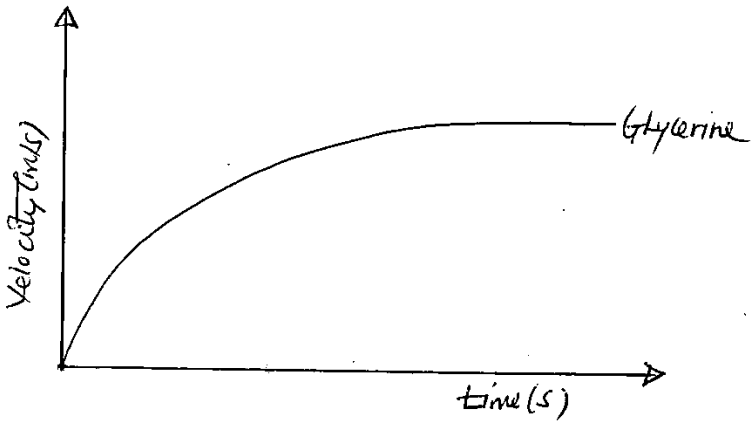
(d) The figure below shows a ball bearing falling through glycerin



(i) Name the two forces acting on the ball bearing. (2mks)

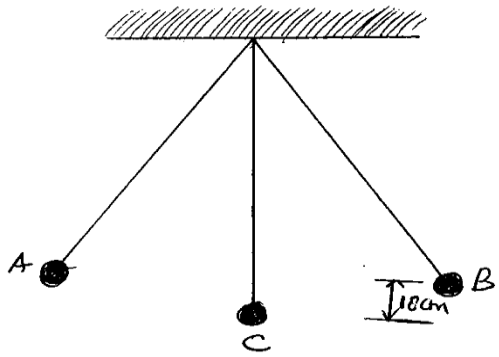
(ii) Write down an equation relating all the forces in (I) above when the ball bearing attains a constant velocity. (1mk)

(iii) The graph below shows the motion of the ball bearing through the above liquid



On the same axes above, sketch the graph to represent the motion of the ball bearing through alcohol and explain your graph (1mk)

16. The figure below shows a simple pendulum of length 80cm. The pendulum bob whose mass is 50g oscillates between points A and B through its rest position C, A and B are both 10cm higher than C.



a. (i) Indicate with an arrow, on the path A,C,B the direction of the greatest velocity of the bob as it moves from A and B (1mks)

(ii) State the form of energy possessed by the pendulum bob at point A. (1mk)

b. Determine

i. The velocity of the bob at point C (3mks)

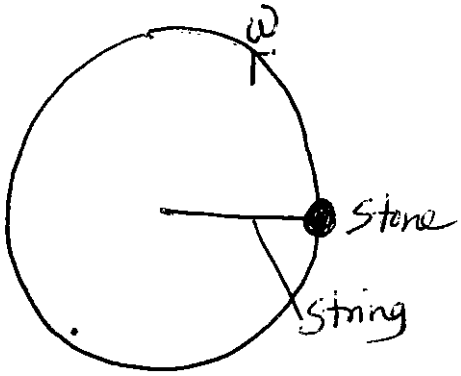
ii. The tension in the string as the bob passes point C. (Take g =10m/s^2) (3mks)

c. After sometime, the pendulum comes to rest at point C. State what happens to the energy it initially possessed. (1mk)

17. (a) Define the term centripetal force (1mk)

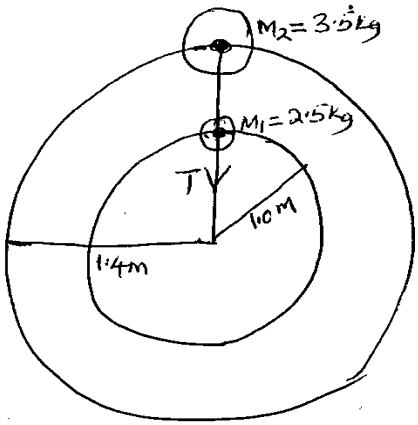
(b) When a car is travelling on muddy road, mud flies off the fast spinning wheels, explain this observation. (1mk)

(c) The figure below shows the path of a stone attached to a string whirled in a space in a horizontal circle.



Sketch on the diagram the path the body follows if the string breaks when the body is at the position shown. (1mk)

(d) Two masses M1=2.5kg and m2=3.5kg are connected by a light string and are in uniform circular motion on a horizontal frictionless surface as shown in the figure below. The masses describe circles of radius r1= 1.0m and r2=1.4m respectively and the angular velocity of the masses is 5.0 rad/s



(i) Which of the two masses is moving faster? Give a reason for your answer (2mks)

(ii) Determine the:

I. Centripetal force on m1. (2mks)

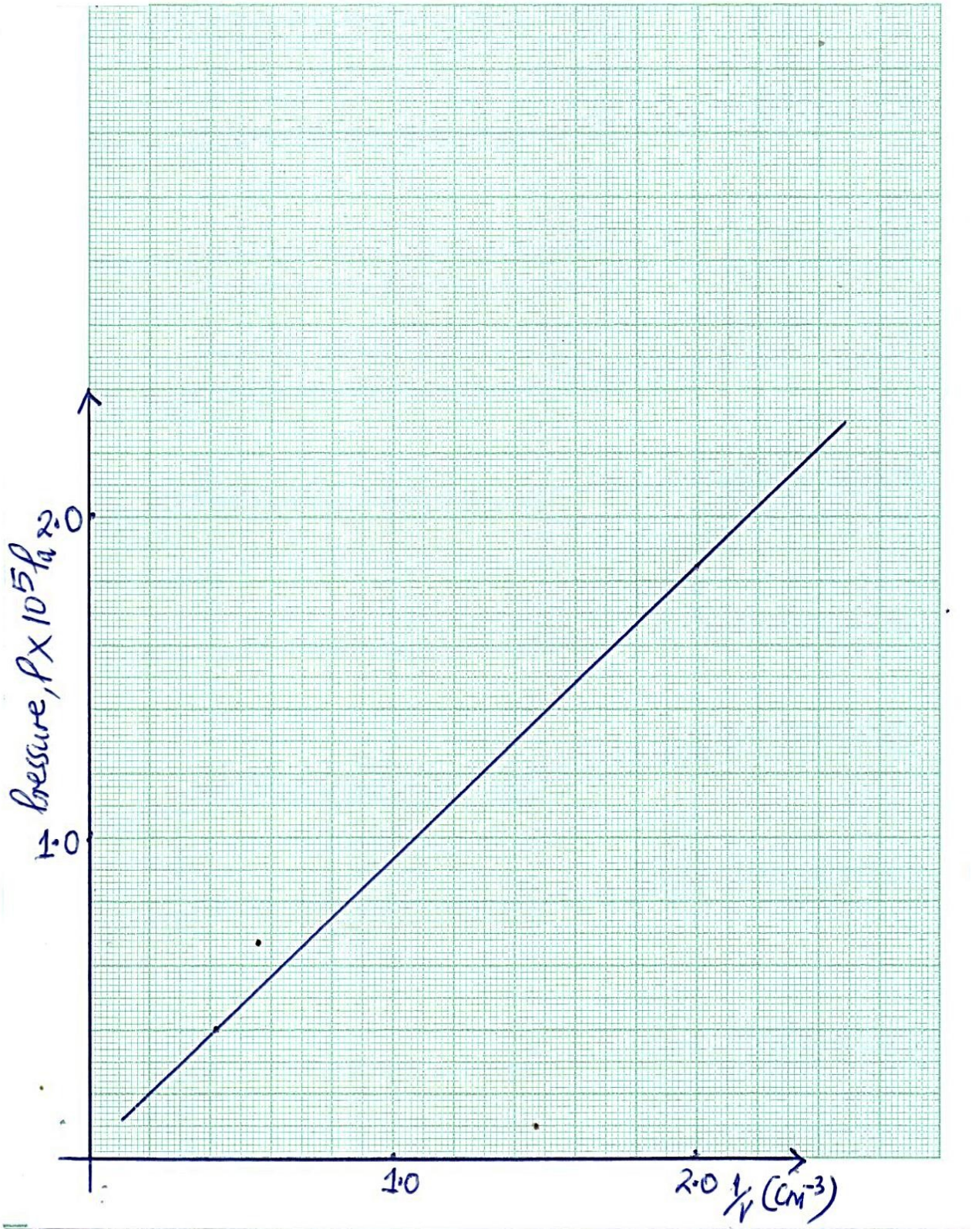
II. Centripetal force on m2 (2mks)

III. The tension T on the string (2mks)

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18. (a) State the pressure law for an ideal gas (1mk)

(b) An air bubble is released at the bottom of a tall jar containing a liquid. The height of the liquid column is 80cm. The volume of the bubble increases from $0.5cm^3$ at the bottom of the liquid to $1.15cm^3$ at the top. The figure below shows the variation of pressure, p on the bubble with the reciprocal of volume, I/v as it rises in the liquid.



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(i) State the reason why the volume increases as the bubble rises in the liquid column (1mk)

(ii) From the graph, determine the pressure on the bubble

I. At the bottom of the liquid column (2mks)

II. At the top of the liquid column (1mk)

(iii) Hence determine the density of the liquid in kg/m^3. (3mks)

(iv) What is the value of the atmospheric pressure of the surrounding (1mk)

(c) A rubber tube is inflated to pressure of $2.7x10^5$pa and volume 3800cm3 at temperature of 25°C. It is then taken to another place where the temperature is 15c and the pressure $2.5x10^5$ Pa. Determine the new volume. (4mks)

19. (a) What is meant by the term SPECIFIC LATENT HEAT OF VAPORIZATION (1mk)

(b) In an experiment to determine the specific latent heat of vaporization of water, steam at 100°C was passed into water contained in a well lagged copper calorimeter. The following measurements were made.

Mass of calorimeter =50g
Initial mass of water = 70g
Final mass of calorimeter+ water + condensed steam =123g
Initial temperature of water + calorimeter = 5°c
Final temperature of mixture = 30°c
Specific heat capacity of water = 4200j/kg/k-1
Specific heat capacity of copper = 390j/kg-1/k-1

Determine

(i) Mass of the condensed steam .(2mks)

(ii) Heat gained by calorimeter and water (3mk)

(iii) Given that Lv, is the specific latent heat of vaporization of steam.

I. Write a simplified expression for the heat given out by steam. (2mk)

II. Determine the value of lv. (3mks)

PAPER 2

SECTION A (25 MARKS)

Answer all the questions in this section

1. A plane mirror suspended from a vertical wall makes an angle of 20^0 with the wall. Determine the angle of reflection for a ray incident on the mirror and parallel to the horizontal (3mks)

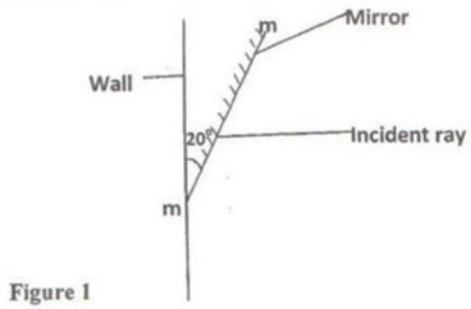
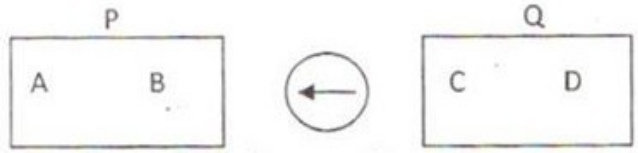


Figure 1

2. Figure 2 shows a plotting compass placed between two strong magnets **P** and **Q**

Figure.2



(a) State the polarity of the end D of magnet Q (1mk)

……
……
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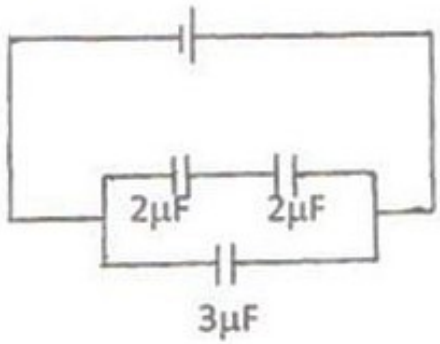
(b) Draw on the diagram the resulting magnetic field pattern between B and C (2mks)

3. Name one major defect of a simple cell and state how it can be minimized. (2mks)

……
……
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4. Figure 3 shows capacitors connected a12V d.c supply

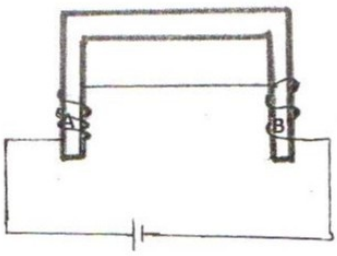
Figure 3



Calculate the charge stored in one of the 2μF capacitor (3marks)

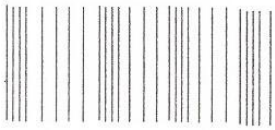
5. Ann measured the height of Madam Ashley's shadow and found it to be 4m long. She also measured the length of the shadow of net ball goal post and found it to be 6 m long. If Ashley's height is 1.76 m estimate the height of the goal post to the nearest metre (2 marks)

6. Figure 4 shows a coil of insulated wire wound on a horse shoe soft core **AB** and connected to a power supply (1 mark)



Name the polarity at **A** and **B** (1mark)

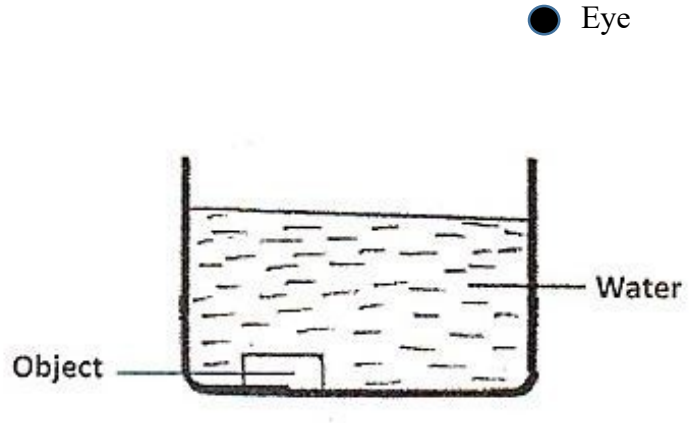
7. Figure 5 shows sound waves passing through air. Study it and answer the questions that follow



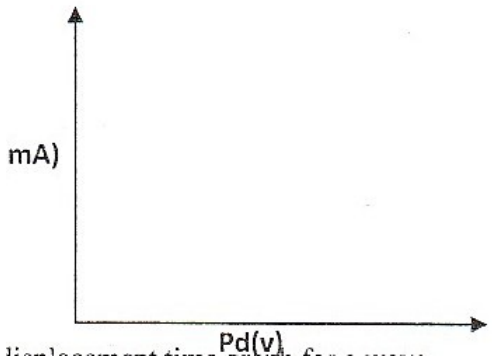
Label the following on the diagram

i) Rarefaction (1 mark)
ii) Wavelength (1mark)

8. Figure 6 shows an object at the bottom of water in a container. Draw rays on the diagram to show how the eye views that object from its position shown. (2 marks)

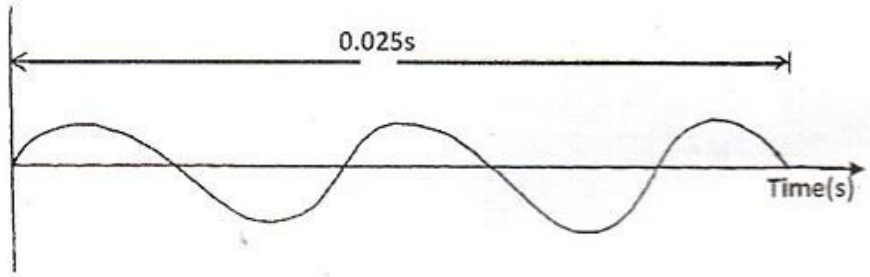


9. In the axes below, sketch the characteristic curve for a forward biased p-n junction diode (1mk)



10. Figure 7 shows a displacement time graph for a wave.

Fig 7.



Determine the frequency of the wave. (2mks)

11. Determine the values of a and b in the nuclear equation below. (2mks

$$ {}^{a}_{b}X = {}^{230}_{90}Y + 2\alpha $$

12. The table below shows a section of the electromagnetic spectrum in descending wavelength.

Radiowave	Microwave	A	Visiblelight	U.V	X-Rays	B

Name (2mks)

(i) A

_____

(ii) One use of B

_____

13. A lens forms an image that is four times the size of object on a screen. State with reason what type of Lens was used. (1mk)

_____

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SECTION B(55 MARKS)

14. (a)A student set up a mass attached to spring such that when it oscillates it taps on the water surface in a wide shallow tank as shown in figure 9

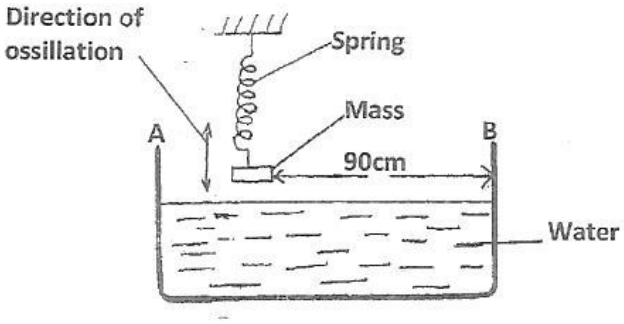


Fig 9.

The student measured time for 20 oscillations and found it as 36 seconds
Determine;

i) The periodic time for the oscillation (2mks)

ii) ii) The frequency of the waves produced on the water surface (2mks)

iii) The speed of the waves if there were four ripples between the mass and end B of the tank

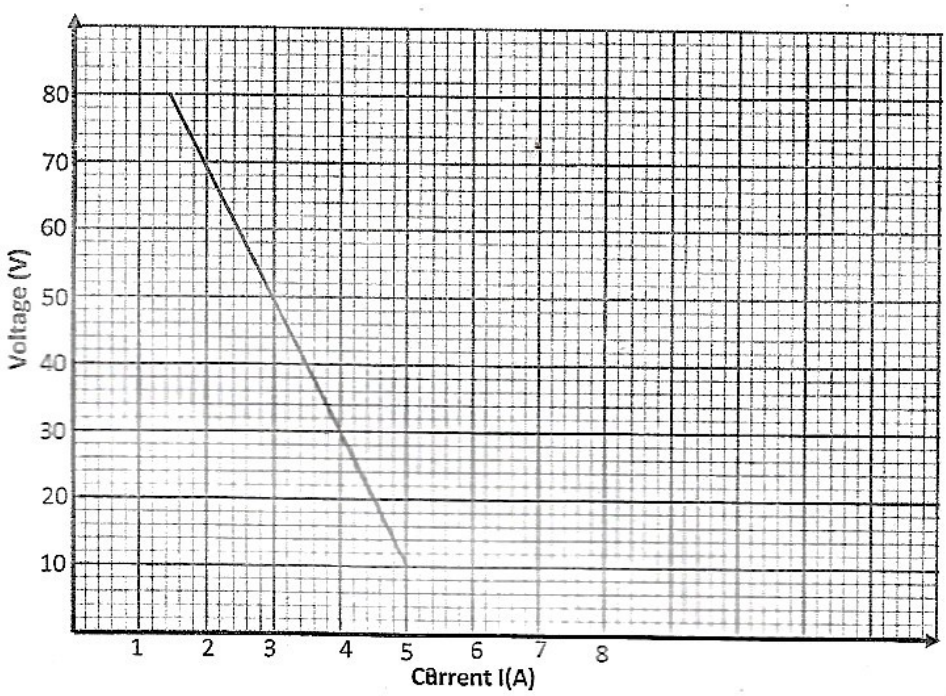
(3mks)

(b) An echo sounder of a ship received the reflected waves from a sea bed after 0.20s

(i) Determine the depth of the sea bed (the velocity of sound in water is 1450m/s) (2mks)

(ii) When the ship above passes over a sunken reef, the echo sounder receives an echo after 0.16s. Determine the height of the sunken reef. (3mks)

15 (a) Figure 10 shows the voltage - current relation for a certain battery used in an electrical circuit.

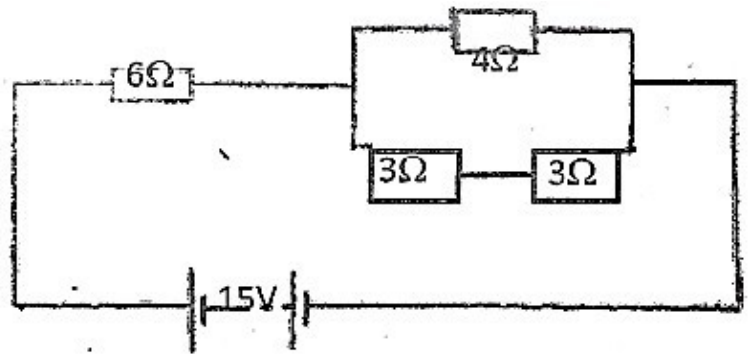


Given that the equation graph is V =E - Ir from the graph determine

i) The e.m.f of the of the battery (1mk)

ii) The internal resistance of the battery used

b) Figure 11 shows a network of resistors connected to a power supply of 15V. (3mks)



Determine:

i) The effective resistance of the network (2mks)

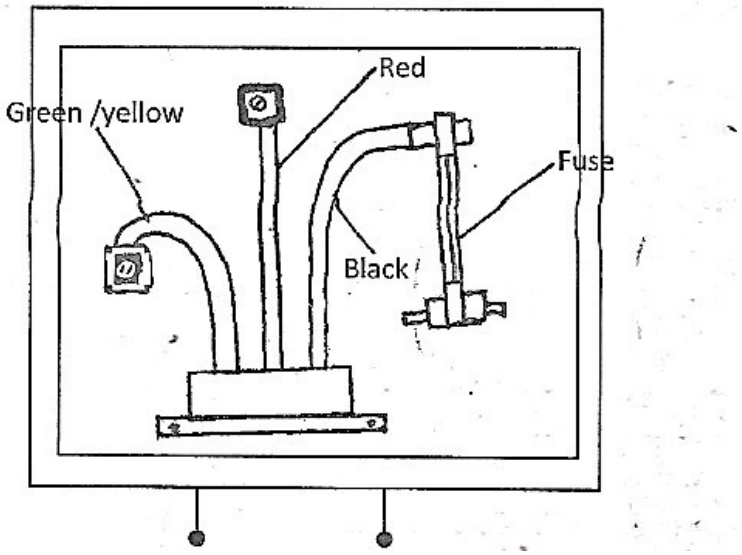
ii) The voltage across the 3Ω resistor. (3mks)

16. (a) A heater rated 2000W is used to heat water for 5hours

Calculate the cost of electricity used if it is charged at Ksh. 6.70 per unit. (3mks)

(b) Give a reason why transmission of electricity is done at very high voltage. (1mk)

(c) Figure 12 below shows a connection of three pin plug

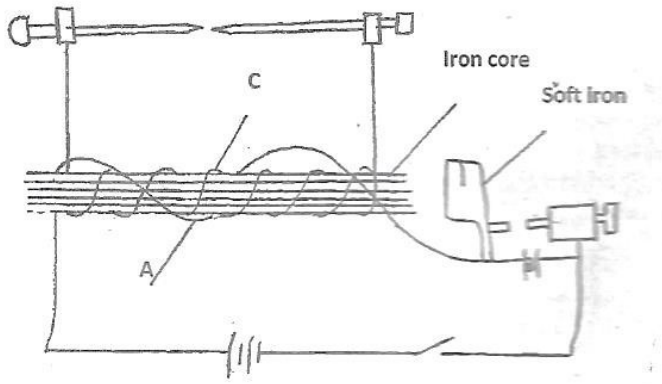


(i) Identify one mistakes in the wiring (1mark)

(ii) Suggest what is likely to happen if this plug was connected to the mains socket. (1mark) .

(iii) Why is the earth pin made longer in the plug (1mk)

(b) Figure 13 shows an induction coil used for producing sparks



(i) Name the parts labeled A,B, and C (3mks)

(iii) Briefly explain how induction coils works (3mks)

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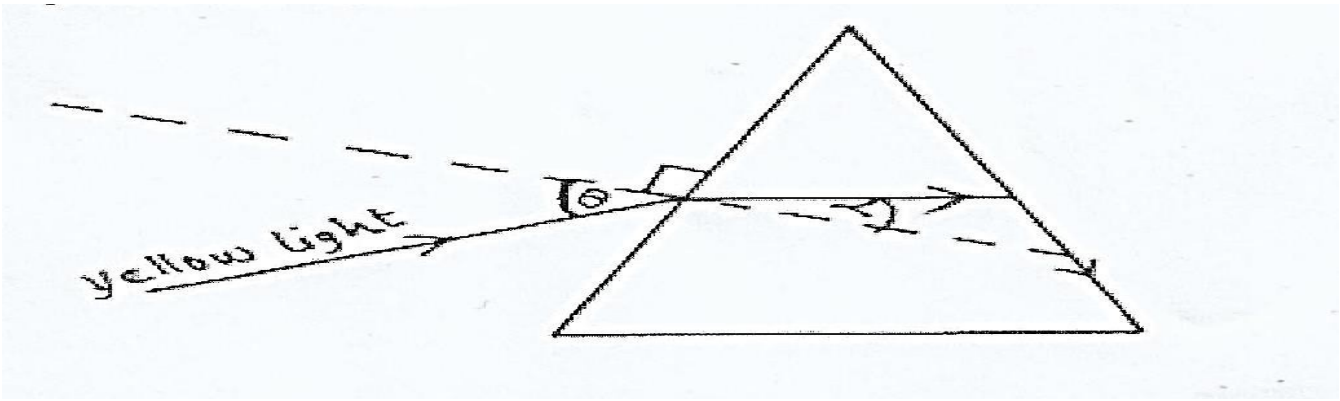
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17. **(a)** State **two** conditions necessary for total reflection to occur. **(**2mks)

(b) Define the term critical angle as used in refraction of light. (1mk)

(c) The figure **below** shows the path of a ray of light through a glass prism. The speed of yellow light in the prism is 1.88 × 108m/s



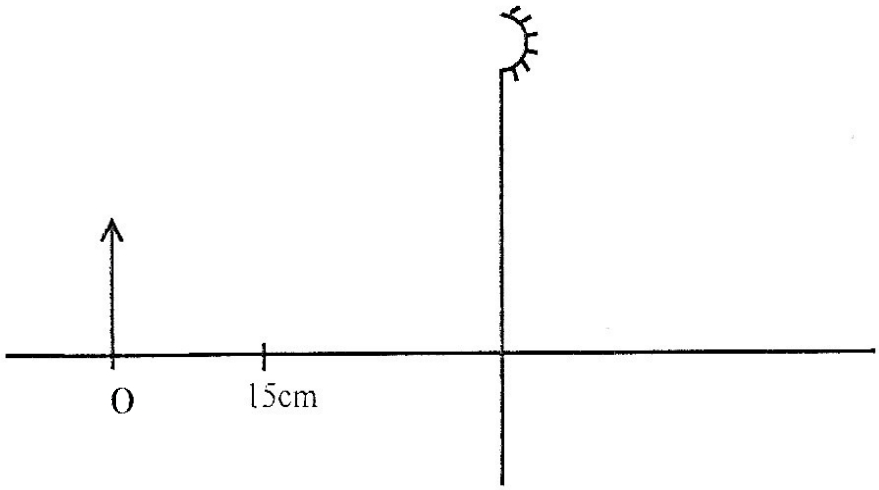
(i) Determine the refractive index of the prism material for the light (speed of light in vacuum, c=3.0 × 108m/s) (3marks)

(ii) Show on the figure, the critical angle, c, and determine its value. (4marks)

(iii) Given that r= 21.2˚, determine the angle. (3marks)

18. (a) State the advantages of using a convex mirror as a driving mirror. (1mark)

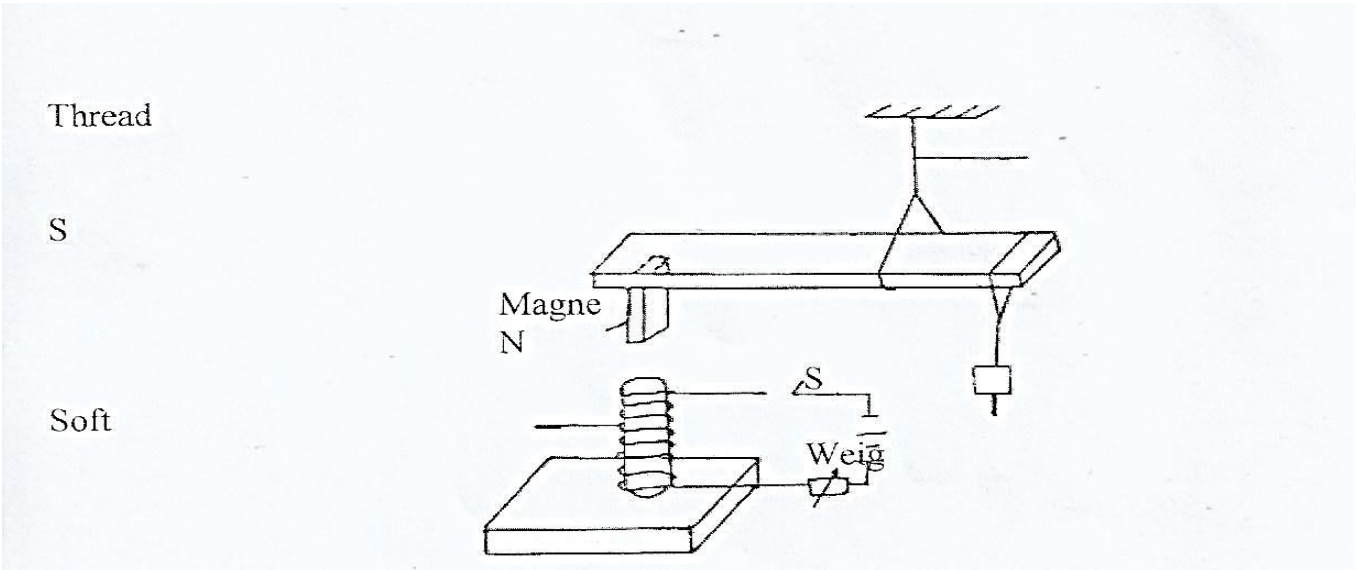
(b) The figure below shows an object O placed in front of a converging mirror of local length 15cm.



Draw on the figure a ray diagram to locate the image formed. (2marks)

c) State three factors that affect the strength of an electromagnet. (2marks)

d) In the set up below, the suspended metre rule is in equilibrium balanced by the magnet and the weight shown. The iron core is fixed to the bench



(i) State and explain the effect on the metre rule when the switch S, is closed. (2marks)

(ii) State the effect of reversing the battery terminals (1mark)

(c) The figure below shows two parallel current carrying conductors A and B placed close to each other. The direction of the current is into the plane of the paper.



On the same figure.
(i) Sketch the magnetic field pattern. (1mark)
(ii) Indicate the force F due to the current on each conductor. (1mark)

PAPER 3

QUESTION 1

You are provided with the following:

- A glass marble
- A stop watch
- A 105cm plastic tube split open with a mark near one end.
- Vernier calipers (to be shared)
- A meter rule of half meter rule.
- A balance (to be shared)
- Retort stand one boss and one clamp.
- Wooden block (for blocking the marble from rolling away.)

Proceed as follows:

a) Use the vernier calipers provided to measure the diameter of the marble hence determine the radius.

i) Diameter of the marble 'd' = (1mk)

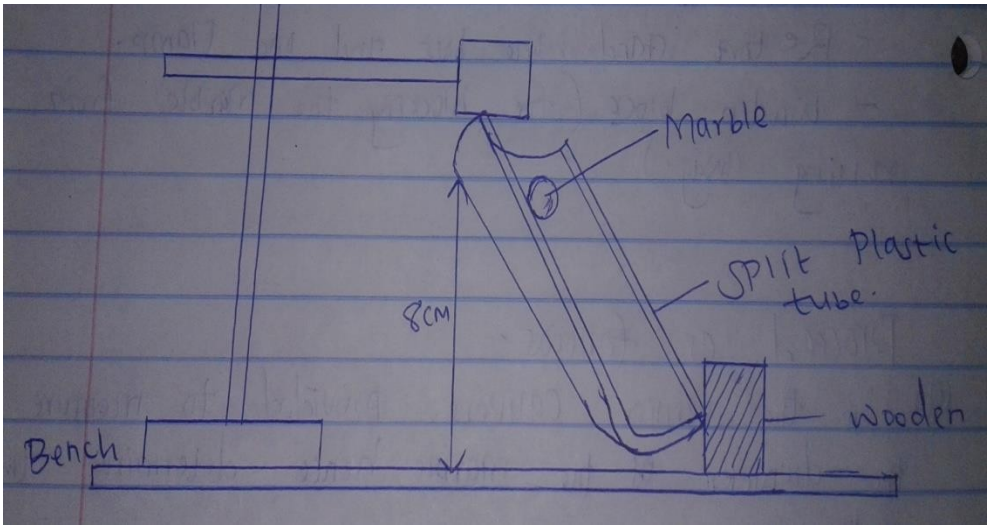
ii) Radius of the marble 'r' = (1mk)

bi) Using the balance provided obtain the mass of the marble. (1mk)

ii) Determine the constant 'p' given that $p = 0.4mr^2$ (1mk)

c) The experiment involves timing a marble as it rolls down the split tube as a runway, lamp the marked end of the split tube with the inside uppermost. Ensure the end with the mark is on the greater slope. Raise this end such that the mark is at a height h = 8cm above the bench level. The other end should rest on the bench as shown in the figure below.

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Place the marble at the mark on the runway and hold it in place gently with the finger as shown in the figure. By simultaneously releasing the ball and starting the stop watch measure and record in the table below the time taken by the marble to reach the lower end of the runway. (It is advisable to measure the time twice and record the average value.)
Vary the height h to other values shown in the table below. Measure and record in the table the corresponding average value of t.
Complete the table. (6mks)

Height h (cm)	8	9	10	11	12	13	14	15
Average time t (s)								
T^2 (s^2)								
$1/h$ (cm^{-1})								

d)i) On the grid provided plot the graph of t^2 (y – axis) against $1/h$ (5mks)

ii) Determine the slope S of the graph. (3mks)

iii) Determine the constant G ffor the marble given that; (2mks)

$$G = Mr^2 (S/20 - 1)$$

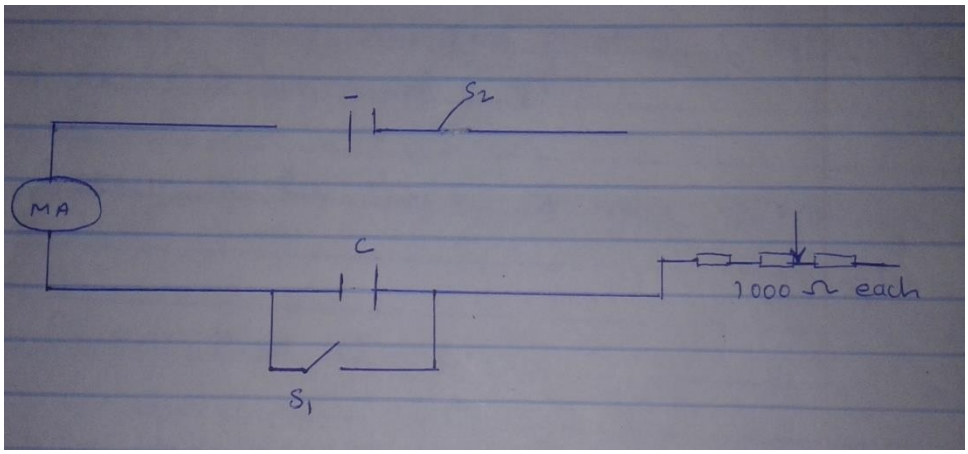
Question 2
You are provided with the following.
- A stop watch.
- A milliameter

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- A capacitor
- Two switches S_1 and S_2
- Six 1000 ohms resistors.
- A dry cell and a cell holder.
- Seven pieces connecting
- At least six crocodile clips

Proceed as follows.

a) Connect the circuit as shown in figure 1.0 below.



(make sure the positive terminal of the capacitor connects to the positive terminal of the cell and negative to negative)

b) Close switch S_1 and then switch S_2 and record the maximum reading of the milliameter in the table 1.0 below.

c) Open switch S_1 and at the same instant, start the stop clock. Record the time taken for the value of current to fall to a half of its original value.

d) Repeat step (b) and (c) with other values R (Ω)

Resistance R(Ω)	2000	3000	4000	5000	6000	7000
Maximum current I (mA)						
Time t (s)						

e)i) On the grid provided, plot a graph of R (Ω) against t (s)

ii) Determine the slope of your graph.

iii) given that $R = {}^{t}/_{k}$ use the graph to determine the constant k.

f) Why should the switch S_1 be closed first and S_2 later?

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g) What is happening to the capacitor when the milliameter reading is decreasing?

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SECTION A (25 marks)

*Answer **all** the questions in this section in the spaces provided.*

1. **Figure 1** shows a section of a vernier calipers used to measure the external diameter of tube. The vernier calipers has a zero error of 0.3cm

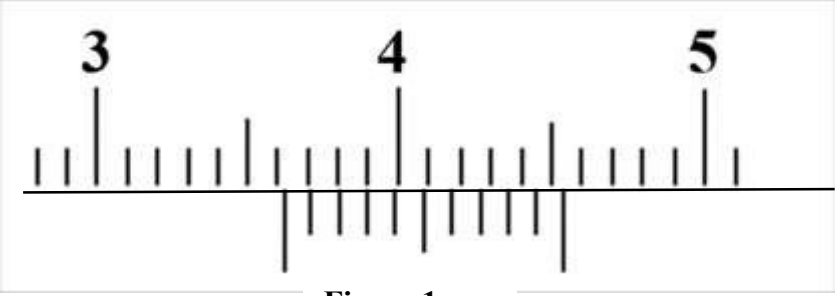


Figure 1

Determine the actual diameter of the tube. (1 mark)

……

2. A student used a container of mass **x** grams in an experiment to determine the density of a liquid. The following data was obtained:

Mass of empty container = **x**g
Mass of container when full of water = 80g
Mass of container when full of the liquid = 70g

The student obtained the density of the liquid to be 0.8gcm^{-3}. If the density of water is 1gcm^{-3}, determine the value of **x**. (3marks)

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3. Figure 2 shows an open horizontal tube filled with water.

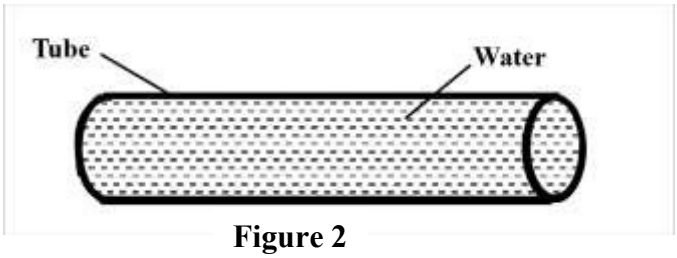


Figure 2

Explaining why the water does not flow out of the tube. (2 marks)

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4. Two ice blocks are pressed together then released. It is observed that they join together to form a single block. Explain the observation. (2 marks)

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5. **Figure 3** shows a circuit used in cars.

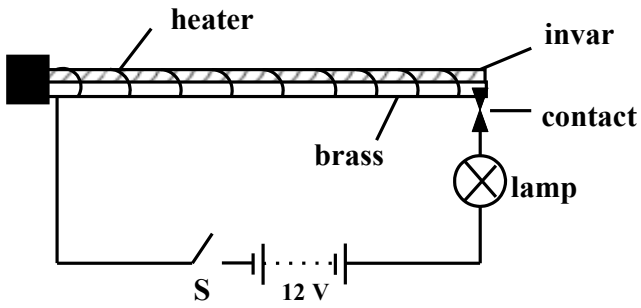


Figure 3

When the switch, S, is closed, the lamp flashes on and off. Explain this observation. (2 marks)

……

……

……

6. The displacement **s** of an object in time, **t** may be given by the equation $\mathbf{s = ½at^2}$, where a is the acceleration of the object. State **two** conditions that must be satisfied for this equation to apply. (2 marks)

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7. A small stone hangs by a sewing thread from a support. A section of the same thread dangles from the lower part of the stone as shown in **figure 4**.

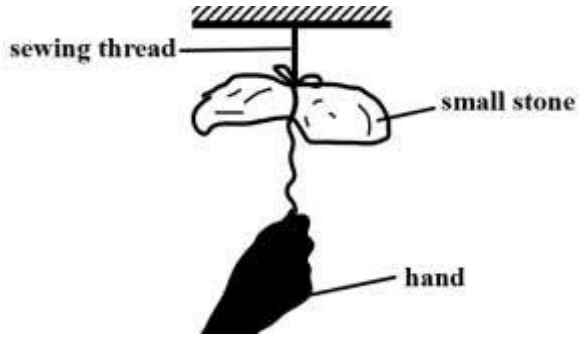


Figure 4

The thread is given very sharp jerk. Explain why the sewing thread is more likely to break below the stone. (2 marks)

……..……

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8. **Figure 5** shows a non-uniform bar balanced on a knife edge. The centre of gravity G is 10 cm from the knife edge.

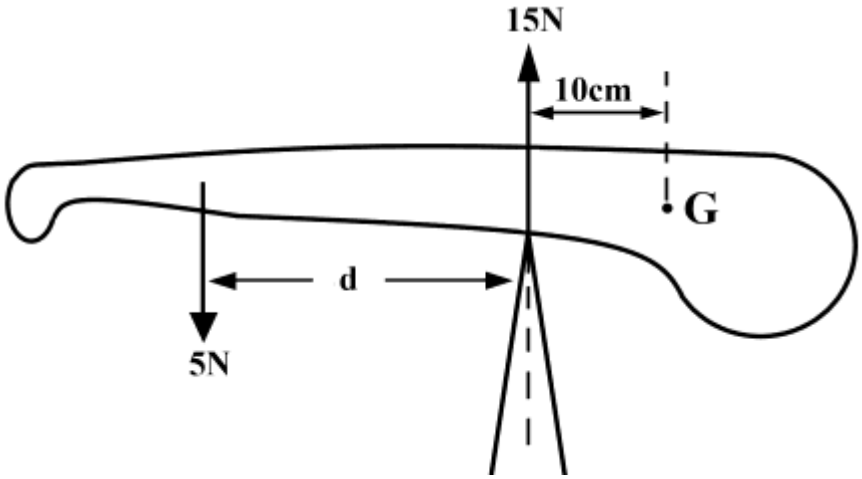


Figure 5

(a) Determine the weight of the bar. (2 marks)

……

……

(b) Find the value of **d**. (2 marks)

Turn Over

……

……

……

9. A pipe of diameter 3 cm is connected to another pipe of diameter 6 cm. Water flows in the narrower pipe at a speed of 2 ms^{-1}. Determine the speed of the water in the wider pipe. (2 marks)

……

……

……

10. Explain how diffusion is evidence that matter is made of tiny particles. (1 mark)

……

……

11. It is easier to drag a boulder in sea water than in fresh water. Given a reason for this. (1 mark)

……

……

12. A spring balance which was calibrated in Mombasa is used by a shopkeeper to measure amount of meat sold to customers. State who benefits; shopkeeper or customer? (1 mark)

……

……

13. Water in an earthen pot placed out in the sun, on a hot day, remains cold. Explain this observation (2 marks)

……

……

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Turn Over

Section B (55 marks)

*Answer **all** the questions in this section in the spaces provided.*

14. (a) The set up shown in **figure 6** is to be used to determine acceleration due to gravity at a certain place.

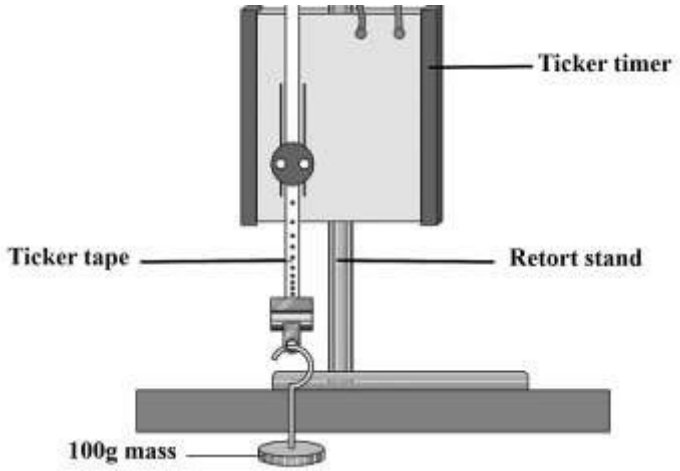


Figure 6

Briefly describe how the set up can be used determine the value of acceleration due gravity at the place. (4 marks)

……

……

……

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……..…….

(b) In a set up similar to the one in figure 8, the mass took 20 seconds to reach the floor of the laboratory. (Take g = 10ms^{-2})

(i) Determine the initial height of the mass. (ignore air resistance)

(2 marks)

……

……

……

(ii) State the reason why the height might be less than the value calculated in (b)(i).

(1 mark)

……

……

(iii) Calculate the initial potential of energy of the mass. (2 marks)

……

……

……

(iv) Determine the velocity of the mass just before it hits the floor. (2 marks)

……

……

……

15. (a) A piece of metal weighs 0.52 N in air, 0.32 N when completely immersed in water and 0.18 N when immersed in another liquid. (Density of water = 1000 kgm^{-3})

Calculate:

(i) upthrust in water (2 marks)

……

……

(ii) upthrust in the other liquid (1 mark)

……

……

(iii) density of the metal. (2 marks)

……

……

……

(iv) density of the other liquid (2 marks)

……

……

……

(b) A balloon of capacity 2.0 m^3 is filled with a gas of density 0.5 kgm^{-3}. It accelerates upwards from rest at 2ms^{-2}. The mass of the fabric of the balloon is 0.2 kg.
(Take density of air to be1.2 kgm^{-3} and acceleration due gravity g = 10ms^{-2})

(i) Calculate the:
(I) upthrust on the balloon (2 marks)

……

……

……

(II) the weight of the gas in the balloon. (2 marks)

……

……

……

(ii) Determine the air resistance to the balloon's motion (3 marks)

……

……

……

……

16. (a) A car is travelling on a circular horizontal track.

(i) State what provides the centripetal force on the car. (1 mark)

……

……..

Turn Over

(ii) State the effect on the required centripetal force if:

(I) the car moves faster. (1 mark)

……

……

(II) the number of passengers reduces. (1 mark)

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……..

(b) **Figure 7** shows a rubber bung of mass 50g whirled in a horizontal circle of radius 20cm.

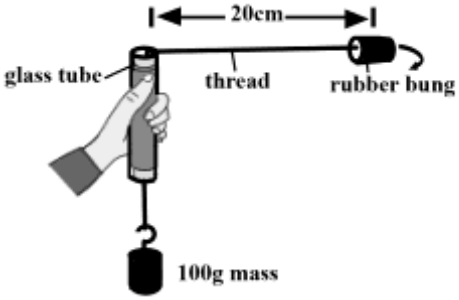


Figure 7

Determine:

(i) the tension in the thread. (Take g =10ms^{-2}) (2 marks)

……

……

(ii) the centripetal force on the rubber bung. (1 mark)

……

(iii) the angular velocity of the rubber bung (2 marks)

……

……

……

(iv) the linear velocity of the rubber bung (2 marks)

……

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17. (a) **Figure 8** shows an experimental set-up that may be used to investigate one of the gas laws.

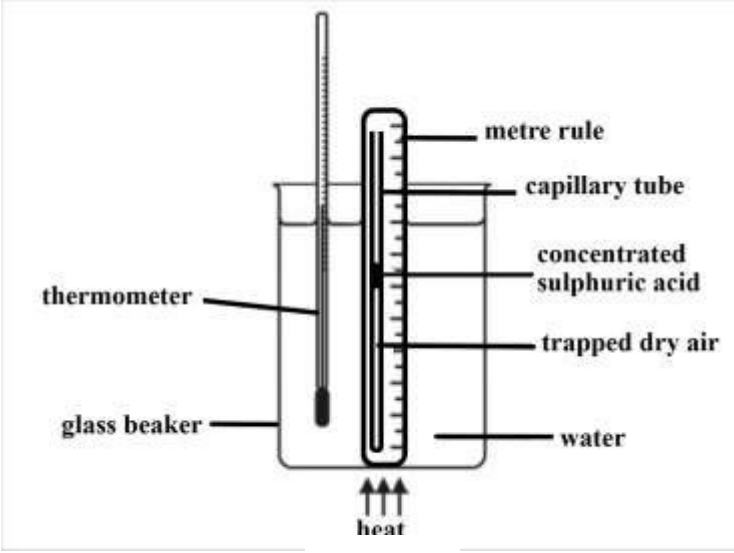


Figure 8

(i) State the gas law which is under investigation. (1 mark)

……

(ii) Briefly describe how the set-up is used to verify the law. (4 marks)

……

……

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……

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……

……..

(iii) State one use of the concentrated sulphuric acid. (1 mark)

……

……

Turn Over

(b) On a day when the atmospheric pressure is102 kPa and the temperature is 8 ^{o}C, the pressure in a car tyre is 190 kPa above the atmospheric pressure. After a long journey, the temperature of the air in the tyre rises to 29^{o}C. Calculate the pressure in the tyre. (4 marks)

……

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18. (a) A toy car on an inclined plane is under two forces as shown in **figure 9**.

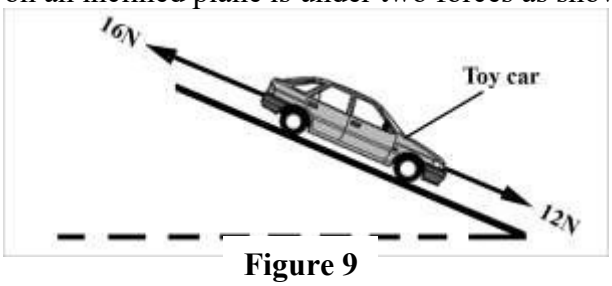


Figure 9

(i) Calculate the resultant force on the car. (2 marks)

……

……

(ii) State the effect of the resultant force on the car's motion. (1 mark)

……

……

(b) (i) Two identical containers **A** and **B** are carrying equal amounts of water and both are left in the sun for some time. A student then measures temperature of water in both containers. If **A** is plastic while **B** is metallic respectively, state and explain the observation in the thermometer readings. (2 marks)

……

……

……

……..

(ii) State the SI unit of heat **capacity**. (1 mark)

……

……

(c) A piece of copper of mass 170g is cooled in a freezer. It is then dropped into water 0ºC making 4.0g of water to freeze. Determine the temperature inside the freezer. (Take specific heat capacity of copper = 390J/(kgK), specific latent heat of fusion of ice = 3.36×10^5 J/kg (3 marks)

……

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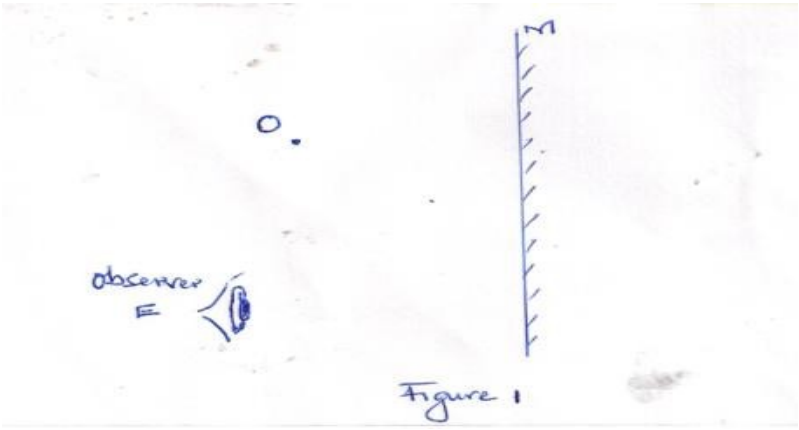
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PAPER 2

SECTION A(25MKS)
ANSWER ALL QUESTIONS IN THIS SECTION IN THE SPACES PROVIDED.

1. Figure 1 shows a point object O in front of a plane mirror M.

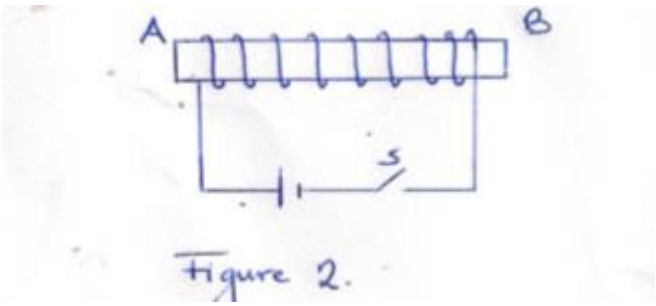


On the same diagram locate the position of the image as observed by the observer E. 3mks

2. A positively charged sphere is suspended by an insulating thread .A negatively charged conductor is suspended near it. The conductor is first attracted ,after touching the sphere it is repelled .Explain this observation. (2mks)

3. A current of 0.5 A flows through an electric circuit. Determine the quantity of change that passes a point in the circuit in 6 minutes.(2mks)

Figure 2 shows a wire wound on a magnetic material, and then connected to direct current source. Use to answer question 4 and 5.



4. Determine the polarity of A and B when the switch is closed.(1mk)

5. State two ways of increasing the strength of the magnet formed through the method in number 4.(2mks)

6. An object is placed in front of a concave mirror as shown in figure 3.

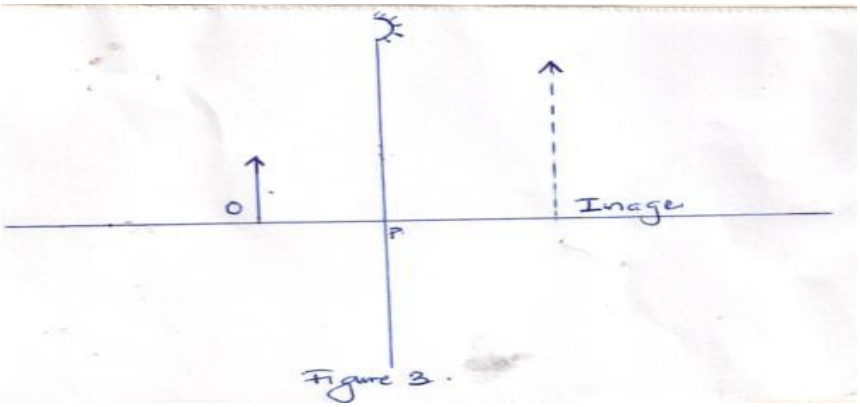


Figure 3.

The image of the object is formed as shown above. Locate the principal focus of the mirror and determine its focal length.(3mks)

7. Figure 4 shows a displacement time graph of a wave travelling at 200 cm/s.

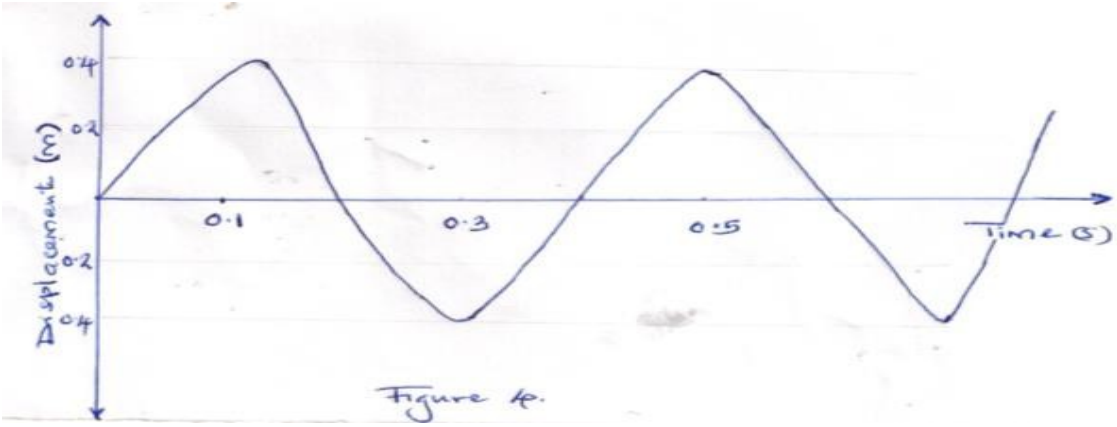


Figure 4.

Determine the wavelength of the wave.(3mks)

8. A solder standing between two cliffs fires a gun. He heard the first echo after 2.0 seconds and the next 5.0 seconds later. Determine the distance between the two cliffs.(Speed of sound in air is 320 m/s.(3mks)

9. An electric heater rated 1.5 kw, 240 v is used to heat water for 6 minutes. Determine the energy consumed by the heater in this time.(2mks)

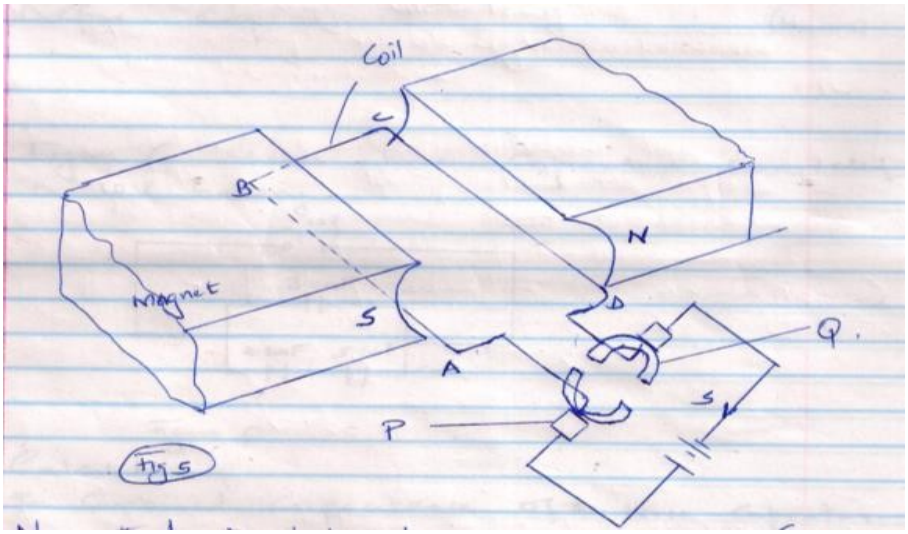
10. State two conditions necessary for two progressive waves moving in opposite direction to produce a stationary wave.(2mks)

11. Arrange the following radiations in order of decreasing wavelength.
Gamma rays, visible light, Radio waves, ultraviolet radiation.(1mk)

12. State one detector of Gamma rays.(1mk)

(SECTION B:55 MARKS)
Answer all questions in this section in the spaces provided.
13. (a) Sate what is meant by the term " electromagnet"(1mk)

(b) Figure 5 shows a simple electric motor.



i.
ii. Name the parts labeled
P-
Q-
iii. The switch s is closed ,indicate the direction of current in the coil and how the motor works.(4mks)

iv. State three ways in which the speed of the motor can be increased.(3mks)

14. (a) Define capacitance.(1mk)

(b) Figure 6 shows three capacitors connected to 10V battery .

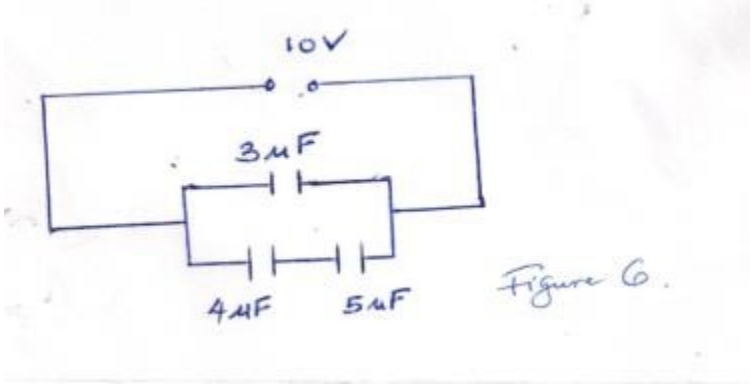


Figure 6.

Calculate

i. The combined capacitance of the three capacitors.(3mks)

ii. The change on the 5.0 μF capacitor.(3mks)

15. (a) State what is meant by " refractive index".(1mk)

(b) In an experiment to determine the refractive index of a liquid, a student measured the real and apparent depths of a coin in a beaker.
The results were as shown.

Real depth(cm)	5	10	15	20	25
Apparent depth (cm)	3.3	6.7	10	13.3	16.7

i. Plot the graph of real depth against apparent depth.(5mks)

ii. From the graph ,determine the refractive index of the liquid.(3mks)

(c)Figure 7 shows a ray of light incident on glass air interface.

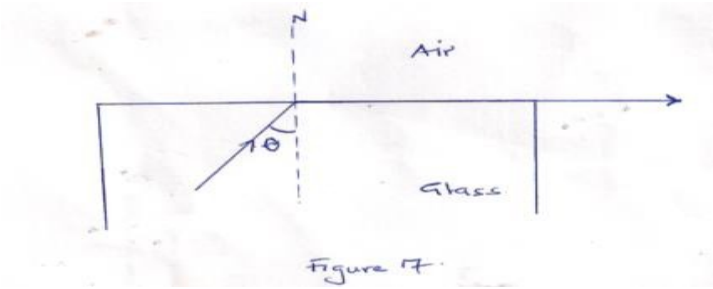
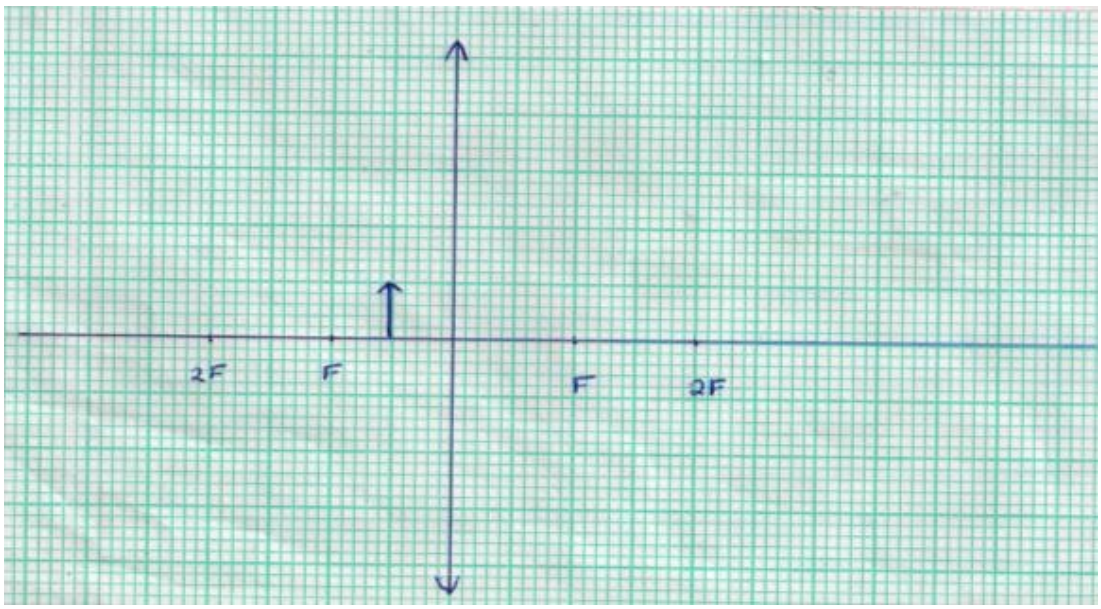


Figure 7.

Given that the refractive index of glass is 1.6, determine angle O.(3mks)

16. (a) Figure 8 shows an object in front of a convex lens of focal length 10cm.



i. On the same figure draw a ray diagram showing the location of image .(4mks)
Use the ray diagram drawn in (i) above to determine the
ii. Image distance (2mks)

iii. The magnification(2mks)

(b) A vertical object is placed 20cm in front of a convex lens of focal length 5cm.
i. Determine
I the image distance (3mks)

II the magnification (2mks)

ii.State two characteristics of the image (2mks)

17. (a) Figure 9 shows a cell in series with a 3 resistor and a switch .A high resistance voltmeter is connected across the cell.

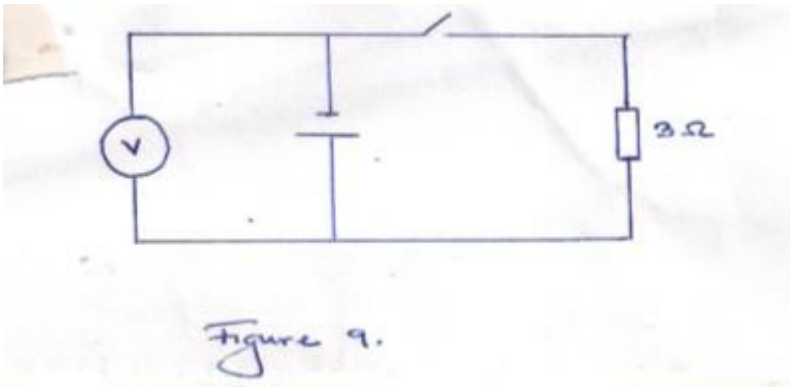


Figure 9.

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The voltmeter reads 1.5v with switch open and 1.2 v with the switch closed.(1mk)

i. State the e.m.f of the cell.(1mk)

ii. Determine the current through the 3 resistance of the cell.(2mks)

(b) Another resistor R is connected in series with the 3 resistor so that a current of 0.15 A flows when the switch is closed. Determine the resistance R.(3mks)

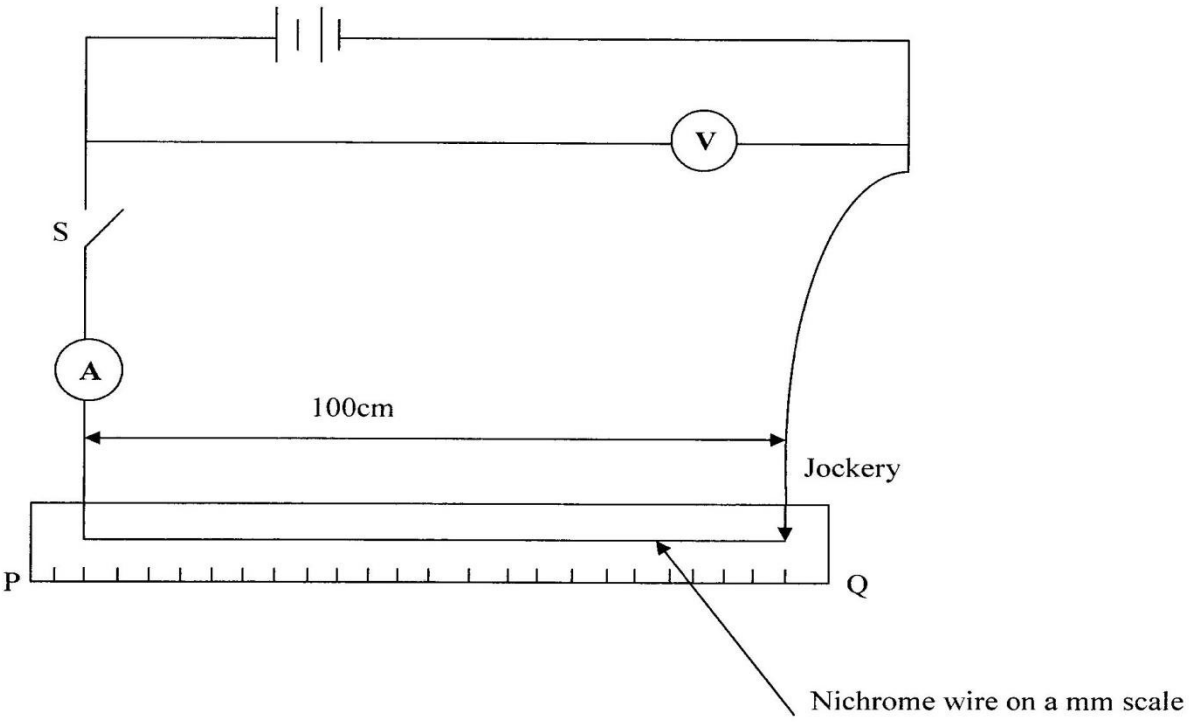
Question one.

You are provided with the following

- Two new dry cells (size D)
- A nichrome wire mounted on a mm scale labeled PQ
- Ammeter 0-1.0 or 0-2.5 A
- Cell holder(s)
- A switch
- A voltmeter 0-2.5A or 0-5.0V or 0-3.0V
- 8 connecting wires with at least 4 with crocodile chips.
- A jockey (a crocodile may be used)

Proceed as follows

a) Connect the circuit as shown in figure 1 below.



b) (i)With the switch open, measure the e.m.f, E of the cells.

E= _____V (1mk)

(ii) With PQ-100, close the switch and record the ammeter and voltmeter reading.

Ammeter reading, I= _____A (1mk)

Voltmeter reading, V= _____V (1mk)

(iii) Move the jockery towards P, such that PQ=80cm and record the voltmeter and ammeter reading. Repeat with values of PQ=60cm, 50cm, 40cm, 30cm, and 20cm.

Enter the results in Table 1

Table 1

Lenth PQ (cm)	100	80	60	50	40	30	20
Ammeter reading, I (A)							
Voltmeter reading, V (V)							
(E-V)							

Complete the table (6mks)

b) (i) Plot a graph of (E-V) (y-axis) against I. (5mks)

Graph paper

(ii) Determine the slope of the graph. (3mks)

(iii) Given that the graph is governed by the equation, E=V+Ir, determine the internal resistance of the cells. (3mks)

Question two

This question consists of two parts A and B.

Part A

You are provided with the following.

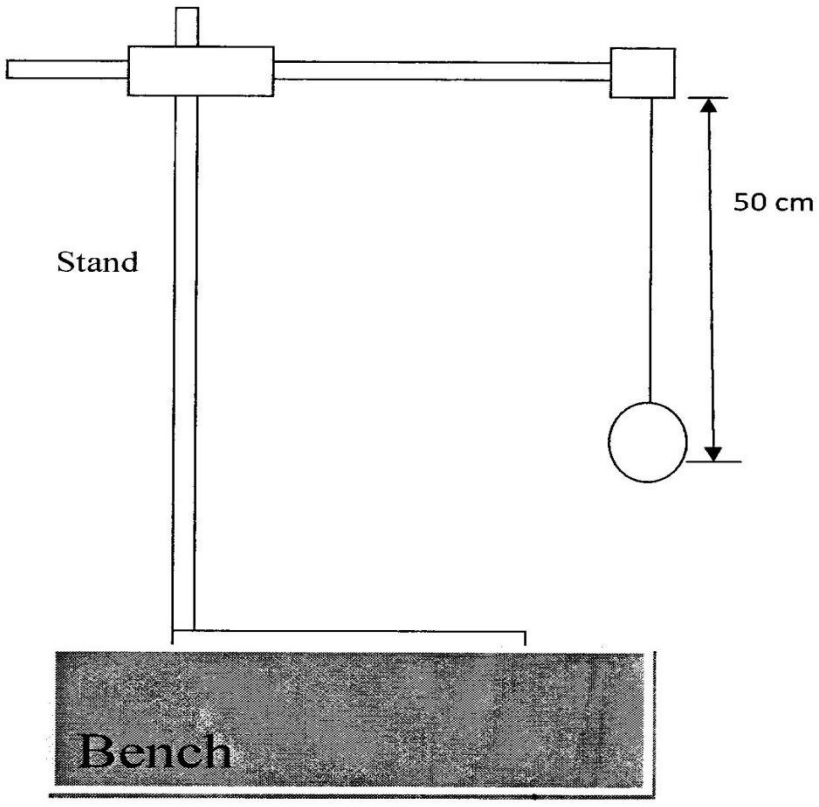
- A stop watch
- A 70 cm long piece of thread.
- A retort stand, clamp and boss
- Two small pieces of wood (wooden claps)
- A metal bob

Proceed as follows.

a) Using the thread provided, tie the marble to be used as the pendulum.

Clamp the thread so that the length of the pendulum to the center of the marble is 50cm.

See figure 2.



(i) Displace the marble slightly (Amplitude less than 10^0) so that it swings in a vertical plane. Record time, t. for 20 oscillations.

T= _____S (1mk)

(ii) Find T, the time for one oscillation. (1mk)

b) Given that the following relation is obeyed.

$T = 2\pi\sqrt{\frac{l}{g}}$ where l is the length of the pendulum.

Determine the value of g. (3mks)

Part B

You are provided with the following,

- A wooden half meter rule.
- 10cm long cotton thread.
- Masses of 10g and 20g.
- Knife edge- approximately 20cm high.

Proceed as follows.

a) Balance the half meter rule on the knife edge when there is no mass suspended. The knife edge is at the centre of gravity (c.o.g)
Record this position.

Position of c.o.g = _____cm (1mk)

b) Arrange the apparatus as shown in figure 3.

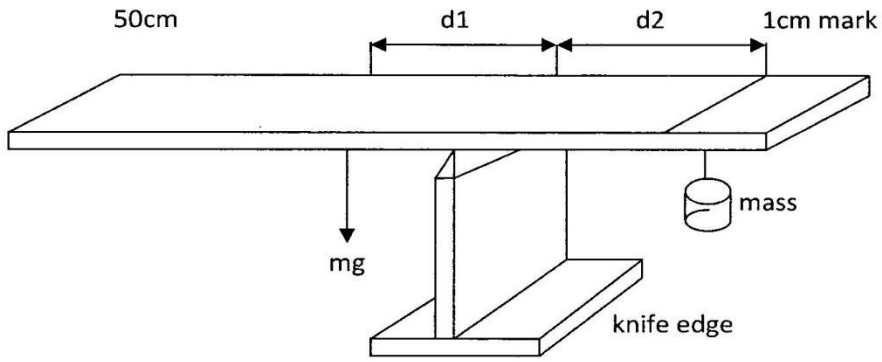


figure 3

Hang a mass of 10g at 1cm mark. Adjust the knife edge until the half meter rule balances again at a new mark. (figure 3). Record the length d1 and the corresponding distance d2 when the system is in balance.

Repeat the procedure for different masses shown on table 2.

Table 2

Mass, m (g)	10	20	30	40	50	60
Distance d1 (cm)						
Distance, d2 (cm)						
m×d2						

Complete the table 2 above.

i. Plat a graph of md2 (y-axis) against d2 (5mks)

Graph paper

ii. Determine the slopes of the graphs. What does it represent? (2mks)

SERIES 20
PAPER 1

SECTION A (25 MARKS)

1. Figure 1, shows a Vernier caliper of zero error 0.02 cm being used for measuring the diameter of a cylindrical container of height 10 cm. The scale reading of the Vernier is as shown alongside.

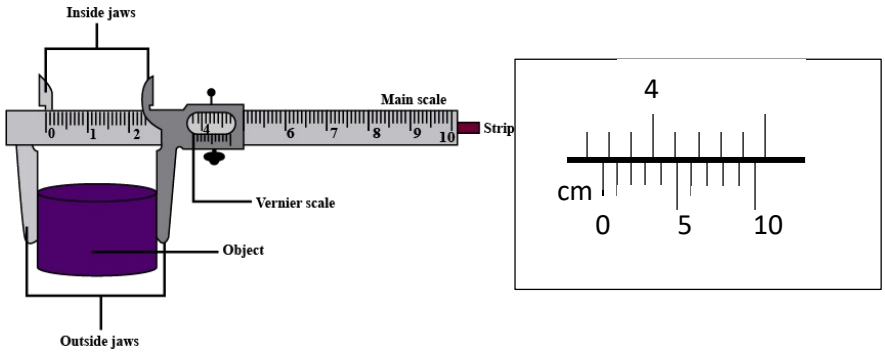


Figure 1

a. Determine the diameter of the container (2 marks)
b. Estimate the volume of a liquid which can completely fill the container (2 marks)

2. State **one** factor that affects the turning effect of a force on a body. (1 mark)

3. **Figure 2** shows some air trapped by mercury in a glass tube. The tube is inverted in a dish containing mercury.

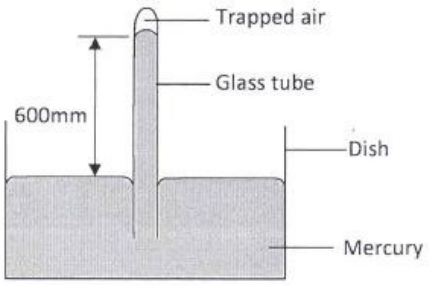


Figure 2

Given that the atmospheric pressure is 760 mmHg and the height of mercury column in the tube is 600 mm, determine the pressure of the air trapped in the tube in mmHg. (2 marks)

4. Figure 3 shows drops of mercury and water on a glass surface, Explain the difference in the shapes of the drops. (2marks)

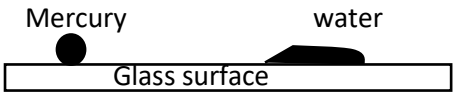


Figure 3

5. A ball is thrown from the top of a cliff 20m high with a horizontal velocity of $10ms^{-1}$. Calculate the distance from the foot of the cliff to where the ball strikes the ground. (3 marks)

6. Explain one advantage of mercury over alcohol as a thermometric liquid. (1mark)

7. A body of mass **M** is allowed to slide down an inclined plane. State **two** factors that affect its final velocity at the bottom of the inclined plane. (2marks)

8. A stopwatch reads 08:10:84 and 09:10: 90 before and after an experiment respectively. Determine the duration of the event in SI units. (2marks)

9. Explain the meaning of thermodynamics as a branch of physics. (1 mark

10.
   a. State the Hooke's Law. (1mark)
   b. **Figure 4** shows identical spiral springs supporting a load of 90N. Each spring has a spring constant k = 200N/m

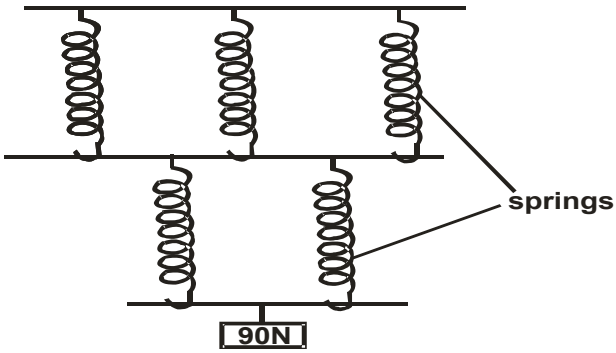


Figure 4

Determine the total extension of the system (take the weight of the cross bars and springs to be negligible) (2 marks)

11. **Figure 5** shows a rectangular loop with a thin thread loosely tied and dipped into a soap solution.

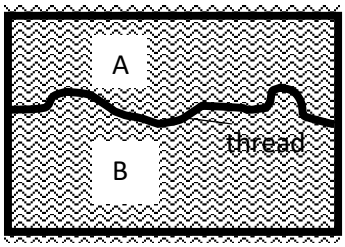


Figure 5

Draw on the space provided what is observed when point **A** is punctured. (1mark)

12. Two horizontal strings are attached to a block, resting on a frictionless surface, as shown in figure 6.

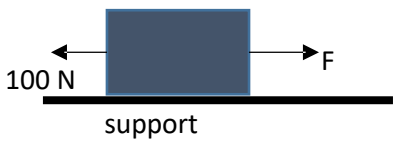


Figure 6

A force of 100N pulls on one string. The block does not move. Find the value of the force, F on the other string. (1 mark)

13. A wooden bench feels neither warm nor cold when touched by your bare hands. Explain this observation. (2 marks)

SECTION B (55 MARKS)

14.

a) Explain why bodies in circular motion undergo acceleration even when their speed is constant. (1mark)

b) A particle moving along a circular path of radius 5cm describes an arc of length 2cm every second. Determine:

i. Its angular velocity. (1mark)

ii. Its periodic time. (2marks)

c) A stone of mass 150g is tied to the end of a string 80cm long and whirled in a vertical circle at 2rev/s. Determine the maximum tension in the string. (3marks)

d) State **one** factor affecting centripetal force (1mark)

e) State the principle of conservation of linear momentum (1 mark)

f) A bullet of mass 60g is fired horizontally with a velocity of 200 m/s into a suspended stationary wooden block of mass 2940g. Determine:

i. Common velocity of both the bullet and the block, if the bullet embedded into the block. (2 marks)

ii. Height to which the block rises. (2 marks)

15.

a) State two factors that affect the boiling point of a liquid (2 marks)

b) 100g of a liquid at a temperature of 10^0 C is poured into a well lagged calorimeter. An electric heater rated 50W is used to heat the liquid. The graph in figure 7 shows the variation of the temperature of the liquid with time.

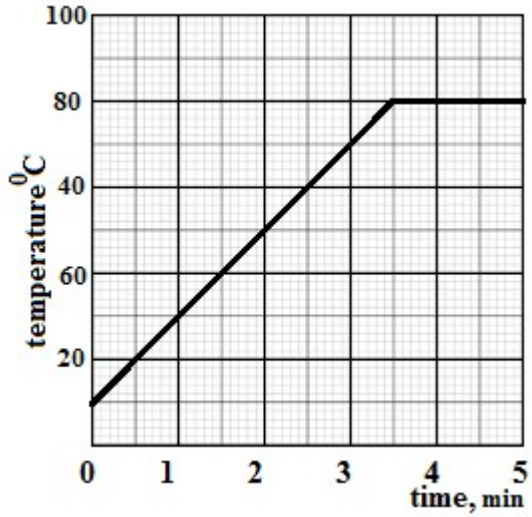


Figure 7

(i) From the graph, determine the boiling point of the liquid (1 mark)

80^0C ;

(ii) Determine the heat given out the by the heater between the times t = 0.5 minutes and t = 5.0 minutes (3 marks)

c) From the graph determine the temperature change between the times t = 0.5 minutes and t = 5.0 minutes, hence determine the specific heat capacity of the liquid (3 marks)

d) 1.8 g of vapor was collected from above the liquid between the times t= 3.5 minutes and t= 4.5 minutes. Determine the specific latent heat of vaporization of the liquid (4 marks)

16.

a) State the law of floatation (1 mark)

b) Figure 8 below shows a simple hydrometer

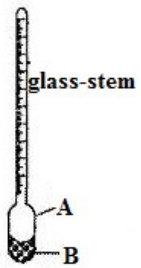


Figure 8

i. Identify the parts labelled A and B (2 marks)

ii. State the purpose of the part labelled B (1 mark)

c) How would the hydrometer be made more sensitive? (1 mark)

d) Describe how the hydrometer is calibrated to measure relative density (3 marks)

e) Figure 9 shows a cork floating on water and held to the bottom of the beaker by a thin thread.

i. Name the forces acting on the cork (3 marks)

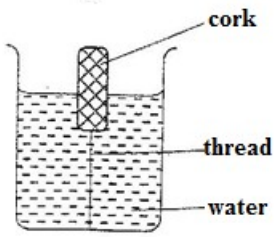


Figure 9

ii. Describe how each of the forces mentioned in (i) above changes when water is added until the container is completely filled (3 marks)

17.

a) Figure 10 shows a graph of pressure against volume for a fixed mass of a gas at constant temperature.

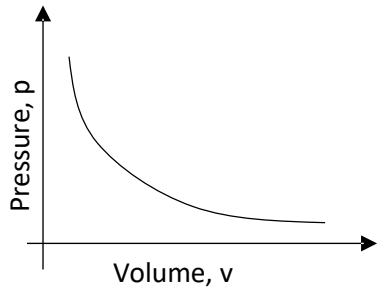


Figure 10

In the space provided, sketch a graph of pressure, p against $\frac{1}{v}$ (1 mark)

b) Explain the pressure law using the kinetic theory of matter (3 marks)

c) $20cm^3$ of a gas exerts a pressure of 760mmHg at 25^0C. Determine the temperature of the gas when the pressure increases to 900mmHg and the volume decreases to 15 cm^3. (3 marks)

18.

a) Define the term velocity ratio of a machine (1 mark)

b) The figure 11, below shows part of the hydraulic lift system. State any property of the liquid under which the hydraulic system works (1 mark)

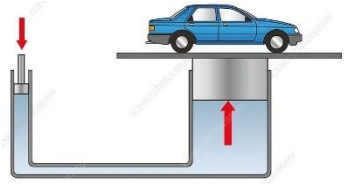


Figure 11

c) The hydraulic lift machine above has velocity ratio 45 and it overcomes a load of 4500 N when an effort of 135 N is applied. Determine:

i. The mechanical advantage of the machine (2 marks)

ii. Efficiency of the machine (3 marks)

iii. The percentage of work that goes to waste (1 mark)

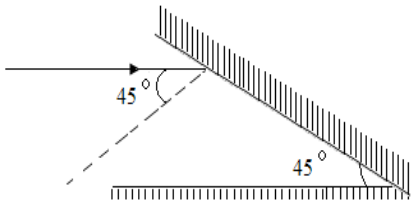
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PAPER 2

SECTION A 25 MARKS

Answer all the questions in the spaces provided.

1. The figure below shows a ray of light incident on a mirror at an angle of 45°. Another mirror is placed at an angle of 45° to the first one as shown. Sketch the path of the ray until it emerges. (2 marks)



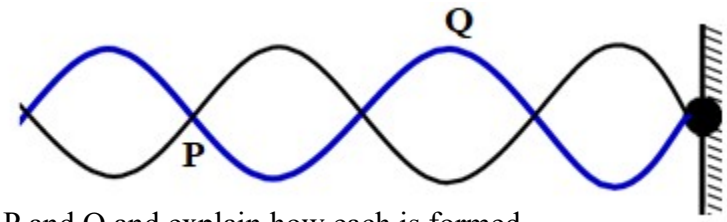
2. State any two ways of reducing the magnetic force of attraction of a magnet (2 marks)

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3. The figure below shows a transverse stationary wave along a string.



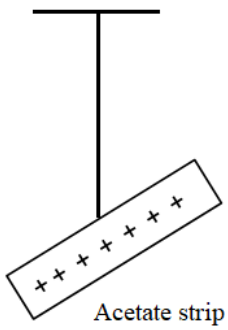
Name P and Q and explain how each is formed. (3 marks)

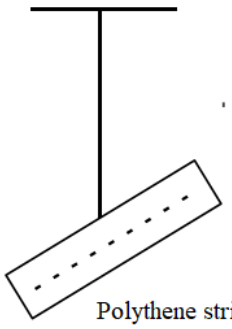
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4. The diagrams below show a positively charged acetate strip and a negatively charged polythene strip freely suspended and isolated.



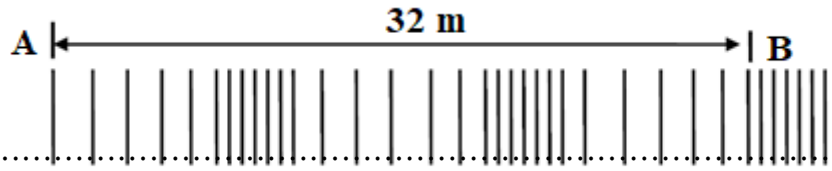


Two rods X and Y are brought up in turn to these strips. X attracts the acetate strip but repels the polythene strip. Rod Y does not repel either the acetate or the polythene. State the type of charge on each rod.

X ..... (1 mark)

Y ..... (1 mark)

5. The diagram below shows waves generated from a tuning fork. If the wave takes 0.1 second to move from point A to B. determine the frequency of the wave. (4 marks)



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6. Name two detectors of microwave (2 marks)

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7. Other than current state two other factors that affect the magnitude of force on a current carrying conductor placed in a magnetic field. (2 marks)

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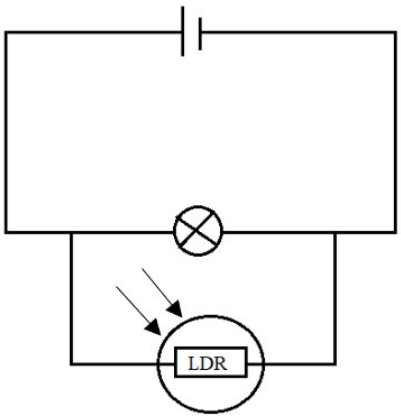
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8. Give a reason why a concave mirror is not preferred as a driving mirror. (1 mark)

……

……

9. A student connected the set up below in the laboratory. Explain the observation made on the bulb when the set-up below is taken to a dark room (2 marks)



……

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10. A person standing 110 m from the foot of a cliff claps his hands and hears a sound 0.75 seconds later. Find the speed of sound in air. (3 marks)

11. The figure below is part of electromagnetic spectrum.

A		Visible light	UV	

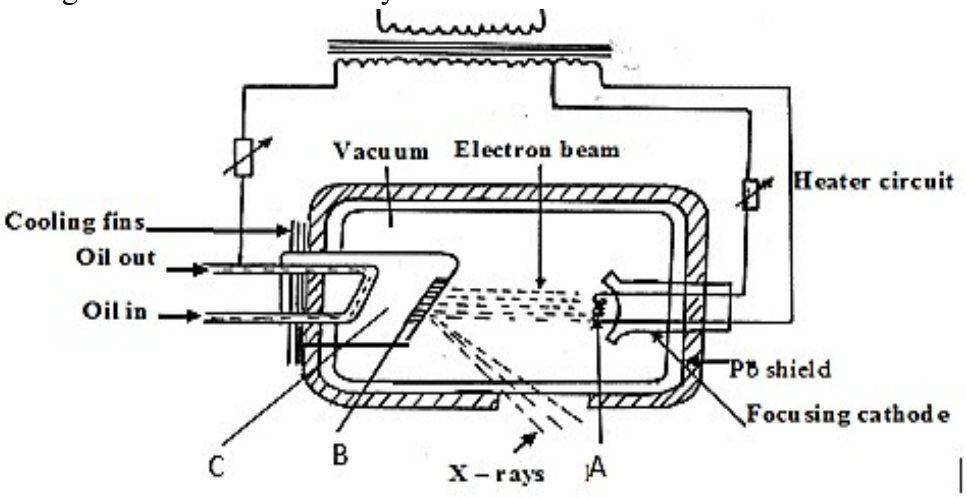
Identify radiation A and state its source. (2 marks)

……

SECTION B 55 MARKS

Answer all the questions in this section in the spaces provided.

12. (a) The figure below shows a X-ray tube.



(i) Name the part labelled C (1 mark)

……

(ii) State the property of the material labelled B on the diagram which makes it suitable for use in the X-ray tube. (1 marks)

……

……

(iii) Why is C inclined at an angle of 45°? (1 mark)

……

……

(iv) State the adjustment that can be made to vary

I. The quality of X-rays (1 mark)

……

……

II. The quantity of the X-rays. (1 mark)

……

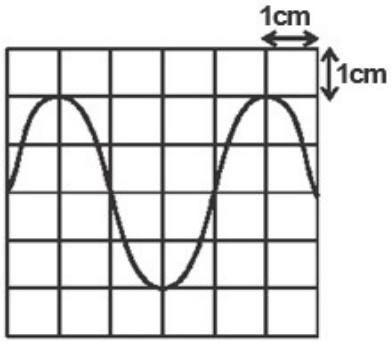
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(v) An x-ray tube has an accelerating potential of 100KV. Determine the maximum frequency of the x-rays produced.
(Plank's constant = 6.63×10^{-34} Js, e = 1.6×10^{-19}C) (3 marks)

……

……

(b) In a CRO, waveform given below was displayed on the screen when the sensitivity at the Y plate was10V/cm and time base set at 20 milliseconds/cm.



Determine:

(i) peak voltage (2 marks)

……

……

(ii) frequency of the signal (2 marks)

……

……

13. a) $88226\ Ra$ decays into $86222\ Rn$ by emission of an alpha particle. Write a nuclear equation for the decay (1 marks)

b) i)What do you understand by the term half-life of a radioactive substance? (1 mark)

……

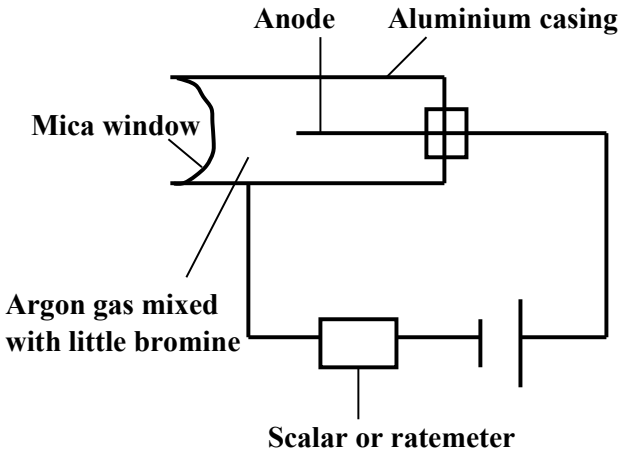
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ii)A G.M tube registers 20 counts. When a radioactive source is brought close to it, it registers 3220 counts and 120 counts 30 hours later. What is the half-life of this substance? (3 marks)

……

……

c) The figure below shows a G.M tube.



i) What is the purpose of the mica window? (1 mark)

……

……

……

ii) Explain the purpose of the bromine (2 mark)

……

……

iii) Why should argon gas be kept at low pressure (1 mark)

……

iv) What is meant by the term "*dead time*" as used in GM tube (1 mark)

……

……

v) Briefly explain how GM tube works. (2 marks)

……

14. (a) State the Ohm's Law (1 mark)

……

(b) You are provided a rheostat, 2 cells, a voltmeter, an ammeter, a switch and a fixed resistor.

i) Draw a circuit diagram that can be used to verify Ohm's law. (2 marks)

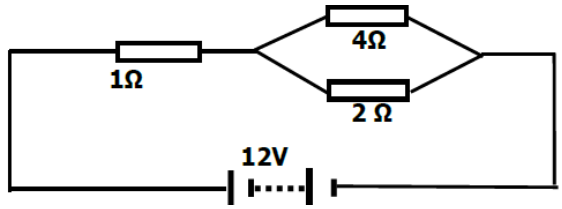
ii) Describe how the above set up can be used to determine Ohms law. (4 marks)

……

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(b) Study the circuit diagram below and answer the questions that follow.



Calculate

(i) Determine the total resistance in the circuit. (2 marks)

……

(ii) The current through the 4Ω resistor (3 marks)

……

……

……

15. a) State Snell's law (1 mark)

……

……

b) A ray of light travelling from water to glass makes an angle of incident of 30^0. Find the angle of refraction in the glass. Refractive index of water $= \frac{4}{3}$. Refractive index of glass $= \frac{3}{2}$ (3 marks)

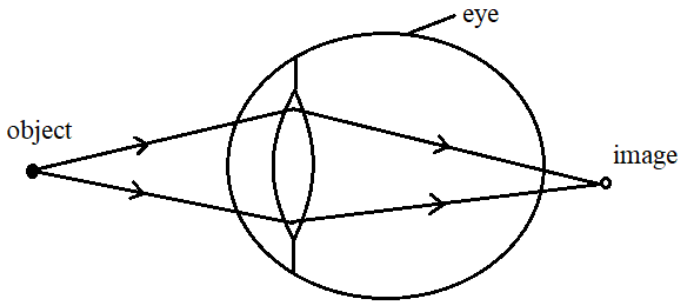
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c) State the necessary and sufficient conditions for total internal reflection to occur. (2 marks)

……

d) The figure below shows a human eye defect.



(i) State one possible cause of this defect. (1 mark)

……

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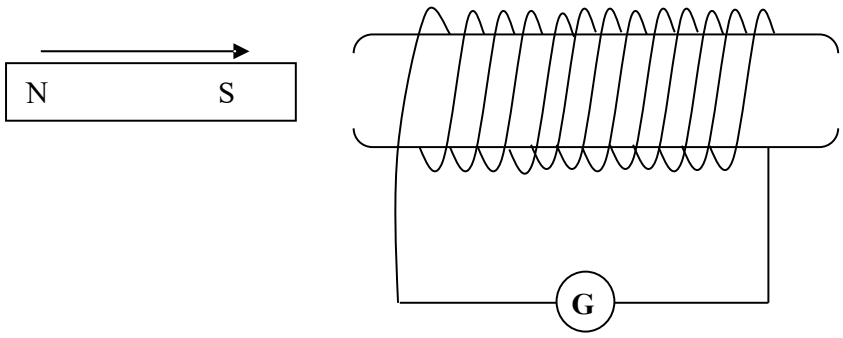
(ii) On the diagram, show how the defect is corrected. (2 mark)

16. (a) State the Lenz's law of electromagnetic induction. (1 mark)

……

……

(b) A bar magnet is moved into a coil of an insulated copper wire connected to a zero centre galvanometer as shown below



(i) Show on the figure above the direction of the induced current in the coil (1 mark)

(ii) State and explain what is observed on the galvanometer when the south pole of the magnet is moved into and then withdrawn from the coil. (2 marks)

……

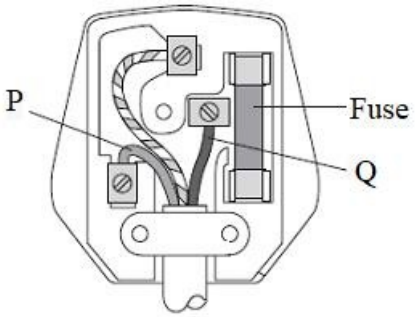
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(c) A transformer has 800 turns in the primary and 40 turns in the secondary winding. The alternating voltage connected to the primary is 240V and current of 0.5.A. If 10% of the power is dissipated as heat within the transformer, determine the current in the secondary coil. (3 marks)

……

……

(d) The diagram below shows a three-pin plug.



(i) Name the colour of conductors P and Q (2 marks)

P……

Q……

(ii) Why is the earth pin longer than the rest in the three-pin plug shown above? (1 mark)

……

……

……

……

……

PAPER 3

QUESTION 1

This question consists of part A and B.

Attempt both parts.

PART A

You are provided with the following:

- *A bare copper wire of diameter 0.71 mm (SWG 22) and length 50cm.*
- *A retort stand, boss and clamp*
- *An optical pin mounted on a cork*
- *A stop watch*
- *Wire cutters /pliers(to be shared)*
- *A metre rule or half metre rule*

Proceed as follows:

(a) Clamp the cork so that optical pin is horizontal. Hang the copper wire from the pin by the loop as shown in figure 1. Ensure the wire is straight and the length X between the lower tip and the optical pin is 32 cm. if the length exceeds 32 cm reduce by cutting at the lower tip using the wire cutters provided.

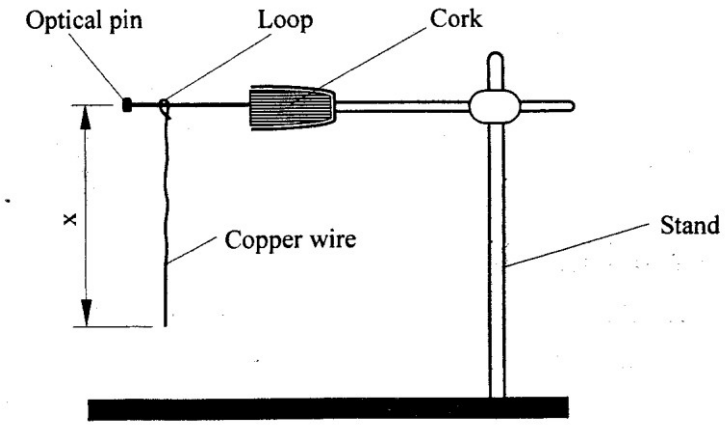


Figure 1

(b) Displace the lower tip of the wire slightly in a plane perpendicular to the optical pin and then release it. Measure the time t=10 oscillations of the wire and record the value in table 1.

(c) Repeat the procedure in (b) above for other values of X shown in the table. (*Note that each length X is obtained by cutting off an appropriate length from the lower tip of the wire. For example to get X= 28 cm cut off 4 cm from the lower end).* Complete the table.

(5 Marks)

Table 1

Length X cm	32	28	24	20	16	12

Time t for 10 oscillations (s)						
Period T=$\frac{t}{10}$ (s)						
T^2 (S^2)						

(d) Plot a graph of T^2 (y-axis) against X (metres) on the graph paper provided. (5 marks)

(e) i) Determine the slope, S, of the graph. (3 marks)

ii) Obtain the value of K in the equation S= $\frac{8\pi}{3k}$ (2marks)

PART B

You are provided with the following:

- *A cylindrical container (about 20cm high and diameter 8cm or more)- used plastic containers can be used by cutting the upper section*
- *Some water*
- *A stop watch*
- *A metre rule or half-metre rule*
- *A boiling tube*
- *Some sand (in 100ml beaker)*
- *Spatula*
- *A rubber band*

Proceed as follows:

(f) Tie the rubber band round the boiling tube so that it is at a distance L =12 cm from the bottom of the tube (see fig 2a). Pour water into the cylindrical container until the level is about 2.0 cm from the top of the beaker. Float the boiling tube in the water in the container. Add sand gradually into the boiling tube until the tube sinks to the 12 cm mark. See figure 2(b).

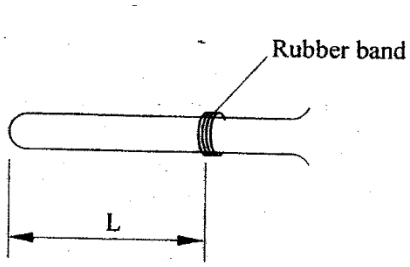


Figure 2(a)

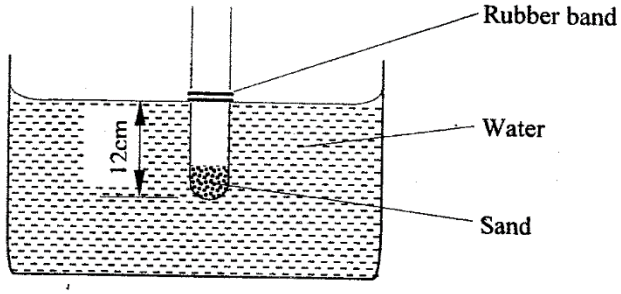


Figure 2(b)

(g) Depress the boiling tube slightly and release so that it oscillates vertically without touching the sides of the container. Measure and record in table 2 the time t_1, for **five** oscillations of the boiling tube. Repeat the procedure two more times to obtain t_2 and t_3 and record the values in table 2. Complete the table. (3 marks)

Table 2

t_1((s)	t_2(s)	t_3(s)	Average t(s) $t=\left(\frac{t_1+t_2+t_3}{3}\right)$	$T=\frac{t}{5}$(s)

(h) Evaluate $P=\frac{40L}{T^2}$ given that L is the length of the tube in metres up to the rubber band in part (f) and T is the value obtained in (g) above. (2 marks)

P=

QUESTION TWO

You are provided with the following.

- *A 250 cm^3 beaker*
- *Water*
- *a metre rule*
- *Screen*
- *Candle*

i) Add 200cm^3 of water to the vessel and obtain 'h' the height in centimetres of the water above the base of the vessel. Determine the appropriate value of R, the internal radius in centimetres from the formulae;

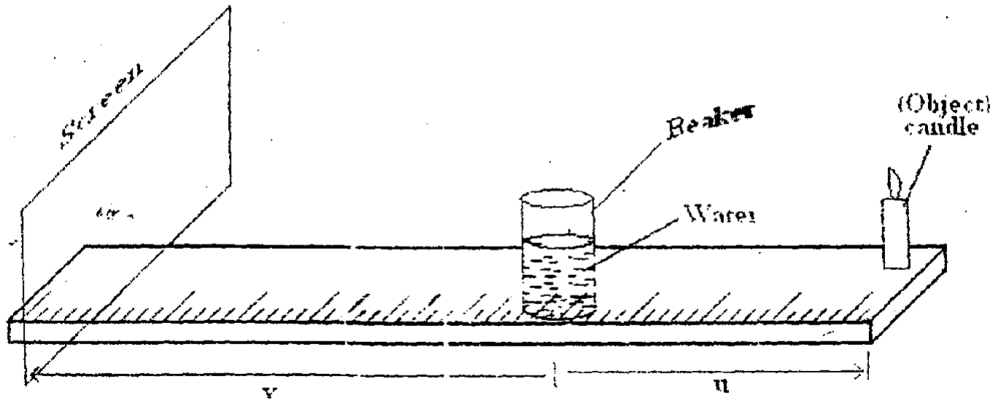
h= _____ cm (1 Marks)

$$R=\sqrt{\frac{100}{h}}$$

R=_____cm (1 Marks)

This experiment uses a cylindrical vessel, filled with water as a lens and compare its radius with the effective focal length.

ii) Set the apparatus as shown in diagram below:



Set u to be about 10R away from the Centre of the 'lens' and adjust the position of the screen to locate the image formed. The image is a sharp vertical line. Measure u and v from the Centre of the vessel. Repeat the experiment with the follow multiples of R. and record all values of u and V in the table below:

(8 marks)

	10R	9R	8R	7R	6R	5R	4R	3R
U (cm)								
V (cm)								

NB: Any other appropriate value of u depending on the value of R obtained can be awarded.

iii) Plot a graph of u (cm) against v (cm). (5 marks)

iv) From the graph determine

a) 'V' the value of V for which v=u (1 Mark)

b) 'U' the value of U for which u=2v (1 Mark)

v) **Determine** the effective focal length of the 'lens' from the formulae f=$\frac{\square' u' + 'v'}{5}$ (2 Marks)

vi) Hence determine the value of $\frac{R}{f}$ (1 Mark)

SERIES 21

PAPER 1

SECTION A: (25 MARKS)
Answer ALL the questions in this section in the spaces provided

1. Figure 1(a) represents a Voltmeter before being connected across a battery while figure 1(b) represents the same Voltmeter after being connected across a battery. Determine the voltage of the battery. (1mk)

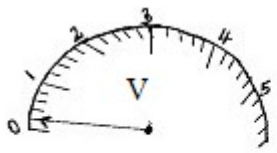
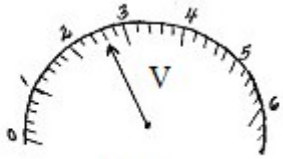


Fig.1(a)



1(b)

2. State the principle of conservation of energy. (1mk)

3. Figure 2 represents a garden sprinkler.

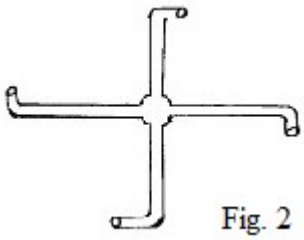


Fig. 2

On the same figure indicate the direction of rotation of the sprinkler when water is ejected through the nozzles at a high velocity (1mk)

4. Figure 3 shows a uniform cuboid block of mass 600g on which a weightless 50cm long wooden plank is fixed.

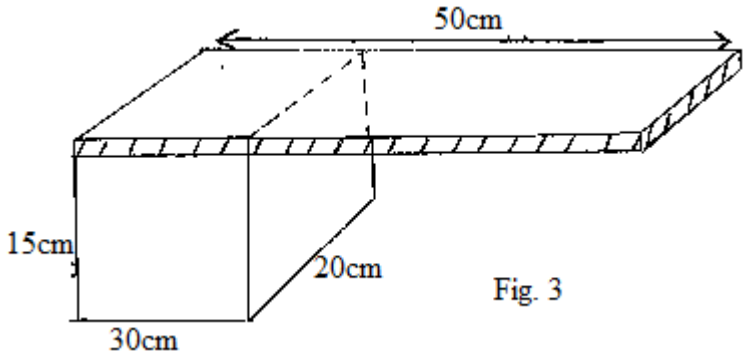


Fig. 3

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If the cuboid block is of dimensions 30cm x 20 cm x 15 cm, find the minimum force F applied at the end of the plank as shown, to tilt the cuboid block. (3mks)

5. Use the kinetic theory to explain thermal expansion of solids. (3mks)

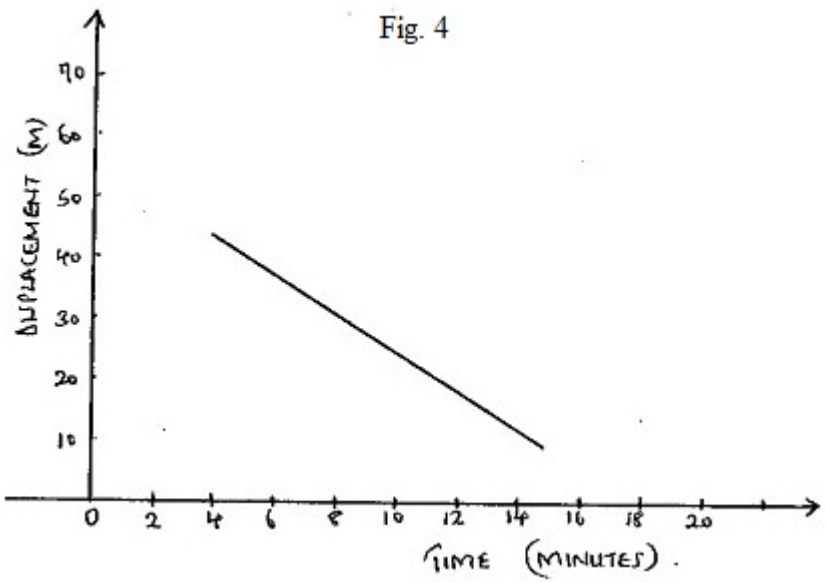
6. Apart from the angle of banking and the radius of the curve, name one other factor that affects the critical velocity of a vehicle negotiating a bend. (1mk)

7. A body weighs 1960N on the surface of the earth. The same body weighs 1470N on the surface of another planet. Determine the acceleration due to gravity on the surface of the planet. Take acceleration due to gravity on the surface of earth, g =10N/Kg. (3mks)

8. Explain why metals are better thermal conductors than non-metals. (1mk)

9. The graph in figure 4 represents part of a displacement – time graph of a motion described by a body moving at constant velocity.

Fig. 4



(a) Use the graph to determine the initial displacement of the body. (1mk)

(b) Describe the motion of the body (2mks)

10. The atmospheric pressure at the foot of Mt. Longonot is 760mm of mercury while at the peak of the mountain, the atmospheric pressure is 580mm of mercury. Given that the density of mercury is 13600Kg/m^3, calculate the height of the mountain (density of air = 1.3 Kg/m^3)(3mks)

11. Figure 5 shows a bimetallic strip.

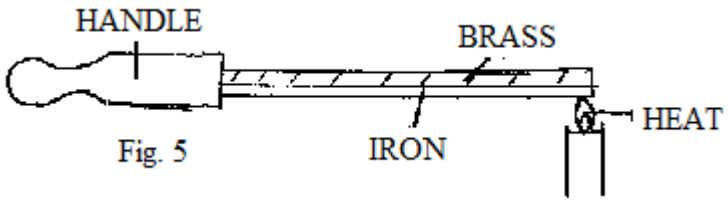


Fig. 5

Draw the final shape of the bimetallic strip when heated at its tip as shown. (1mk)

12. Figures 6 (i) and 6(ii) show two identical pulleys A and B supporting equal loads.

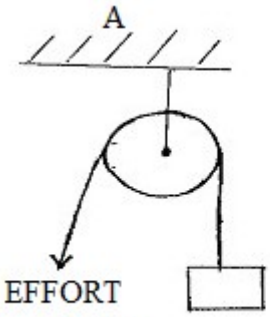


Fig. 6(i)

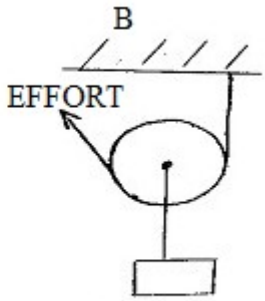


Fig. 6(ii)

State with reason(s) which of the two pulleys is easier to operate (3mks)

13. State one assumption made when estimating the size of an oil molecule using the oil-patch experiment. (1mk)

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SECTION B: (55 MARKS)
Answer ALL questions in this section in the spaces provided.

14. (a) State Charles' Law of gases (1mk)

(b) You are provided with a capillary tube sealed at one end containing concentrated Sulphuric acid index, a thermometer, a rule, a stirrer, source of heat, retort stand, rubber band and a water bath.

(i) Using a well labeled diagram briefly describe an experiment you can perform using the apparatus to verify Charles Law. (6mks)

(ii) Explain the other use of concentrated Sulphuric acid other than a pointer and trap of air. (1mk)

(c) The volume of a gas at 70°C is 6 x 10^{-3} m^3. The gas is cooled at constant pressure until its volume is 0.0014m^3. Find the final temperatures of the gas. (3mks)

15(a) State Hooke's law. (1mk)

(b) Define the term spring constant. (1mk)

(c)(i) State two factors that determine spring constant. (2mks)

(ii) The graph in figure 7 shows the relationship between force and extension of a given spring.

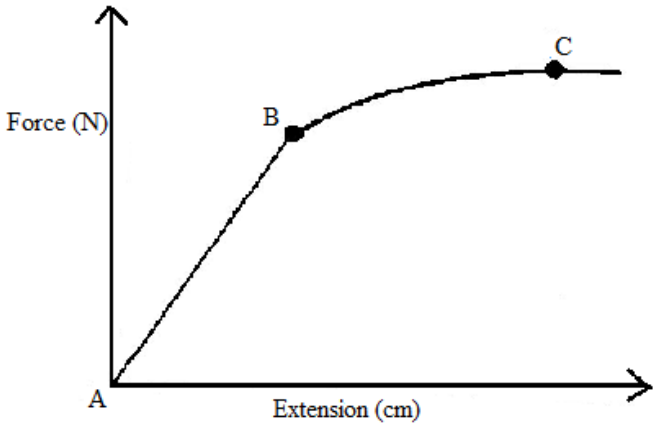


Fig. 7

Explain the shape of the graph between the points:

(I) AB (1mk)

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(II). BC (1mk)

(iii) State the significance of the gradient of the graph between the points A and B. (1mk)

(d) The pointer of a spring reads 32cm when there is no load. When loaded with 120g, the pointer reads 38cm, when a pan containing 210g mass is loaded onto the spring, the pointer reads 48cm. Determine the mass of the pan. (4mks)

16 (i) State Bernoulli's principle of fluids (2mks)

(ii) Figure 8 below shows cross – sections of two submerged bodies A and B inside water in a swimming pool. The bodies were then fast pulled in the direction shown by the arrows.

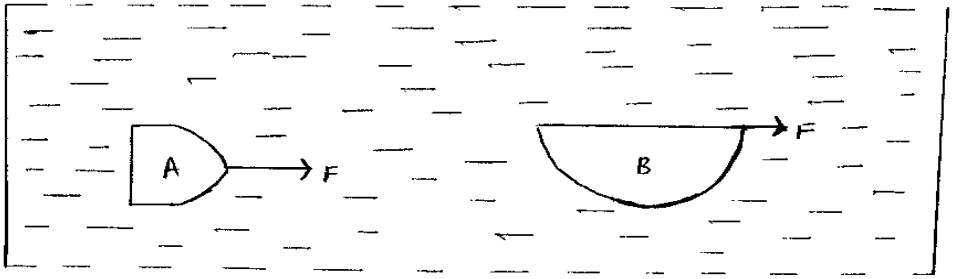


Fig. 8

Use the figure to answer the questions below.

(a) State with a reason which body is easier to pull if they have equal volume and density.(2mks)

(b) On the same diagram show the path followed by each body. (2mks)

(iii)Water flows steadily in a pipe as shown in figure 9 below. The diameters at A and B are given.

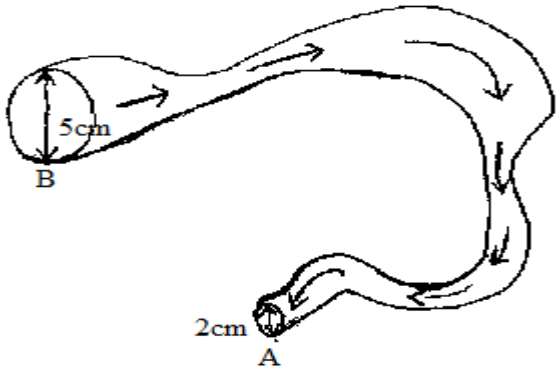


Fig. 9

If the volume flux at A is 45cm^3 /s, find the speed of the water at B. (3mks)

17. (a) State Archimedes' principle (1mk)

(b) Figure 10 shows a solid cylinder floating between two liquids A and B of densities 0.8g/cm^3 and 1.2g/cm^3 respectively. Half of its volume sinks in liquid B as shown. The cylinder has a diameter of 7cm and a length of 12cm. Use it to answer questions that follows.

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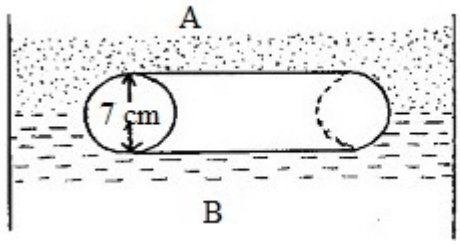


Fig. 10

Find; (i) The volume of the liquid B displaced (2mks)

(ii) Upthrust on the cylinder due to liquid B (3mks)

(iii) Upthrust on the cylinder due to liquid A (3mks)

(iv) The mass of the cylinder (3mks)

18 (a) i) Define latent heat of fusion of a substance (1mk)

(ii) 83.6 kilojoules of heat was lost in cooling an amount of water at 15^0C to ice at -10^0C. Find mass of the water cooled. *(Take specific heat capacity of water 4.2 x 10^{-3} $JKg^{-1}K^{-1}$, specific heat capacity of ice = 2.1 x 10^2 $JKg^{-1}K^{-1}$, Latent heat of fusion of water = 3.3 x 10^5 JKg^{-1})* (5mks)

Figure 11 shows a Six's maximum and minimum thermometer in a room. Use it to answer questions that follow.

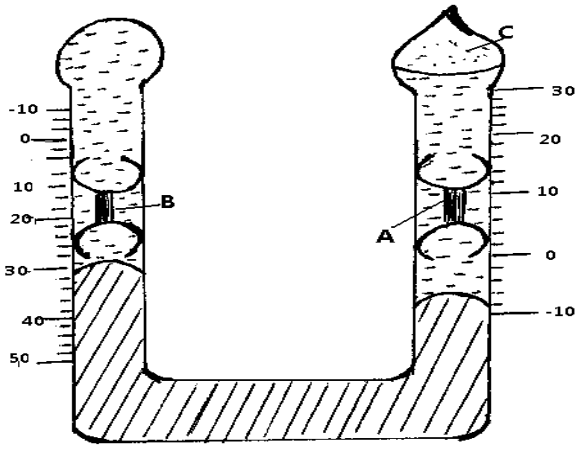


Fig. 11

(i) State the function of part marked A. (1mk)

(ii) State and explain the function of part C. (2mks)

(iii) Explain what is observed in the thermometer if it is placed in a colder refrigerator. (2mks)

(iv) State the type of material suitable for part B. (1mk)

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PAPER 2

SECTION A (25 MARKS)

Answer ALL the question in this section in the spaces provided

1. State the condition under which the p.d across the terminals of a cell is equal to its e.m.f.

(1 mark)

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2. Explain why radio wave signals are easier to receive than TV waves signals in a place surrounded by hills. (2 marks)

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3. Kiss FM is broadcasting at a frequency of 70MHz. What is the wavelength of the waves, if the speed of the waves is 3.0 x 10^8 m/s? (2 marks)

……

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4. How can it be shown that the strength of a magnet is concentrated at the poles? (1 mark)

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5. **Figure 1** shows a fuse.



Figure 1

MARANDA HIGH SCHOOL PRE-MOCK EXAMINATIONS 2024

a) Explain how the fuse works in an electric circuit. (2 marks)

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b) What modification can be made on the above fuse so that it can be used in a circuit supplying a higher current? (1 mark)

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6. State the Snell's law of refraction. (1 mark)

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7. Give **two** reasons why soft iron is used as a core of the coil in an electric bell. (2 marks)

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8. A real object of height 1cm placed 50mm from a concave mirror forms a virtual image 100mm from the mirror. Determine the focal length of the mirror. (3 marks)

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9. **Figure 2** shows a p-n junction diode in series with a small bulb. Complete the diagram to show how a battery should be connected so that the diode is forward biased. (1 mark)

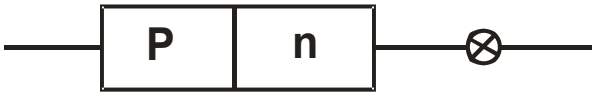


Figure 2

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10. Alpha and beta particles from a radioactive source deviate by different amounts when moving in a magnetic field. Give **two** reasons why alpha particles deviate less. (2 marks)

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11. Arrange the following in order of increasing frequency. Visible light, infrared radiation, X-rays, U.V radiation, Radio waves. (1 mark)

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12. **Figure 3** shows a human eye with a certain defect.

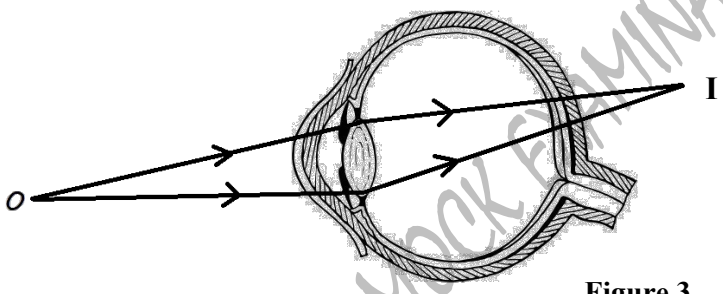


Figure 3

a) Name the defect. (1 mark)

……..

b) On **Figure 3**, sketch the appropriate lens to correct the defect and sketch the rays to show the effect of the lens. (2 marks)

13. Give the difference in the deflection system of a cathode ray oscilloscope and a television set. (1 mark)

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14. **Figure 4** below shows a single phase demonstration transformer intended to converted 24V, 50Hz as AC supply to 240V, 50Hz.

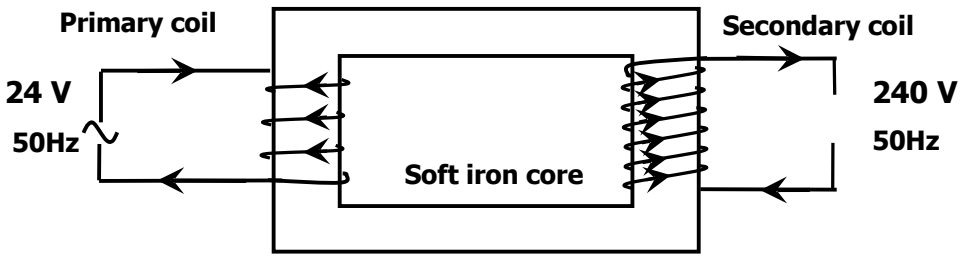


Figure 4

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If the primary core has 50 turns of coil, how many turns of coils should the secondary have?

(2 marks)

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SECTION B (55 MARKS)

Answer ALL the questions in this section in the spaces provided

15. a) **Figure 5** shows ultraviolet light striking a clean zinc plate placed on a positively charged leaf electroscope.

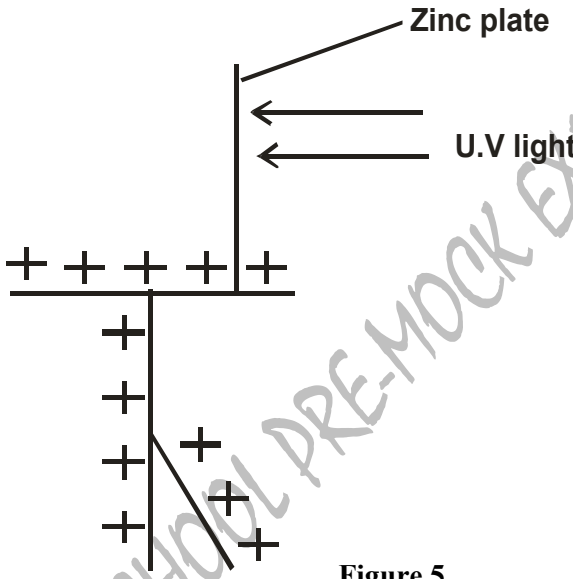


Figure 5

Explain the following observations;

i) The leaf does not fall. (1 mark)

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ii) When the same experiment is carried out with a negatively charged electroscope, the leaf falls. (1 mark)

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b) State **two** factors that affect photoelectric emission. (2 marks)

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c) In an experiment on photoelectric emission, a metal surface was illuminated by light of different 20 frequencies but of constant intensity. The maximum kinetic energy (K.E. $_{max}$) of the photoelectrons emitted for each frequency f, was measured. The graph below shows how the K.E. $_{max}$ varied with frequency.

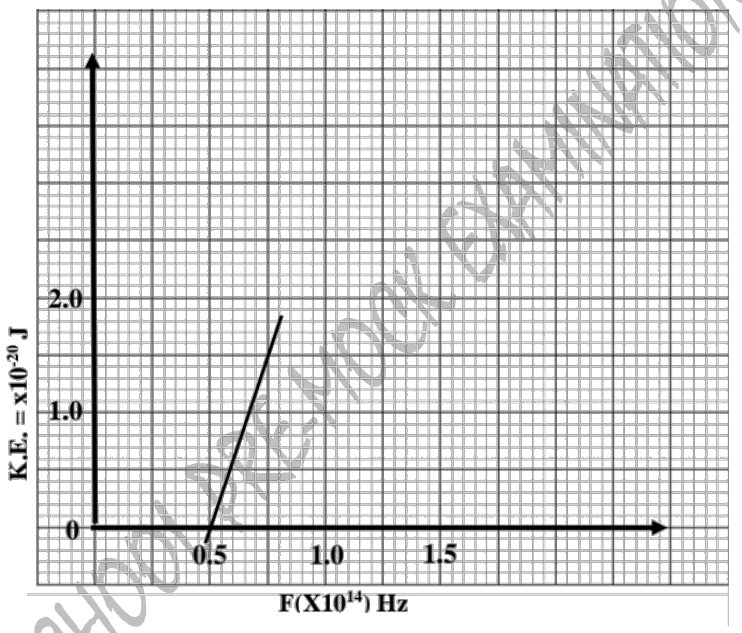


Figure 6

Use the graph and Einstein's equation of photoelectric effect to determine the value of;

i) Planck's constant. (3 marks)

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ii) Work function of the metal surface. (3 marks)

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16. a) **Figure 7** below shows a goldleaf electroscope

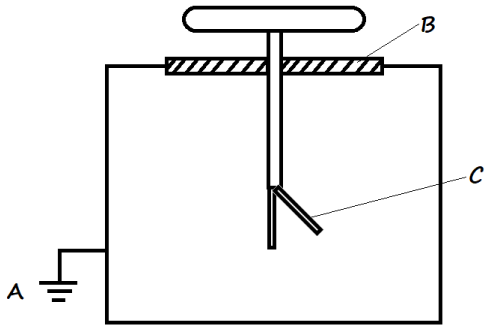


Figure 7

i) Identify the part labeled A (1 mark)

……

ii) State the function of the parts labelled

I. B – (1 mark)

……..

II. C – (1mark)

……..

b) A highly negatively charged rod is brought close to a lightly positively charged gold leaf electroscope

i) State what is observed on the gold leaf (1 mark)

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……

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ii) Explain the observation made in **b i)** (2 marks)

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c) **Figure 8** shows a thin wire connected to a highly positively charged rod and placed close to a candle flame.

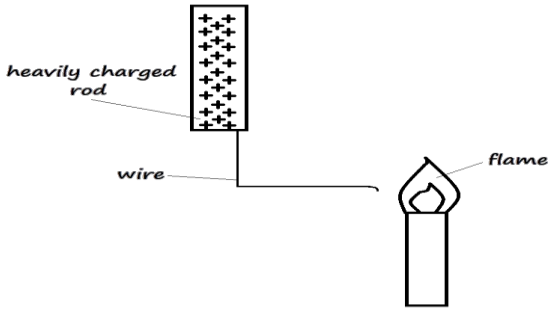


Figure 8

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i) State what is observed on the flame when the wire is brought closer (1 mark)

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ii) Explain the reason for the observation in **c i)** (1 mark)

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d) The **figure 9** shows an arrangement of **three** capacitors in a circuit.

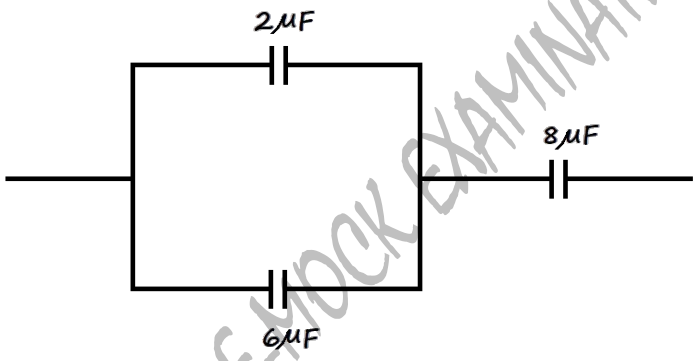


Figure 9

Determine the effective capacitance of the arrangement (3 marks)

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17. a) When power stations generate electricity, it is always stepped up to very high voltages so as to be transmitted over long distances.

i) Explain why it is necessary to do so. (1 mark)

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ii) State any **two** dangers of this high voltage transmission. (2 marks)

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b) **Figure 10** shows a section of a house wiring system.

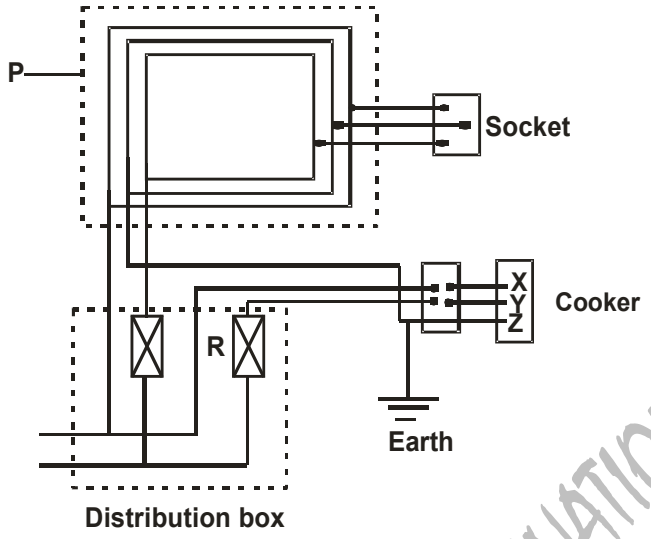


Figure 10

i) Name the circuit labeled **P**. (1 mark)

……

ii) Name the terminals labeled **X** and **Y**. (2 marks)

X ……

Y ……

iii) State the purpose of **R** in the circuit. (1 mark)

……

……

iv) Give a reason why **R** is connected to **Y** but not to **X**. (1 mark)

……

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……

v) Why is the earthing necessary in such a circuit? (1 mark)

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c) Determine the cost of using an electric iron box rated 1500W, for a total of 30 hours, given that, the cost of electricity is Ksh. 8 per unit. (2 marks)

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d) **Figure 11** shows a Geiger-muller tube:

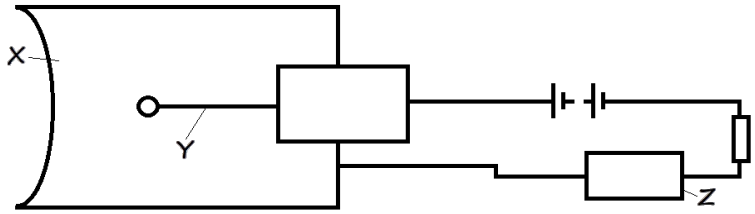


Figure 11

Name the parts labelled **X**, **Y**, **Z** (3 marks)

X ……

Y ……

Z ……

18. a) State **two** differences between hard and soft X-rays (2 marks)

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b) **Figure 12** shows the features of an X-ray tube.

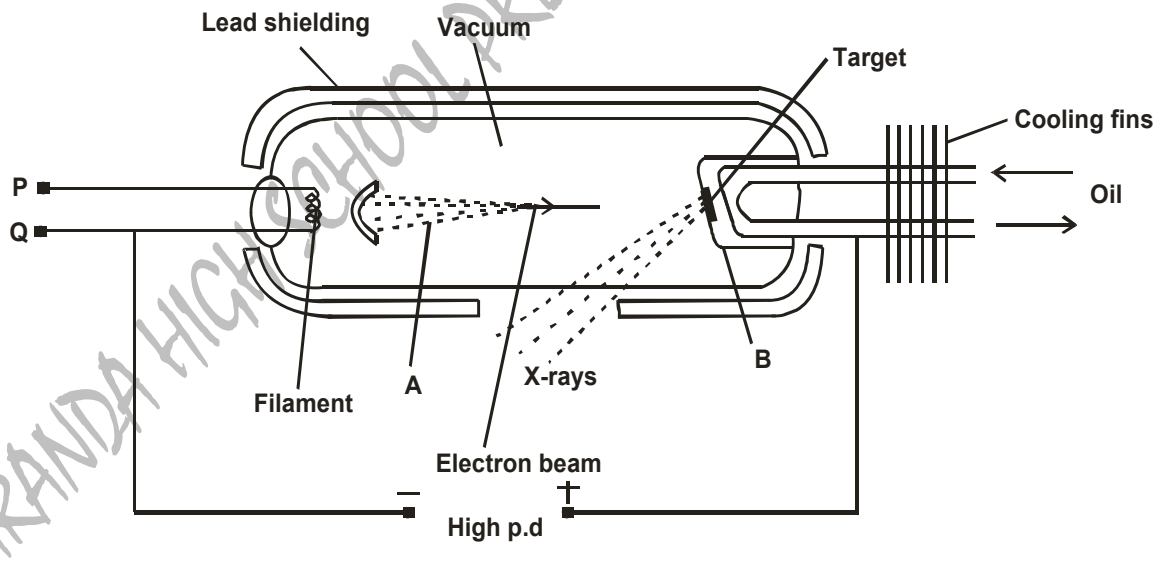


Figure 12

i) Name the parts labeled **A** and **B**. (2 marks)

A……

B……

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ii) Explain how a change in the potential across **PQ** changes the intensity of the X-rays produced in the tube. (2 marks)

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iii) During the operation of the tube, the target becomes very hot. Explain how this heat is caused. (1 mark)

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iv) What property of lead makes it suitable for use as a shielding material? (1 mark)

……

c) In a certain X-ray tube, the electrons are accelerated by a potential difference (P.d.) of 12000V. Assuming all the energy goes to produce X-rays, determine the frequency of the X-rays produced. (3 marks)

(Planck's constant h = 6.62 x 10^{-34}Js, and charge of an electron **e** = 1.6 x 10^{-19}C)

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19. a) State Fleming's left hand rule (1 mark)

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b) **Figure 13** shows an electric motor with a coil **ABCD** in the magnetic field

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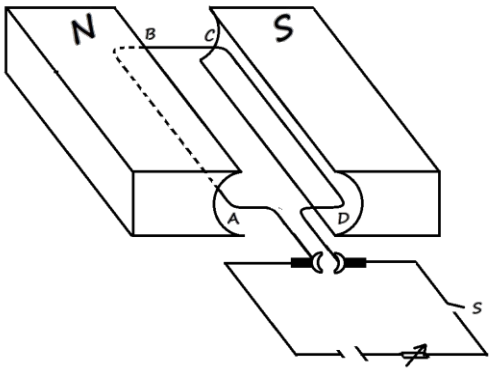


Figure 13

i) Indicate with an arrow on the coil **ABCD**, the direction of the current **I** when switch S is closed

ii) State the direction in which the coil rotates when the switch is closed (1 mark)

……

iii) Explain what makes the coil to rotate (3 marks)

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iv) State **three** ways in which the power of this motor can be increased (3 marks)

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v) State the purpose of the rheostat in the setup (1 mark)

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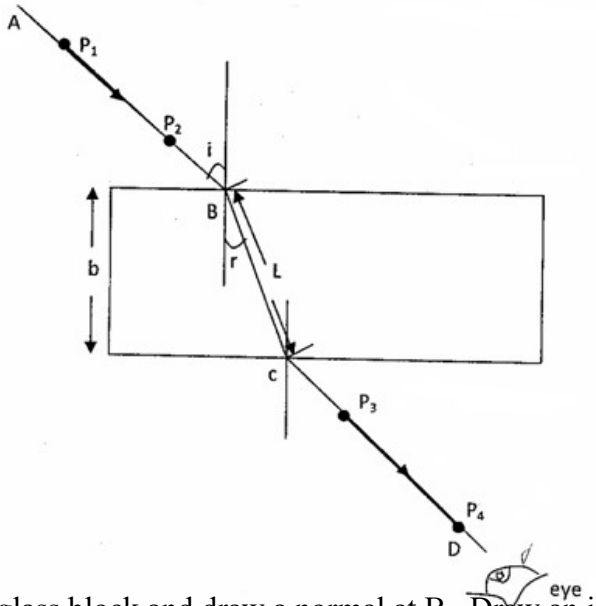
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PAPER 3

1. You are provided with the following:
   - A rectangular glass block.
   - 4 optical pins.
   - A softboard.
   - A plain paper.

   Proceed as follows:

   (a) Place the glass block on the plain paper with one of the largest face upper most. Trace round the glass block using a pencil as shown below.



   (b) Remove the glass block and draw a normal at B. Draw an incident ray AB of angle of incidence, i = 20°.

   (c) Replace the glass block and trace the ray ABCD using the optical pins.

   (d) Remove the glass block and draw the path of the ray ABCD using a pencil. Measure length L and record it in the table below.

Angle i°	L(cm)	$L^2(cm^2)$	$\frac{1}{L^2}\left(cm^{-2}\right)$	Sin^2 i
20				0.1170
30				0.2500
40				0.4132
50				0.5868
60				0.8830
70				

(6 marks)

e) Repeat the procedure above for the angles of incidence given.

Calculate the value of L^2 and $\frac{1}{L^2}$; Record in the table.

(e) Plot a graph of $\frac{1}{L^2}$ (y-axis) against $Sin^2 i$ (χ-axis). (5 marks)

(F) Calculate the gradient, S. (4 marks)

(i) Given that the equation of that graph: $\frac{1}{L^2} = -\left(\frac{1}{n^2 b^2}\right) Sin^2 i + \frac{1}{b_2}$

Determine the $\left(\frac{1}{L^2}\right)$ intercept C and the ($Sin^2 i$) intercept B. (4marks)

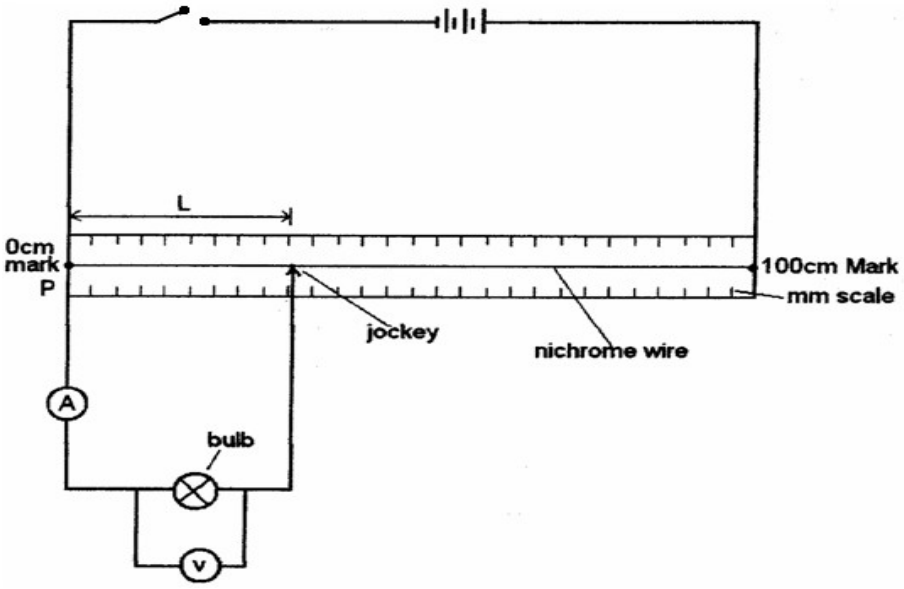
(j) Calculate the value of Q given by: (3 marks)

$$Q = -\left(\frac{C}{S}\right) \div B$$

(k) Hand in your constructions on the plain paper together with the answer script. (2marks)

2. You are provided with the following apparatus:
   - 2 size D dry cells.
   - 100cm nichrome wire on a mm scale.
   - A bulb (2.5v) and a bulb holder.
   - 8 conductivity wires (at least 4 with crocodile clips).
   - Cell holder.
   - A switch.
   - A voltimeter (0 – 5v).
   - An ammeter (0 – 1A).
   - A jockey.

   (a) Connect the apparatus provided as show in the diagram below.



Procedure

(b) Place the jockey at χ = 20cm from P, then close the switch.
Record the ammeter reading and the voltmeter reading in the table below.

(c) Repeat the experiment by placing the jockey at χ = 40, 60, 70 and 80cm from P.
Record your readings and complete the table below. 5marks

Length L(cm)	1(A)	Pd V(v)	1(mA)	Pd V(mv)	Log 1	Log V
20						
30						
40						
50						
60						
80						

d)Plot a graph of log I (y-axis) against log V. (5 marks)

(e) Determine the slope of the graph. (3 marks)

(f) Given that Log I = n log v + log k where k and n are constants of the lamp.
(i) Determine using your graph the value of

K _____(2 marks)
N _____(1 mark)

PAPER 2

SECTION A: (25 MARKS)

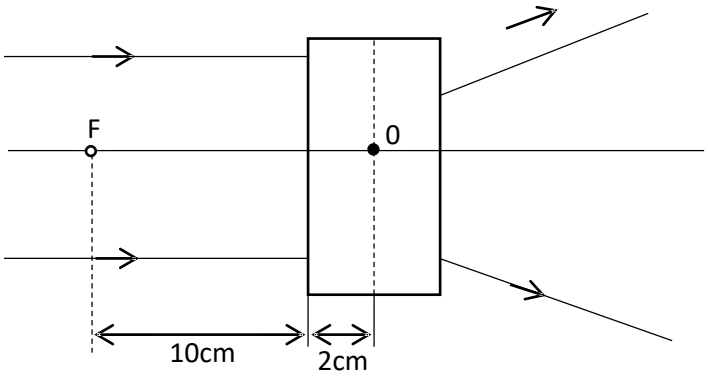
1. Explain why repulsion method is the sure test for polarity of a magnet as opposed to attraction. (1 mark)

2. Define the following;

   (i) the direction of an electric field. (1 mark)

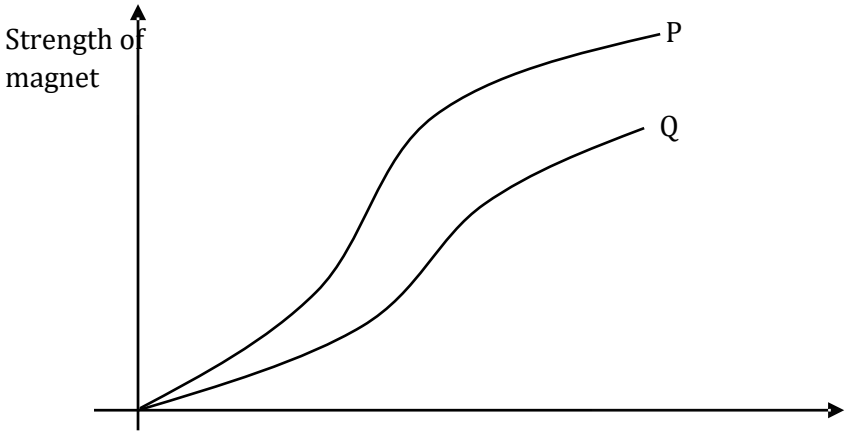
   (ii) the capacitance of a capacitor. (1 mark)

3. The diagram below shows a set of parallel rays of light incident on a thin lens and emerging out from the lens. The lens is placed inside a black box with narrow opening on both sides.



   (a) State the type of the lens in the box and explain your answer. (2 marks)

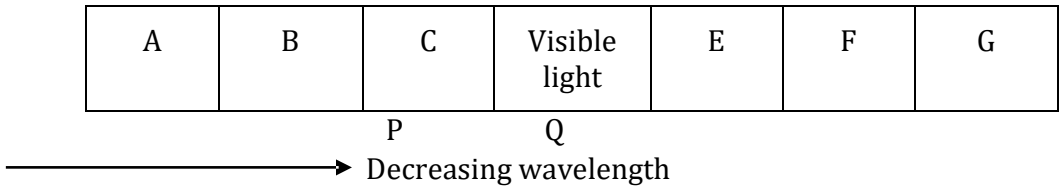
4. In an experiment to magnetize two substances P and Q using electric currents, two curves were obtained as shown below.



   (i) Explain the difference between substances P and Q with reference to domain theory. (1 mark

(ii) State and explain which of the two substances in (i) above would be suitable for use as a core of an electromagnet. (1 mark)

5.The letters in the figure below represents different types of radiations in the electromagnetic spectrum.



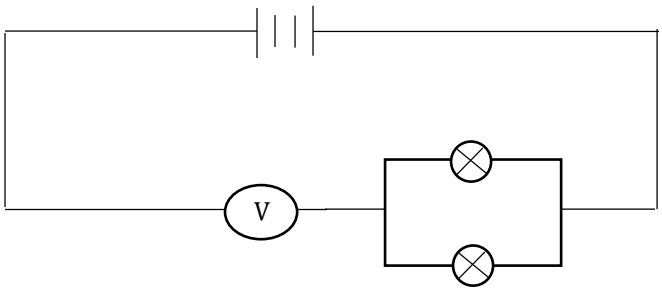
(i) Which colours of spectrum appears at P and Q?

P - ..... (1 mark)

Q - ..... (1 mark)

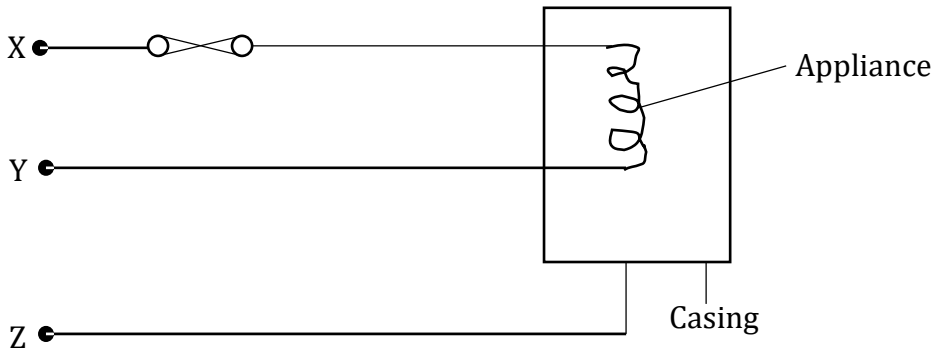
(ii) How is radiation marked C detected? (1 mark)

6.The diagram below shows a circuit that was connected by a form one student. Comment with a reason on the brightness of the bulbs. (2 marks)



7.A car battery requires topping up with distilled water occasionally. Explain why this is necessary and why distilled water is used. (2 marks)

8. The figure below shows the wiring in a modern mains appliance.



Identify the wires X, Y and Z. (2 marks)

X - ……

Y - ……

Z - ……

9. Three resistors of resistance 2.0Ω, 4.0Ω and 6.0Ω are connected together in a circuit. Draw a circuit diagram to show the arrangement to the resistors which gives;

(i) An effective resistance of 3.0Ω (2 marks)

(ii) A minimum resistance. (1 mark)

10.When rod X was rubbed with material Y, it was observed that the material acquired a negative charge.

(i) State the charge on the rod X. (1 mark)

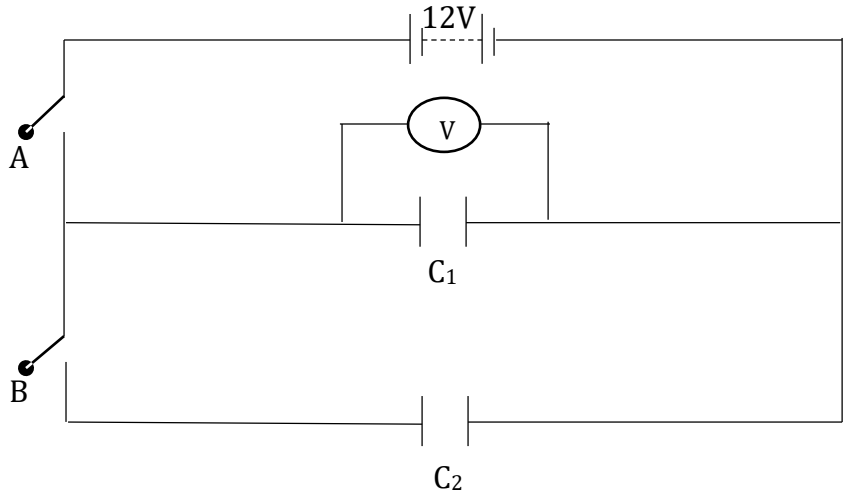
(ii) Explain how the rod X acquired the charge. (1 mark)

(iii) Explain briefly how you would test the nature of the charge on rod X using an electroscope. (2 marks)

11. Distinguish between intrinsic semi-conductor and extrinsic semiconductor. (1 mark)

SECTION B: (55 MARKS)

12. The following figure shows a circuit where a battery of an e.m.f. 12v, switches A and B, two capacitors $C_1 = 9.0\mu F$ and $C_2 = 3.0\mu F$ and a voltmeter connected as shown below.



(i)Determine the charge on C_1 when the switch A is closed and B open. (2 marks)

(ii)What is the voltmeter reading when switch A is closed and switch B open?
(Assume capacitor C_1 is fully charged). (1 mark)

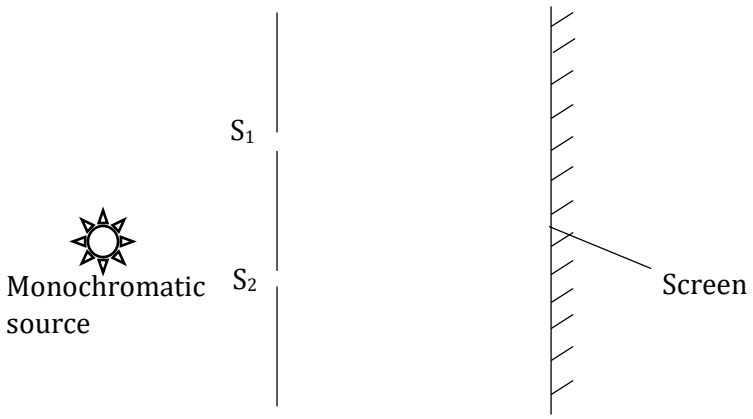
Suppose both Switch A and switch B are closed. Determine:

(iii) The effective capacitance of C_1 and C_2. (2 marks)

(iv) The voltmeter reading V. (3 marks)

(v) The energy stored by C_1 (2 marks)

13. (a) In an experiment to study one of the properties of waves, a double slit was placed close to the source of monochromatic light as shown below.



(i) What property of waves is being investigated? (1 mark)

(ii) State the function of the double slit. (1 mark)

(iii) State and explain the observation made on the screen. (2 marks)

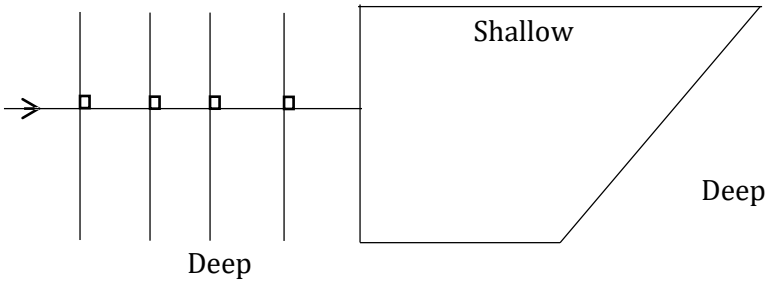
(iv) State what is observed on the screen when;

(I) the slit separation S_1 S_2 is decreased. (1 mark)

(II) White source of light is used in place of monochromatic source. (1 mark)

(III) S_1 and S_2 are made larger. (1 mark)

(b) The diagram below shows plane wave fronts in a ripple tank incident on a boundary between a deep to shallow region.



On the same diagram, sketch the wave pattern in and beyond the shallow region. (2 marks)

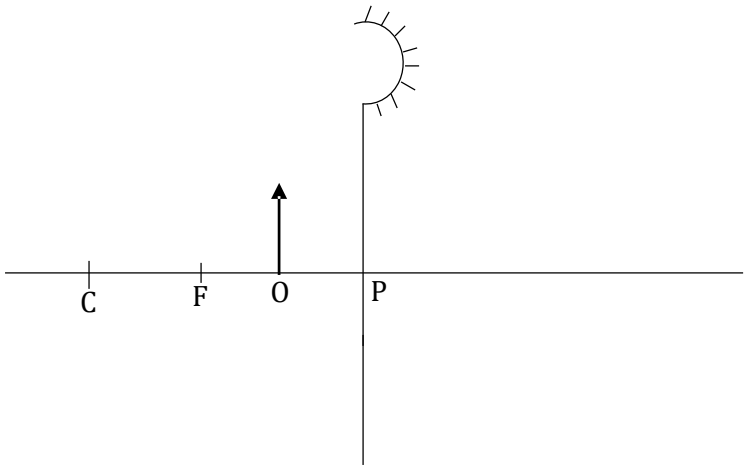
(c) The equation below represents a nuclear decay. (1 mark)

$$^{232}_{90}W \xrightarrow{A} {}^{228}_{88}X$$

Identify the radiation A.

A - ……

14. (a) The diagram below shows an object O placed in front of a concave mirror as shown.

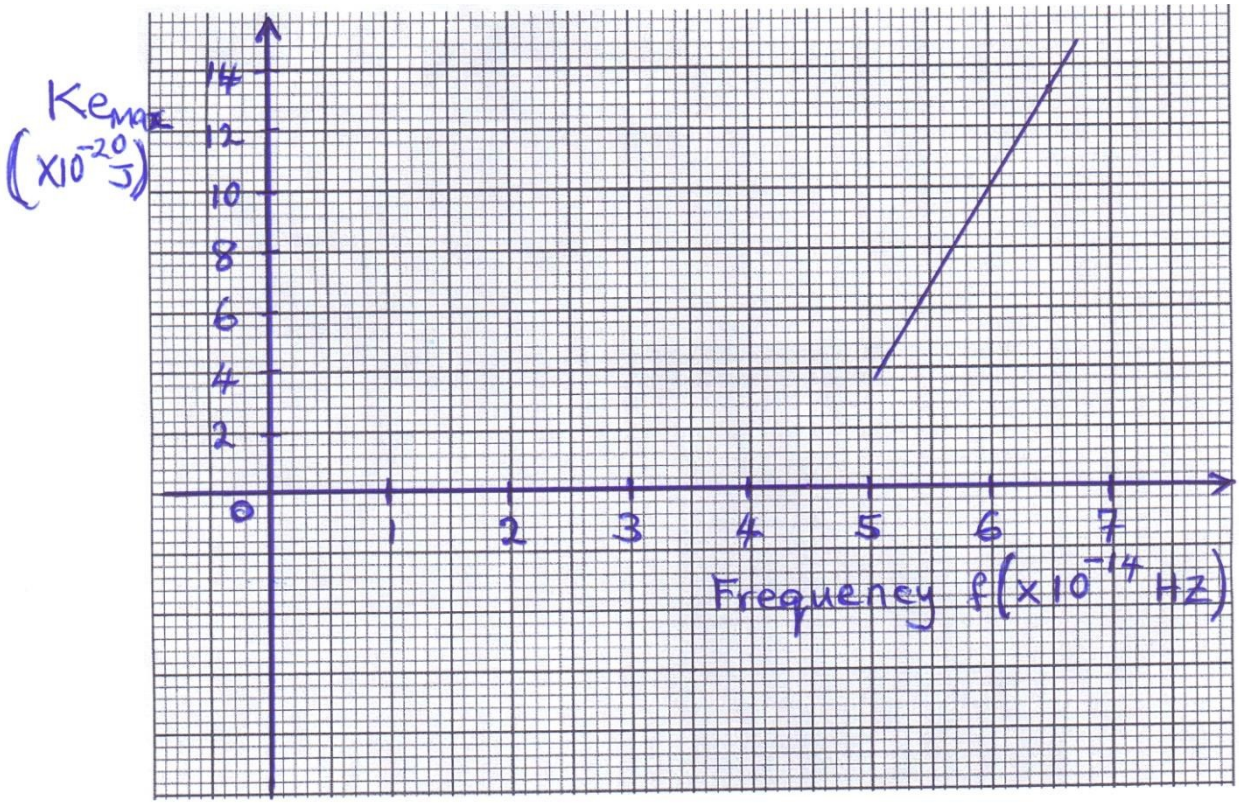


(i) Complete the diagram to show the image formed. (2 marks)

(ii) State two characteristics of the image formed. (1 mark)

(b) (i) State two factors that determine the speed by which electrons are emitted from metal surface by light falling on it. (2 marks)

(ii) In an experiment using a photocell, light of varying frequency but constant intensity was shone onto the surface of a metal. The maximum kinetic energy, $(Ke)_{max}$ emitted for each frequency, was determined. The graph below shows how Ke_{max} varies with frequency f.



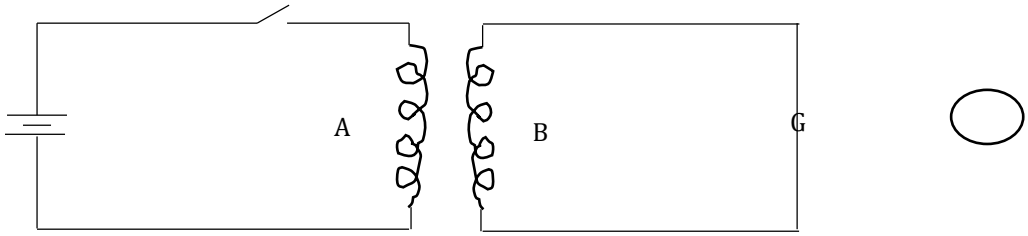
From Einstein's equation, $hf = \Theta + Ke_{max}$, where Θ is the work function. Determine.

(i) The threshold frequency, f_0 from the graph (1 mark)

(ii) the planks constant, h (2 marks)

15. (a) An electric cooker has an oven rated 3KW, a grill rated 2KW and two rings each rated at 500W. The cooker operates from 240V mains. What is the cost of operating all the parts for 30 minutes if electricity cost Ksh.6.50 per unit? (3 marks)

(b) Fig. below shows identical copper coils A and B placed close to each other. Coil A is connected to a d.c. power supply while coil B is connected to a galvanometer.



(i)State and explain what is observed on the galvanometer when the switch is closed. (2 marks)

(ii) State what is observed on the galvanometer when the switch is opened. (1 mark)

(iii) State what would be observed if the number of turns of coil B is doubled. (1 mark)

(c)A transformer with 2000 turns in the primary circuit and 150 turns in the secondary circuit has a primary circuit connected to a 800V ac source. It is found that when a heater is connected to the secondary circuit, it produces heat at the rate of 1000w. Assuming 90% efficiency, determine the;

(i) Voltage in the secondary circuit. (2 marks)

(ii) the current in the primary circuit. (2 marks)

(iii) Current in the secondary circuit (1 mark)

(d)A cell drives a current of 5A through a 1.6Ω resistor. When connected to a 2.8Ω resistor, the current that flows is 3.2A. Determine the e.m.f. (E) and internal resistance (r) of the cell. (4 marks)

16. (a) State how each of the following can be increased in an x-ray tube.

(i) Intensity of x-rays. (1 mark)

(ii) Penetrating power of x-rays. (1 mark)

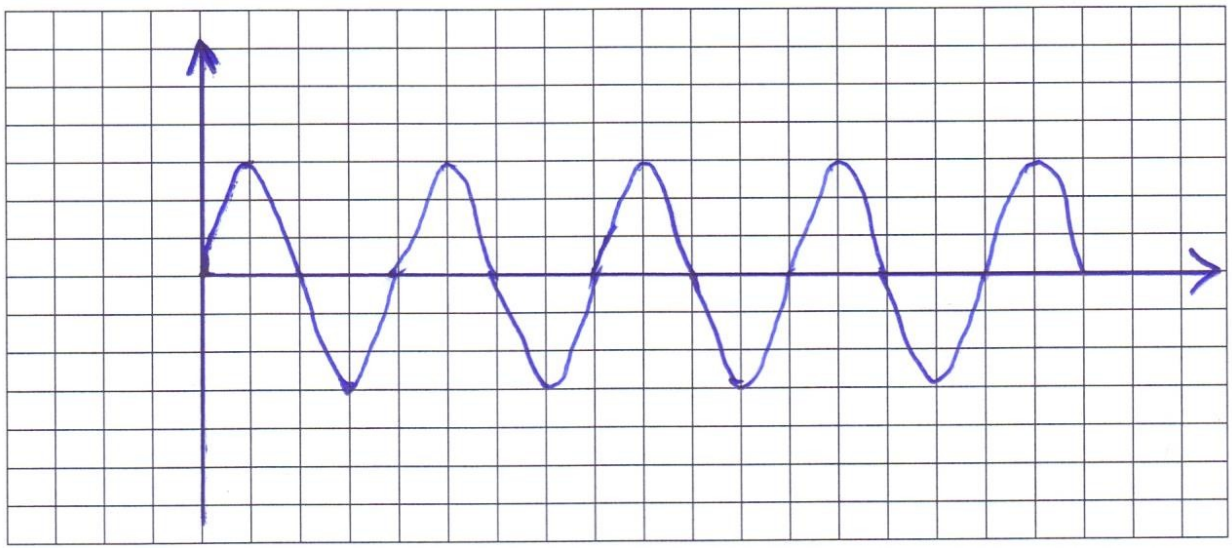
(b)An x-ray tube has an electron beam current of 10mA and is accelerated through a p.d of 60KV. The efficiency is 99.5%. Calculate;

(i) The input power (2 marks)

(ii) The quantity of heat produced per second. (1 mark)

(ii) the number of electrons hitting the target per second.(take $e=1.6\times10^{-19}C$) (2 marks)

(c) The fig. below shows an a.c. signal on the C.R.O screen.



Determine:

(i) The frequency of the signal given that the time base is set at 10ms/div. (2 marks)

(ii) The peak voltage of the signal given that the y-gain is set at 50v/div (2 marks)