2017

FORM THREE

MAY

CHEMISTRY

PAPER

M A R K I N G S C H E M

1. (a) (i) Same group : U and Y
(ii) Same period: V, W and X
b) i) X, Bpt = (-186 + 273)
= 87K below room temp.
ii) X
c) i) V3(SO4)2
= V2(SO4)3
ii) Y(s) + W2 2Y2W(s)

d) Ionic bond
U looses electrons the electrons gained by W
e) i) Cathode
Hydrogen gas
ii) Anode: oxygen gas

2. I. a) Blue copper (II) sulphate turned to white.
- Colourless liquid condenses on the cooler parts of the apparatus.
b) Water
c) i) Condense the vapour
ii) Salts acts as an impurity lowers the freezing point of ice.
iii) To prevent the condensing water from running back into the hot boiling tube and crack it.
d) Take a sample of substance F and add it to blue anhydrous cobalt (II) chloride which will turn to pink.
NB: Anhydrous white copper (II)(sulphate can also be used.

II. Mass of water = 12.5 - 8.0
= 4.5g

$CuSO_4.5H_2O$

	$CuSO_4$	H_2O
Mass	8.0	4.5
RFM	159.5 ✓½	18 ✓½
No. of moles	$\frac{8.0}{159.5}$	$\frac{4.5}{18}$
	0.05012	0.25 ✓½
Ratio of moles	$\frac{0.05012}{0.05012}$	$\frac{0.25}{0.05012}$
	1	4.988 ≃ 5 ✓½

3. a)

i. CO_2 is collected by downward delivery✓1mk

ii. Exchange apparatus containing water and concentrated sulphuric (IV) acid.✓1

iii. Use dilute hydrochloric acid for dilute sulphuric acid✓1

b)

- It does not support combustion✓$^1/_2$
- It is denser than air✓$^1/_2$

c) i)

- M-Ammonia gas
- Q-carbon (iv) oxide

ii)

- F-Ammonium chloride
- X-Sodium hydrogen carbonate

iii)

- L-Calcium chloride
- Used as a drying agent

iv) Tower P-$NH_{3(aq)}+CO_{2(g)}+Nacl_{(aq)}+H_2O_{(l)} \longrightarrow Na_4HCO_{3(s)}+NH_4Cl_{(aq)}$

v) Sodium chloride, Ammonia, coke or limestone

4. a) Sulphur powder □½

b) Sulphur (IV) oxide □½

c) Barium sulphate □½

d) Copper (II) ⟶ nitrate ¬½

ii) $2H_20_{2(l)} \longrightarrow MnO_2\ \ 2H_2O_{(l)} + O_{2(g)}$ ¬1

iii) a) $4K_{(s)} + O_{2(g)} \longrightarrow 2K_2O_{(s)}$ ¬1

b) $S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$ ¬1

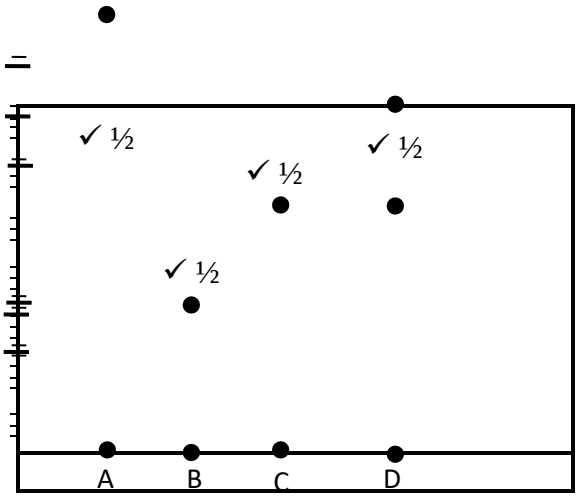
c) $CuO_{(s)} + H2SO_{4(aq)} \longrightarrow CuSO_{4(aq)} + H2O_{(l)}$ ¬1

Introduce a glowing splint into a gas jar containing oxygen gas, if the splint relights the gas is oxygen. ¬1

$Ba^{2+}_{(aq)} + SO_4^{2-} \quad BaSO_{4(s)}$ ¬1

iv)
- It combines with acetylene to form oxyacetylene used in welding.
- Used in hospitals by people with breathing problems.
- Mountain climbers and deep sea drivers.
- Oxyhydrogen – welding.

5. (a) (i)



Baseline ✓ 1

(ii) A and C ✓ 1

(b) Place the mixture in a beaker and cover it with a watch glass containing cold water ✓ ½. Heat the mixture. Ammonium Chloride sublimes ✓ ½ and collects on the cooler parts of the watch glass while Sodium Chloride which does not sublime remains in the beaker. ✓ 1

(c) (i) Fractional distillation ✓ ½

(ii) Since the two liquids are immiscible,pour the two in a separating funnel and allow them to settle ✓ ½ The dense liquid settles at the bottom and the less dense forms a second layer on top ✓ ½. Open the tap and run out the liquid✓½ in the bottom layer leaving the liquid in the upper layer.✓ ½.

(c) (i) Fractional distillation ✓ ½

(ii) Molecular mass/density/boiling point. ✓1✓ 1

6. (a) The rate of diffusion of a gas at constant temperature and pressure is inversely proportional to the square root of its density. ✓1

(b) Molar mass of SO_2 = 32 + 16 x 2 = 64g
Molar mass of CO_2 = 12 + 16 x 2 = 44g

$$\frac{TA}{TB} = \sqrt{\frac{MMA}{MMB}}, \qquad \frac{TSO_2}{TCO_2} = \sqrt{\frac{MMSO_2}{MMCO_2}}$$

$$\frac{4}{TCO_2} = \sqrt{\frac{64}{44}}$$ ✓

$$\frac{4}{TCO_2} = \frac{1.206}{1}$$

$$TCO_2 = \frac{4}{1.206}$$ ✓

TCO_2 = 3.32 seconds ✓

(c) (i) $Mg + 2HCl_{(aq)} \longrightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$
1 mol 2 mol 1 mol 1 mol

0.1 mol → $1000cm^3$
? ← 50

$\frac{50 \times 0.1}{1000} = 5$ = 0.005 moles of HCl
1000

Moles of Mg

1 mole weigh ⟶ 24g
? ⟵ 4g

$\frac{4 \times 1}{24}$ = 0.167 moles

Moles of Mg that reacted = 0.005 moles ½

Excess Mg 0.167 – 0.005 = 0.162 moles ½

This paper consists of 6 printed pages

Turn Over

(ii) Moles of H_2 produced = 0.005 moles

1 mole of $H_{2\,(g)}$ occupies 24000cm^3 at r.t.p

0.005 mol → ?

$0.005 \times 24000 = 120cm^3$

(d) 1. Manufacture of margarine (to harden oils)
2. Oxy-hydrogen flame, used for welding and cutting some metals.
3. Manufacture of ammonia, in the haber process.
4. Manufacture of hydrochloric acid.

(e) Heating ammonium chloride, decomposes to form ammonia gas and hydrogen chloride gas.

$NH_4Cl \underset{\text{Heat}}{\rightleftharpoons} NH_{3\,(g)} + HCl_{\,(g)}$

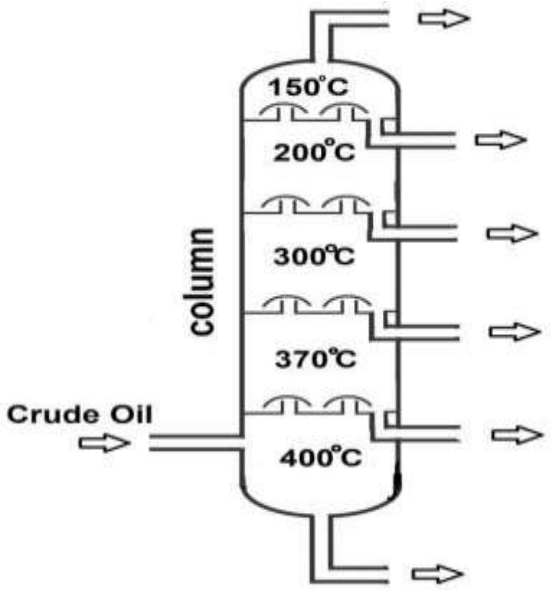
NH_3 is lighter, diffuses faster than $HCl_{\,(g)}$

NH_3 gets to the moist red – litmus paper first, turns it blues as its basic

HCl gas then turns the blue litmus paper red.

7. a) (i) Fractional distillation

(ii)



(iii) Asphalt/all weather roads/ water proofing roofs (1 mark)
(iv) The column is divided into several compartments, the crude oil vapour rises up the column with the different fractions condensing (1/2 mark) in different compartments according to their boiling point/volatility (1/2 mark)

(v) Changamwe / Mombasa (1 mark)
b) (i) To allow enough time for contact between copper and air/ to ensure all the oxygen was used up. (1 mark)
(ii) Copper metal turned black / volume of air reduced (1 mark)
(iii) No. (1/2 marks) Reaction would be violent/explosive potassium would also react with nitrogen (1/2 mark)
c) (i) Hydrated iron (III) oxide/ brown coating that forms on iron/steel /objects made from iron
(ii) $Fe_2O_3.nH_2O$ (n/1/2/3). (1 mark)
(iii) Coating iron sheets with zinc (1 mark)
Q6. a) (i) Heat/enthalpy of combustion of carbon/enthalpy of formation of carbon (IV) oxide (1mark)
(ii) Heat/enthalpy