

WAFKIRI SCHOOL  
NAME: MARKING SCHEME ADM NO: .....

SCHOOL: ..... STREAM: .....

INDEX NO: ..... SIGNATURE: .....

233/1

CHEMISTRY

PAPER 1

JULY 2024

2 HOURS

### MUSLIM SCHOOLS JOINT EXAMINATIONS TEST (MUSJET)

Kenya Certificate of Secondary Education

CHEMISTRY – FORM 4

#### INSTRUCTIONS TO CANDIDATES

1. Write your name, school and index number in the spaces provided.
2. Answer ALL questions in the spaces provided.

#### FOR EXAMINERS' USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 - 28	80	

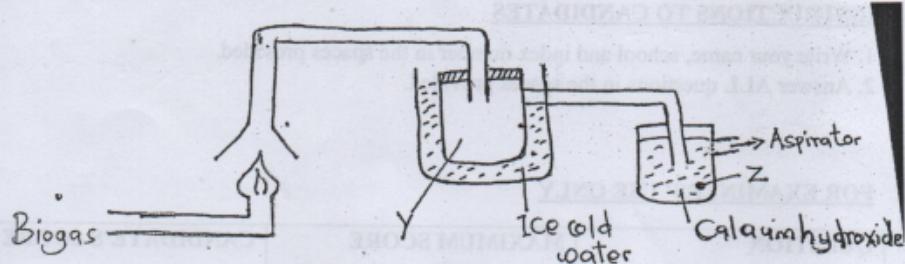


## MARKING SCHEME

1. Describe an experimental procedure that can be used to extract oil from nut seeds. (2mks)
  - Crush the seeds in a mortar using a pestle ✓
  - Add a suitable solvent (Propanone / Acetone) ✓
  - Decant ✓
  - Evaporate the filtrate to obtain the oil ✓
2. A luminous flame produces more light than a non-luminous flame. Explain. (1mk)
 

*presence of unburnt carbon which glows.* ✓
3. Ethanol and dimethyl ether have both molecular formulae  $C_2H_6O$ . Explain why ethanol boils at  $78.2^{\circ}C$  and dimethyl ether has a boiling point of  $-24^{\circ}C$ . (2mks)
 

*Ethanol contains hydrogen bonds which are stronger bonds than van der Waals forces in dimethyl ether.* ✓
4. In an experiment, ammonium chloride was heated in a boiling tube with a moist red and blue litmus paper at the mouth of tube. State and explain the observation made. (3mks)
  - *moist red litmus paper changed to blue and no effect on blue. Later they both changed to red.*
  - *Ammonium chloride decomposes into  $NH_3$  and  $HCl$ .*
  - *$NH_3$  is less dense and diffuses faster changing red litmus to blue.  $HCl$  is denser diffuses slower changing the litmus back to red.*
5. The set up below was used to investigate the products of burning biogas (methane). Study it and answer the questions that follow:

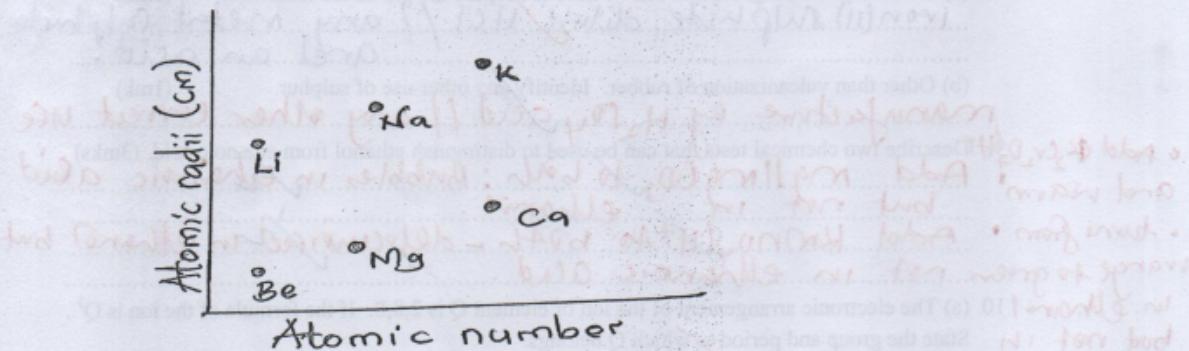


- a) State one chemical test for the product formed in tube Y. (1mk)
 

*Changes white anhydrous CuSO<sub>4</sub> to blue // any one  
" Blue " COCl<sub>2</sub> to pink*
- b) State and explain the observation which would be made in Z. (2mks)
 

*white precipitate. insoluble CaCO<sub>3</sub> was formed //  
white ppt CO<sub>2</sub> + Ca(OH)<sub>2</sub> → CaCO<sub>3</sub> + H<sub>2</sub>O  
(g) (aq) (s) (l)*

6. The plots below were obtained when the atomic radii of some elements in group I and II were plotted against atomic number.



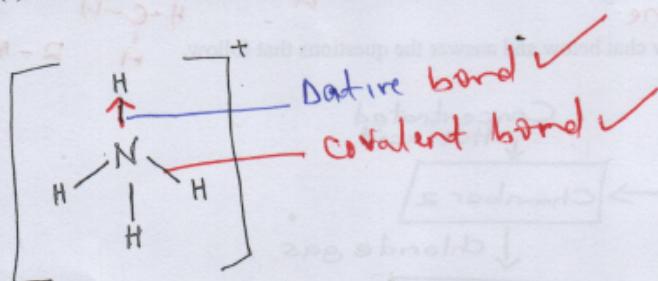
- a) Explain the trends shown by Li, Na and K. (1mk)

Atomic radii increase with increase in atomic number due to increase in energy levels.

- b) Explain why the atomic radius of elements Be, Mg and Ca are lower than those of Li, Na and K. (2mks)

Group (II) elements have more protons than group I elements, hence their increases the nuclear attraction for the outer electrons.

7. (a) Ammonium ion has the following structure



Label on the structure:

- (i) Covalent bond (1mk)

- (ii) Dative bond (1mk)

- (b) Why does an ammonia molecule form an ammonium ion with a proton? (1mk)

Ammonia molecule has lone pair of electrons



8. Hydrogen sulphide is highly toxic and flammable gas and is usually prepared in the flame chamber.

(a) Name any two reagents that can be used to prepare the gas in the laboratory. (1mk)

Iron(II) sulphide, dilute HCl // any metal sulphide and an acid.

(b) Other than vulcanization of rubber. Identify any other use of sulphur. (1mk)

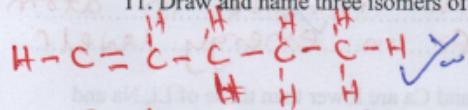
manufacture of  $H_2SO_4$  and // any other correct use

- Add  $K_2Cr_2O_7$  and warm. Describe two chemical tests that can be used to distinguish ethanol from ethanoic acid. (3mks)
- turns from white to orange in  $NaOH$  bath - decolorized in ethanol but not in ethanoic acid.

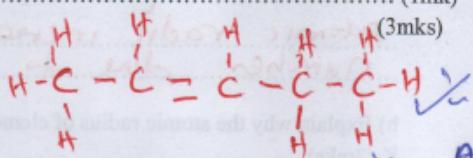
In ethanol 10. (a) The electronic arrangement of the ion of element Q is 2,8,8. If the formula of the ion is  $Q^{3-}$ . State the group and period to which Q belongs.

Group ..... ✓✓ (1mk)  
Period ..... 2 ✓ (1mk)

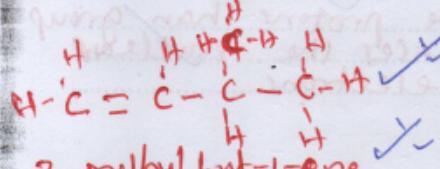
11. Draw and name three isomers of pentene.



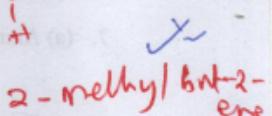
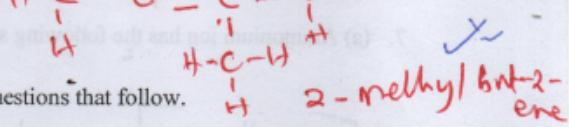
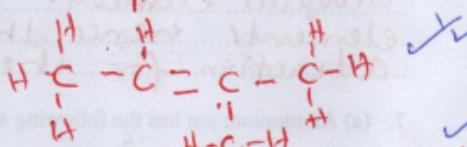
Pent-1-ene ✓



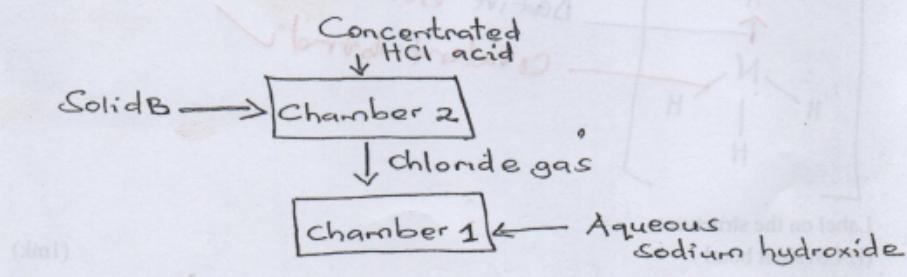
Pent-2-ene ✓ Any 3



3-methyl but-1-ene ✓



12. Study the flow chart below and answer the questions that follow.



(a) Identify solid B. (1mk)

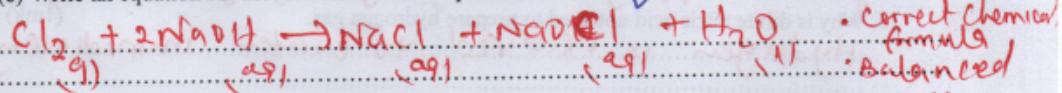
Potassium manganate (VII) // manganese (IV) oxide // lead(IV) oxide



(b) Name the type of reaction that takes place in chamber 2. (1mk)

Oxidation / Redox ✓

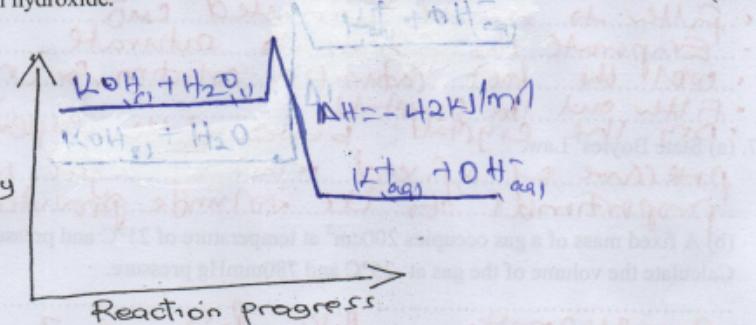
(c) Write an equation for the reaction that takes place in chamber 1. (1mk)



- correct chemical formula
- balanced
- correct physical state

13. The molar enthalpy of solution for potassium hydroxide is  $-42\text{ kJ/mole}$ .

a) On the axes provided, draw a labelled energy level diagram for the dissolution process of potassium hydroxide. (2mks)



b) Calculate the enthalpy change when 5.6g of potassium hydroxide is completely dissolved in water ( $K=39$ ,  $O=16$ ,  $H=1$ ) (2mks)

$$No\ of\ moles = \frac{5.6}{56}$$

$$= 0.1\text{ moles}$$

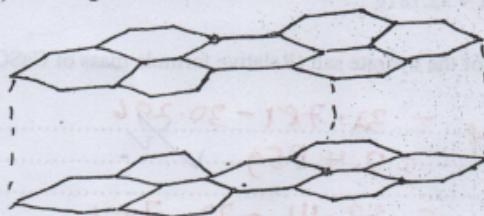
$$\Delta H = 0.1 \times 42$$

$$= -4.2\text{ kJ}$$

14. a) What is meant by allotropy. (1mk)

Existence of an element in more than one form in the same physical state

b) The diagram below shows the structure of one of the allotropes of carbon.



(i) Identify the allotrope. (1mk)

Graphite ✓

(1mk)



(ii) State two properties of the above allotrope and explain how it is related to its structure.(2mks)

- Conduct electricity due to delocalised electrons
- Soft and slippery - has hexagonal layer held by weak van der waals forces.

15. Why is dilute nitric acid not used to prepare hydrogen gas. (1mk)

Hydrogen is oxidized to Water immediately.

16. Starting with copper (II) oxide, describe how you can prepare copper (II) sulphate crystals.(3mks)

- React excess CuO with dilute  $H_2SO_4$   $\frac{1}{2}$  each procedure
- Filter to remove unreacted CuO
- Evaporate the filtrate to saturate
- Cool the hot saturated solution for crystals to form
- Filter out the crystals.

17. (a) State Boyle's Law.

pressure of a fixed mass of a gas is inversely proportional to its volume provided temperature is kept constant

(b) A fixed mass of a gas occupies  $200\text{cm}^3$  at temperature of  $23^\circ\text{C}$  and pressure  $740\text{mmHg}$ . Calculate the volume of the gas at  $-25^\circ\text{C}$  and  $780\text{mmHg}$  pressure. (2mks)

$$\begin{aligned}P_1 &= 740 \text{ mmHg} & \frac{P_1V_1}{T_1} &= \frac{P_2V_2}{T_2} & V_2 &= ? \\V_1 &= 200 \text{ cm}^3 & \frac{740}{273+23} &= \frac{780}{T_2} & T_2 &= ? \\T_1 &= 273 + 23 \text{ K} & 740 \times 200 \times 273 &= 780 \times T_2 & T_2 &= 250 \text{ K} \\P_2 &= 780 \text{ mmHg} & 296 \times 200 &= 780 \times T_2 & T_2 &= 158.98 \text{ cm}^3 \\T_2 &= -25 + 273 & & & & = 158.98 \text{ cm}^3\end{aligned}$$

18. When a hydrated sample of calcium sulphate  $\text{CaSO}_4 \cdot n\text{H}_2\text{O}$  was heated until all the water was lost, the following data was recorded.

Mass of crucible = 30.296g

Mass of crucible + hydrated salt = 33.111g

Mass of crucible + unhydrous salt = 32.781g

Determine the empirical formula of the hydrate salt (Relative formula mass of  $\text{CaSO}_4$  = 136,  $\text{H}_2\text{O}$  = 18) (3mks)

$$\begin{aligned}\text{mass of } \text{CaSO}_4 &= 33.111 - 30.296 \\&= 2.815 \text{ g}\end{aligned}$$

$$\begin{aligned}\text{mass of } \text{H}_2\text{O} &= 33.111 - 32.781 \\&= 0.339 \text{ g}\end{aligned}$$

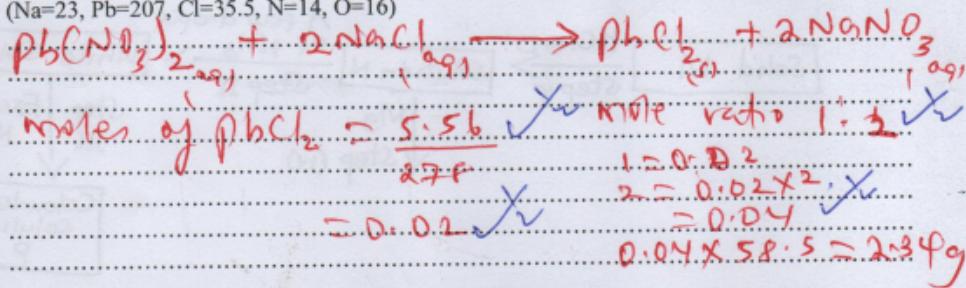
Compound	$\text{CaSO}_4$	$\text{H}_2\text{O}$		
mass	2.815	0.339		
RFM	136	18		
moles	$\frac{2.815}{136}$	$\frac{0.339}{18}$		
	0.0183	0.0183		

$\text{CaSO}_4 \cdot \text{H}_2\text{O}$

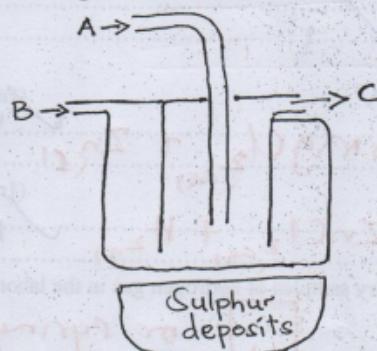


19. When excess lead (II) nitrate solution was added to a solution of sodium chloride, the precipitate was found to weigh 5.56g, determine the amount of sodium chloride in the solution. (3mks)

(Na=23, Pb=207, Cl=35.5, N=14, O=16)



20. The diagram below shows how sulphur is extracted from sulphur deposits.



(a) Name the process represented above. Frasch process (1mk)

(b) Identify A. Hot compressed air (1mk)

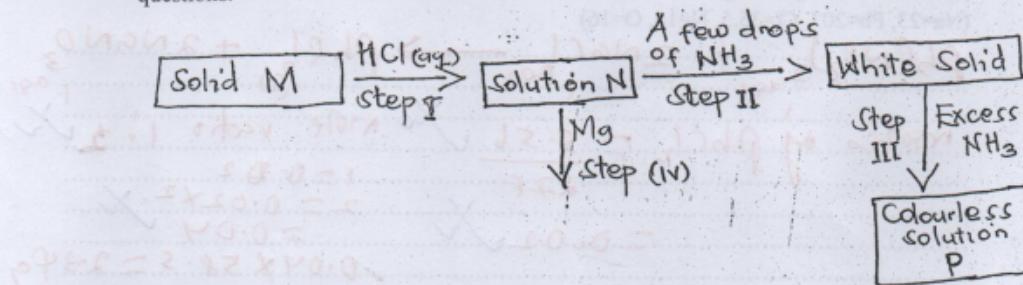
(c) State one physical property of sulphur that makes it possible to be extracted by this method. (1mk)

To melt sulphur / maintain sulphur in molten form

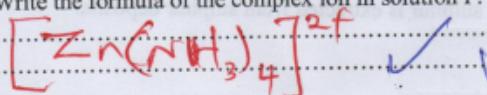
d). State one physical property of sulphur that makes it possible to be extracted by this method (1mk)

- Melting point of sulphur is lower than  $170^\circ\text{C}$
- Sulphur is insoluble in water

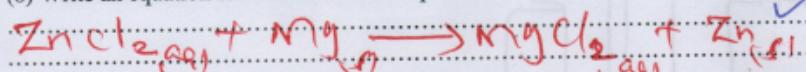
21. The scheme below shows some reaction sequence starting with solid M. Study it and answer the questions.



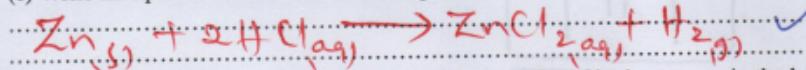
(a) Write the formula of the complex ion in solution P. (1mk)



(b) Write an equation for the reaction in step IV. (1mk)



(c) Write an equation for the reaction in step I. (1mk)



22. Draw a well labelled diagram used to prepare dry samples of hydrogen gas in the laboratory. (3mks)

Zinc granules + Dilute HCl → Zinc ions + Hydrogen gas

Hydrogen gas + Drying agent (concentrated H<sub>2</sub>SO<sub>4</sub>) → Dry hydrogen gas

- ✓ Drying agent
- ✓ method of gas collection
- ✓ Workability

23. (a) What are Isotopes. (1mk)

Atoms of the same element having same atomic number but different mass number.

(b) Element Q (not the actual symbol of the element) has two isotopes with mass numbers 8 and 9. If the relative atomic mass of Q is 8.94, determine the percentage abundance of each isotopes. (3mks)

$$\begin{aligned}
 R.A.M &= 8x + 9(100-x) \\
 8.94 &= 8x + 900 - 9x \\
 8.94 &= 900 - x \\
 x &= 9.6\%
 \end{aligned}$$

24. Aluminium is extracted from aluminium oxide by electrolysis.

(a) Other than the cost of electricity, give another reason why this method is expensive. (1mk)

*Graphite anode has to be replaced periodically since it is oxidised by air to carbon dioxide*

(b) Calculate the mass of aluminium obtained when a current of 20A is used for 5 hours (1

faraday=96500C, Al=27)



(3mks)

$$\Phi = It$$

$$= 20 \times 5 \times 60 \times 60$$

$$\frac{360000}{3 \times 96500} = 1.244$$

$$= 360.000c$$

$$\sqrt{1.244 \times 27 = 33.588g}$$

25. (a) Name two ores of iron.

*Hematite ✓, Magnetite ✓, Siderite } any 2.*

(b) Give the name of the suitable method used in extracting iron from the ore. (1mk)

*Reduction*

(c) Name one impurity present in pig iron and state one effect of the impurity in the physical property of iron. (2mks)

*Carbon // Silicon makes Iron brittle*

26. The concentration of a solution of aluminium sulphate is 0.02M. How many sulphate ions are contained in 150cm<sup>3</sup> of the solution. (3mks)

(Avogadros constant  $6.0 \times 10^{23}$ )

$$\text{Moles of } Al_2(SO_4)_3 = \frac{150 \times 0.02}{1000}$$

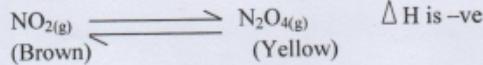
$$= 0.003 \text{ moles}$$

$$\text{Moles of } SO_4^{2-} = 0.003 \times 3$$

$$= 0.009 \text{ moles}$$

$$\text{No of } SO_4^{2-} \text{ ions} = 0.009 \times 6.0 \times 10^{23} = 5.4 \times 10^{21}$$

27. At room temperature, nitrogen (iv) oxide exists as an equilibrium mixture with dinitrogen tetroxide.



(Brown) (Yellow)

State the observation made when the mixture is heated. Give a reason. (2mks)

*Brown colour intensifies // yellow colour fades  
Equilibrium shifts to the left, more NO<sub>2</sub> is formed*

28. Define solubility.

THE END

