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Grade 12 Chemistry Memorandum – Preliminary Examination 2016

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

2.1.1 Polar covalent

2.1.2 Non polar covalent/ pure covalent

2.1.3 Non polar covalent/ pure covalent

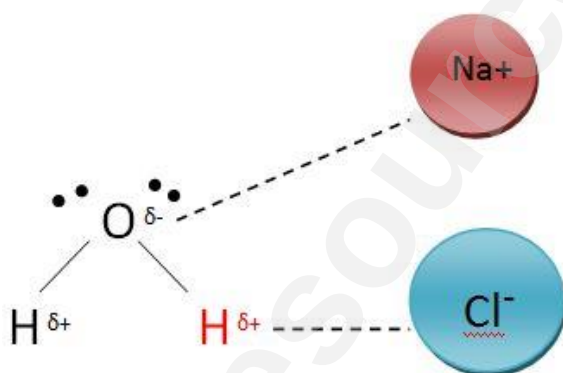
2.1.4 Metallic

2.1.5 Ionic

2.2. Electron cloud symmetry, therefore non-polar molecule, therefore London forces.



2.3 Ion-dipole is stronger than Ion-Ion attraction. The slightly positive side of the water molecule pulls the anion out of the crystal lattice, and the slightly negative side of the water molecule pulls the cation out of the crystal lattice.



3.1.1 Define an homologous series as 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 CH₂ unit

3.1.2 C₃H₆O₂ / C₃H₅COOH

3.1.3a CH₃COOH + CH₃CH₂CH₂CH₂OH → CH₃COOCH₂CH₂CH₂CH₃ + H₂O

3.1.3b Concentrated sulphuric acid

3.1.3c Substitution/dehydrolysis/condensation

3.1.3d Functional: hexanoic acid

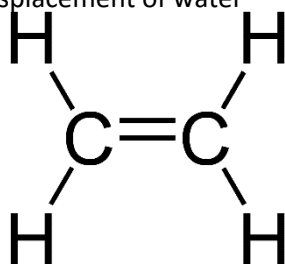
Positional: methyl pentanoate, propyl propanoate, ethyl butanoate, pentyl methanoate.

3.2.1 C₂H₆O + 3O₂ → 2CO₂ + H₂O

3.2.2a test tube (boiling tube)

3.2.2b Downward displacement of water

3.2.3c Ethene



3.3.1 hydrogen bromide

3.3.2 The red brown colour of Br_2 would slowly fade.

3.4 Ethane < Ethanol < Ethanoic acid

Ethane, non polar, London force

Ethanol, Polar, Hydrogen bond force

Ethanoic acid, polar, HBF & dipole

Therefore Ethanoic acid had the strongest IMF and would need the most energy to overcome the IMF's.

4.1 Define reaction rate as the change in concentration per unit time of either a reactant or product

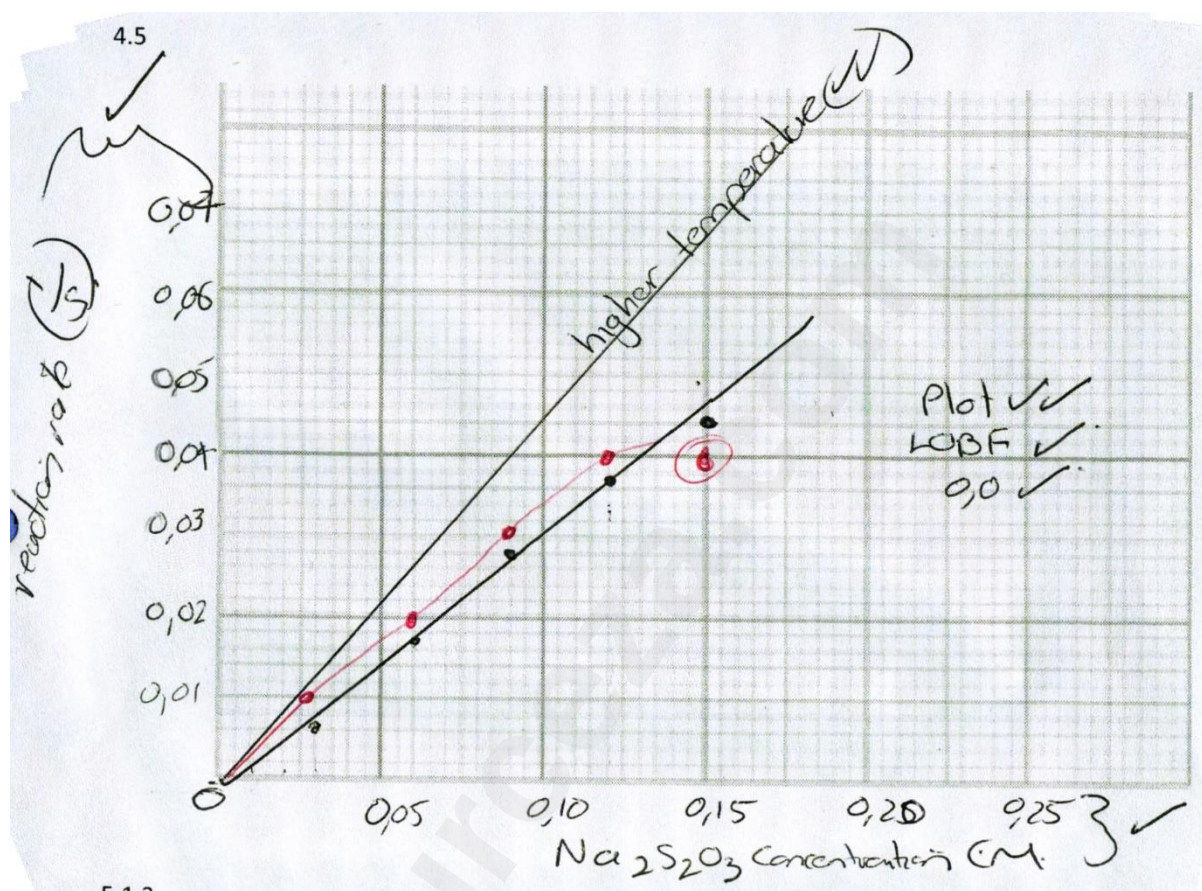
4.2 $n = c \cdot V = 0,15 \times 0,03 = 0,0045 \text{ mol}$ $C = n/V = 0,0045/0,05 = 0,09 \text{ M}$

4.3

Beaker	Volume of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)	Volume of H_2O (ml)	$[\text{Na}_2\text{S}_2\text{O}_3]$ (M)	Reaction time (seconds)	$\frac{1}{\text{time}}$ (.....)
1	50	0	0,15	22,5	0,044
2	40	10	0,12	27,3	0,037
3	30	20	0,09	35,1	0,028
4	20	30	0,06	60,0	0,017
5	10	40	0,03	159,1	0,006

0,04
0,04
0,03
0,02
0,01

4.4



ANSWER SHEET

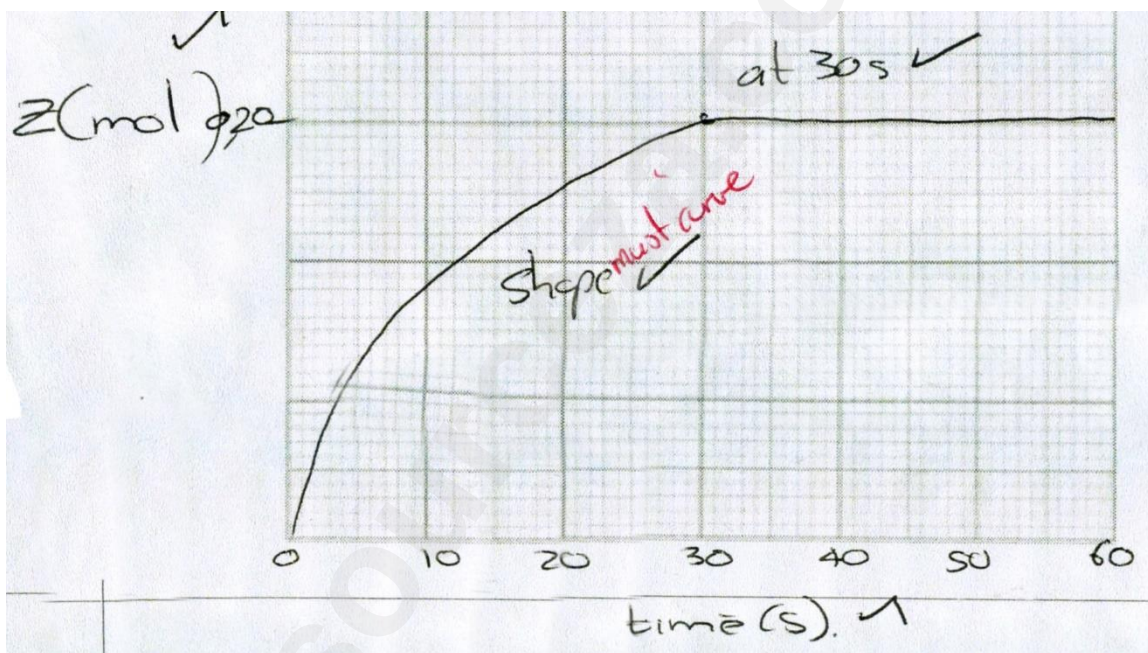
- 4.5 An inverse relationship, $\text{time} \propto \text{concentration of sodium thiosulphate}$
- 4.6 An increase in concentration means an increase in the particles, more particles mean more collisions and therefore more successful collisions per unit time, and an increase in the rate of the reaction.
- 4.7.1 Concentration of thiosulphate OR volume of final solution.
- 4.7.2 ANSWER SHEET
- 4.8 DECREASE
- 4.9 Decrease the precision, as there would be more moles of acid and this would affect the reaction time.

5.1.1

R	1X	2Y	1Z
I	0,5	0,5	0
C	-0,2	-0,4	+0,2
E	0,3	0,1	0,2

X = 0,3 mol & Y = 0,1 mol

5.1.2



5.1.3a $K_c = \frac{[Z]}{[X][Y]^2}$

5.1.3b $(y)^2 = (z)/(x)(k_c)$

$$= \sqrt{\frac{0,35}{0,4 \times 2,9}}$$

$$= 0,55 \text{ mol.dm}^{-3}$$

5.2.1a HIGHER THAN

5.2.1b EQUAL TO

5.2.2a Increase $[\text{NO}_2]$

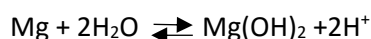
5.2.2b Decrease in pressure/ increase in volume

6.1.1 Define a salt as a substance in which the hydrogen of an acid has been replaced by a cation.

6.1.2 Magnesium chloride

6.1.3 Define hydrolysis of a salt as a reaction with water where water itself is decomposed

6.1.4 pH less than 7



The OH^- ions from water and the Mg^{2+} ions will form a weak base, $\text{Mg}(\text{OH})_2$, which is only partially dissociated. Therefore OH^- ions are removed from the solution leading to an excess of $\text{H}^+/\text{H}_3\text{O}^+$ ions, and hence decreasing the pH.

Handwritten calculations for a chemistry problem:

6.1.5. $n = c \times v$ ✓
 $= 2 \times 0,1$ ✓
 $= 0,2 \text{ mol}$ ✓ (3)

6.1.6 $n = c \times v$
 $= 0,6 \times 0,04$ ✓
 $= 0,024 \text{ mol}$ ✓ (2)

6.1.7 $n = 0,2 - 0,024 = 0,176 \text{ mol}$ ✓ (1)

6.1.8 $\text{MgO} : \text{HCl}$
 $1 : 2$

(Que) $0,088 \text{ g} : 0,176$

$n = \frac{m}{M} = \frac{5}{40,3} = 0,124 \text{ mol impure MgO}$

$\% \text{ purity} = \frac{0,088}{0,124} \times 100$
 $= 70,1 \%$

Red handwritten calculations on the right:

$m = n \cdot M$
 $= 0,088 \times (24,3119)$
 $= 3,55 \text{ g}$

$\frac{3,55}{5} \times 100$
 $= 71 \%$

6.1.9 Burette

6.1.10a Define neutralization as the point where an acid and base have reacted so neither is in excess. Also defined as the equivalence point

6.1.10b B, Strong acid and strong base.

6.2.1 Sulphurous acid is stronger. A strong acid ionises almost completely in solution. Sulphurous acid has a higher K_a , meaning more of the molecules ionise, making it stronger.

6.2.2 State Le Chatelier's principle: "When an external stress is applied to a system in chemical equilibrium, the equilibrium point will change in such a way as to counteract the stress"

6.2.3 S-Increase in temperature

O- LC says that the system will absorb heat to relieve the stress by favouring the endothermic reaction

D- Favours the revers reaction

R- Kc is decreased, as there is less product and more reactant.

6.2.4 S – OH⁻ ions are added, which removes H₃O⁺ ions and forms more water

O- Increase H₃O⁺ ion concentration

D –The forward reaction is favoured to Increase H₃O⁺ ion concentration to relieve the stress

R – The ionisation of the acid increases.

7.1 Chemical energy to electrical energy.

7.2 reduction as the gain of electrons

7.3 H₂

$$\begin{aligned} E_{mp} &= E^{\circ}_{\text{cath}} - E^{\circ}_{\text{anode}} \\ &= 0,34 - 0 \\ &= 0,34 \text{ V} \end{aligned}$$

7.4.1

7.4.2 Increase the Cu²⁺ ion concentration

Increase the H₂ gas pressure

7.5 H_{2(g)} (Pt) | H⁺_(aq) || Cu²⁺_(aq) | Cu_(s)

7.6.1 Cu²⁺ ions are removed from solution, the half-cell becomes negative. Na⁺ ions from the salt bridge replace the lost positive charge.

H⁺ ions are added to solution, therefore the half-cell becomes positive. NO₃⁻ ions flow from the salt bridge to electrically neutralize the half cell.

7.6.2 Close the circuit OR prevent bulk mixing

7.6.3 Increase the thickness of the salt bridge.

7.7 $Q = I \cdot t$ $= 0,65 \times (10 \times 60)$ $= 390 \text{ C} \checkmark$ $\text{mol} = \frac{390}{96500} \checkmark$ $= 4,041 \times 10^{-3}$	$\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$ 1 2 : 1 $m = \frac{Q}{2} \times 63,5 \checkmark$ $= 0,128 \text{ g Copper gained} \checkmark$
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- 8.1.1 Define solute as the substance that is dissolved in the solution
- 8.1.2 Sodium chloride
- 8.1.3 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
- 8.1.4 Asbestosis
- 8.1.5a Water is a stronger oxidizing agent than sodium ions and gains electrons more easily, causing the half reaction to occur more readily than the one that produces Na.
- 8.1.5b $2\text{H}_2\text{O} + 2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{OH}^- + \text{H}_2$
- 8.1.6 DC allows for the product to be collected at the same electrodes. AC would keep swapping and gasses could not be collected.
- 8.1.7 a rocket fuel b, water purification c, making paper
- 8.1.8 Mercury Cell
- 8.2.1 Electro refining
- 8.2.2 anode as the electrode where oxidation takes place
- 8.2.3 $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
- 8.2.4 CuSO_4 OR $\text{Cu}(\text{NO}_3)_2$
- 8.2.5 $\text{Cu}_{\text{impure}} \rightarrow \text{Cu}_{\text{pure}}$
- 8.2.6 Platinum / Silver / Gold