CHEMISTRY
FORM 4
PAPER 1 – MARKING SCHEME

10. a) Two sampes of water A and B were tested on volume of soap required to lather before and after boiling. The results were recorded in the table below.

b)

Sample of water	Volume of soap used before boiling (cm^3)	Volume of soap used after boiling (cm^3)
A	30	10
B	30	30

i. Explain the observation made in water sample A (1mks)

A – had temporary hardness / $Ca(HCO_3)_2$ or $Mg(HCO_3)_2$ present 01

ii. Name one cation and one anion that could be present in sample water B(1mark)

Cation..... Mg^{2+} or Ca^{2+} 1

Anion..... NO_3^- or SO_4^{2-} 1

iii. State **one** uses of hard water. (1 mark)

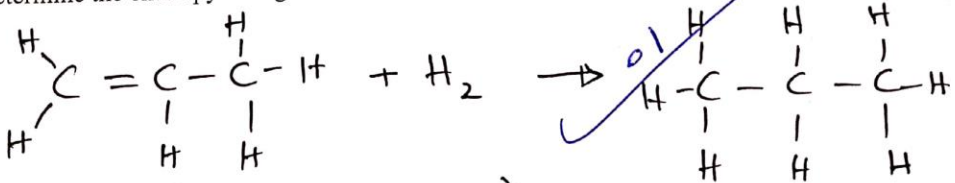
– Beer making 01

11. Use the bond energy value given below for questions that follows

Bond	Bond energy ($KJmol^{-1}$)
H – H	432
C = C	610
C – C	346
C – H	413

Determine the enthalpy change for the conversion of propene to propane by hydrogen.

(3mks)

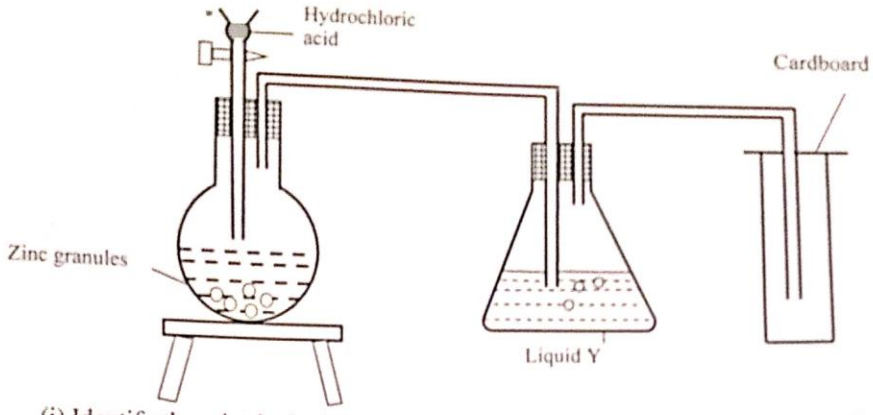


01

(610 + 346 + 432) (+1388) + (346×2) + (413×2) (−1518) 01

= −130 KJmol⁻ 01

12. The set up below was used to prepare **dry** hydrogen gas. Study it and answer the questions that follow.



(i) Identify the mistake in the set-up above. (1 mark)

Method of gas collection – should be upward delivery / downward displacement of air 01

(ii) What would be liquid Y? (1 mark)

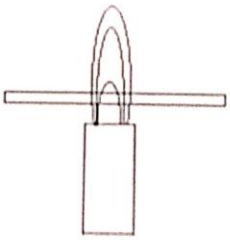
Concentrated Sulphuric vi acid 01

(iii) Give two properties that hydrogen gas share with carbon II oxide (1 mark)

- Reducing agent
- Burn with blue flame
- Neutral to litmus

01½ Any two.

13. Study the diagram below then use it to answer the questions that follow.

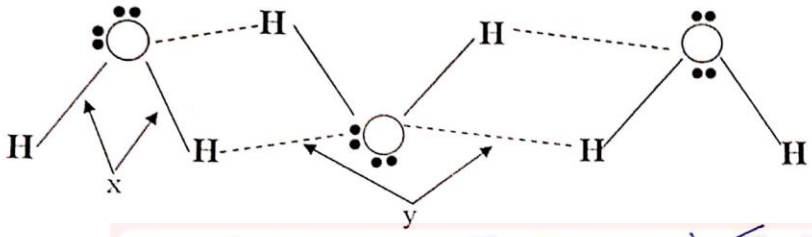


b) Determine the values of **a** and **b** in the equation. (2mks)

$$^{216}_{84}X \longrightarrow {}^{208}_{82}Pb + 2\,^{4}_{2}He + 2\,^{0}_{-1}e$$

a = 2
b = 2 02

23. The diagram below shows a structure of water molecules.



(a) Name the bonds (1mk)

X ..... Covalent bond 1/2

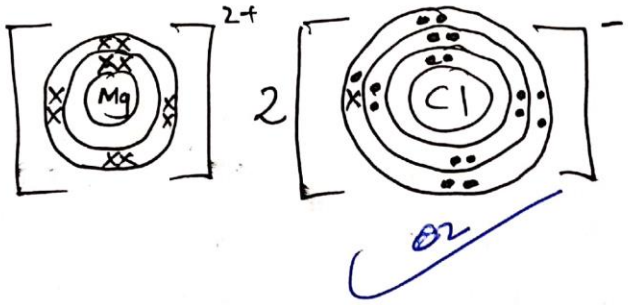
Y ..... Hydrogen bond 1/2

b) Using dots (•) and crosses (X) to represent electrons, draw diagrams to represent the bonding in magnesium chloride (Mg=12, Cl=17) (2mk)

$MgCl_2$

Mg = 2.8.2

Cl = 2.8.7

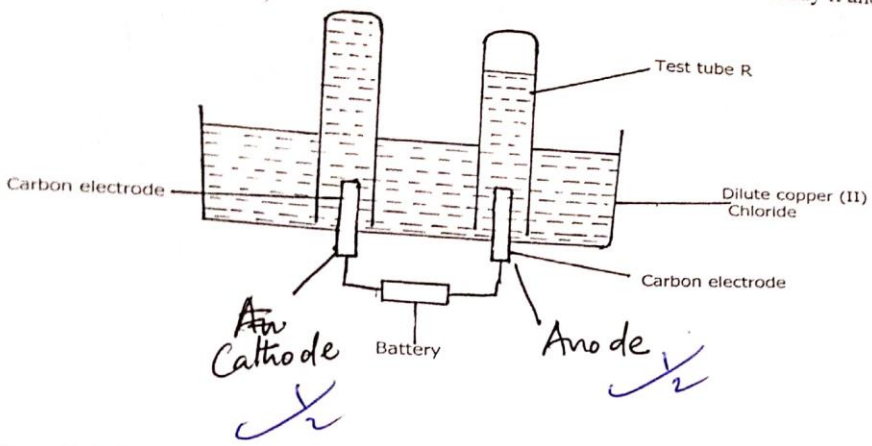


02

24. The set up below shows the electrolysis of dilute copper (II) chloride. Study it and answer the questions that follow.

CHEMISTRY
FORM 4
PAPER 1 – MARKING SCHEME

24. The set up below shows the electrolysis of dilute copper (II) chloride. Study it and answer the questions that follow.



(a) Label the cathode and anode on the diagram. (1mk)

(b) Write an equation for the reaction responsible for formation of gas in tube R. (1mk)

$4OH^-_{(aq)} \longrightarrow O_{2(g)} + 2H_2O_{(l)} + 4e^-$ 01

25. 20 cm^3 of sodium carbonate solution was reacted completely with 25cm^3 of 0.8 M hydrochloric acid . calculate the concentration of sodium carbonate solutions in moles per litre (3marks)

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$

1 : 2 01 or ratio.

Moles of HCl $= \frac{25 \times 0.8}{1000} = 0.02$ ½

Moles of $Na_2CO_3 = \frac{1}{2}(0.02) = 0.01$ ½

13

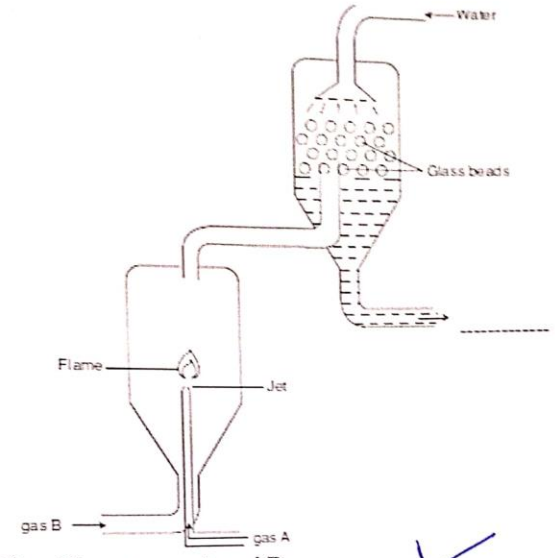
$Moles = \frac{M \times V}{1000}$

$0.01 = \frac{M \times 20}{1000}$ 01

$M = \frac{0.01 \times 1000}{20} = 0.5M$

CHEMISTRY
FORM 4
PAPER 1 – MARKING SCHEME

26. The following diagram represents a section of the plant for the large scale manufacture of hydrochloric acid.



(a) Name gases A and B. (1 mark)

A..... Hydrogen ½

B..... Chlorine ½

(b) State the role of the glass beads in the plant (1 mark)

Increase surface area for dissolving HCl gas 01

(c) Why is gas A introduced into the reaction chamber through a jet?(1 mark)

In Excess Hydrogen and Chlorine mixture explodes 01

27. a) What does the abbreviation **PVC**s stand for?(1 mark)

Poly vinyl chlorides 01

b).State **one** advantage and **one** disadvantage of **PVC** over natural polymers .

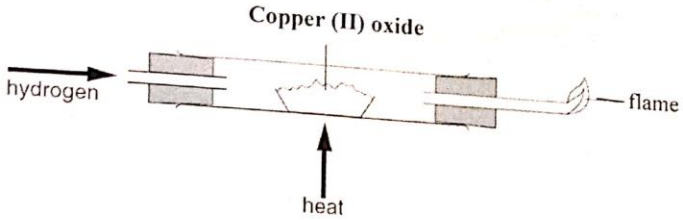
Advantage.....(1mk) Cheap ½

Disadvantage ---(1 mk) 14

non biodegradable. ½

CHEMISTRY
FORM 4
PAPER 1 – MARKING SCHEME

18. Hydrogen gas was passed over heated copper (II) oxide in a combustion tube as shown below.



i) State and explain the observations made in the combustion tube. (2 marks)

black copper II oxide ~~Change~~ brown in colour
Copper II oxide reduced to copper 02

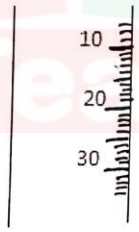
ii) Write equations for the reaction that took place;

I. In the combustion tube. (1 mark)

$CuO_{(s)} + H_{2(g)} \rightarrow Cu_{(s)} + H_2O_{(l)}$ 01

19. a) Below is a section of an apparatus used to measure accurate volume of liquids in the laboratory

(a) Identify the apparatus. (1 mark)



Burette 01

b) Give two reasons why glass is preffered in making of apparatus above in question 19(a) (1 mark)

- Easy to clean 2
- clear / Easy visibility 1/2
- Does not react with most of the Chemicals.

1/2 for any.

20. a) State Le'Chatelier's principle (1mk)

When a change in condition is applied to a system in 10 equilibrium, the system moves so as to oppose that change. 01

14. Determine the oxidation state of element in bracket in the following substances

(i) $KMnO_4$ (Mn) (1mk)

$(+1) + (x) + (-2\times4) = 0$

$x = (+8) - (1) = +7$ 01

(ii) $K_2Cr_2O_7$ (Cr) (1mk)

$[(+1)\times2] + 2x + (-2\times7) = 0$ $x = +6$ 01

$2x = +14 - 2$

(ii) Explain this observation.When acidified hydrogen peroxide is added to pale-green iron (ii) sulphate solution . the solution turns yellow (1mk)

H_2O_2 oxidised Fe^{2+} ions to Fe^{3+} ions 01

15. a) State Grahams law (1 mk)

Under the same condition of temperature and pressure the rate of diffusion of a gas is inversely proportion to the squareroot of its density. 01

b) A sample of unknown compound gas X is shown by analysis to contain Sulphur and oxygen. The gas requires 28.3 seconds to diffuse through a small aperture into a vacuum. An identical number of oxygen molecules pass through the same aperture in 20 seconds. Determine the molecular mass of gas X. (O =16, S = 32) (3marks)

$$\frac{T_x}{T_{O_2}} = \frac{\sqrt{M_x}}{\sqrt{M_{O_2}}}$$

$$\frac{28.3}{20} = \frac{\sqrt{x}}{\sqrt{32}}$$ 01

$$(1.415)^2 = \frac{x}{32}$$ 01

$X = 32 \times (1.415)^2$

$= 64.07$

$\simeq 64$ 01

b) When sulphur(vi) is heated the equilibrium shown below is established.

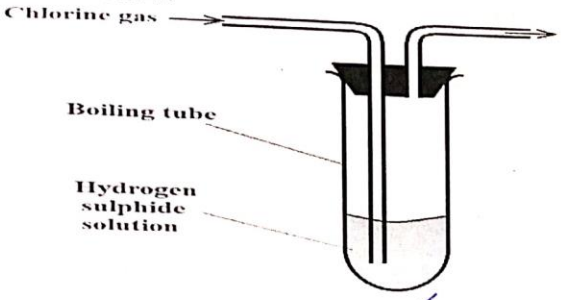
$$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$$

2 vol ↑ 3 vol

How would the position of the equilibrium be affected if the pressure is increased. Explain (2mks)

More SO_3 is formed | shift to left – increase in pressure result to reduction in volume 02

21. Chlorine gas was bubbled into as solution of hydrogen sulphide as shown in the diagram below.



a. Explain the observation made in the boiling tube (2 Marks)

Yellow solid – Chlorine oxidises Hydrogen Sulphide to Sulphur. 01 01

$Cl_{2(g)} + H_2S_{(aq)} \rightarrow HCl_{(aq)} + S_{(s)}$ – yellow

b. State the precaution that should be taken in this experiment? (1 Mark)

– Done in fume chamber | open field

* Chlorine is poisonous 01

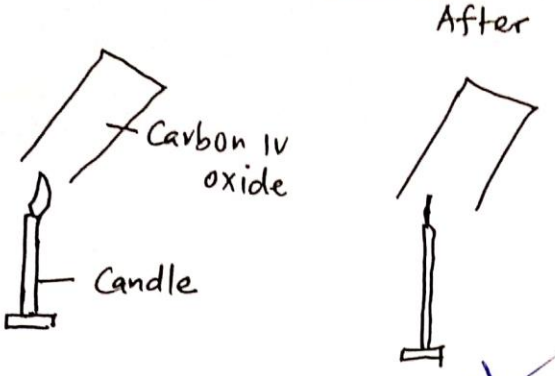
22. A radioactive element X decays as shown below.

$$^{216}_{84}X \longrightarrow {}^{208}_{82}Pb + a\alpha + b\beta$$

a) Give the number of neutrons in element **X**. (1mk)

216 – 84 = 132 01

16. The diagram below demonstrate two properties of carbon iv oxide.



(a) .Identify the two properties demonstrated.. (2marks)

- ~~Denser than air~~ Density 01
- Does not burn or support burning 01

(b) .State one use of carbon iv oxide based on other properties apart from the one identified in question 16 (a). (1mark)

- refrigeration 1/2
- Manufacture of Sodium Carbonate 1/2
- Manufacture of fizzy drinks. Any.

17. The molecular formula mass of gas A is 42 and its empirical formula is CH_2.

(a) Determine the molecular formula of gas A (**C = 12.0, H = 1.0**). (2mks)

$CH_2 = 12+(1\times2)=14$ 01

$n = \frac{42}{14} = 3$

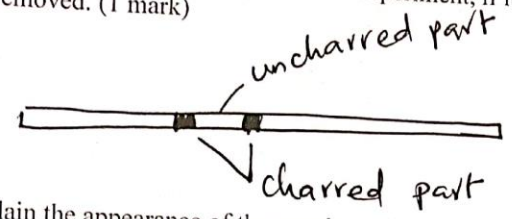
$MF = (CH_2)_3$ 01

$= C_3H_6$

(b) Write the equation of the reaction between A and 1 mole of chlorine gas.(1mk)

$C_3H_6(g) + Cl_2(g) \longrightarrow C_3H_6Cl_2(g)$ 01

a) Draw the wooden splint at the end of experiment, if it was slipped in at that position then removed. (1 mark)



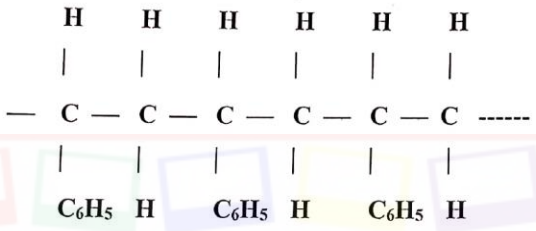
01

b) Explain the appearance of the wooden splint in a) above. (2 marks)

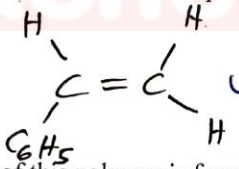
Uncharred part – Almost colourless region / less heat.

Charred part – pale blue region / very hot 02

c) Below is the structure of polymer



i. Draw the monomeric unit of polymer (1mk)



01

ii. A sample of this polymer is found to have a molecular mass of 10400 .determine the number of monomers in the polymer.(C=12, H=1) (2marks)

Mass of Monomer = (12×8)+(1×8)
= 104

$n = \frac{10400}{104} = 100$ units

4. Calculate the volume of nitrogen iv oxide produced when 10g of lead (ii) nitrate was completely decomposed by heating at s.t.p. (Pb= 207, N = 14, O = 16, Molar gas volume at s.t.p. = 22.4dm^3) (3 Marks)

$2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2$ 01

$Pb(NO_3)_2 = 331$ 1/2

Moles $= \frac{10}{331} = 0.03021$ 1

moles of $O_2 = \frac{1}{2}(0.03021) = 0.01511$ 1

1 mole $= 22.4\,dm^3$

$0.01511 \times$

$0.3385\,dm^3$ 1/2

5. A solution of hydrogen chloride gas in water conducts an electrical current, while that of hydrogenchloride in methylbenzene does not conduct. Explain. (1Mark)

HCl ionises in water (polar) but remain Molecular in methylbenzene (non polar) 01

6. a) The electron arrangement of ions X^{2+} and Y^{3-} are **2.8**, and **2.8** respectively. In which groups do **X** and **Y** belong? (1 Mark)

X..... 2 1/2

Y..... 5 1/2

c) Give the fomula of compound that would be formed between **X** and **Y** and state the bond present in that compound. (1 Mark)

Formula..... X_3Y_2 1/2

Bond type..... Ionic / Electrovalent 1/2

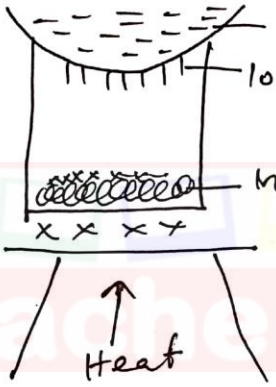
7. The elements nitrogen, phosphorus and potassium are essential for plant growth. Phosphorus in the fertilizer may be in the form of ammonium phosphate. Calculate the mass of nitrogen present in a 50kg bag containing pure ammonium phosphate. $(NH_4)_3PO_4$ (N=14.0, H=1.0, P=31.0, O=16.0) (3 Marks)

$(NH_4)_3PO_4 = 149$ 01

Mass of Nitrogen $= 14 \times 3 = 42$ 01

$\frac{42}{149} \times 50 = 14.09$ 01 kg

8. A mixture consists of iodine and sodium chloride
(i) By use of **diagram** illustrate how this mixture can be separated. (3 marks)

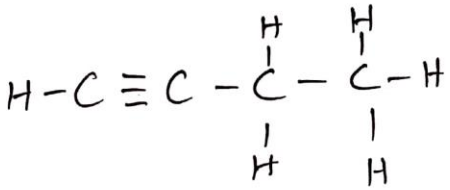


Workability 01
Labeling 01
Diagram 01
03

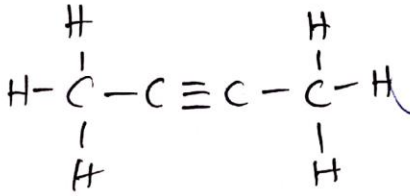
9. a) What are positional Isomers (1mk)

Compounds with the same molecular formula but different structural formula due to position of the ~~double~~ functional or ~~triple~~ group bond 01

b)Draw and name two isomers with molecular formula C_4H_6. (2 marks)



but-1-yne 01



but-2-yne 01

CHEMISTRY
FORM 4
PAPER 1 – MARKING SCHEME

1. Element A has two isotopes with mass numbers **30** and **X**. Given that the RAM of element A is **34.5** and the percentage abundance of ^{30}A is **55%**, calculate the value of **X**. (3 marks)

$$R.A.M = \frac{M_1 \times \% + M_2 \times \%}{100} \quad \frac{1}{2}$$

$$34.5 = \frac{30 \times 55 + x \times 45}{100} \quad \frac{1}{2}$$

$$3450 = 1650 + 45x \quad \frac{1}{2}$$

$$3450 - 1650 = 45x$$

$$\frac{1800}{45} = x \quad \frac{1}{2}$$

$$x = 40 \quad \frac{1}{2}$$

2. Describe how you would prepare crystals of copper (ii) sulphate starting with copper (ii) oxide. (3 marks)

- React excess copper II oxide with dilute Sulphuric VI acid 01
- Filter excess copper II oxide ½
- Heat to evaporate excess water / until crystals start appearing 01
- Allow slow evaporation ½ to form crystals

3. 10 grammes of sodium carbonate decahydrate ($Na_2CO_3.10H_2O$) was left exposed in air for a few days after which the mass was measured again.

a) State and explain the observation made on change of mass taken after some days (2mks)

Mass decreased – lost water of crystallization 2/2

b) Give the name of the process demonstrated in question (3) above. (1 Mark)

- efflorescence 01