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PHYSICAL SCIENCES: PAPER 2

Time: 2 hours

130 marks

Examiner: K Mari

Moderator: J Morrison-Young

NAME	M	E	M	O													
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1.1	A	B	C	~~D~~
1.2	A	~~B~~	C	D
1.3	A	B	~~C~~	D
1.4	A	B	C	~~D~~
1.5	A	B	~~C~~	D
1.6	A	~~B~~	C	D
1.7	A	~~B~~	C	D

Question 2

2.1.1 An ionic bond is a transfer of electrons and subsequent electrostatic attraction. It is between a metals and non-metals. ✓✓

2.1.2 In the molten and aqueous state. ✓ Ions are free to move. ✓

2.1.3 Magnesium oxide has a higher melting point. ✓

Magnesium oxide has ions with a larger charge, hence stronger ionic bonds. ✓

More energy will be required to break the ionic bonds in MgO. ✓

2.2.1 Metallic ✓

2.2.2 Any metal ✓

2.2.3 Due to the delocalised electrons. ✓

2.3

$$n(\text{Pb}(\text{NO}_3)_2) = \frac{m}{M} = \frac{198,6}{207 + 28 + 96} \checkmark = 0,6 \text{ moles} \checkmark$$

$$n(\text{NaOH}) = cv = (0,2)(4,5) \checkmark = 0,9 \text{ moles} \checkmark$$

$$\text{Pb}(\text{NO}_3)_2 : \text{NaOH} = 1 : 2$$

$$n(\text{NaOH required}) = 0,12 \text{ moles}$$

Since there isn't sufficient NaOH, NaOH is the limiting reagent. $\checkmark$

2.4.1

$$n(\text{CO}_2) = \frac{V}{V_m} \checkmark = \frac{1,9}{22,4} \checkmark = 0,085 \text{ moles} \checkmark$$

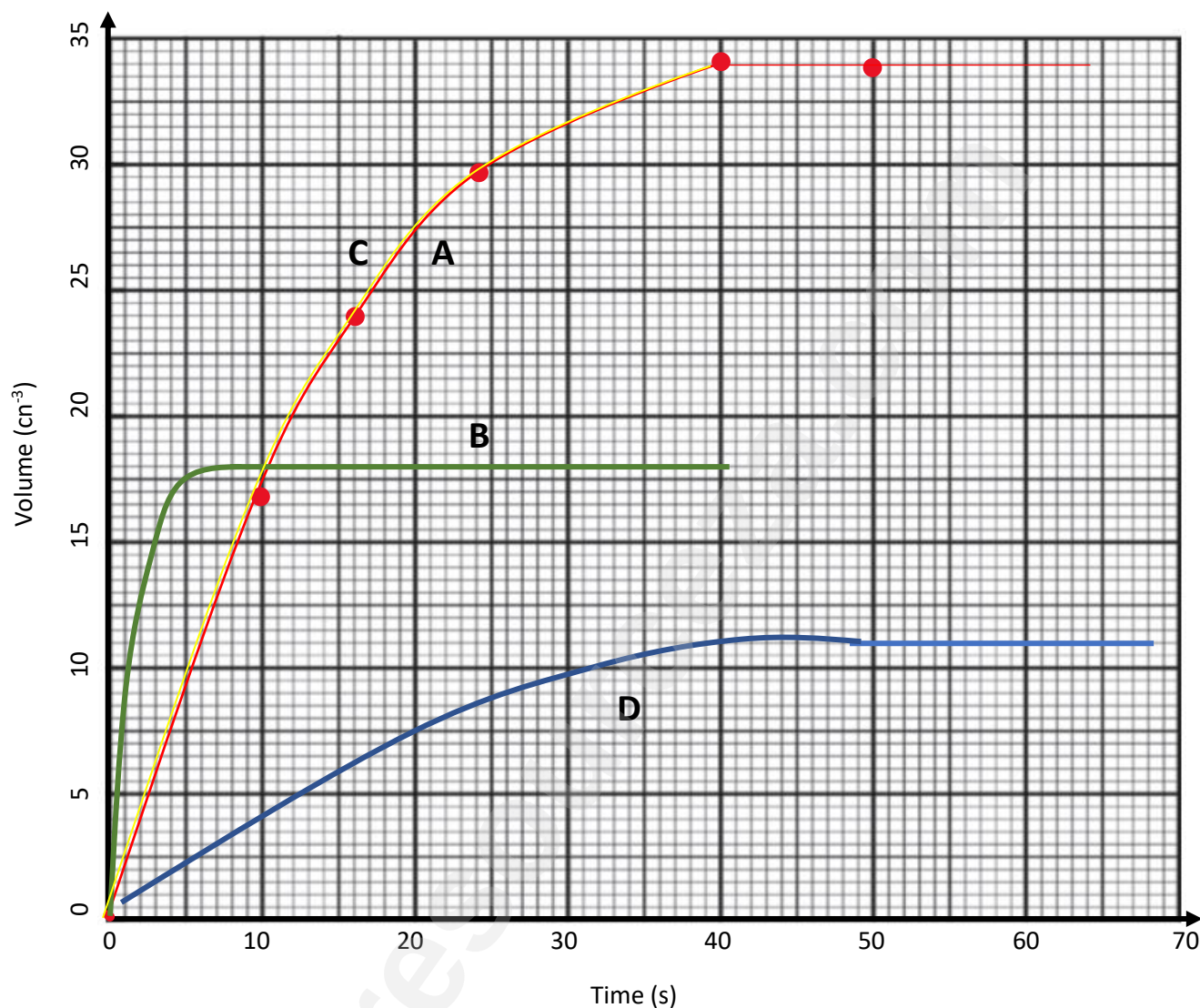
2.4.2

$$\text{Mole ratio } \text{CO}_2 : \text{CaCO}_3 = 1 : 1$$

$$n(\text{CaCO}_3) = 0,085 \text{ moles}$$

$$m(\text{CaCO}_3) = nM = (0,085)(100) \checkmark = 8,5 \text{ g} \checkmark$$

$$\% \text{ Purity} = \frac{8,5}{10} \times 100 \checkmark = 85 \% \checkmark$$

Question 3**Graph of Volume versus Time**

Heading ✓ x axis ✓ y axis ✓ Plotting of points ✓✓ Line of best fit ✓

3.3

$$n(\text{CO}_2) = \frac{V}{V_m} \checkmark = \frac{0,0336 \checkmark}{24,06} = \checkmark 1,4 \times 10^{-3} \text{ moles}$$

$$n(\text{CaCO}_3) = 1,4 \times 10^{-3} \text{ moles} \checkmark$$

$$m(\text{CaCO}_3) = nM = (1,4 \times 10^{-3})(40 + 12 + 48 \checkmark) = 0,14 \text{ g}$$

$$\% \text{ Purity} = \frac{0,14}{0,15} \times 100 \checkmark = 93,33 \% \checkmark$$

Question 4

4.1.1 The reaction is reversible. ✓

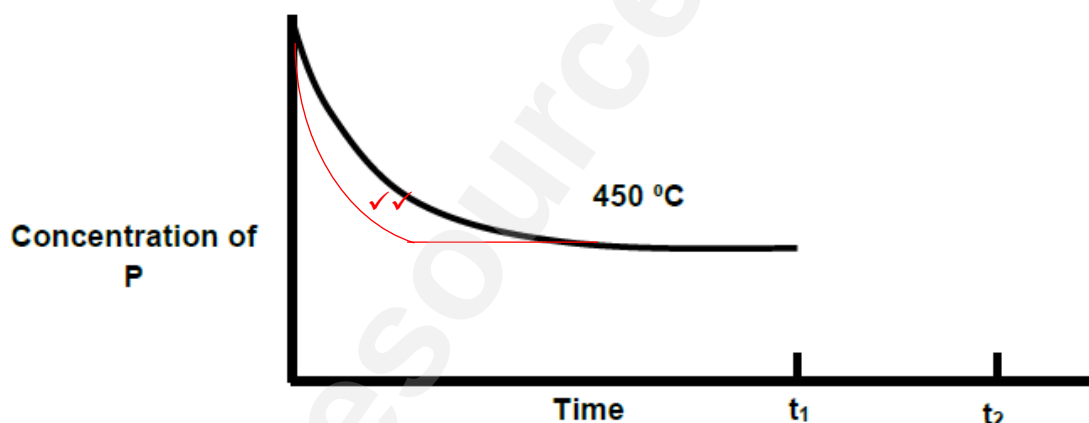
4.1.2 A closed system (in chemistry) is one in which mass is conserved inside the system but energy can enter or leave the system freely. ✓✓

4.1.3 Molecules must have sufficient kinetic energy ✓ and must have the correct orientation. ✓

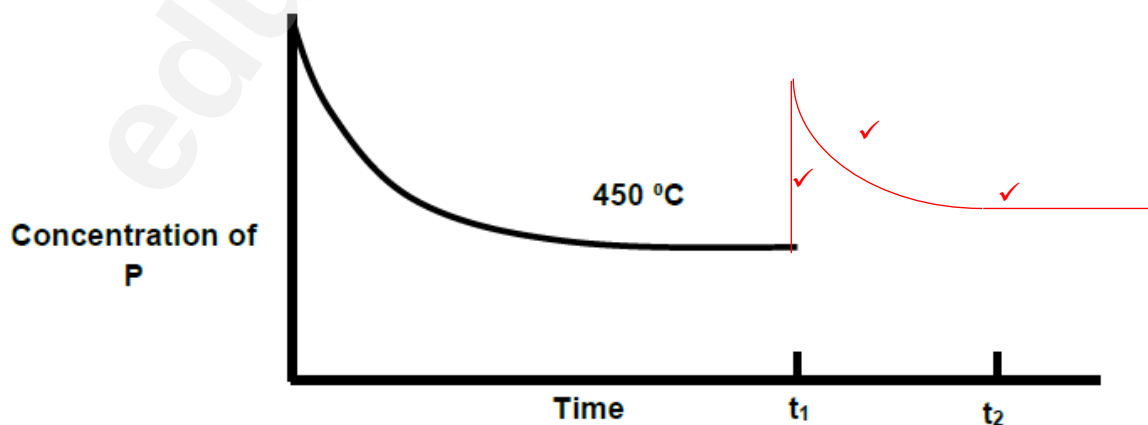
4.1.4 The concentration of P becomes constant. ✓✓

4.1.5 Yes ✓

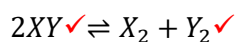
4.1.6



4.1.7



4.2.1



4.2.2a)

	XY	X ₂	Y ₂
Ratio	2	1	1
Initial	1,2	0	0
Change	1	0,5	0,5
Equilibrium	0,2	0,5	0,5
Conc	0,1	0,25	0,25

$$K_c = \frac{(0,25)(0,25)}{(0,1)^2} = 6,25$$

b) The yield high since $K_c > 1$

4.3.1 When an external stress (change in pressure, temperature or concentration) is applied to a system in chemical equilibrium, the equilibrium point will change in such a way as to counteract the stress.

4.3.2

Stress: Decrease in temperature

Response: The rate of the forward reaction increases, the forward reaction is favoured. Due to the colour being less yellow.

Reason: The forward reaction produces more heat and increases the temperature.

Conclusion: The forward reaction is exothermic. The heat of the reaction is negative.

Question 5

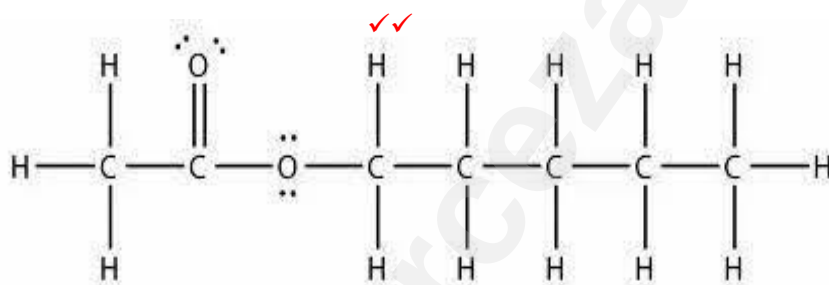
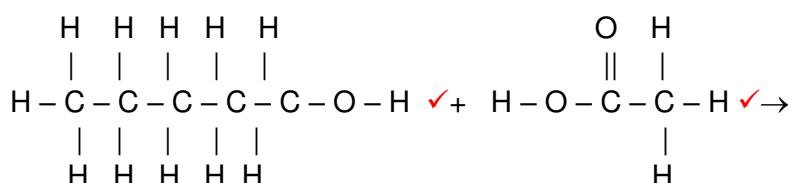
- 5.1 A homologous series is a series of similar compounds which have the same functional group and have the same general formula, in which each member differs from the previous one by a single CH_2 unit. ✓✓
- 5.2 Halo Alkane ✓
- 5.3 2 – bromo ✓ – 3 – ethyl ✓ – 5,5 – dimethyl ✓ hexane ✓
- 5.4 $\text{C}_{10}\text{H}_{20}$ ✓ & HBr ✓
- 5.5
 $\text{C}_7\text{H}_{16} + 11\text{O}_2 \rightarrow 8\text{H}_2\text{O} + 7\text{CO}_2 + \text{Heat}$ ✓✓
- 5.6 Structural isomers as compounds having the same molecular formula but different structural formulae. ✓✓
- 5.7 Chain isomerism. ✓
- 5.8 Any suitable answer. ✓✓

Question 6

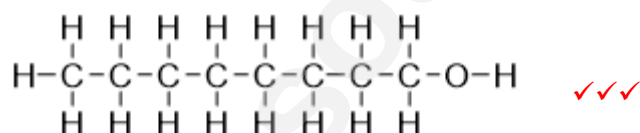
6.1.1 Esterification ✓

6.1.2 Heat in a water bath ✓ and add sulphuric acid. ✓

6.1.3



6.2.1



6.2.2 Hydrolysis ✓

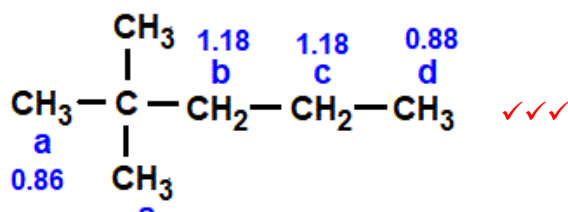
6.3.1 An unsaturated compound is a compound in which there is at least one double and/or triple bond between carbon atoms ✓✓

6.3.2 2-methylbut-1-ene ✓✓

6.3.3a) Hydration ✓✓

b) 2-methylbutan-1-ol ✓✓

6.4.1



6.4.2 Any suitable answer ✓✓

6.5 Compound A has dipole dipole forces between the molecules. ✓

Compound B both has hydrogen bonds between the molecules. ✓

Hydrogen bonds are stronger than dipole dipole forces. ✓

More energy will be required to overcome the hydrogen bonds between the molecules of compound B. ✓

Compound B will have a higher boiling point. ✓

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