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MEMORANDUM G12 CHEMISTRY PRELIMINARY EXAMINATION 2016**QUESTION 1**

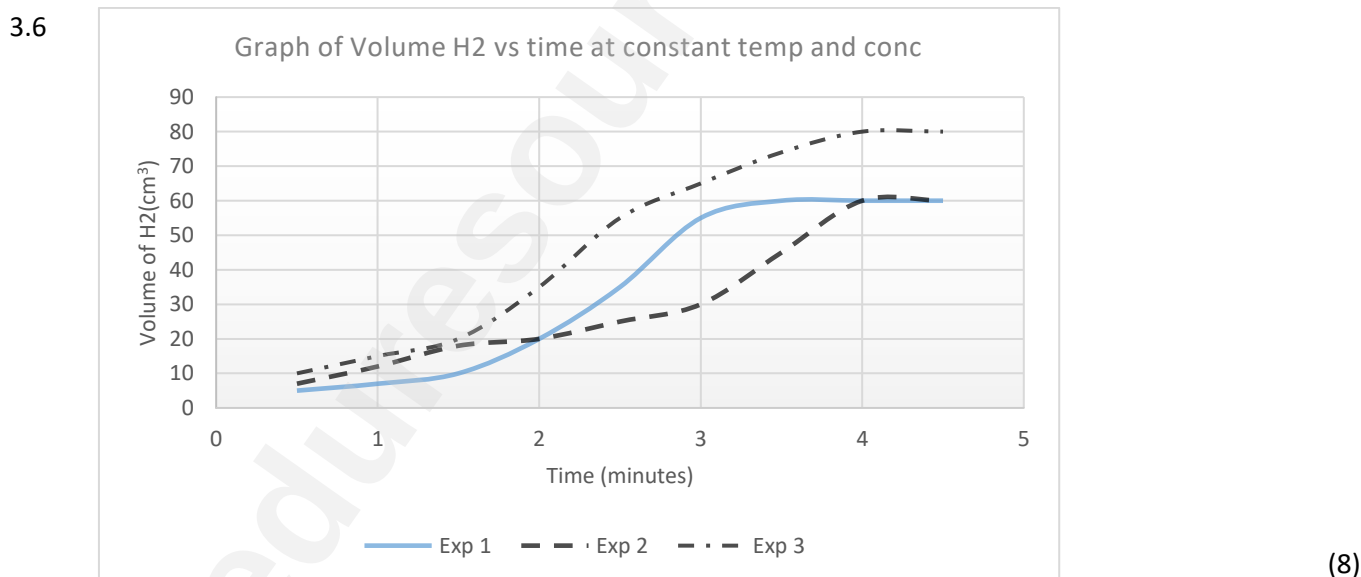
1.1	D	1.2	C	1.3	D	1.4	B	1.5	C
1.6	B	1.7	C	1.8	D	1.9	D	1.10	C

[20]**QUESTION 2**

- 2.1 Hydrocarbon (2)
 2.2 Heterogeneous (2)
 2.3 Exothermic (2)
 2.4 Volumetric flask (2)
 2.5 Hydrolysis/Protolysis (2)

[10]**QUESTION 3**

- 3.1 Intramolecular bond – between atoms in a molecule
 Intermolecular force – between different molecules (2)
- 3.2 Polar covalent
 $0 < \text{END} < 1.9$ (3)
- 3.3 Hydrogen bonds – between H_2O molecules
 Ion Dipole – Between ions and H_2O molecules (4)
- 3.4 HCl is a gas at room temperature (1)
- 3.5 Temperature
 Concentration of HCl (2)

**(8)**

- 3.7 3,5 minutes
 Volume of $\text{H}_2(\text{g})$ remains constant (2)
- 3.8 Experiment 2
 Gradient of graph is steeper (2)
- 3.9 Rate of Exp 2 decreases
 Mg is in powder form therefore more particles should be available to react in the same time
 As rate decreases surface area and available number of particles decrease
 Less collisions in same time interval (4)

- 3.10 See graph
Steeper gradient
Must end at volume higher than Exp 1 and 2

(2)
[30]

QUESTION 4

- 4.1 Acid is a proton donar (2)
- 4.2 $\text{CH}_3\text{COOH}(\text{aq}) \rightleftharpoons \text{CH}_3\text{COO}^-(\text{aq}) + \text{H}^+(\text{aq})$ (3)
- 4.3 Weak acid only ionises partially
Small number of ions are released compared to the number of unionised acid molecules. (3)
- 4.4 $K_a = \frac{[\text{CH}_3\text{COO}^-] \cdot [\text{H}^+]}{[\text{CH}_3\text{COOH}]} = 1,8 \times 10^{-5} \therefore [\text{H}^+]^2 = [\text{CH}_3\text{COOH}] \times K_a = 0,2 \times 1,8 \times 10^{-5}$
 $[\text{H}^+] = \sqrt{(3,6 \times 10^{-6})} = 1,9 \times 10^{-3} \text{ mol.dm}^{-3}$ (4)
- 4.5 $\text{pH} = -\log[\text{H}_3\text{O}^+] = -\log(1,9 \times 10^{-3}) = 2,72$ (2)
- 4.6 Solution of known concentration that stays constant for a period of time (2)
- 4.7 $n = cxv = 1 \times 0,25 = 0,25 \text{ mol}$
 $m = nxM = 0,25 \times 40 = 10 \text{ g}$ (5)
- 4.8 Basic salt (2)
- 4.9 CH_3COO^- ion is the strong conjugate base of the weak acid CH_3COOH
Causes the H_2O to act like an acid and donate a proton
 $[\text{OH}^-]$ increases
 $\text{pH} > 7$ (4)
- 4.10 PHENOLPHTHALEIN (2)
- 4.11 $n = cxV = 1 \times 0,005 = 0,005 \text{ mol}$
 $\text{NaOH}:\text{CH}_3\text{COOH}$
1 : 1
 $\therefore 0,005:0,005$
 $c = \frac{n}{V} = \frac{0,005}{0,025} = 0,2 \text{ mol.dm}^{-3}$ (4)
- 4.12 $m = nxM = 0,005 \times 60 = 0,3 \text{ g}$ (3)
- 4.13 No, %acid below norm
 $\% \text{ Acid} = \frac{\text{Mass of pure}}{\text{Mass of impure}} \times 100 = \frac{0,3}{25} \times 100 = 1,2\%$ (4)

[40]

QUESTION 5

- 5.1 A group of compounds all with the same functional group and general formula. Each member differs from the other by the same group. (2)
- 5.2 Halo alkanes (1)



5.4 No
Halothane is a saturated compound
No extra atoms can be added to the structure (3)

5.5 Schematic representation of a molecule showing all the atoms and bonds in the molecule. (2)



5.7 Ether group (1)

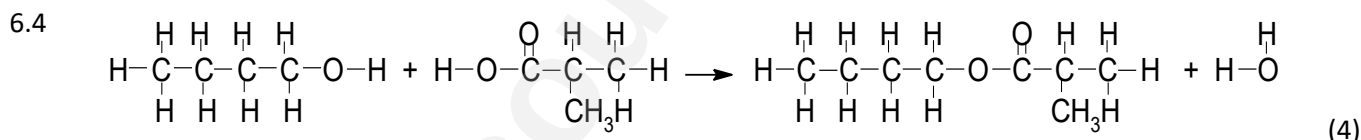
5.8 Weak
Halothane easily changes to a gas to be inhaled (2)
[16]

QUESTION 6

6.1 Substitution - Halogenation (1)

6.2 ELIMINATION (1)

6.3 1,2-dibromobutane (3)



6.5 Butan-1-ol; Product 2; Product 1 (3)

6.6 Butan-1-ol – Hydrogen bonding
Product 2 – Dipole-Dipole VdWaals forces
Product 1 – London forces
Hydrogen bonding is the strongest IMF and therefore requires the most energy to change phase
London forces are the weakest IMF and require the least energy to change phase (5)

6.7 $\text{C}_4\text{H}_{10} + 6\text{O}_2 \rightarrow 4\text{CO}_2 + 5\text{H}_2\text{O}$ (2)

6.8 $n = \frac{m}{M} = \frac{20}{74} = 0,27\text{mol}$

$$\begin{array}{l} \text{C}_4\text{H}_{10} : \text{CO}_2 \\ 1 : 4 \\ \therefore 0,27 : 1,08 \end{array}$$

$V = nV_0 = 1,08 \times 22,4 = 24,19\text{dm}^3$ at STP (5)

[24]

QUESTION 7

7.1

	NOCl	NO	Cl ₂
Mol Initial	5	0	0
Mol React/Form	1	1	0,5
Mol at Equilibrium	4	1	0,5
Conc at Equilibrium (mol.dm ⁻³)	$c = \frac{n}{V} = \frac{4}{2} = 2$	0,5	0,25

$$K_c = \frac{[\text{NO}]^2 \cdot [\text{Cl}_2]}{[\text{NOCl}]^2} = \frac{(0,5)^2 \times 0,25}{(2)^2} = 0,016 \quad (8)$$

7.2 When a system in equilibrium is disturbed, the system will react to oppose the disturbing factor and return to equilibrium. (4)

7.3 PALE GREEN (2)

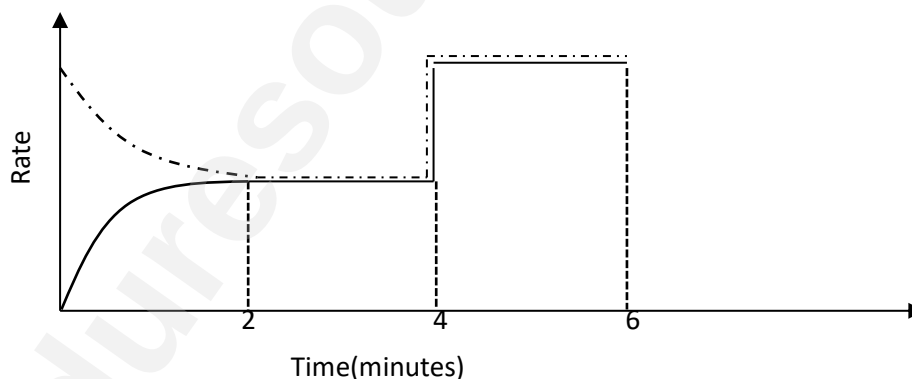
7.4 No effect (2)

7.5 Endothermic (2)

7.6 Temp is decreased
According to LCP system wants to increase temperature
Reaction releasing energy will be favoured
But reverse reaction is favoured
Reverse reaction releases energy
∴ Forward reaction is endothermic (4)

7.7 K_c will decrease
[Reactants] increase (2)

7.8



(6)

[30]

QUESTION 8

8.1 Temperature: 25°C
Pressure: 101,3 kPa (1 atm)
Electrolyte concentration: 1 mol.dm⁻³ (3)

8.2 Mg – Lowest reduction potential/ Strongest Reducing agent (2)

8.3 Any soluble Mg²⁺-salt (2)

8.4 Metal electrode to conduct the current through the Cl₂(g) (2)

8.5 Cl₂(g) + 2e⁻ → 2Cl⁻(aq) (2)

- 8.6 $E^\circ_{\text{cell}} = E^\circ_{\text{Oxidising Agent}} - E^\circ_{\text{Reducing Agent}}$
 $= (+1,36) - (-2,36)$
 $= +3,72 \text{ V}$ (4)
- 8.7 Na^+ is a weaker oxidising agent than Cl_2 and cannot force Cl^- ions to oxidise to Cl_2
 Cl_2 -half cell is the cathode where reduction takes place. Cl^- -ions cannot accept e^- . (3)
- 8.8 Completes the circuit
Maintains electrical neutrality (2)
- 8.9 Cl_2 -half cell
During reduction Cl^- ions are formed
 K^+ -ions must neutralise the build up of Cl^- -ions. (3)
- 8.10 Mg to Cl_2 (1)
- 8.11 DECREASE
Increase in $[\text{Cl}^-]$ will favour the reaction in which e^- are released
This will prevent e^- flowing towards the Cl_2 -half cell
Current strength will decrease (3)
- 8.12 $\text{Mg(s)}/\text{Mg}^{2+}(\text{aq})(1 \text{ mol.dm}^{-3})//\text{Cl}_2(\text{g})(1 \text{ atm}),\text{Pt(s)}/\text{Cl}^-(\text{aq})(1 \text{ mol.dm}^{-3})$ (4)
- [30]**

TOTAL: 200