4.6.2 Chemistry Paper 2 (233/2)

1. (a) (i) **R** - (1) it has the largest atomic radius with the weakest nuclear attraction for outermost electron (1).

(ii) Across the period the atomic radius decreases due to the increase in nuclear attraction (1). Number of electrons in **P** is greater than in **H**.

(iii) $2M(s) + 2H_2O(\ell) \longrightarrow 2MOH(aq) + H_2(g)$ (1)

Moles of $H_2 = \frac{200}{24000} = 0.0083$ $(\frac{1}{2})$

Moles of $M = 0.0083 \times 2 = 0.0166$ $(\frac{1}{2})$

$\frac{\text{Moles of M}}{\text{RAM}} = 0.0166$

Mass of M = 0.0166×7 $(\frac{1}{2})$

Mass of M = 0.117 g $(\frac{1}{2})$

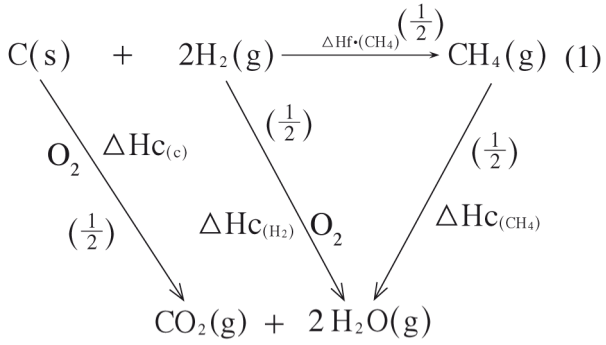
(b) (i) **W** - (1) forms a basic oxide which forms an ionic bond (1).

(ii) **Y** - (1) the oxide is gaseous that forms a neutral solution (1).

(iii) **U** - (1) the oxide is solid at room temperature, which is acidic with covalent bond (1).

2. (a) (i) This is the heat absorbed or evolved when one mole of any substance is formed from its constituent elements in their normal states. (1 mark)

(ii) I



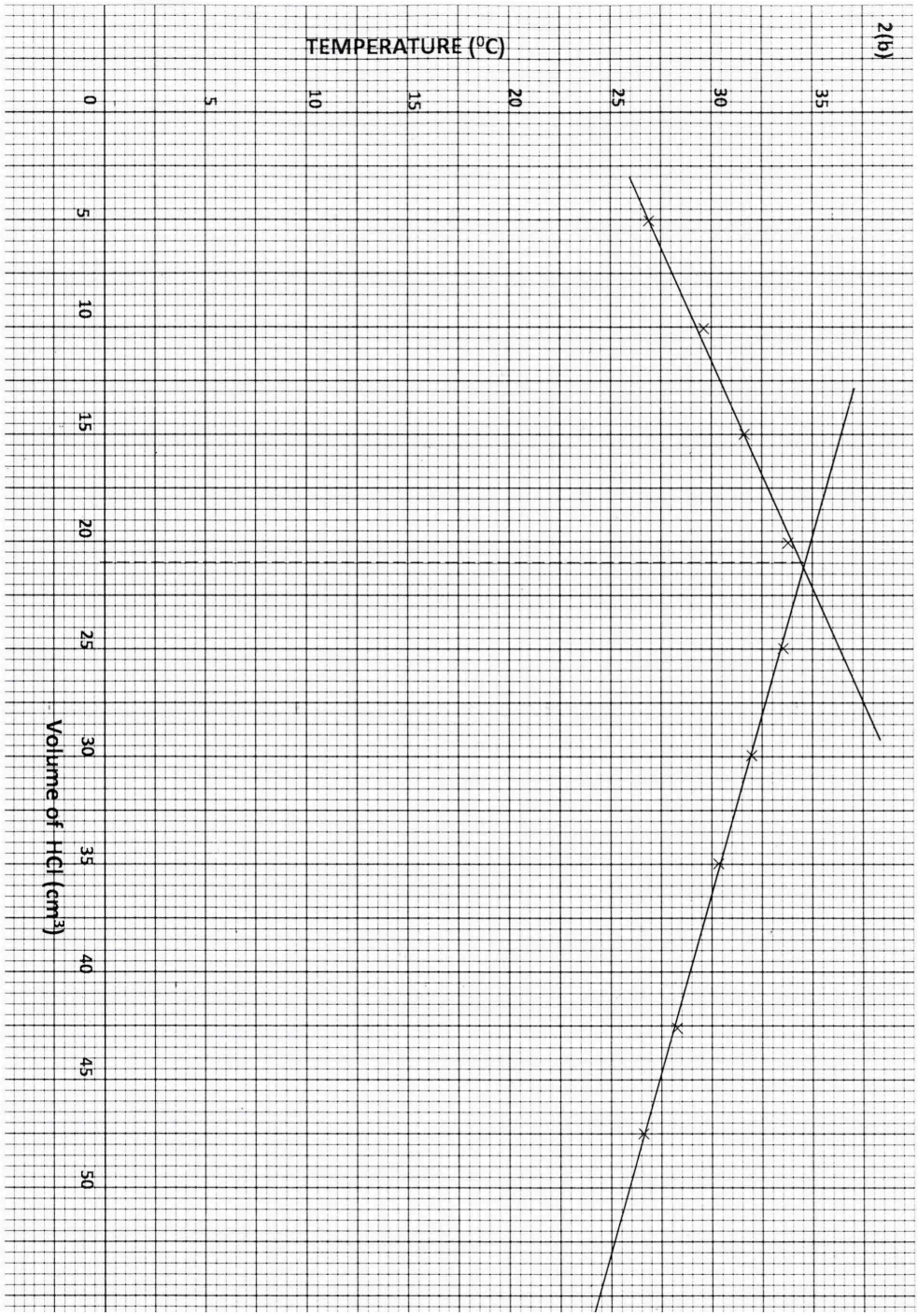
II $\triangle Hf(CH_4) = \triangle Hc(c) + 2\triangle Hc(H_2) - \triangle Hc(CH_4)$

$= -393 + 2(-286) + 890$ (1)

$= -965 + 890$

$= -75 \text{ kJ mol}^{-1}$ (1)

(b) (i) (3 marks)



(ii) I 34.8°C $(\frac{1}{2})$

II 21.2 cm^3 HCl $(\frac{1}{2})$

(iii) $50 \times 9.8 \times 4.2$ (1)

$= 2058$ Joules (1)

(c) The molar heat of neutralisation between a strong acid and a weak base is low because some of the heat is used to ionise (1) the weak base before neutralization. For strong acid and strong base they are completely ionised.

3. (a) (i) Hot compressed air (1)

(ii) To melt the sulphur and maintain it in molten state (1)

(iii)
- low melting point of sulphur (1)
- insolubility of sulphur in water (1)
- less dense than water

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

(ii) To dry the SO_2 and air (1)

(iii) Vanadium (v) oxide (1) and platinum (1) or titanium

(iv)
- it provides the reactants (SO_2 and O_2) with enough energy to react (1)
- it removes heat from the product hence preventing decomposition (1)
  or conserves heat, or recycles heat or reduces cost of production.

Accept any other.

(c)
- contributes to acid rain which corrodes buildings (1)

OR
- causes aquatic solutions to be acidic hence affecting aquatic life etc.
- poisonous/toxic

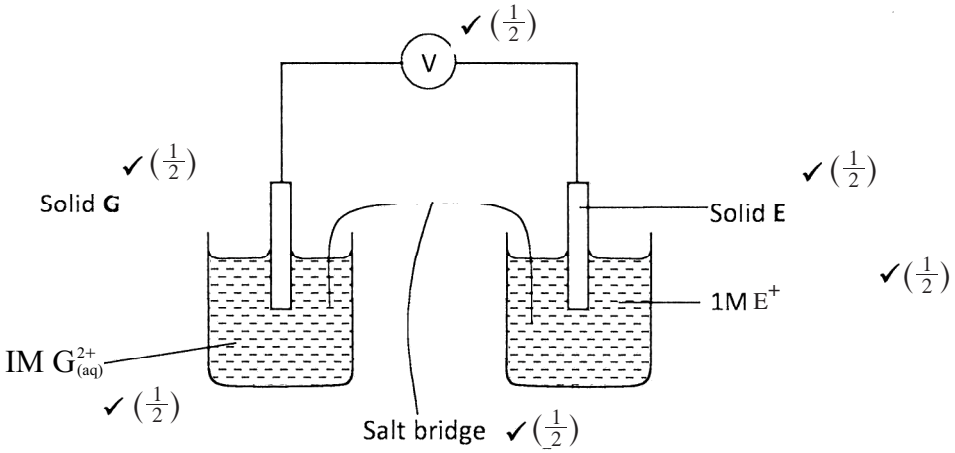
(d) Turns black ($\frac{1}{2}$) conc H_2SO_4 removes hydrogen and oxygen from the sugar molecule leaving only carbon which is black ($\frac{1}{2}$). Dehydration of sugar forms carbon which is black.

4. (a) (i) Gas Y is chlorine. (1)

(ii)
- sodium and hydrogen ions migrate to the cathode ($\frac{1}{2}$). The hydrogen ions are preferentially discharged, liberating hydrogen gas.
- chlorine and hydroxide ions migrate to the anode ($\frac{1}{2}$). The chloride ions are preferentially discharged liberating chlorine gas.
- the sodium ions migrate to the cathode through the membrane ($\frac{1}{2}$).
- the sodium ions combine with the hydroxide ions to form sodium hydroxide ($\frac{1}{2}$).

(iii) Glass making/paper manufacture (1), unclogging of drains, etching $NaClo_3$, Purification of bauxite.

(b) (i)



(ii) EMF = 0.8 + 2.87 (1)

= 3.67V (1)

(iii) H will go into solution as H^{2+} ions (1) since it is more reactive than E hence displacing E^+ ions which are deposited as solid (1).

5. (a) Test the acidity using a litmus pager. There will be no change on litmus when dipped into a solution of sodium sulphate (1). The litmus paper turns to red when dipped into a solution of sodium hydrogen sulphate (I).

OR

Add a solid carbonate to each solution. No effervescence observed when the carbonate is added to a solution of sodium sulphate. Effervescence is observed when the carbonate is added to a solution of sodium hydrogen sulphate.

(b) Add dilute nitric acid (½) to lead to form a soluble salt, $Pb(NO_3)_2$, add a soluble salt sodium sulphate to form insoluble (½), $PbSO_4$ and soluble Na_2SO_4 (½) separate by filtrating (½). Wash the $PbSO_4$ with distilled water to remove traces of (½) soluble salt, Na_2SO_4. Then dry the salt between filter papers (½).

(c) (i) I $NH_4NO_{3(s)} \longrightarrow N_2O(g) + 2H_2O_{(g)}$ (1)

II $2Fe(OH)_{3(S)} \longrightarrow Fe_2O_{3(s)} + 3H_2O_{(l)}$ (1)

(ii) The colour changes from pale green to brown (1) . The iron (II) is oxidised to iron (III) chloride by hydrogen peroxide (1)

(iii) Carbon monoxide (1)

6. (a) A proton has a +ve charge while a neutron has no charge (1)

(b) Substances undergo radioactive decay or disintergration. (1)

(c) - causes genetic mutation (1)
- can cause death (1)
- prone to cancer

(d) (i) I Atomic mass of a = 4 (1)

II Atomic number of b = 2 (1)

(ii) Fusion (1)

(e) (i) This is the time taken for half of the radioactive isotope to decay (1)

(ii) 288 — 144 — 72 — 36 — 18 — 9

$\therefore$ 5 half lives (1)

$\frac{40}{5}$ = 8 days (1)

7. (a) (i) Propanoic acid (1)

(ii) Pent - 1 - ene (1)

(iii) But - 1 - yne (1)

(b) (i) Ethane (1)

(ii) $C_3H_6Cl_2$ (1)

(iii) I Water/steam/Conc. H_2SO_4 (1)

II Acidified potassium dichromate (VI)

(iv) $2CH_3CH_2CH_2OH + 2Na \longrightarrow 2CH_3CH_2CH_2ONa + H_2$ (1)

(c) Cleansing agent has the hydrophilic ($\frac{1}{2}$) and hydrophobic ends ($\frac{1}{2}$), the hydrophobic end is attracted to grease ($\frac{1}{2}$) while the hydrophilic end is attracted to water ($\frac{1}{2}$) during agitation the grease is pulled off ($\frac{1}{2}$) the cloth then surrounded by soap molecules ($\frac{1}{2}$)