CHEMISTRY PAPER 2 (233/2)
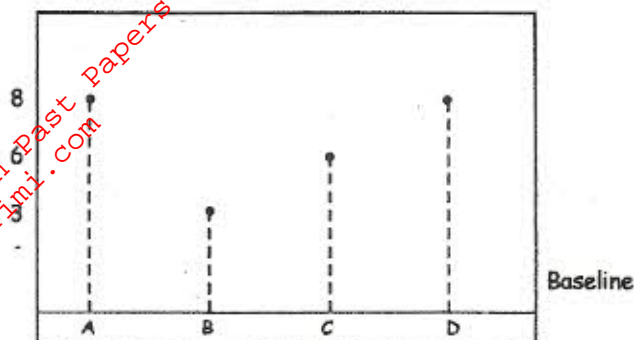### MARKING SCHEME

1. (a) (i)

(ii) A and C

(b) Since NH_4Cl sublimes but $CaCl_2$ does not; sublimation process would do. Heat the mixture. Ammonium chloride sublimates into vapour and condenses on the cooler part of the heating tube. Calcium chloride will remain on the bottom of the heating tube.

(c) (i) Fractional distillation

(ii) Separating funnel method
Since the two liquids are immiscible, pour the liquids in a separating funnel and allow to settle, the denser liquid will settle down and the less dense will form a second layer on top. Open the tape and run out the liquid in the bottom layer leaving the liquid in the second layer in the funnel.

2. (a) Brine (Sodium Chloride)

(b) (i) $2NaOH_{(aq)} + H_2SO_{4(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$
   2 mol   1 mol
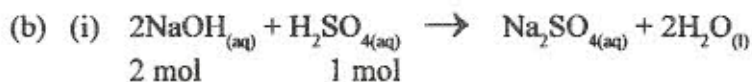
(ii) No. of moles of H_2SO_4 used $= \dfrac{40}{1000} \times 0.5$ moles

$= 0.02$ moles

No. of moles of NaOH $= 0.02 \times 2$
                            $= 0.04$ moles

0.5×2 mole $= 1.0$ moles will react with 1 litre of the solution of the acid

$100 \ cm^3 = 0.04$ moles of NaOH

$1000 \ cm^2 = \dfrac{0.04 \times 1000}{100} = 0.4$ moles

Molar mass of NaOH $= 23 + 16 + 1$
                            $= 40$

1 mole $= 40$

       0.4 moles $= 0.4 \times 40$
                       $= 16g$

Mass of the unreacted $= 17.6 - 16$
                               $= 1.6g$

(c) (i) M is ammonium chloride

(ii)

Ammonia gas
Card bard cover
Dry tower
Calcium Oxide
Heat
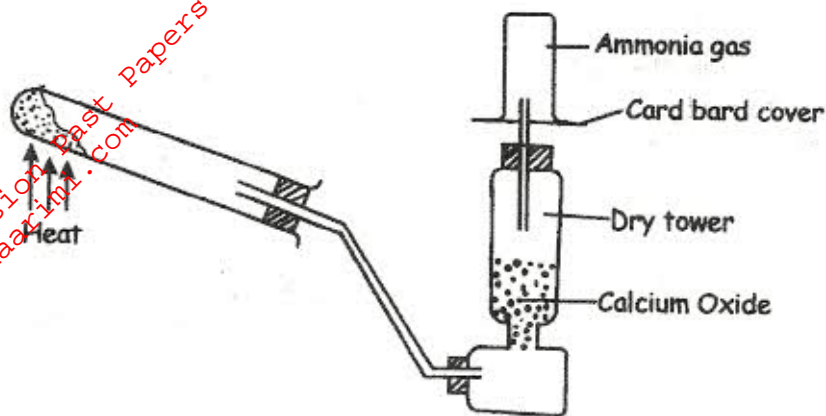
(d) (i) Black Copper(II)oxide turned to reddish brown which is copper metal.
   (ii) Ammonia acts as a reducing agent.
   (iii) Manufacture of nitrogenous fertilizers, nitric acid, refrigerant in ships and warehouses, softening water, removal of greasy stains, manufacture of hydrazine that is used as rocket fuel.

3. (a) (i) G^{2+}

    (ii) $G_{(s)} + H^{2+}_{(aq)} \longrightarrow G^{2+}_{(aq)} + H_{(s)}$
    (iii) $E_O - E_R$ = $+ 0.34 - (\cdot 0.44)$
                 = $0.34 + 0.44 = 0.78$ Volts

(b) (i) H
   (ii) Pure water does not contain ions or to make the water ionize
   (iii) Chlorine is not used because the chlorine ions will react the electrode due to its high reactivity level.

(c) 144750 coulombs   = $\dfrac{144750}{96500}$ Faraday

                     =   1.5 Faraday

2 Faraday yield   =   64g of Copper
1.5 Faradays   =   48g of Copper

4. (a) The number 52 represents mass number i.e: the sum of the number of protons and neutrons in an atom of an element.
    N = 20 = 2:8:8:2   P = 17 = 2:8:7

(b) (i) $N + P_2 \longrightarrow NP_2$
   (ii) P, R and S.
       P is a non-metal while R and S are metals, arranged in the order of S, R and P from left to right for metals (S and R) but increases from left to right for non-metals (P).
   (iii) S, it is a metal and is the one having the largest atomic radius which decreases from left to right for metal of the same period.
   (iv) P and U

(c) (i) I - ionic   II - metallic
   (ii) IV - Sulphur has molecular bond which require less energy to break, hence low MP and BP

5. (a) To remove any oxide film on it i.e layer of magnesium oxide
(b) A white solid formed which is magnesium oxide
(c) The increase in mass was due to the oxygen which combines with magnesium.

(d) $2Mg(s) + O_2(g) \xrightarrow{\text{heat}} 2MgO(s)$

(e) The filtrate is magnesium hydroxide which is an alkaline.
There was not change in blue litmus paper but red litmus paper turned blue.

(f) From equation in (d)
1 mole of Magnesium atom combines with a mole of oxygen atom.

OR

	Mg	Oxygen
Mass	2.4	1.6
Molar mass	24	16
No. of moles	$\frac{2.4}{24} = 0.1$	$\frac{1.6}{16} = 0.1$
Mole ratio	1 :	1

No. of moles of oxygen used = $\frac{1.6}{16}$ = 0.1 moles

1 mole   = 24,000 cm³
0.1 mole   = 24,000 × 0.1
Volume of oxygen used = 2,400cm³

6. (a) (i) V_1 : $CH_3CH_2CH_2CH_2OH$ and

$$V_3 : CH_3CH_2CH_2\overset{\displaystyle O}{\overset{\displaystyle \|}{C}} - OH$$

(ii) V_2 : $CH_3CH_2CH_2$ and V_5 : $CH_3CH_2CH_2CH_3$

(iii) V_4 : $CH_3CH_2CH - CH_2$
It is unsaturated compound and during polymerisation the double bond is broken to allow another monomer to combine.

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(b)

	Advantage	Disadvantage
R - COO - Na⁺	They are cheaper compared to soapless detergents	Forms a scum with water containing Calcium and Magnesium ions
R - SO₃ - Na⁺	They do not form scum with Ca^{+2} and Mg^{2+}	They are made from petroleum products or vegetable oils which are expensive.

(c) (i) Esters

(ii) $C_2H_4O_{2(aq)} + C_2H_5OH_{(l)} \rightleftharpoons CH_3COOC_2H_{3(l)} + H_2O_{(l)}$

(iii) Used as solvents
In the manufacture of drugs and chemicals
In flavouring and preservation of food.
In manufacture of synthetic fibres

(iv) $2CH_3COOH_{(aq)} + K_2CO_{3(aq)} \rightarrow 2CH_3COOK_{(aq)} + CO_{2(g)} + H_2O_{(l)}$

(d) (i) Natural fibres include rubber, cellulose, wool, starch, silk etc
(ii) Advantages; can be made into complicated shapes more easily, less expensive, not affected by acids, alkalis, water and air, less dense and stronger.

7. (a) (i) Graphite or titanium. They do not react with chlorine gas.
(ii) A steel diaphragm is suspended between the electrodes.

(iii) $2Cl^-_{(aq)} \rightarrow 2Cl_{2(g)} + 2e$

(b) (i) Calcium chloride ($CaCl_2$)
(ii) It is economical i.e.: reducing cost of production

(c) Hydrogen is preferentially discharged at the expense of sodium.
At the anode, hydroxyl ions will be prefentially discharged at expense of chlorine gas.

(d)
$$2Na_{(s)} + O_{2(g)} \xrightarrow{\text{Limited}} Na_2O_{2(s)}$$

$$Na_{(s)} + O_{2(g)} \xrightarrow{\text{Excess}} Na_2O$$

(e) Making Sodium compounds eg. Sodium Cyanide, NaCN, which is used in the extraction of gold, make lead alloy, sodium & Potassium alloy is used as a 'coolant" in nuclear reactors. (accept any two)