

***CHEMISTRY
FORM THREE
PAPER 1 (233/1)
END TERM 2
EXAMINATIONS
JULY/AUGUST 2025
MARKING SCHEME***

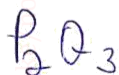
1. Element P3+ and Q2- belong to period three of the periodic table.

(i) Write the electronic arrangement of their atoms. (2mks)

P- 2-8-3

Q- 2-8-6

ii) Write the formula of the compound formed by P and Q. (1mk)



2) The combustion of a hydrocarbon compound gave 4.4g carbon (IV) oxide and 2.25g water.

i) Calculate the mass of carbon and hydrogen in the hydrocarbon sample. (2 mrks)

$$\text{Mass of carbon} \Rightarrow \frac{12}{44} \times 4.4g = 1.2g$$

$$\text{Mass of Hydrogen} \Rightarrow \frac{2}{18} \times 2.25g = 0.25g$$

ii) Calculate the empirical formula and hence determine the molecular formula of the hydrocarbon given that it has a molecular mass of 58. (C=12.0, H=1.0) (2 marks)

Element	Mass	RM	molar	
Carbon	1.2g	12	0.1	$\frac{29n}{29} = \frac{58}{29}$
Hydrogen	0.25	1	0.25	$n = 2$
$C : H$ $0.1 : 0.25$				$(C_2H_5)_2$ C_4H_{10}
$C : H$ $(1 : 2.5) \times 2$ $2 : 5$				$(C_2H_5)_n = 58$

3. (i) State Graham's law of diffusion (1mk)

The rate of diffusion of a gas is inversely proportional to the square root of its density at constant temp & pressure.

ii). A given mass of gas T diffuses through a porous plug in 48 seconds while a similar mass of gas R diffuse in 70 seconds. Given that the density of gas T is 0.6g/cm³, find the density of gas R [2mks]

Gas T
Time = 48 sec
Density = 0.6 g/cm³

Gas R
Time = 70 sec
Density = ?

$$\frac{T_F}{T_R} = \sqrt{\frac{d_T}{d_R}} \Rightarrow \left(\frac{48}{70}\right)^2 = \left(\sqrt{\frac{0.6}{d_R}}\right)^2 \Rightarrow$$

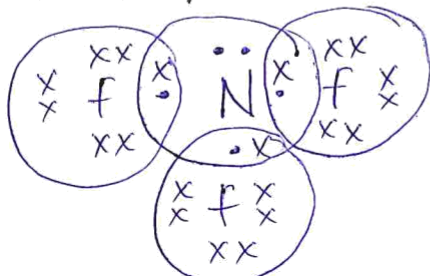
$$0.4706 = \frac{0.6}{d_R}$$

density of Gas R = 1.276 g/cm³

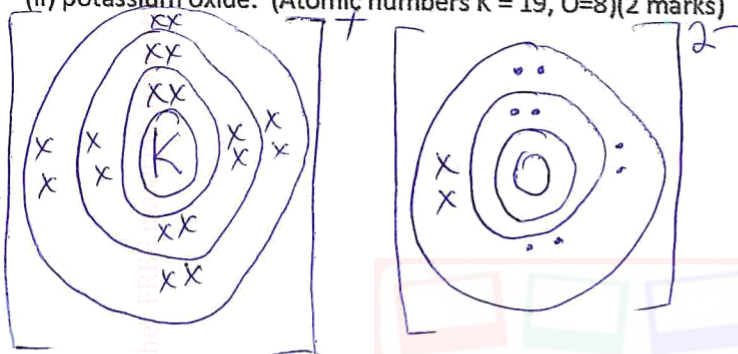
4. Using dots (•) and crosses (x) diagrams to represent electrons, show bonding in:

(i) the compound formed when fluorine and nitrogen combine. (2 mark)

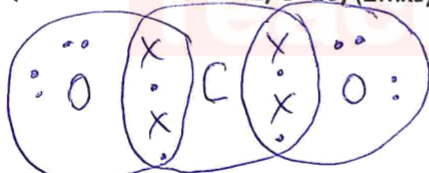
(atomic numbers N = 7, fluorine = 9)



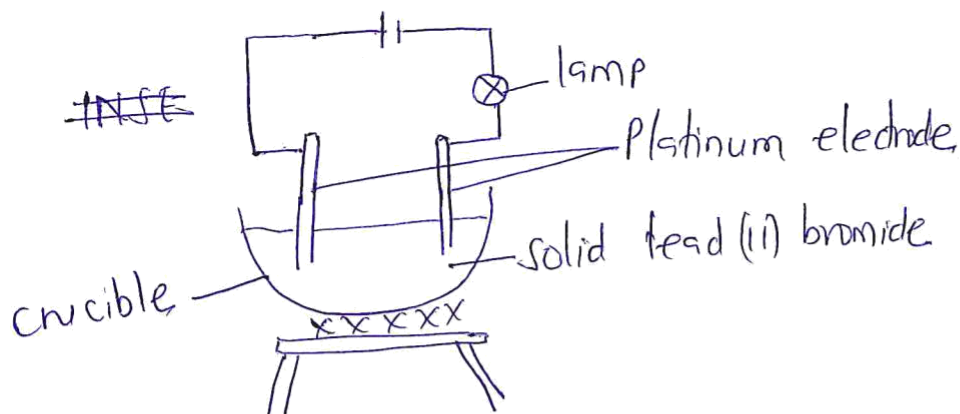
(ii) potassium oxide. (Atomic numbers K = 19, O = 8) (2 marks)



iii) Carbon (iv) oxide (Atomic number C = 12, O = 16) (2 mks)



5. In an experiment to investigate the conductivity of substances, a student used the set up shown below.



The student noted that the bulb did not light.

a) What had been omitted in the set up. (1mk)

Source of Heat

b) Explain why the bulb lights when the omission is corrected? (2mks)

Ionic compounds do not conduct electric current in solid state due to lack of mobile ions. On heating, solid lead (II) bromide becomes molten and has mobile ions responsible for conductivity.

c) State all the observations that would be made when the omission is corrected (3mks)

1. The bulb lights
2. Deposits of grey beads on the cathode
3. Brown gas formed at the anode.

6. Define the following terms as used in Chemistry

i) Flame (1 mark)

A mass of burning gas

ii) Allotropy (1 mark)

Is the existence of an element in more than one form but in the same physical state.

iii) End point of a reaction (1 mark)

Is the point of an reaction at which just enough of the acid has neutralised the acid

7. Why is solid carbon (IV) Oxide (Dry ice) preferred in cool boxes than the normal ice (solid water)? (2mks)

It sublimates without leaving any residue.

8. Name the following processes;

a) When anhydrous calcium chloride is left in an open beaker overnight a solution was formed. (1mk)

Deliquescence

b) When sodium carbonate decahydrate crystals are left in an open beaker for some days it turned into a powder. (1mk)

Efflorescence

9. Study the table below and answer the questions that follow.

a) Do the elements represent a metallic or non-metallic group? Explain. (2 marks)

Non metallic group - The ionic radii of the element is bigger than its.

Atomic radii

b) Compare atomic and ionic radii of the elements. Explain. (2mark)

The ionic radii of the element is bigger than the atomic radii. Non-metals form ions by gaining an electron which leads to a reduction in the nuclear force of attraction. Thus an increase in ionic radii

c) Identify the strongest oxidizing agent. (1mark)

X

10. Give one use of graphite and diamond and relate the use to properties of each. (4 marks)

I. Graphite : Use

Used as an electrode

Property

It conducts electricity due to presence of delocalised electrons.

II. Diamond: Use

Used in drill bits.

Property

Due to its hardness

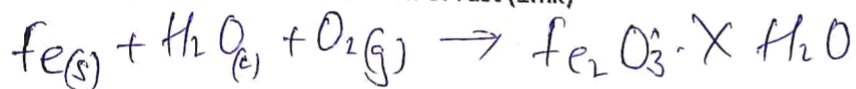
11. A crystalline sample of sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ was heated until there was no further change. The mass of the residue reduced by 14.5%. Determine the value of X in the formula. (3marks)

Element	Mass	RMM	molar	
Na_2CO_3	85.5	106	0.8066	$\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ $0.8066 \div 0.8055$ $1 \div 1$
H_2O	14.5	18	0.8055	$\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ $x=1$

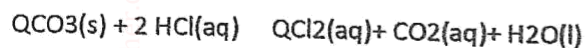
12.(i) State the most effective method of preventing rusting?(1mark)

Sacrificial Protection

(ii) Write an equation for the formation of rust (1mk)



13. A certain metal carbonate, QCO_3 , reacts completely with 20 cm^3 of 1M hydrochloric acid according to the equation below.



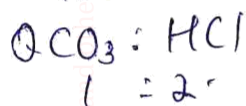
Determine the relative atomic mass of Q if 1g of the carbonate reacted completely.

(C=12, O=16) (3mks)

$$\text{HCl} = 20\text{ cm}^3 \text{ of } 1\text{M}$$

$$1\text{mole} \rightarrow 1000\text{ cm}^3$$

$$20\text{ cm}^3 \rightarrow \frac{20 \times 1}{1000} = 0.02\text{ moles}$$



$$0.01\text{ moles} = 0.02\text{ moles}$$

$$\text{QCO}_3 = 0.01\text{ moles}$$

$$\text{mass} = 1\text{g}$$

$$\text{molar mass} = \frac{1}{0.01} = 100$$

$$\text{Q} + 12 + 48 = 100$$

$$\text{Q} + 60 = 100$$

$$\text{Q} = 40$$

14. Two miscible liquids K and H have boiling points of 58°C and 93°C . If the liquids are mixed accidentally,

a) Suggest a method used to separate the mixture. (1mark)

fractional distillation

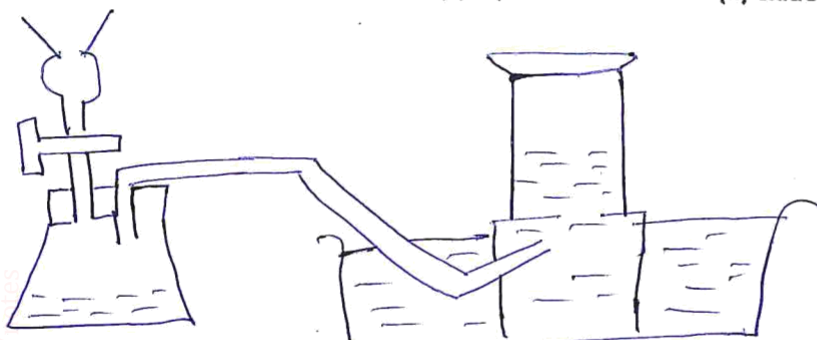
b) Which liquid will be collected first? Explain. (1mark)

K - Has a lower boiling point

c) State two industrial applications of the method identified in (a) (2mark)

1. Distillation of crude oil to obtain diesel, petroleum & cooking gas
2. Fractional distillation of liquefied air.

15. The set-up below was used in the laboratory preparation of carbon (II) oxide.

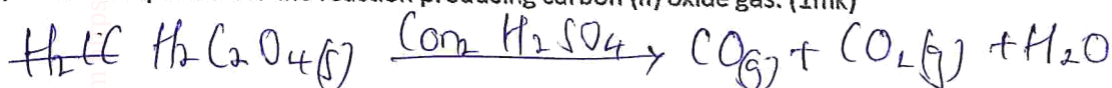


(i) Complete the set up to show how carbon (II) oxide was collected. (2mks)

(ii) Identify liquid H and state its function (2 mks)

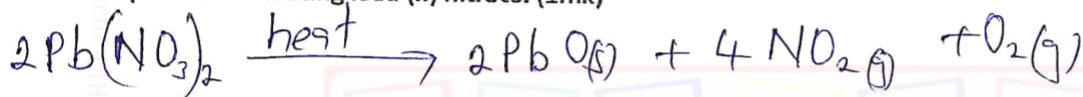
Conc H_2SO_4

(iii) Write an equation for the reaction producing carbon (II) oxide gas. (1mk)



16. Lead (II) nitrate was heated completely.

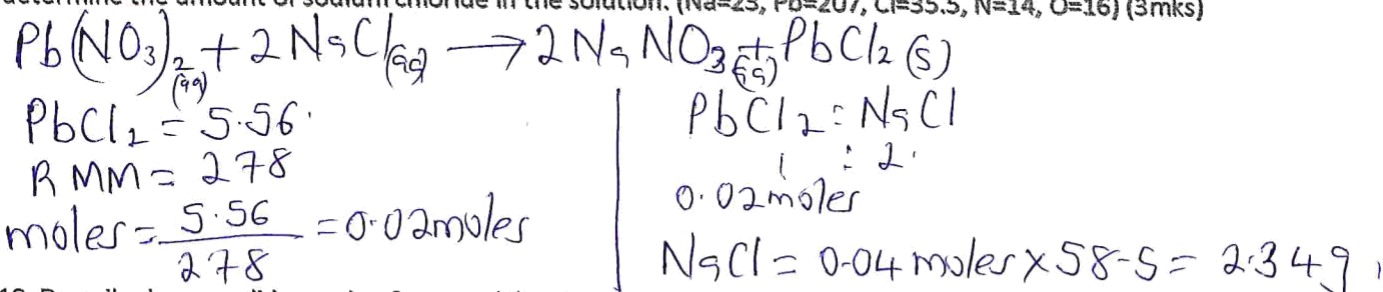
a) Write an equation for heating lead (II) nitrate. (1mk)



b) Calculate the mass of the oxide formed given that 0.2 moles of the nitrate was heated. (Pb = 207, O = 16) (2mks)

$$\begin{array}{l} Pb(NO_3)_2 : PbO \\ 2 : 2 \\ 0.2 \text{ moles} : 0.2 \text{ moles} \end{array} \quad \begin{array}{l} \text{Mass} = \text{moles} \times \text{molar mass} \\ 0.2 \times 223 = 44.6g \end{array}$$

17) 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. (Na=23, Pb=207, Cl=35.5, N=14, O=16) (3mks)



18. Describe how a solid sample of copper (II) carbonate can be prepared starting with copper metal. (3 marks)

Heat the metal in air to form Copper (II) oxide. React the copper (II) oxide with Nitric acid to form copper nitrate. React copper nitrate with sodium carbonate to form Copper carbonate and sodium nitrate. Filter the mixture and obtain copper carbonate as the residue and sodium carbonate nitrate as the filtrate. Dry the crystals of the copper carbonate between filter papers.

19. What is the role of the following parts during the fractional distillation of a mixture of water and ethanol?

(i) Fractionating column (1 mark)

To allow water vapour to condense into liquid and flow back into the flask.

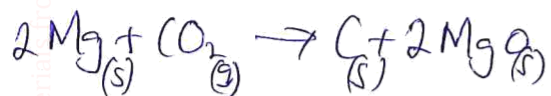
(ii) Glass beads in the fractionating column (1 mark)

Increase surface area for condensation.

20. Carbon (IV) oxide does not support combustion but burning magnesium continues to burn in carbon (IV) oxide. Explain. (2 marks)

Burning Magnesium produces a lot of heat which decomposes CO_2 to Carbon & Oxygen. Oxygen supports combustion.

(b) Write an equation for the reaction in (a) above. (1 mark)



21. (a) Give the meaning of the term prescription. (1 mark)

The written instructions by a qualified medical officer giving details on the type of drugs and how the drugs should be used.

(b) A patient was given tablets with prescription 2 x 3 on the envelope. Clearly outline how the patient should take the tablets. (1 mark)

Two tablets, three times a day after every six hours.

(c) State two long-term effects of drug abuse. (2 marks)

Depression

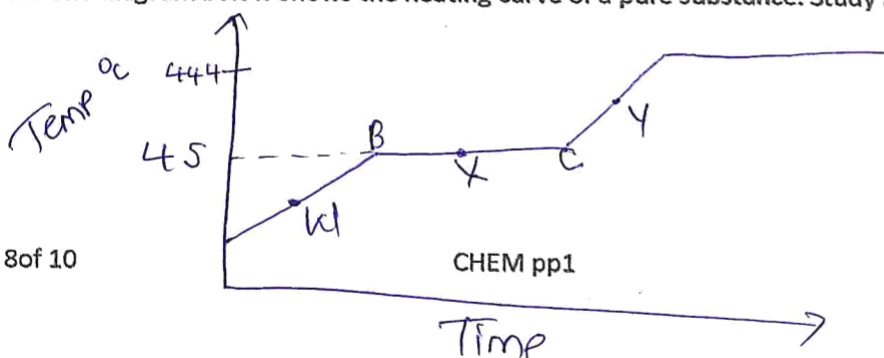
Addiction.

22. a) Distinguish between strong and concentrated acid (1 mark)

Strong acid - has more hydrogen ions.

Concentrated acid - has less distilled water added to it.

23. The diagram below shows the heating curve of a pure substance. Study it and answer the questions that follow.



a) What are the physical states of the substances at point W and Y. (2mks)

W - Solid

Y - Liquid

b) Explain why the temperature remains constant between point B and C. (2mks)

The heat energy absorbed is used in breaking the bonds of the solid ~~and liquid~~ to liquid.

c) Draw the expected curve for an impure substance on the curve above (2mks)

