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PHYSICAL SCIENCES: PAPER 2
MEMORANDUM

Question 1

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~~
1.8	A	B	C	~~D~~
1.9	A	~~B~~	C	D
1.10	A	B	~~C~~	D

Question 2

- 2.1 Carbon dioxide gas is released from the beaker when the reaction takes place. ✓ ✓
- 2.2 So that none of the other contents in the beaker will spill. ✓ ✓
- 2.3 5,7 ✓
- 2.4 Labels on both axis ✓
 Appropriate scale on x axis ✓
 Appropriate scale on y axis ✓
 Correctly plotted points ✓ ✓
 Line of best fit ✓ -1 for no heading
- 2.5

$$\text{Average Rate} = \frac{6,1 - 0}{140 - 0} = 4,36 \times 10^{-2} \text{ g.s}^{-1}$$

2.6 Due to the reaction being exothermic, there is an increase in temperature ✓

A higher temperature means that the particles have a greater average kinetic energy. ✓

there is a greater proportion of particles with sufficient kinetic energy to overcome the activation energy.. ✓

Increase in the number of effective collisions per unit time, higher reaction rate and steeper gradient. ✓

2.7

$$n = \frac{m}{M} \checkmark = \frac{6,1}{12+32} \checkmark = 0,14 \text{ moles} \checkmark$$

$$V = nV_m \checkmark = (0,14)(22,4) = 3,14 \text{ dm}^3 \checkmark$$

2.8

$$m = nM = (0,14) \checkmark (40 + 12 + 48) \checkmark = 14 \text{ g} \checkmark$$

Question 3

3.1.1

$$K_c = \frac{[CO][H_2O]}{[CO_2][H_2]}$$

3.1.2

	CO_2	H_2	CO	H_2O
Ratio	1	1	1	1
Initial	2	3	0	0✓
Change	0.723	0.723	0.723	0.723✓
Equilibrium	1,277	2,277	0,723	0,723✓
Conc	0,64	1,14	0,36	0,36✓

$$K_c = \frac{(0,36)(0,36)}{(0,64)(1,14)} = 0,18✓$$

3.1.3 Negative

3.1.4 More reactants were formed.

The reverse reaction was favoured.

Reverse reaction is endothermic, forward reaction is exothermic.

3.1.5 a) Decrease

b) Stress: The concentration of the reactants decreases more than the products.

Response: The rate of the reverse reaction increases, the reverse reaction is favoured.

Reason: The reverse reaction increases the concentration of reactants.

3.1.6 a) Yes

b) As volume of vessel increases, the concentration of all species will decrease, including CO .3.2.1 $2XA_2 + A_2 \rightarrow 2XA_3$

3.2.2 Rate of forward reaction equals to rate of reverse reaction, the system is in equilibrium.

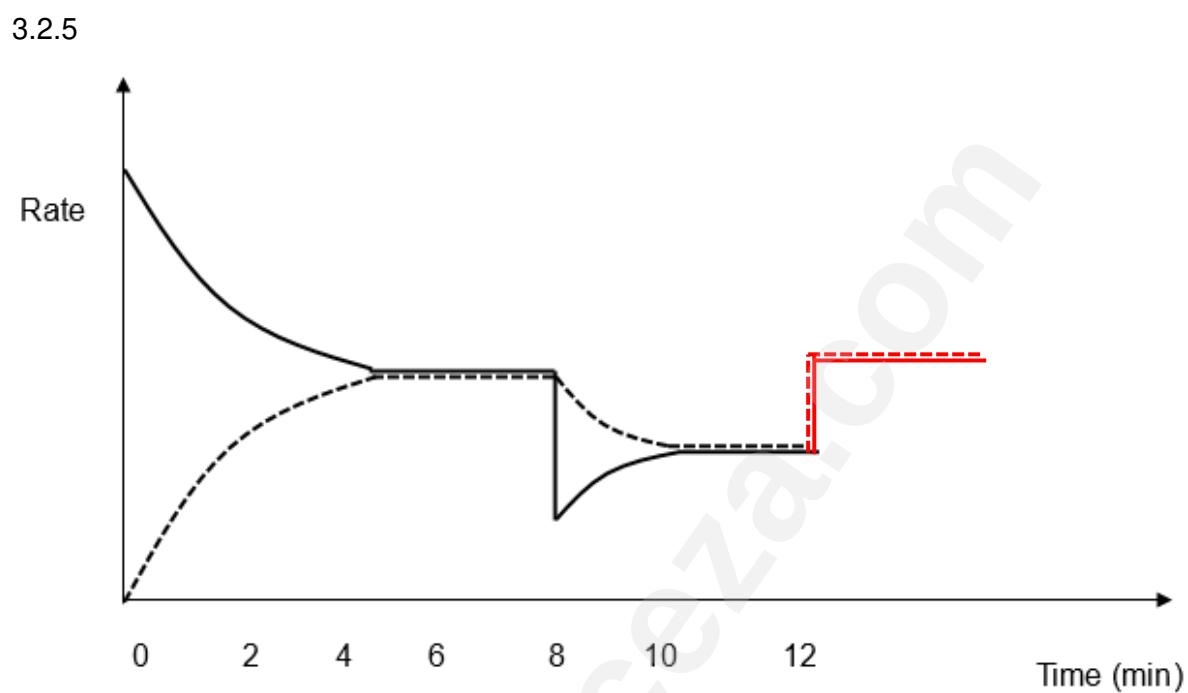
3.2.3 Decrease in temperature.

3.2.4 Stress: Decrease in temperature.

Response: Rate of forward reaction increased; the forward reaction was favoured.

Reason: The forward reaction will produce more heat and increase the temperature.

Effect: The concentration of products will be larger than the concentration of reactants, K_c will increase.



Question 4

4.1.1

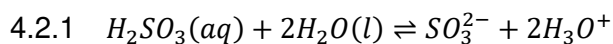
$$M = 39 + 16 + 1 = 56$$

$$m = cMv = (0,2)(56)\left(\frac{300}{1000}\right) = 3,36 \text{ g}$$

4.1.2 Dissociation is the splitting of an ionic compound into its ions.

4.1.3 The ionic compound splits into its cations and anions.

4.1.4 A strong base is a base that dissociates almost completely in an aqueous solution.

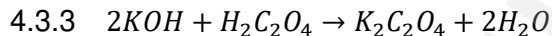


4.2.2 Sulphurous acid ionises partially.

4.2.3 Both are weak acids but oxalic acid is stronger than sulphurous acid meaning that it ionizes to a greater degree than sulphurous acid in water.

4.3.1 A standard solution is a solution of known concentration.

4.3.2 It donates two protons per molecule.



4.3.4

$$n(KOH) = cv = (0,25)\left(\frac{24,66}{1000}\right) = 6,17 \times 10^{-3} \text{ moles}$$

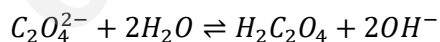
$$n(H_2C_2O_4) = 6,17 \times 10^{-3} \times \frac{1}{2} = 3,09 \times 10^{-3} \text{ moles}$$

$$m = nM = (3,09 \times 10^{-3})(2 + 24 + 64) = 0,28 \text{ g}$$

4.3.5 Neutralisation is the point where an acid and base have reacted so neither is in excess.

4.3.6 The reaction between a strong base and a weak acid with an equivalence point $pH > 7$.

4.3.7



Question 5

5.1.1

~~P~~	Q	~~R~~
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5.1.2

P	Q	~~R~~
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5.1.3

P	Q	~~R~~
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5.2 $P: Cu \rightarrow Cu^{2+} + 2e^{-}$

$R: 2H_2O \rightarrow O_2 + 4H^{+} + 4e^{-}$

5.3 Sludge

5.4 It contains precious metals.

5.5 Mn^{2+} ions are weaker oxidizing agents than Cu^{2+} so Cu^{2+} will be reduced in preference.

5.6 Carbon atoms are pure covalently bonded.

5.7 Each atom has one delocalized electron which is free to move and conduct a current

5.8 $Cu^{2+} + 2e^{-} \rightleftharpoons Cu$ (or $Cu^{2+} + Zn \rightleftharpoons Cu + Zn$)

In the cathode the forward reaction is favoured by the increased concentration of Cu^{2+} ions so the emf increase

Question 6

6.1 Reduction is the substance that donates electrons.

6.2 *Pb*

6.3 Lead (II) Sulphate

6.4 Sulphate Ion

6.5 The number of moles of solute per unit volume of solution.

6.6 The sulphate from the sulphuric acid forms a precipitate (lead(II)sulphate) so the sulphate ions are no longer part of the solution.

6.7

$$E_{cell}^0 = E_{cathode}^0 - E_{anode}^0$$

$$2,04 = E_{cathode}^0 - 1,69$$

$$E_{cathode}^0 = 3,73 \text{ V}$$

6.8

$$Q = It = (400)(3) = 1200 \text{ C}$$

$$n = \frac{Q}{F} = \frac{1200}{96500} = 0,0124 \text{ moles}$$

$$n(\text{PbSO}_4) = \frac{1}{2}(0,0124) = 6,22 \times 10^{-3} \text{ moles}$$

$$m(\text{PbSO}_4) = nM = (6,22 \times 10^{-3})(207 + 32 + 64) = 1,88 \text{ g}$$

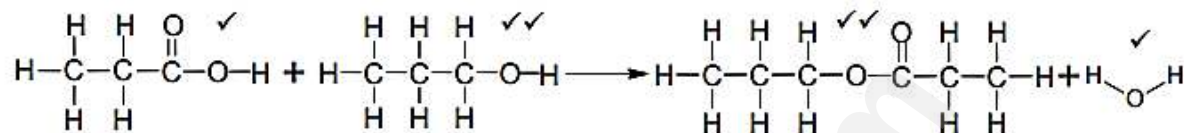
$$\text{Total Mass} = 1,88 \times 2 \times 6 = 22,62 \text{ g}$$

6.9 The reaction is exothermic. ✓✓

Question 7

7.1 Carboxyl

7.2.1



7.2.2 Propyl Propanoate

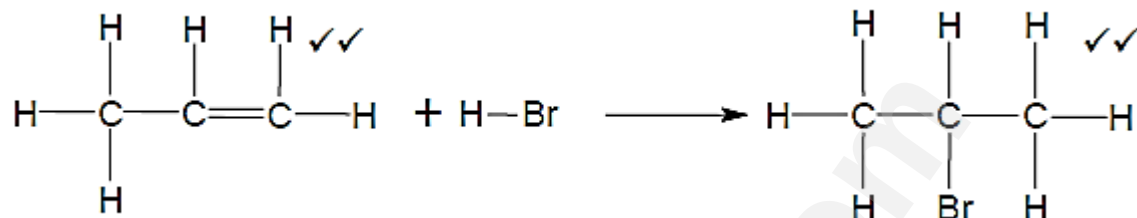
7.2.3 Sulphuric Acid

7.2.4 Hexanoic Acid

Question 8

8.1 It contains a double bond.

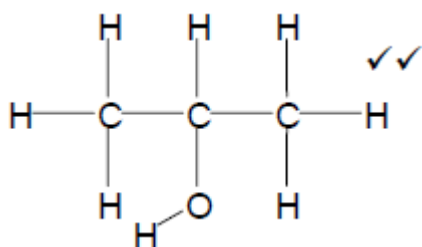
8.2



8.3 No water may be present

8.4 Addition

8.5



Propan-2-ol

8.6 Hydrolysis

8.7 Heat under reflux in a dilute alkali solution.

8.8.1 steam and a catalyst

8.8.2 H_3PO_4

8.8.3 Hydration

8.9.1 prop-1-ene

8.9.2 Dehydrohalogenation

8.9.3 NO water can be present.

Question 9

9.1

- Both compounds have London forces between the molecules.
- Compound B has a longer carbon chain with a greater surface area.
- More sites for formation of temporary dipoles and a stronger London force.
- More energy will be required to overcome the stronger London forces between the molecules of compound B.

9.2

- Compound D has hydrogen bonds.
- Hydrogen bonds are stronger than London forces.
- More energy will be required to overcome the stronger hydrogen bonds in compound D.
- Compound D has a higher boiling point.