



eduresourceza.com

St Mary's DSG Pta P2 2020 Memo

Chemistry Memo

QUESTION 1

- 1.1 B ✓✓
- 1.2 A ✓✓
- 1.3 B ✓✓
- 1.4. D ✓✓
- 1.5 A ✓✓
- 1.6 D ✓✓
- 1.7 B ✓✓
- 1.8 B ✓✓
- 1.9 B ✓✓
- 1.10 A ✓✓

[20]

QUESTION 2

- 2.1 Ionic bond is a transfer of electrons and subsequent electrostatic attraction. ✓✓ (2)
- 2.2 Any ionic substance ✓ (1)
- 2.3.1 Polar covalent bonds ✓✓ (2)
- 2.3.2 Non-polar (pure) covalent bonds ✓✓ (2)
- 2.4.1 Hydrogen bonding forces ✓✓ (2)
- 2.4.2 Dispersion forces/London forces/induced dipole forces ✓✓ (2)
- 2.5 The IMF in HF is stronger than the IMF in F₂. ✓ More energy is needed To overcome the stronger IMF. ✓ (2)
- 2.6 SiO₂ forms a giant atomic network or lattice ✓ where each atom is covalently bonded to many others. ✓ A lot of energy ✓ is needed to break these many strong covalent bonds ✓ which results in a high

melting point. (4)

2.7.1 A solution of known concentration. ✓✓ (2)

$$\begin{aligned} 2.7.2 \quad m &= c.M.V \quad \checkmark \\ &= 0,2 \times 142 \quad \checkmark \times 0,25 \quad \checkmark \\ &= 7,1 \text{ g} \quad \checkmark \end{aligned}$$

OR

$$\begin{aligned} n &= cV \\ &= 0,2 \times 0,25 \quad \checkmark \\ &= 0,05 \text{ mol} \end{aligned}$$

$$\begin{aligned} M &= n \times M \quad \checkmark \text{ (both formulae)} \\ &= 0,05 \times 142 \quad \checkmark \\ &= 7,1 \text{ g} \quad \checkmark \end{aligned}$$

(4)

2.7.3 **Making a standard solution:**

1. Use a scale/balance to accurately mass ✓ out the required amount of solute onto a watch glass or weighing boat.
2. Transfer the solute into a volumetric ✓ flask.
3. Add distilled water ✓ to the flask until approximately half full' (Shake the flask until all of the solute has dissolved.) ✓
4. Add distilled water to make up the total volume of the solution to the amount require. The bottom of the meniscus should sit on the ✓ line on the neck of the flask.

(5)

[28]

QUESTION 3

3.1.1 To ensure reliability ✓ (1)

3.1.2 Yes ✓

The time for experiment **B** is much less than for experiments **A** and **C**. ✓ (2)

3.1.3 Average time = $(34 + 33)/2$ ✓
 $= 33,5 \text{ s}$ ✓ (2)

3.1.4 Average rate = total volume of gas/ time ✓
 $= 50/33,5$ ✓
 $= 1,49 \text{ cm}^3 \cdot \text{s}^{-1}$ ✓ (3)

3.2.1 The rate of a reaction increases with an increase in concentration.
 Relationship must be stated between the independent and dependant variables. (2)

3.2.2 Average rate ✓ (1)

3.2.3 The amount of CaCO_3 ✓
 The particle size (solid or powder) of CaCO_3
 The volume of the acid ✓ (any ONE) (1)

3.2.4

Concentration of Acid ($\text{mol} \cdot \text{dm}^{-3}$)	Average rate ($\text{cm}^3 \cdot \text{s}^{-1}$)
0,75 ✓	2,6 ✓

(2)

3.2.5 An increase in the concentration ✓ increases the reaction rate. ✓ (2)

[16]

QUESTION 4

4.1 Exothermic ✓ (1)

4.2 When an external stress (change in pressure, temperature or concentration)✓ is applied to a system in dynamic chemical equilibrium✓, the equilibrium point will change in such a way as to counteract the stress✓. (3)

4.3 **LOW** ✓ (4)

- The system will, according to Le Chatelier's principle, react by trying to increase the pressure✓. A decrease in pressure (Low) favours the reaction that produces the highest no of moles of gas.✓
- Forward reaction will be favoured.✓ (9 mol reactants vs 10 mol products)
- ∴ Yield of NO greater at low pressure.

4.4.1 30s✓ to 50s ✓ (2)

4.4.2 On the graph NO and H₂O are increased, and NH₃ and O₂ decreased.✓ (5)

- This indicates that the forward reaction is being favoured✓
- The forward reaction is exothermic
- According to LCP, when **temperature is decreased**✓ the exothermic reaction✓ is favoured because it releases heat energy✓, thereby increasing the temp and counteracting the stress

4.4.3
$$K_c = \frac{[\text{NO}]^4 [\text{H}_2\text{O}]^6}{[\text{NH}_3]^4 [\text{O}_2]^5} \quad \checkmark \checkmark$$
 (2)

4.4.4 **R** $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g}) \quad \Delta H = -905 \text{ kJ} \cdot \text{mol}^{-1}$ (6)

I	4	8	16	24
C	-2	-2.5	+2 ✓	+3✓ratio
E _{mol.}	2	5, 5	18	27✓diff
(2dm ³) E _{conc.}	1	2, 75	9	13, 5✓conc

Calculation of K_c

$$K_c = \frac{[\text{NO}]^4 [\text{H}_2\text{O}]^6}{[\text{NH}_3]^4 [\text{O}_2]^5}$$

$$= \frac{(9^4) (13,5^6)}{(1^4) (2,75^5)} \quad \checkmark$$

$$= 2,5 \times 10^8 \checkmark \quad (5)$$

4.4.5 The equilibrium constant will **NOT** change $\checkmark\checkmark$ (2)

4.4.6 The equilibrium constant (K_c) is only affected by a temperature change. $\checkmark\checkmark$ (2)

[27]

QUESTION 5

5.1.1 OPTION 1:

$$M(\text{NaOH}) = 23 + 16 + 1 = 40 \text{ g} \cdot \text{mol}^{-1} \checkmark$$

$$m = cMV \checkmark$$

$$= 0,25 \times 40 \checkmark \times 0,25 \checkmark$$

$$= 2,5 \text{ g} \checkmark$$

OPTION 2:

$$n = cV \checkmark$$

$$= 0,25 \times 0,25 \checkmark$$

$$= 0,0625 \text{ mol}$$

$$m = nM$$

$$= 0,0625 \checkmark \times 40 \checkmark$$

$$= 2,5 \text{ g} \checkmark$$

(5)

5.1.2 OPTION 1

$$c_a V_a / c_b V_b = n_a / n_b \checkmark$$

$$c_a \times 25 \checkmark / 0,25 \times 16 \checkmark = 1/1 \checkmark$$

$$c_a = 0,16 \text{ mol} \cdot \text{dm}^{-3} \checkmark$$

OPTION 2

$$n_b = cV$$

$$= 0,25 \times 0,016$$

$$= 0,004 \text{ mol} \checkmark$$

$$n_b : n_a$$

1 : 1

0,004: 0,004 ✓ ratio

$$c_a = n/V \quad \checkmark$$

$$= 0,004/0,025 \quad \checkmark$$

$$= 0,16 \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark \quad (5)$$

$$5.1.3 \quad 1,23 \times 10^{-4} \times [\text{H}_3\text{O}^+] = 10^{-14} \quad \checkmark$$

$$[\text{H}_3\text{O}^+] = 10^{-14}/1,23 \times 10^{-4} \quad \checkmark$$

$$= 8,13 \times 10^{-11} \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark \quad (3)$$

5.2.1 Greater than 7 ✓ (1)

5.2.2 ($\text{NH}_3/\text{NH}_4\text{OH}$) is a base / OH^- ions in solution/ OH^- / an alkaline solution ✓ (1)

5.2.3 $\text{NH}_3 (\text{g}) + \text{H}_2\text{O} (\text{aq}) \checkmark \rightarrow \text{NH}_4^+ (\text{aq}) \checkmark + \text{OH}^- (\text{aq}) \checkmark$ (3)

5.2.4 Decrease ✓✓ (2)

5.2.5 NH_4^+ is a (weak) acid/proton donor ✓✓ **OR**

According to Le Chatelier's principle an increase in $[\text{NH}_4^+]$ will favour the reverse reaction in **5.2.3**, which will increase the $[\text{OH}^-]$ and therefore decrease the pH ✓✓ **OR**

NH_4Cl is an acidic salt.

Hydrolysis: NH_4OH – weak base – decreases $[\text{OH}^-]$ ✓

HCl – strong acid – no effect ✓ (2)

[22]

QUESTION 6

- 6.1 A substance that can conduct electricity by forming free ✓ions (2)
when molten or dissolved in solution. ✓
- 6.2 Anode ✓
Oxidation occurs at the anode (Al atoms are oxidized to form Al^{3+} ions) ✓ (2)
- 6.3 $\text{Al}_2(\text{SO}_4)_3$ ✓✓ (any soluble Al salt) (2)
- 6.4 Copper ✓
Half cells are made of an electrode dipped in a solution of its own ions and the ions in this half-cell are Cu^{2+} ✓ ✓ **OR**
Cu is more easily reduced than Al and reduction occurs at the cathode (3)
- 6.5.1 Concentration = 1 mol.dm^{-3} ✓
Room temperature - 25°C or 298 K ✓ (2)
- 6.5.2 $E^\circ_{\text{Cu}} = +0,34\text{V}$ ✓✓ (2)
- 6.6.1 Decreases ✓✓ (2)
- 6.6.2 Decreases ✓✓ (2)
- 6.6.3 Decreases ✓✓ (2)
- 6.7 Increases ✓
 - Al^{3+} ions are removed from the electrolyte (precipitate) ✓
 - According to Le Chatelier a decrease in the concentration of Al^{3+} ions will favour the forward reaction. $\text{Al} \rightleftharpoons \text{Al}^{3+} + 3\text{e}^-$ ✓
 - The negative charge on the anode will increase. ✓
 - The emf will increase. ✓
(4)
- 6.8 Larger (greater surface area) electrodes will result in a larger current delivered ✓ because the rate of the reaction increases ✓ and hence more current is delivered but no will be no change to the cell's emf ✓ (3)

[26]**QUESTION 7**

- 7.1 The process in which electrons are lost by a substance. ✓✓ (2)
- 7.2 spoon ✓✓ (2)
- 7.3 $\text{Ag}^+ (\text{aq}) + \text{e}^- \rightarrow \text{Ag} (\text{s})$ ✓✓ (2)
- 7.4 Silver ✓✓ (2)
- 7.5 The rate of oxidation (of Ag) equals the rate of reduction (of Ag) IF: Equilibrium is reached – 0/2 (2)

[10]

QUESTION 8

- 8.1 Electrical energy✓ to chemical energy✓ (2)
- 8.2 $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$ ✓✓ (2)
- 8.3 For every one Cu^{2+} ion that goes into solution✓ at the anode one Cu^{2+} deposits as Cu at the cathode✓. Hence the concentration of Cu^{2+} ions remains constant✓ in the electrolyte. (3)
- 8.4 Zn^{2+} ions ($E^0 = -0,76\text{V}$) are weaker oxidising agents✓ than the Cu^{2+} ions ($E^0 = +0,34\text{V}$) and therefore are not as easily reduced✓. Therefore Cu^{2+} is preferentially reduced at the cathode✓ (3)

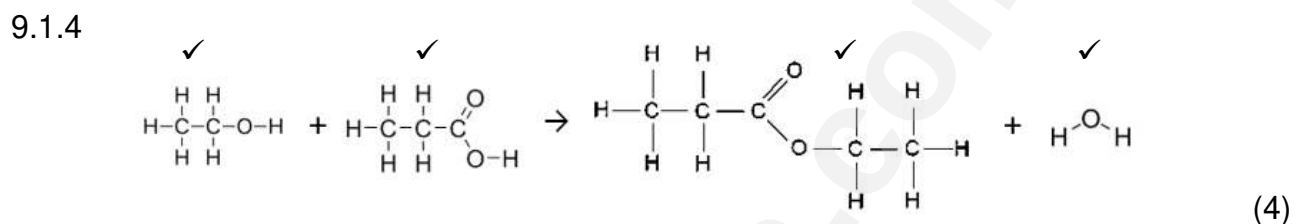
[10]

QUESTION 9

9.1.1 Esters ✓ (1)

9.1.2 Esterification ✓ or condensation ✓ (1)

9.1.3 Heat ✓
Concentrated acid catalyst/H₂SO₄ ✓ (2)



9.1.5 E ✓✓ (2)

9.2.1 Methylpropene ✓✓ (2)

9.2.2 Unsaturated. ✓
There's a double bond between two C atoms ✓ (2)

9.3 D ✓ and F ✓ (2)

9.4.1 The temperature at which the vapour pressure is equal to the atmospheric acid. ✓✓ (2)

9.4.2 A ✓✓ (2)

9.4.3 **A, E and H** are carboxylic acids
They all contain London forces, dipole-dipole, as well as 2 sites of hydrogen bonding forces. ✓✓✓
They differ in surface area ✓ with regards to the number of C's in their chains
A need less energy to break the bonds than **E** and **E** needs less than **G** ✓ (5)

9.5 Both **D** and **F** contain London forces only. They are both alkanes.
D has a bigger surface area; therefore, more energy is needed to break the bonds in **D** than in **G**.
D has a higher BP than **G**. (3)

[28]

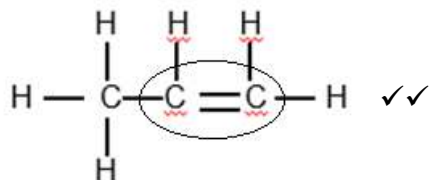
QUESTION 10

10.1 Substitution / Halogenation ✓ (1)

10.2 Heat / UV light ✓ (1)

10.3 $\text{C}_3\text{H}_8 (\text{g}) \checkmark + 5 \text{O}_2 (\text{g}) \checkmark \rightarrow 3 \text{CO}_2 (\text{g}) + 4 \text{H}_2\text{O} \checkmark$ ✓balancing (4)

10.4



(2)

10.5 Hydrogen bromide / HBr ✓ (1)

10.6 Hydrohalogenation ✓ (1)

10.7 Substitution ✓ (1)

10.8 Propan-2-ol ✓✓ (2)

[13]