

# BUKAKA CLUSTER EXAMINATIONS

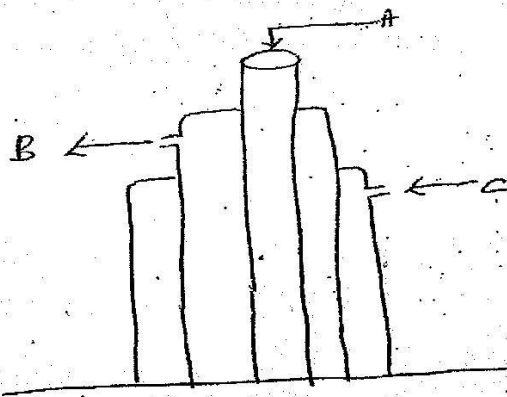
## CHEMISTRY PAPER 1

### MARKING SCHEME

END OF TERM 1, 2025

FORM 4

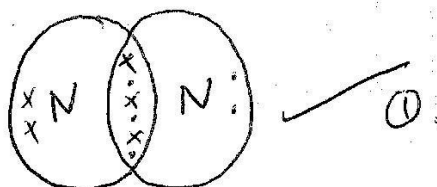
1. The diagram below shows the process used in mining sulphur. Study it and use it to answer the questions that follows



- a) Name the process illustrated above (1 mark)  
 Frasch process ✓
- b) Give the function of pipe; (2 marks)
- B To remove froth a mixture of molten sulphur and water. ✓
  - C To pass super heated water at  $170^{\circ}\text{C}$  and 10 atmosphere pressure ✓
- c) Name two allotropes of sulphur (1mark)  
 Rhombic ✓  
 Mono clinic ✓
2. (a) The atomic number of nitrogen and fluorine are 7 and 9 respectively. Draw electron dot(.) and cross(x) diagram to illustrate bonding in the molecules of;

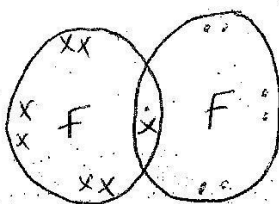
- (i) Nitrogen

(1mark)



- (ii) Fluorine

(1mark)



- (b) With reference to the diagram in (a). State why fluorine is more reactive than nitrogen any one  
 Nitrogen has tripple bond while fluorine <sup>①</sup> has a single bond (1 mark)  
 single bond is weaker than tripple bond hence easy to break

3. Complete table 1 by writing the formulae of all the products formed when the metal nitrates are heated strongly (3 marks)

Table 1

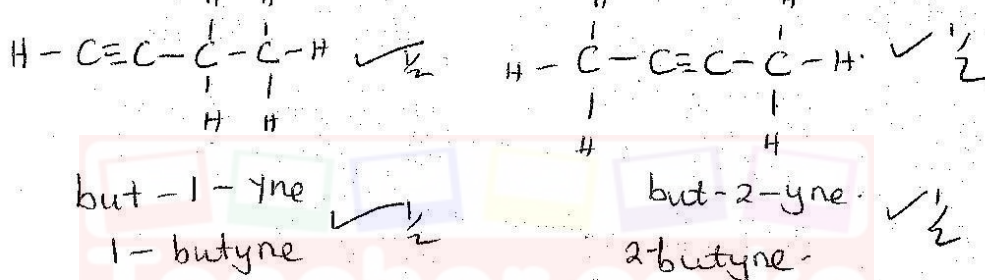
| Nitrate           | Formulae of products                        |
|-------------------|---------------------------------------------|
| Potassium Nitrate | $\text{KNO}_2 + \text{O}_2$ ✓ ①             |
| Lead (II) Nitrate | $\text{PbO} + \text{NO}_2 + \text{O}_2$ ✓ ① |
| Silver Nitrate    | $\text{Ag} + \text{NO}_2 + \text{O}_2$ ✓ ①  |

4. The molecular formula of two straight hydrocarbons is  $\text{C}_4\text{H}_6$

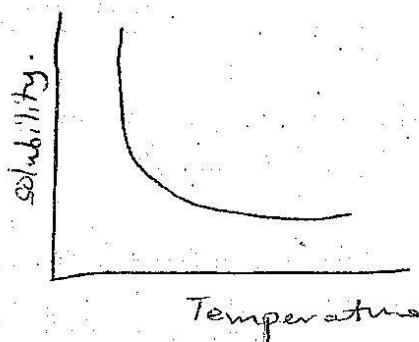
- (a) Give the general formula of the homologous series to which the hydrocarbons belong (1 mark)

$\text{C}_n\text{H}_{(2n-2)}$  ✓ ①

- (b) Draw the structures of the two compounds and give their names (2 marks)



5. Figure 1 shows how the solubility of oxygen varies with changes in temperature



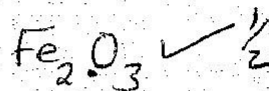
- a) Explain using kinetic theory why the solubility varies as shown (2 marks)

solubility of Oxygen decreases with increase in temperature. Because particles gain kinetic energy and escape from the soln. ✓ ①

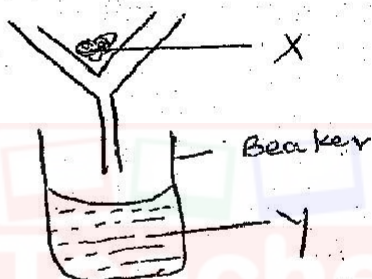
- b) Explain the pollution effect that may be caused by a large increase in temperature of sea water. (1 mark)  
less dissolved oxygen in sea water leading to death of marine life / organism. ✓ 1/2

6. The percentage composition by mass of an oxide of iron is 70% and 30% oxygen. Determine its empirical formula (Fe=56, O=16) (3 marks)

| Element      | Fe                  | O                    |       |
|--------------|---------------------|----------------------|-------|
| mass         | 70                  | 30                   | ✓ 1/2 |
| molar mass   | 56                  | 16                   | ✓ 1/2 |
| No. of moles | $\frac{70}{56}$     | $\frac{30}{16}$      | ✓ 1/2 |
| mole ratio   | $\frac{1.25}{1.25}$ | $\frac{1.875}{1.25}$ | ✓ 1/2 |
|              | 1                   | 1.5                  | ✓ 1/2 |
|              |                     | $1 \times 2 = 2$     |       |
|              |                     | $1.5 \times 2 = 3$   |       |



7. Filtration is carried out in apparatus shown



- a) Name; (1 marks)  
X Residue ✓ 1/2  
Y Filtrate ✓ 1/2

- b) State one property that makes it possible to separate mixtures using filtration (1 mark)  
Insolubility of solute in a solvent ✓ ①

8. Table 2 shows the boiling point of ethane, butane and ethanol

Table 2

| Compound                         | $\text{C}_2\text{H}_6$ | $\text{C}_4\text{H}_{10}$ | $\text{C}_2\text{H}_5\text{OH}$ |
|----------------------------------|------------------------|---------------------------|---------------------------------|
| Relative molecular mass          | 30                     | 58                        | 46                              |
| Boiling point $^{\circ}\text{C}$ | -88.6                  | -0.5                      | 78.5                            |

Give reasons for the following

a) Boiling point of butane is higher than that of ethane (2 marks)  
 Butane has a higher mass than ethane ✓  
 hence stronger weak van der Waals forces  
 compared to ethane ✓

b) Boiling point of ethanol is higher than that of butane (2 marks)  
 Ethanol has hydrogen bonding ✓ which is  
 stronger than weak van der Waals forces  
 in butane ✓

9. A volume of  $120\text{cm}^3$  of nitrogen gas diffused through a membrane in 40 seconds, how long will  $240\text{cm}^3$  of carbon (IV) oxide diffuse through the same membrane (3 marks)

$$\frac{T_{\text{CO}_2}}{T_{\text{N}_2}} = \sqrt{\frac{M_{\text{CO}_2}}{M_{\text{N}_2}}}$$

$$M_{\text{CO}_2} = 44$$

$$M_{\text{N}_2} = 28$$

$$T_{\text{CO}_2} = ?$$

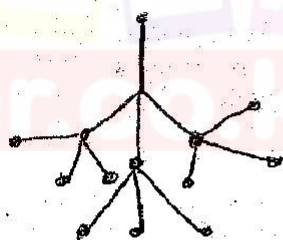
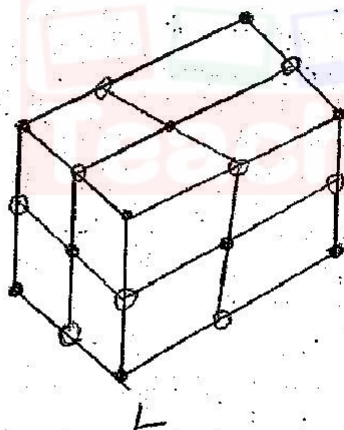
$$T_{\text{N}_2} = 120 \times \frac{40}{240}$$

$$= 80\text{sec}$$

$$\frac{T_{\text{CO}_2}}{80} = \sqrt{\frac{44}{28}}$$

$$T_{\text{CO}_2} = 80 \times \sqrt{\frac{44}{28}} = 100.29\text{sec}$$

10. Study the structure of substances L and M



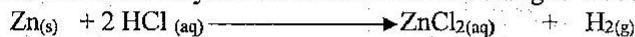
Complete the table below

| Substance | L             | M                |
|-----------|---------------|------------------|
| Structure | Giant ionic ✓ | Giant covalent ✓ |
| Bonding   | ionic bond ✓  | covalent ✓       |

11. State one physical property that would suggest the presence of each of the following gases from a leaking gas cylinder.

- a)  $H_2S$  ... Rotten egg smell ..... (1 mark)  
 b)  $N_2O$  ... Pleasant smell ..... (1 mark)  
 c)  $Cl_2$  ... Yellow-green gas ..... (1 mark)

12. Zinc metal and hydrochloric acid react according to the following equation



1.96g of zinc metal were reacted with 100cm<sup>3</sup> of 0.2M hydrochloric acid (Zn=65.2)  
 molar gas volume at stp 22.4 litres)

a) Determine the reagent that was in excess

(2 marks)

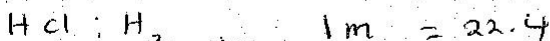
$$\text{moles of Zn} = \frac{1.96}{65.2} = 0.03 \text{ moles}$$

$$\text{moles of HCl} = 0.2 \times \frac{100}{1000} = 0.02 \text{ moles}$$

Zinc was in excess by 0.01 moles

b) Calculate the total volume of hydrogen gas that was liberated at stp

(2 marks)



$$2 : 1$$

$$0.01 \times$$

$$H_2 = 0.01 \text{ moles}$$

$$0.01 \times 22.4$$

$$= 0.224 \text{ L}$$

13. The following ions have the same number of electrons  $N^{3-}$ ,  $Mg^{2+}$ ,  $O^{2-}$ ,  $Na^+$

Arrange them in order of increasing ionic size. Give a reason for the order (2 marks)

$Na^+$ ,  $O^{2-}$ ,  $N^{3-}$ ,  $Mg^{2+}$   
 reason: decrease from  $Mg$  to  $N$  hence nuclear attraction increases

14. The solubility of sodium chloride is 36.2 in 100g of water at room temperature.

Determine the concentration in mole per litre of a saturated aqueous sodium chloride at room temperature (Na=23, Cl=35.5, density of water 1g cm<sup>-3</sup>)

(2 marks)

$$\frac{36.2}{100} \times 1000$$

$$\text{molarity} = \frac{\text{mass}}{\text{molar mass}}$$

$$\frac{36.2 \times 1000}{100}$$

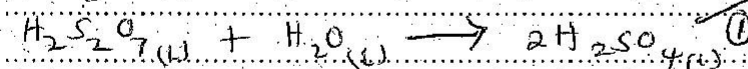
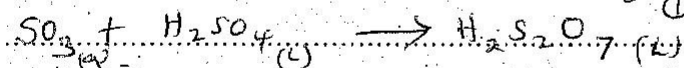
$$= 362$$

$$\frac{362}{58.5}$$

$$= 6.19 \text{ M}$$

15. Explain how concentrated sulphuric (VI) acid is prepared starting with  $SO_3$

(2 marks)



or

$SO_3$  is dissolved in sulphuric (VI) acid to form oleum that is diluted in water to form conc sulphuric (VI) acid

16. (a) Atomic number of element Q is 16... write the electron arrangement of Q2- (1 mark)

2.8.8 ✓ ①

(c) Give the period and group of Q (1 marks)

period 3 ✓ ②

group VI ✓ ②

17. Name the apparatus that can be used to;

a) Lower a burning piece of magnesium ribbon into a gas jar (1 mark)

deflagating spoon ✓ ①

b) Measure volume of solution accurately than a measuring cylinder (1 mark)

pipette / volumetric flask ✓ ①

c) Scoop solids (1 mark)

Spatula ✓ ①

18. (a) Complete the table below (2 marks)

| Ion                        | Number of electron | Proton | Neutrons |
|----------------------------|--------------------|--------|----------|
| $^{31}_{15}\text{P}^{3-}$  | 18 ✓ ②             | 15 ✓ ② | 16       |
| $^{56}_{26}\text{Fe}^{2+}$ | 24 ✓ ②             | 26 ✓ ② | 30       |
| $^X_Y\text{O}^n$           | 10                 | 8      | 9        |

(b) Determine the value of X, Y, and n in  $^X_Y\text{O}^n$  (3 marks)

i) X 17 ✓ ①

ii) Y 8 ✓ ①

iii) n 2- / -2 ✓ ①

19. A form four student accidentally mixed sodium chloride with copper (II) oxide

a) Give the colour of (1 mark)

i) Sodium chloride - white ✓ ②

ii) Copper (II) Oxide - black ✓ ②

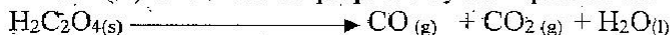
b) Briefly describe how the mixture of sodium chloride and copper (II) oxide can be separated (3 marks)

1. Add water to dissolve sodium chloride ✓ ①

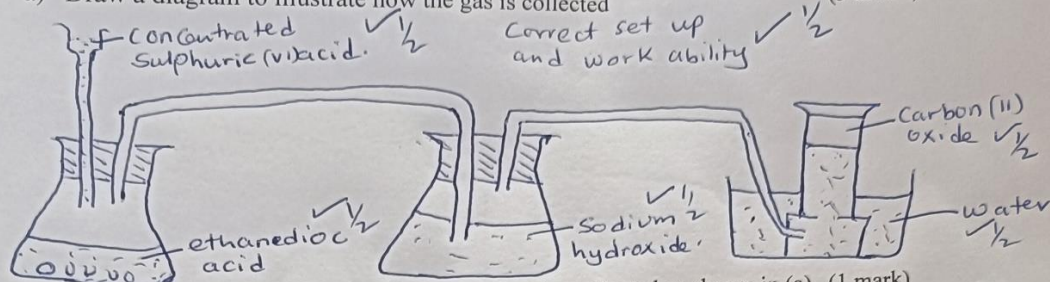
2. Filter to remove copper (II) oxide as residue. ✓ ①

3. evaporate the filtrate to saturation and allow to cool to form sodium chloride crystals ✓ ①

20. Carbon (II) Oxide can be prepared by the equation shown below



- a) Draw a diagram to illustrate how the gas is collected (3 marks)



- b) State one property of the gas that allows it to be collected as shown in (a) (1 mark)

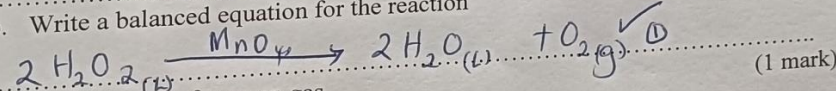
Insoluble / slightly soluble in cold water

1. Oxygen gas is prepared in the laboratory by decomposing hydrogen peroxide using a catalyst.

- a. Name the catalyst used in the process. (1 mark)

$MnO_4$  manganese (IV) oxide

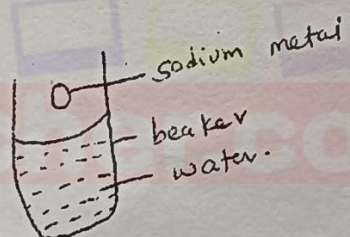
- b. Write a balanced equation for the reaction (1 mark)



- c. Give one use of oxygen gas (1 mark)

welding  
combustion

2. The diagram below shows sodium metal being dropped in water. Study it and answer the questions that follows

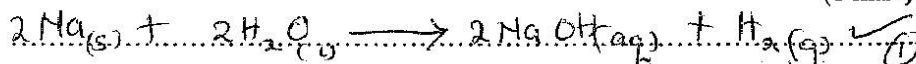


- (i) State and explain two observations made during the reaction (2 marks)

floats in water because it's lighter than water  
dissolves in water because it's reactive with water

- (ii) Write an equation for the reaction that takes place during the experiment

(1 mark)



23. The atomic number of two isotopes of element P are 7 and 6 respectively. If the relative atomic mass of P is 6.94. Calculate the percentage abundance of each isotope

(3 marks)

$$7 = a\%$$

$$6 = 100 - a\%$$

$$a = 94\%$$

$$7 = 94\%$$

$$6 = 6\%$$

$$100 \times \frac{(7 \times a) + (6(100 - a))}{100} = 6.94 \times 100$$

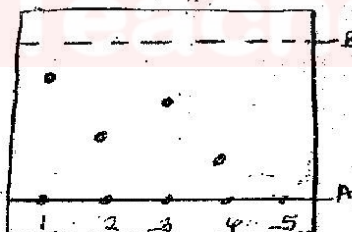
$$7a + 600 - 6a = 694$$

$$a = 694 - 600$$

24. A colourless solution was suspected to be water. Give one chemical and one physical test that can be used to show that the colourless solution is water

- (i) Chemical test: Turns anhydrous  $\text{CuSO}_4$  from white to blue / Turns anhydrous  $\text{CoCl}_2$  from pink to blue (1/2 mark)
- (ii) Physical test: B.P.  $100^\circ\text{C}$  above sea level / m.p.  $0^\circ\text{C}$  (1/2 mark)

25. Use the chromatogram below to answer the questions that follows



- a) Name A and B

(1 mark)

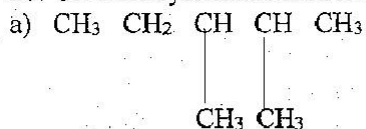
A: base line

B: solvent front

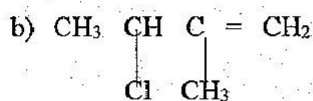
- b) 5 is a mixture that contains ink 1 and 4 only. Show on the chromatogram diagram the chromatography of 5

(1 mark)

26. Give the systematic names of the following



2,3 - dimethyl pentane (1 mark)



3-chloro, 2-methyl but-1-ene (1 mark)

27. An oxide of element A has the formula as  $\text{A}_2\text{O}_3$

a) State the valency of A

3 ✓

(1 mark)

b) In which group of the periodic table is element A

III ✓

(1 mark)

28. Diamond and graphite are allotropes of carbon. What is an allotrope?

different forms of an element at the same physical state. ✓

(1 mark)