

Name:..... Index No.:

Adm No:.....

Candidate's Signature:

Date:

233/1

CHEMISTRY

Paper 1

THEORY

SEPTEMBER 2021

Time: 2 hours

KASSU JOINT EVALUATION EXAMINATION

Kenya Certificate of Secondary Education

CHEMISTRY

Paper 1

Instructions to Candidates

- ❖ *Write your name and index number in the spaces provided above.*
- ❖ *Sign and write the date of the examination paper.*
- ❖ *Answer **ALL** the questions in the spaces provided in the question paper.*
- ❖ *ALL working **MUST** be clearly shown where necessary.*
- ❖ *Mathematical tables and silent electronic calculators may be used.*
- ❖ *Candidates should check the paper to ascertain that all the pages are printed as indicated and that no questions are missing.*

1. (a) Give **two** differences between luminous and non-luminous flames.(2 marks)

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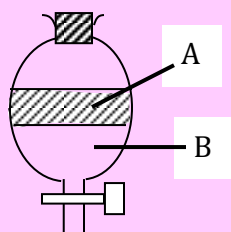
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- (b) How is the non-luminous flame produced? (1 mark)

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.....

2. (a) The apparatus below were used to separate a mixture of liquid A and B.



State **two** properties of liquids that make it possible to separate using such apparatus. (2 marks)

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- (b) Give the name of the above apparatus. (1 mark)

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3. (a) Explain why solid Carbon (IV) oxide is preferred over ordinary ice for use by ice cream venders. (1 mark)

.....

.....

- (b) Name one piece apparatus used to measure volume of gases. (1 mark)

.....

- (c) Draw a diagram of a deflagrating spoon. (1 mark)

4. The table below shows the pH values of solutions P, R, Q and S.

Solution	P	R	Q	S
pH	2	7	6.5	13.5

(a) Which solution represent:

(i) Strong base - (1 mark)

(ii) Weak acid - (1 mark)

(b) Give an example of solution S. (1 mark)

.....

5. 6.95g of hydrated iron (II) sulphate $\text{FeSO}_4 \cdot n\text{H}_2\text{O}$ was dissolved in 250 cm^3 solution resulting into a 0.1M solution. Determine the value of n. (3 marks)
- (Fe = 56, O = 16, S = 32, H = 1).

6. Rusting leads to fast wearing out of farm tools and equipment as well as buildings.

(a) Give the chemical name of rust. (1 mark)

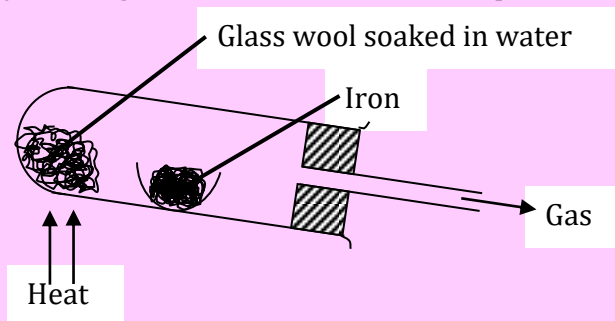
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(b) What **two** conditions accelerate rusting process? (2 marks)

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7. Study the diagram below and answer the questions that follow.



- (a) Write an equation for the reaction that take place in the combustion tube. (1 mark)

.....

- (b) Why would it not be advisable to use potassium in place of iron in the set-up? (1 mark)

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- (c) Glass wool should be heated before heating iron. Explain. (1 mark)

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8. I. Name the following organic compounds.

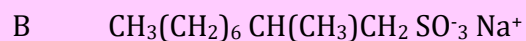
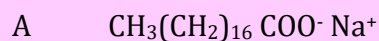
- (a)
$$\begin{array}{ccccccc} \text{CH}_3 & \text{CH} & \text{CH}_2 & \text{CH} & \text{CH}_3 \\ & | & & | & \\ & \text{CH}_3 & & \text{Br} & \end{array}$$
 (1 mark)

.....

- (b) $\text{HOCH}_2 - \text{CHOH} - \text{CH}_2\text{OH}$ (1 mark)

.....

- II. Given



Identify detergent

- A - (1 mark)

- B - (1 mark)

9. In terms of structure and bonding, explain the following.

- (a) Graphite is used as a lubricant. (1 mark)

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(b) Alluminium is better conductor of electricity than magnesium. (1 mark)

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(c) Water is a liquid at room temperature while hydrogen sulphide is a gas. (1 mark)

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10. (a) Define the term molar latent heat of fusion. (1 mark)

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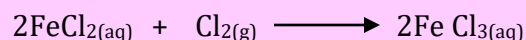
(b) The molar heat of fusion of ice at 0°C is 6kJ mol^{-1} . Calculate the heat change when 36g of ice is converted to 36g of water at 10°C . (3 marks)
(SHC = $4.2\text{J g}^{-1}\text{K}^{-1}$, density = 1.0g/cm^3 , H = 1.0, O = 16.0)

11. Draw a well labeled diagram showing how blister copper is purified. (3 marks)

12. Gas Q with a relative molecular mass of 48 took 50 seconds to diffuse through a porous diaphragm. How long will it take for the same amount of hydrogen Chloride (HCl) to diffuse through the same diaphragm under similar conditions? (H = 1.0, Cl = 35.5).
(3 marks)

13. (a) Calculate the oxidation state of chromium in the ion $\text{Cr}_2\text{O}_4^{2-}$. (1 mark)

- (b) Using oxidation numbers, determine from the equation below the species which undergoes oxidation and reduction.



Oxidation - (1 mark)

Reduction - (1 mark)

14. Given elements A, B and C with atomic numbers 11, 19 and 13 respectively.

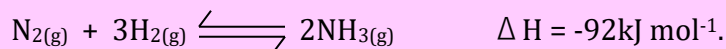
- (a) Compare the atomic radius of A and C. Explain. (2 marks)

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.....

- (b) Compare reactivity of A and B. (1 mark)

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15. Haber process (the manufacture of ammonia gas) is given by the following equation.



State and explain the effect of:

- (a) Introducing some drops of water to the equilibrium. (1 mark)

.....
.....

- (b) Pumping nitrogen gas to the equilibrium mixture. (1 mark)

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- (c) Lowering the temperature of the reaction. (1 mark)

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.....

16. Elements P and Q have the following atomic numbers 19 and 8 respectively.

- (i) Using dot (•) and cross draw a diagram to show how the elements form bonds. (1 mark)

17. Describe how sodium sulphate crystals can be prepared starting with 50cm³ of 2M sodium hydroxide and 1M sulphuric (VI) acid. (3 marks)

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18. Write ionic equations to show how;

- (a) (i) Excess ammonia solution reacts with a solution containing Copper II ions. (1 mark)

.....

(ii) Excess sodium hydroxide added to a solution containing Al^{3+} ions. (1 mark)

.....

(b) Give the name of the following ion $[\text{Zn}(\text{NH}_3)_4]^{2+}$ (1 mark)

.....

19. (a) Define electrolysis. (1 mark)

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(b) During the electrolysis of molten aluminium oxide, write the equations at the;

Anode - (1 mark)

Cathode - (1 mark)

20. (a) Give any **two** differences between alpha and beta particles. (2 marks)

.....

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(b) A radioactive isotope T decays by emitting three alpha particles to form $^{214}_{83}\text{Bi}$
what is the atomic number and mass number T?

Atomic number - (1 mark)

Mass number - (1 mark)

21. (a) Using acidified potassium dichromate (VI) solution, describe how you would differentiate between sulphur (IV) oxide and hydrogen sulphide. (2 marks)

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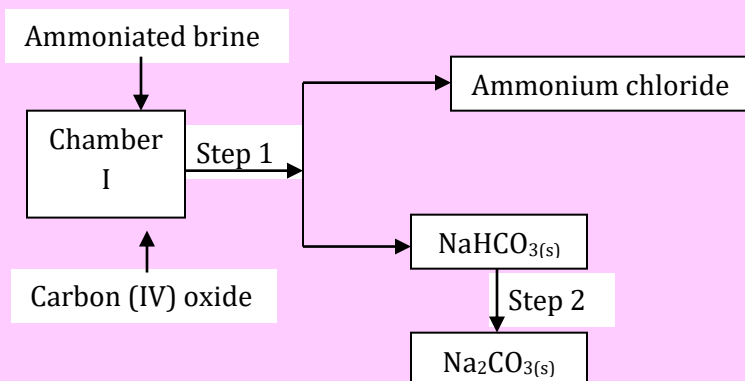
(b) Identify the catalyst preferred in contact process. Explain. (2 mark)

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22. Study the following part of the solvay process for the manufacture of sodium carbonate and answer the questions that follows:



- (i) State the main source of Carbon (IV) oxide in the process. (1 mark)
-
- (ii) Write down the overall equation for the reaction in chamber I. (1 mark)
-
- (iii) Name process in step 1. (1 mark)
-
23. (a) The following equation involve hydrochloric acid.
- $$\text{MnO}_{2(s)} + 4\text{HCl}_{(aq)} \longrightarrow \text{MnCl}_{2(aq)} + 2\text{H}_2\text{O}_{(l)} + \text{Cl}_{2(g)}$$
- State the type of reaction taking place in the reaction. (1 mark)
-
- (b) State **two** contrasting chemical properties of hydrogen and chlorine. (2 marks)
-
-
-
24. (a) An element O has two isotopes $^{16}_8\text{O}$ containing 90% and Isotope $^{18}_8\text{O}$.

- (i) What are isotopes? (1 mark)

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(ii) Find the R.A.M of O. (2 marks)

25. (a) When a hydrocarbon is completely burnt in oxygen 4.2g of Carbon (IV) oxide and 1.71g of water were formed.

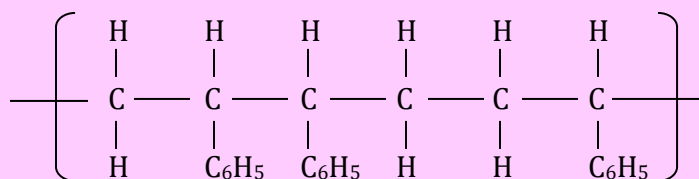
(a) Determine the empirical formular of the hydrocarbon. (3 marks)

(b) Given that formula mass of compound above is 28. Find the molecular formular. (1 mark)

26. (a) Name the **two** types of polymerization. (1 mark)

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(b) Study the section of the polymer below and answer the questions that follow.



(i) Give the name of the polymer above. (1 mark)

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NAME.....INDEX NUMBER.....

CLASS.....CANDIDATE'S SIGNATURE..... DATE.....

CHEMISTRY
233/2
THEORY
SEPTEMBER 2021
2 Hours

KASSU JOINT EVALUATION TEST

INSTRUCTIONS TO CANDIDATES:

- Write your **name** and **index number** in the spaces provided above.
- **Sign** and write the **date** of examination in the spaces provided.
- Answer **all** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators may be used.

For Examiner's Use Only:

Question	Maximum score	Candidate's score
1	12	
2	12	
3	14	
4	08	
5	13	
6	10	
7	11	
Total	80	

This paper consists of 13 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

FOR MARKING SCHEMES INBOX 0724351706 OR 0739570230

1. The grid below shows part of the periodic table. Use it to answer the questions that follow. The letters do not represent actual symbols.

						S	U	V
P	R					T	X	W
Q								

- (a) Which of the elements has the highest atomic radius? Explain. (2 marks)

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- (b) Identify the most reactive Oxidizing agent. Explain. (2 marks)

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- (c) Compare the atomic radius of P and R. Explain (2 marks)

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- (d) Give the formula of one stable ion with an electron arrangement of 2.8 which is:

- (i) A Negatively charged divalent ion. (2marks)

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- (ii) A Positively charged monovalent.

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(e) Given that the mass number of W is 40. Write down the composition of its nucleus.

(2 marks)

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(f) Write the formula of the compounds formed between.

(i) Element R and X.

(1 mark)

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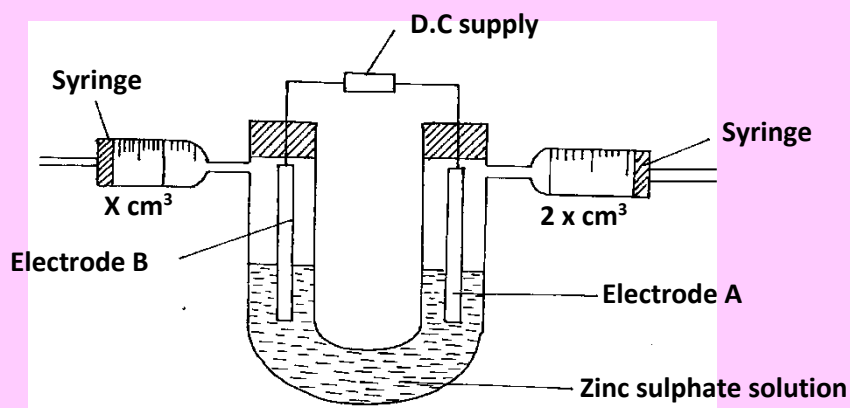
(ii) Give one property of the structure formed when R and X bond.

(1 mark)

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2. An aqueous solution of zinc sulphate is electrolysed using platinum electrodes as shown in the set up below.



- (a) (i) Write a half equation for the reaction taking place at electrode A. (1mark)

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- (ii) Identify electrodes A and B

(2 marks)

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(iii) State and explain the observation at electrode **B** if copper plate was used instead of platinum electrode. (2marks)

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(b) 0.22g of metal **Q** is deposited by electrolysis when a current of 0.06A flows for 99 minutes.
(RAM of **Q** = 184, 1F = 96500c)

(i) Find the number of moles of **Q** deposited. (1mark)

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(ii) Determine the value of n in the metallic ion **Qⁿ⁺** (3marks)

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(c) Determine oxidation number of chlorine in **ClO₃⁻** (1mark)

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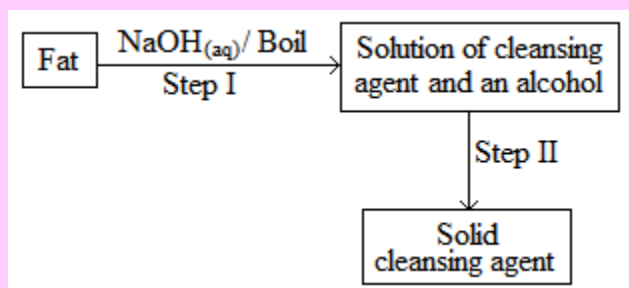
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(d) An iron spoon is to be electroplated with silver. Draw a labelled diagram to represent the set-up that could be used to carryout this process. (2marks)

3. (a)The scheme below was used to prepare a cleansing agent. Study it and answer the questions that follow.



(i)What name is given to the type of cleansing agent prepared by the method above? (1mark)

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(ii)Name one chemical substance added in step II (1mark)

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(iii)What is the purpose of adding the chemical substance named in a (ii) above? (1mark)

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(iv)Name any other suitable substance that can be used in step I (1mark)

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(v) Explain how an aqueous solution of the cleansing agent removes oil during washing (2marks)

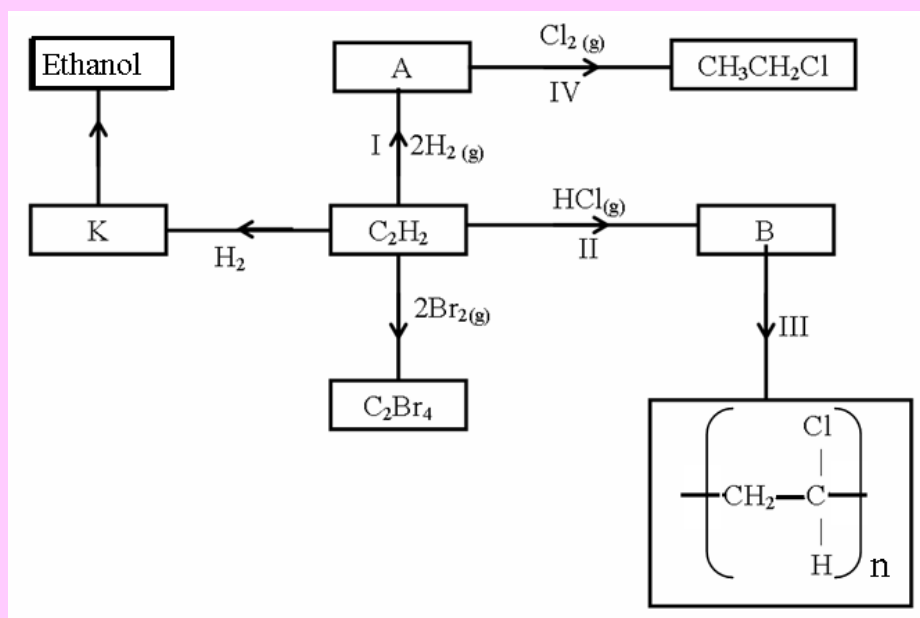
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(b). Study the scheme below and answer the questions that follow.



(i) Identify the catalyst used in step I (1mark)

.....

(ii) Name the compounds A and B (2 marks)

A.....B.....

(iii) Give one disadvantage of compound formed in step III (1mark)

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(iv) Name the reactions taking place at steps: (1mark)

I.....IV.....

(v) Describe how substance K is converted to ethanol (2marks)

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4. (a) State the Hess' law. (1 mark)

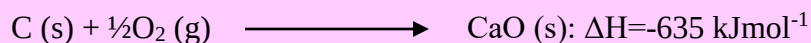
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(b) The enthalpies of combustion of calcium, carbon and decomposition of calcium carbonate are indicated below;



Enthalpy of decomposition of $\text{CaCO}_3 = +178 \text{ kJmol}^{-1}$

(i) Draw an energy cycle diagram that links the enthalpy of formation of calcium carbonate to enthalpies of combustion of calcium, carbon and decomposition of calcium carbonate.

.....(2 marks)

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(ii) Determine the enthalpy of formation of calcium carbonate. (2 marks)

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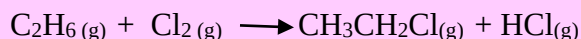
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(c) Some average bond energies are given below.

Bond	Energy in kJ mol ⁻¹
C – C	348
C – H	414
Cl – Cl	243
C – Cl	432
H – Cl	340

Calculate the energy change for the reaction below. (3 mks)



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5.(a) Define the term solubility. (1 mark)

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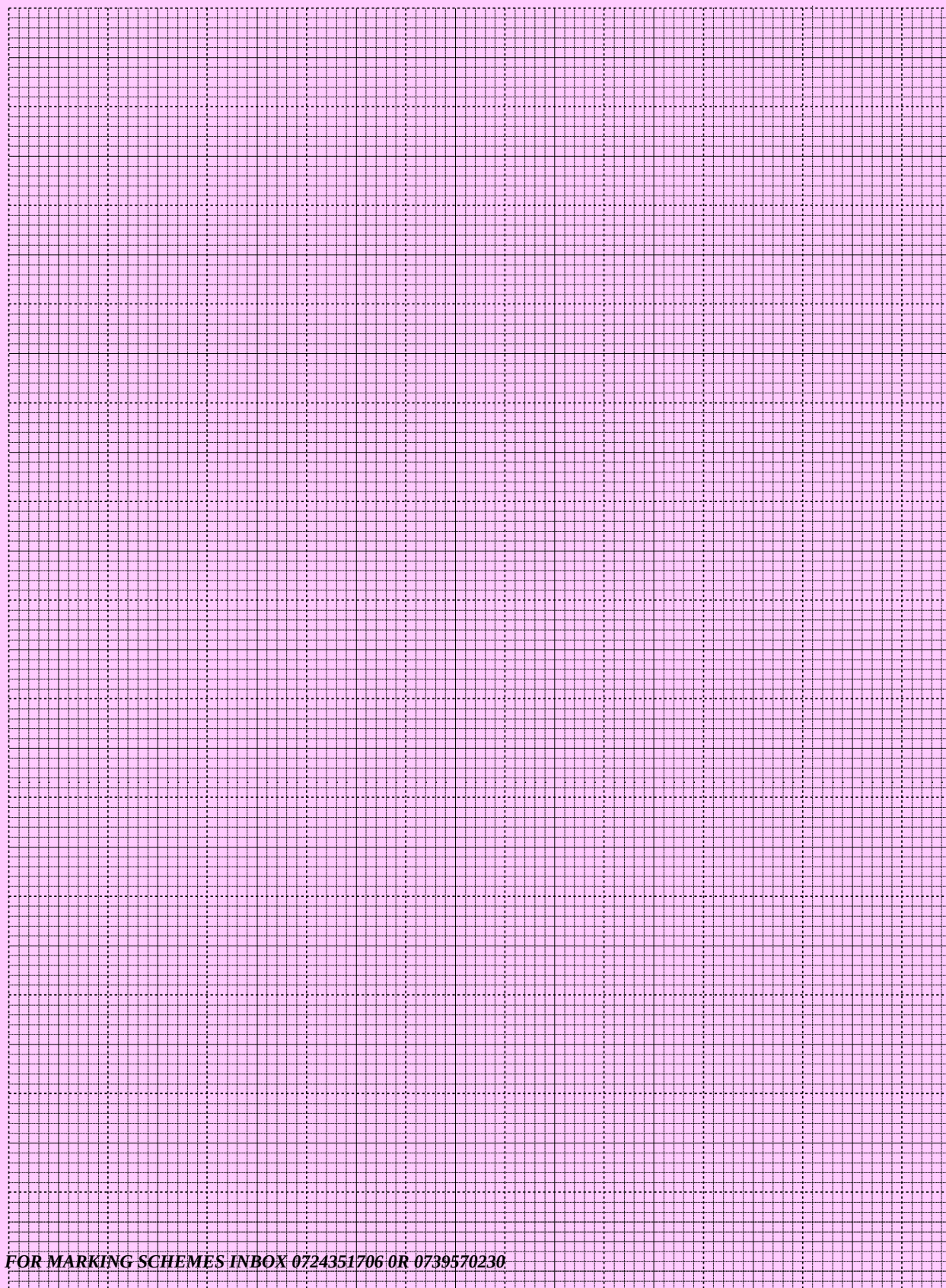
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(b) In an experiment to determine the solubilities of two salts X and Y at different temperatures, a candidate recorded her observations as shown below.

Temperature (°C)	0	10	20	30	40	50	60	70	80	90
Solubility of X in g/100 g of H ₂ O	14.3	17.4	20.7	25.0	28.5	33.3	40.0	47.0	55.0	64.0
Solubility of Y in g/100 g of H ₂ O	25.0	27.5	30.0	32.5	35.0	37.6	40.1	42.4	45.0	48.0

(a) On the same axes plot the solubility curves of X and Y.

(4 marks)



(b) From your graph to determine;

(i) The solubility of X and Y at 47 °C

Solubility of X

(1 mark)

.....

Solubility of Y

(1 mark)

.....

(ii) The temperature at which the two salts are soluble in water.

(1 mark)

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(c) If 60g of X is dissolved in 100 g of water and heated to 90°C, calculate the amount of salt that crystallized out if cooled to 20 °C. (1 mark)

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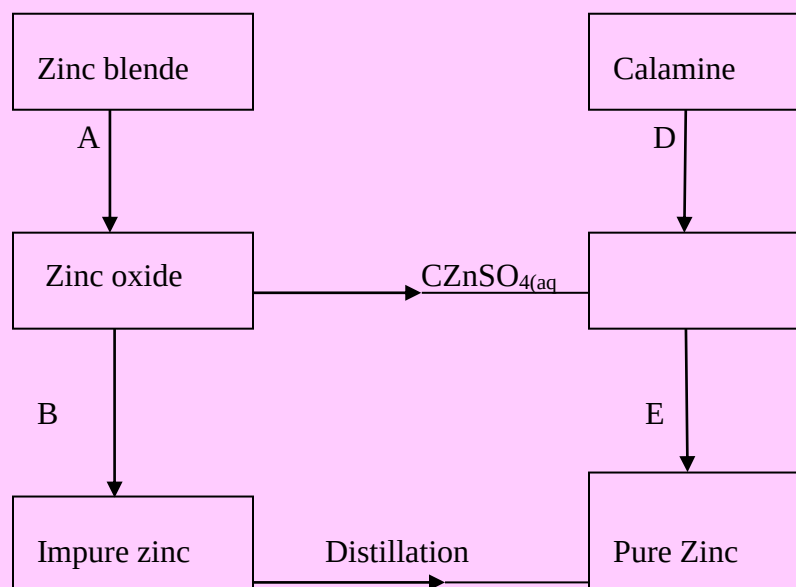
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(d) State what would happen if a mixture salt X in 100 g of water and 30 g of Y in 100 g of water were cooled from 90 °C to 70 °C. (3 marks)

(e) State one application of solubility. (1 mark)

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6. The flow chart below shows some processes in the extraction of zinc. Study it and answer the questions that follow.



(a) Name the processes represented by A and E. (2 marks)

A.....

E.....

(b) State the reagents required for processes B, C and D. (3marks)

B.....

C.....

D.....

(c) Write a chemical equation of the reaction that occurs in process B. (1mark)

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(d) With an aid of a diagram, explain how you would obtain a pure sample of zinc by process E
(3 marks)

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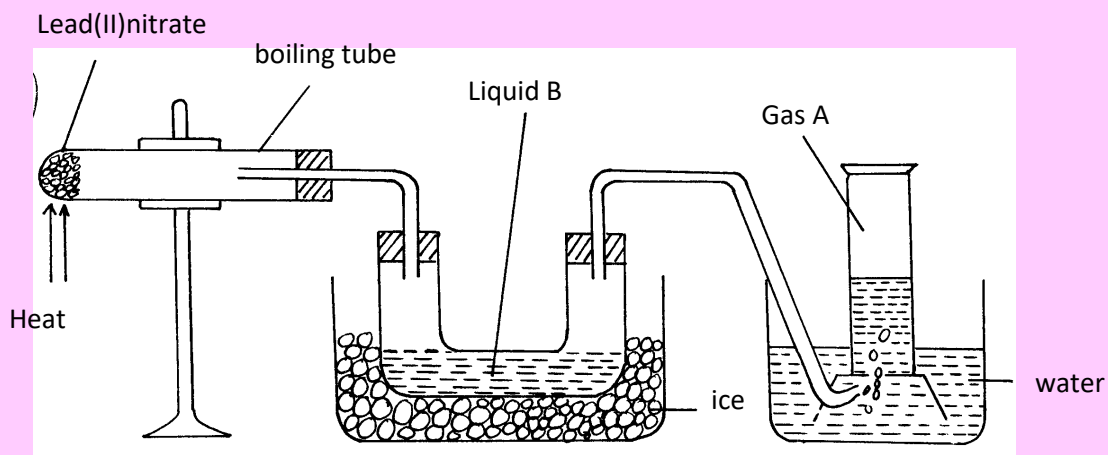
(e) State two commercial uses of zinc metal. (1 mark)

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7. The diagram below shows a set-up of apparatus that can be used to prepare nitrogen (IV) oxide. Study it and use it to answer the questions that follow



- (a) (i) Write the equation for the reaction that takes place in the boiling tube. (1 mark)

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- (ii) State the observations made in the boiling tube. (2 marks)

.....

- (iii) Explain why lead (II) nitrate is preferred over other metal nitrates in this experiment.

(1 mark)

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- (iv) Describe how gas A can be identified. (1 mark)

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- (b) (i) Name liquid B (1 mark)

.....

- (ii) Write a chemical equation to show how liquid B is formed in this experiment. (1mark)

- (c) (i) In another experiment, excess aqueous lead (II) nitrate solution was reacted with a solution which contained 2.34g of sodium chloride. Calculate the mass of precipitate formed in this reaction. (Pb = 207, Cl = 35.5, Na = 23) (3 marks)

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- (ii) Write an ionic equation for the reaction that takes place when nitrogen (IV) oxide reacts with aqueous sodium hydroxide. (1 mark)

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NAME: INDEX NUMBER:

SCHOOL: CANDIDATE'S SIGNATURE:.....

DATE:

233/3
CHEMISTRY
PAPER 3
PRACTICAL
SEPTEMBER 2021
2 ¼ Hours

KASSU
JOINT EVALUATION TEST - 2021
Kenya Certificate of Secondary Education (K.C.S.E)

233/3
CHEMISTRY
Paper 3
Time: 2 ¼ Hours

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For Examiners use only.

Question	Maximum Score	Candidates Score
1	14	
2	13	
3	13	

This paper consists of 6 Printed pages.

FOR MARKING SCHEMES INBOX 0724351706 OR 0739570230

*Candidates should check the question paper to ensure that all the
Papers are printed as indicated and no questions are missing*

1. You are provided with:

Solution **M** containing 3.95g Potassium Manganate (vii), (KMnO_4) per litre of solution.

Solution **N**, containing 49.0g of ammonium Ferrous Sulphate (NH_4)₂SO₄. $\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ per litre of solution. You are required to determine the reacting mole ratio of manganate (VII) Ions, MnO_4^- with Iron

(II) ions Fe^{2+} .

PROCEDURE:

Using and pipette filter transfer 25.0cm^3 of solution N into a conical flask. Titrate with solution M in the burette. No indicator is required for this experiment. Record your results in the table below. Repeat the procedure to obtain the accurate volumes.

Table I

	1 st	2 nd	3 rd
Final burette readings cm^3			
Initial burette readings cm^3			
Volume of solution M used cm^3			

(4mk)

a) Determine the average volume of solution M used. (1mk)

b) Calculate:

i) The concentration of solution M in moles per litre. ($\text{K} = 39$, $\text{Mn} = 55$, $\text{O} = 16$) (1mk)

ii) The number of moles of solution M that reacted with N (2 mks)

iii) The concentration in moles per litre of solution N in moles per litre

(1mks) (Fe=56, S=32, N=14, H=1)

iv) The number of moles of solution N that reacted with solution M in this experiment (2mks)

c) Given that 1 mole of solution M gives 1 mole of MnO_4^- ions and 1 mole of solution N gives 1 mole of Fe^{2+} ions. Calculate the reaction mole ratio of Fe^{2+} ions to MnO_4^- ions (3mks)

2. You are provided with:

Solution WI – containing 40g of substance Y per litre.

Solution WII – 1M hydrochloric acid solution.

You are required to investigate experimentally the rate of reaction of Y with hydrochloric acid. Y reacts with hydrogen ions in the hydrochloric acid to give a final yellow precipitate. You will in each experiment measure at room temperature, the time taken to produce a certain amount of precipitate that will make the cross on the white piece of paper just invisible.

PROCEDURE

On the white piece of paper, make a cross using a pen. Measure 10cm^3 of solution W_I using a 10cm^3 measuring cylinder provided and put into 100cm^3 glass beaker provided and place on the cross. The cross should be visible through the solution from a view point directly above the beaker. Using another measuring cylinder transfer 10cm^3 of the acid W_II to the beaker containing

W_I and start the stopwatch immediately after the addition. Looking from above the beaker, stop the watch as soon as the cross becomes invisible. Enter the time taken in the table below. Repeat the experiment using the volumes indicated in the table below each time adding appropriate quantity of distilled water to make up the volume to 10cm^3 before adding 10cm^3 of solution W_{II} .

xpt. No	Vol. of W_I used cm^3	Vol. of water cm^3	Vol. of W_{II} cm^3	Time Seconds
1	10	0	10	
2	8	2	10	
3	6	4	10	
4	4	6	10	
5	2	8	10	

(4mks)

a) Plot a graph of volume W_I against time in seconds (provided graph paper) (3mks)

b) From your graph, state how the volume of W_I varies with time (1mk)

c) What time would 7.0cm^3 of W_I take to react with 10cm^3 of W_{II} (1mk)

d) State two factors which must be kept constant during the experiment (1mks)

e) Could the time taken for experiment be shorter or longer if temperature of reacting mixture was at (i) 50°C ? Sketch a graph on the same axis that would appear for this experiment.(3 mks)

3. You are provided with solid F. Carry out the tests below. Record your observations and inferences in the spaces provided.

- a) Place about half of solid F on a metallic spatula and burnt it using a non-luminous flame

Observations	inferences
(1mk)	(1mk)

- b) Place the remaining solid F in a clean boiling tube and add about 10cm³ of water and shake thoroughly.

- i) To about 2cm³ of the solution F, put the universal indicator solution provided.

Observations	inferences
(½ mk)	(½ mk)

- ii) To about 2cm³ of solution F, add 2cm³ of acidified potassium dichromate (VI) and warm to boiling

Observations	inferences
(1mk)	(1mk)

Observations

(1 mk)

(1mk)

1. (i) Place all solid P in a boiling tube. Add about 10 cm³ of distilled water and shake vigorously, filter and keep both the residue and filtrate.

Inferences

 $(\frac{1}{2}mk)$ $(\frac{1}{2}mk)$

Observations

Inferences

 $(\frac{1}{2}mk)$ $(\frac{1}{2}mk)$

Observations

Inferences

(½ mk)

(½ mk)

(ii) To about 2 cm³ of the filtrate add four drops of solution K (lead (II) Nitrate)

Observations

Inferences

(½ mk)

(½ mk)

(b) Carefully transfer the residue into a test tube and add 5 cm³ of dilute nitric (V) acid.
(i) To about 2 cm³ of the solution add a few drops of dilute sulphuric (VI) acid.

Observations

Inferences

(½ mk)

(½ mk)

(ii) To about 2 cm³ of the solution add ammonia solution drop wise till in excess.

Observations

Inferences

(½ mk)

(½ mk)