

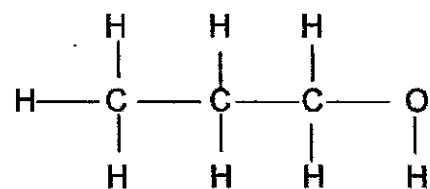


QUESTION 1 (Start on a new page.)

- 1.1 C ✓✓ (2)
 1.2 A ✓✓ (2)
 1.3 B ✓✓ (2)
 1.4 C ✓✓ (2)
 1.5 A ✓✓ (2)
 1.6 C ✓✓ (2)
 1.7 A ✓✓ (2)
 1.8 B ✓✓ (2)
 1.9 D ✓✓ (2)
 1.10 D ✓✓ (2)
[20]

QUESTION 2 (Start on a new page.)

- 2.1
 2.1.1 E ✓ (1)
 2.1.2 F ✓ (1)
 2.1.3 B ✓ (1)
 2.1.4 D ✓ (1)
 2.2 ~~Butanal~~ ✓✓ (2)
 2.3
 2.3.1 Propyl ethanoate. ✓✓ (2)
 2.3.2



✓✓

N.B. Accept condensed -OH

Marking criteria structural formula:

- Three carbons in longest chain
- OH – group on terminal carbon

Notes:

- One or more H-atoms omitted: ½
- Condensed or semi-structural formula: 1/2

(2)
[10]

QUESTION 3 (Start on a new page.)

3.1

3.1.1 Substitution(halogenation/bromination) ✓ (1)

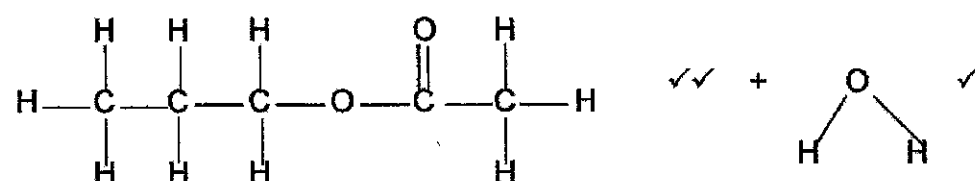
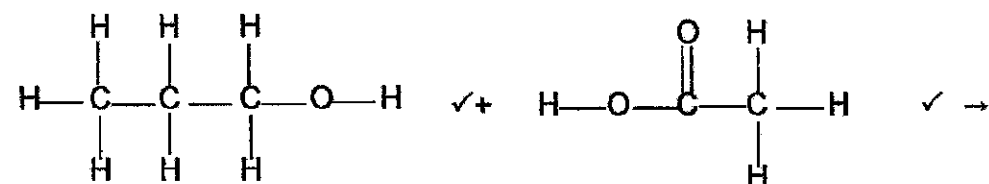
3.1.2 Substitution(hydrolysis) ✓ (1)

3.1.3 Elimination ✓ ~~esterification~~ (1)3.2 $\text{CH}_3\text{CHBrCH}_3 + \text{KOH} \checkmark \rightarrow \text{CH}_3\text{CHCH}_2 + \text{H}_2\text{O} + \text{KBr} \checkmark$ bal ✓ (3)**N.B.** Max 1/3 if extra product or reactant is written

3.3

3.3.1 Ethanoic acid ✓ (2)

3.3.2

**N.B.** Accept linear molecule of water.

(6)

3.4

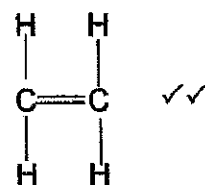
3.4.1 Heat/ Sunlight/ UV light or rays/ Sun rays. (1)

3.4.2 Hydrogen bromide. ✓ (1)

3.5

3.5.1 A polymer formed when two monomers combine through an addition reaction. ✓✓ (2)

3.5.2

**Marking criteria structural formula:**

- Two carbons in chain
- Whole structure correct

Notes:

- One or more H-atoms omitted ½
- Condensed or semi-structural formula 1/2

(2)

[19]

QUESTION 4 (Start on a new page.)

4.1

- 4.1.1 A series of organic compounds that can be described by the same general formula. ✓✓ (2)

OR

A series of organic compounds in which the members differ from the next with a $-\text{CH}_2$ group.

- 4.2 Alcohol. ✓ (1)

4.3

- 4.3.1 Molecular mass(of different homologous series). (1)

N.B. Accept surface area, chain length/contact area.

- 4.3.2 Vapour pressure. (1)

- 4.3.3 The larger the molecular mass, the lower the vapour pressure (2)

OR

The smaller the molecular mass, the higher the vapour pressure.

N.B. Accept surface area/chain length/contact area

4.4 **Butane**

- Weak✓ London forces between its molecules✓ (2)

OR

- London forces between its molecules✓
- less energy is needed for molecules to break out of liquid and form vapour ✓

- **Butan -1-ol**

- – alcohol, has stronger✓ hydrogen bonds between its molecules✓ (2)

OR

- Hydrogen bonds between its molecules. ✓
- lots of energy is needed for molecules to break out of liquid and form vapour✓

4.5 Compound D✓ or (Butanol)

- It has stronger hydrogen bonds between its molecules✓
- Therefore more energy is required to break the bonds between the molecules✓ (3)

N.B. Accept it has lowest vapour pressure.

[14]

QUESTION 5 (Start on a new page.)

5.1 $\text{CO}_2(\text{g})$ forms during the reaction. ✓ (1)

5.2 40s. ✓ The mass of the beaker and its contents remained 60,00g. ✓ (2)

5.3

$$\begin{aligned} n_{\text{CO}_2}(\text{reacted}) &= \frac{m(\text{CO}_2)}{M(\text{CO}_2)} \checkmark \\ &= \frac{2,00}{44} \checkmark \\ &= 0,05 \text{ mol} \checkmark \end{aligned}$$

$$V(\text{CO}_2) \text{ at STP} = n(\text{CO}_2) \times V_m \checkmark$$

$$\begin{aligned} &= (0,05 \times 22,4) \checkmark \\ &= 1,12 \text{ dm}^3 \checkmark \end{aligned}$$

(6)

OR

$$1 \text{ mol} \rightarrow 22,4 \text{ dm}^3$$

$$0,05 \text{ mol} \rightarrow X$$

$$X = 1,12 \text{ dm}^3$$

5.4

- More particles per unit volume. ✓
- More HCl molecules have enough kinetic energy and correct orientation. ✓
- More effective collisions take place per second/ per unit time. ✓ (3)

N.B. Accept: Higher frequency of effective collisions

[12]

QUESTION 6 (Start on a new page.)

- 6.1 A reversible reaction in which the rate of the forward reaction equals to the rate of the reverse reaction. ✓✓ (2)

$$6.1.1 \quad n(\text{NH}_3) = \frac{m}{M}$$

$$= \frac{25,5}{17} \checkmark$$

$$= 1,5 \text{ mol}$$

	N _{2(g)}	3H _{2(g)}	2NH _{3(g)}	
Initial quantity(mol)	3	8	0	
Change in (mol)	0,75	2,25	1,5✓	Ratio ✓
Quantity at equilibrium(mol)	2,25✓	5,75✓	1,5	
Equilibrium concentration (mol.dm ⁻³)	0,45	1,15	0,3	Divide by 5✓

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3} \checkmark$$

$$= \frac{(0,3)^2}{(0,45)(1,15)^3} \checkmark$$

$$= 0,13 \checkmark$$

Wrong K_c expression Max 6/9

No K_c expression Max 8/9

- 6.1.2 Smaller than ✓
✗ K_c 1✓ (2)

- 6.1.3 Decrease✓
✗ Increases in temperature favours the reverse reaction (endothermic reaction) ✓ less product is formed✓, K_c value decreases. ✓ (4)

N.B. a) Accept: equilibrium position shifts to the left.

b) The sign ✗ means negative marking in 6.1.2 & 6.1.3 above

[17]

QUESTION 7 (Start on a new page.)

7.1

7.1.1 A substance that can act as an acid and as a base. ✓✓ (2)

7.1.2 Acid. ✓
It is a proton donor/it donates a proton. ✓ (2)7.1.3 $\text{PO}_4^{3-}(\text{aq})$ ✓ (1)

7.2

7.2.1 Basic. ✓ (1)

7.2.2 $\text{pH} = -\log [\text{H}^+]$ ✓

$$13,3 \checkmark = -\log [\text{H}^+]$$

$$[\text{H}^+] = 5,01 \times 10^{-4} \text{ mol.dm}^{-3}$$

$$[\text{OH}^-] = \frac{10^{-14}}{[\text{H}^+]} \checkmark$$

$$= \frac{10^{-14}}{5,01 \times 10^{-4}} \checkmark$$

$$= 0,2 \text{ mol.dm}^{-3} \checkmark \quad (5)$$

7.2.3 $\frac{C_a V_a}{C_b V_b} = \frac{n_a}{n_b} \checkmark$ **N.B Positive marking - 7.2.2 to 7.2.3.**

$$\frac{Ca(17,85)}{(0,2)(25)} \checkmark \checkmark = \frac{1}{2} \checkmark$$

$$Ca = 0,14 \text{ mol.dm}^{-3} \checkmark \quad (5)$$

7.2.4 $X + 16 + 1 = 56$

$$X = 39 \text{ g.mol}^{-1} \checkmark$$

$$X = \text{K (potassium)} \checkmark \quad (2)$$

[18]

QUESTION 8 (Start on a new page.)

8.1 A solution/ liquid/ dissolved substance that conducts electricity through movement of ions. ✓✓ (2)

8.2 Salt-bridge. ✓
- completes the circuit/ cell. ✓
- maintains the cell neutrality.
- supplies a path through which ions can move to restore neutrality. (2)

8.3 B ✓ Lead is a stronger reducing agent than Pb ✓ and Mg will be oxidised to Mg^{2+} . ✓ (3)

8.4 – $Pb(NO_3)_2$ or $Pb^{2+}(aq)$ ✓ or any saline solution with the corresponding ion as the cathode. (2)

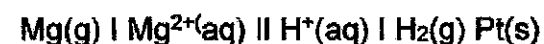
8.5

8.5.1 $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$ ✓ (2)

Notes:

8.5.2 $Mg(g) | Mg^{2+}(aq) (1 \text{ mol} \cdot \text{dm}^{-3}) || (1 \text{ mol} \cdot \text{dm}^{-3}) H^+(aq) | H_2(g) Pt(s)$ (3)

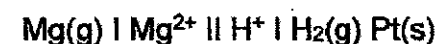
OR



OR



OR



8.6 - It has Pt as inert/ does not react with the H^+ ions OR acid.
- It has Pt as a conductor (of electricity) . (1)

[15]

N.B. QUESTION 8.6, subtract that **1 mark** from the total (i.e **14 marks** for it) and hence **GRAND TOTAL** will be **149** instead of **150** for the paper.

QUESTION 9 (Start on a new page.)

9.1 Electrode where reduction takes place ✓✓ (2)

9.2 T ✓ the negative electrode/ cathode ✓ (2)

9.3 $\text{Cu(s)} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$ ✓✓ (2)**Notes:**

(2)

9.5 Pt and Ag are both weaker reducing agents than copper and will be oxidised to form ions. ✓✓ (2)

OR

Cu is a stronger reducing agent than Ag & Pt, so it will reduce Ag & Pt.

9.6 The rate at which copper is oxidised at the anode is equal to the rate at which copper ions are reduced at the cathode. ✓✓ (2)
[10]**QUESTION 10 (Start on a new page.)**

10.1 Ostwald (process). ✓ (1)

10.2.

10.2.1 Pt (Platinum) ✓ (Accept Nickel (Ni))
Temperature $+ 900^\circ\text{C}$ ✓ (2)10.2.2 $4\text{NH}_3 + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}$ ✓ bal ✓ (3)

10.2.3 Catalytic oxidation. ✓ (1)

10.2.4 Nitrogen dioxide/ Nitrogen(IV)oxide ✓ (1)

10.2.5 H_2O or Water ✓ (1)

10.3

10.3.1 KNO_3 ✓✓ (2)10.3.2 $m(\text{N}) = \frac{22}{39} \times 6,35$ ✓
 $= 3,58 \text{ kg}$ ✓ (4)

[15]

GRAND TOTAL: 149