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KING DAVID HIGH SCHOOL
VICTORY PARK

PHYSICAL SCIENCES GRADE 12 PRELIM EXAMINATION
PAPER 2 - CHEMISTRY

MARKS: 200

TIME: 3 HOURS

EXAMINER: Mrs I Govender

MODERATOR: Ms S Nargaroo

NAME: **MEMORANDUM**

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

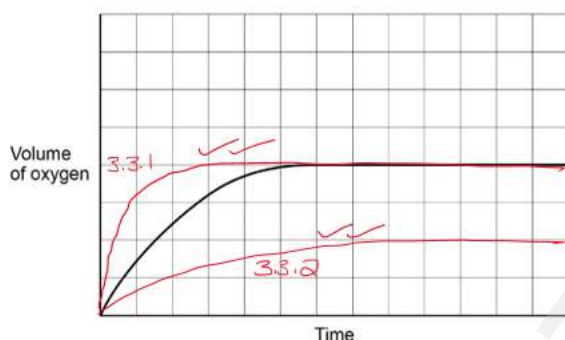
QUESTION 2

- 2.1 an intermolecular force is a force of attraction between molecules or between atoms of noble gases ✓✓ it doesn't have to be word perfect. (2)
- 2.2 Hydrogen bonding. ✓ (1)
- 2.3 **Giant covalent** structure. ✓ **Many strong** covalent bonds between **atoms** . ✓
A large amount of energy is needed to **break** these many bonds. ✓ (3)
- 2.4.1 *a measure of the tendency of an atom to attract a bonding pair of electrons* ✓✓ (2)
- 2.4.2 ΔEN for Si-Cl = 1,2 ✓ ΔEN for H-Cl = 0,9 ✓
 ΔEN greater for Si-Cl therefore more polar bonds ✓ (3)
- 2.5.1 liquid phase. ✓ (1)
- 2.5.2 • Random movement of electrons more electrons on one side of the molecule or uneven distribution of electron cloud for a moment - The electron cloud can become unevenly distributed ✓
• resulting in the formation of temporary / instantaneous / momentary dipoles which induce dipoles in neighbouring molecules. ✓
• (The opposite ends of) these dipoles attract each other. ✓ (3)
- 2.5.3 SiCl₄ has London forces only; HCl has London forces and dipole-dipole forces. ✓
Since SiCl₄ has a much bigger electron cloud / more electrons than HCl ✓,
SiCl₄ will have larger temporary dipoles. ✓
∴ The London forces in SiCl₄ are stronger than the London and dipole-dipole forces in HCl. More energy is needed to overcome these IMFs. ✓ (4)

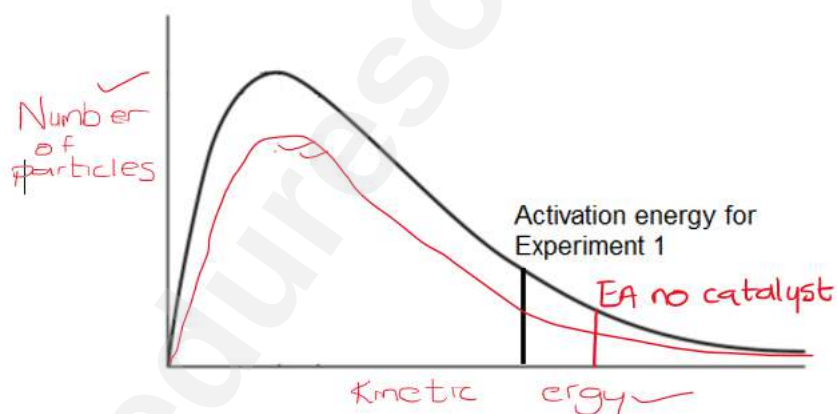
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QUESTION 3

- 3.1 catalyst as a substance that increases the rate of the reaction but remains unchanged at the end of the reaction ✓✓ (2)
- 3.2.1 oxygen is liberated, mass loss is measured (change of mass) ✓ over a time period ✓ (2).
- 3.2.2 Gas is not lost ✓ whilst preparing the apparatus ✓ (2)
- 3.3.



- 3.4 Increase in concentration increases the number of particles per volume ✓
 More collisions per second ✓
 Increases the chance of more effective collisions per second/per unit time ✓
 Increases the rate of reaction. ✓
- 3.5.



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Question 4

4.1.1 refers to a reversible reaction in which the forward and the reverse reactions are taking place at the same rate, and hence the concentrations of reactants and products are constant. ✓✓ (2)

4.1.2.1 2✓ (1)

4.1.2.2 1✓ (1)

4.1.2.3 3✓ (1)

4.1.3 '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' ✓✓ (2)

4.1.4 Increase in temperature✓ favours the endothermic reaction✓

By Le Chateliers principle the system shifts to counteract the stress, favouring the reverse reaction✓

The concentrations of A and B increase and C decreases. ✓ (4)

4.2

Balanced reaction equation	$3\text{H}_2(\text{g}) + \text{N}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$		
Initial quantity (mol)	0,4	0,2	0
Quantity used or produced (mol)	-0,03	-0,01	+0,02
Final quantity at equilibrium (mol) ✓	= 0,37	= 0,19	0,02
Final concentration at equilibrium ($\text{mol}\cdot\text{dm}^{-3}$)	0,37/0,25 =1,48✓	0,19/0,25 =0,76✓	0,02/0,25 =0,08✓

$$K_c = \frac{[\text{NH}_3]^2}{[\text{H}_2]^3[\text{N}_2]}$$

$$= \frac{[0,08]^2}{[1,48]^3[0,76]}$$

$$= 2,6 \times 10^{-3} \text{ ✓ (7)}$$

$$= 2,6 \times 10^{-3} \text{ ✓ (7)}$$

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QUESTION 5

5.1.1 a base that dissociates almost completely in an aqueous solution ✓✓ (2)



5.1.2 $\text{KOH} \rightarrow \text{K}^+(\text{aq}) + \text{OH}^-(\text{aq})$ ✓✓ (3)

5.1.3 $\text{K} : \text{OH}^-$

1 : 1

0,5: 0,5 ✓

$$[\text{OH}^-][\text{H}_3\text{O}^+] = 1 \times 10^{-14} \checkmark$$

$$[\text{H}_3\text{O}^+] = 1 \times 10^{-14} / 0,5 \checkmark$$

$$= 2 \times 10^{-14} \text{ mol.dm}^{-3} \checkmark (4)$$

5.1.4 a) The type of base/ the concentration of ions in solution ✓

b) Same volume of each basic solution/ same carbon graphite electrodes ✓

c) To ensure a fair test ✓

d) ▪ There is a greater current flowing in the KOH solution ✓

or the current through the bulb is greater in the KOH solution

▪ Higher concentration of ions in the KOH solution ✓

▪ The bulb shines brighter in the stronger the base/ better conductor of electricity ✓

5.2.1 HY ✓ (1)

5.2.2 H_2X ✓ (1)

5.2.3 HY ✓ (1)

5.3.1 H_2O ✓ & HSO_4^- ✓ (2)

5.3.2 H_2O ✓ or HSO_4^- (1)

5.4.1 $\text{NH}_4\text{OH} + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3 + \text{H}_2\text{O}$ ✓ ✓ (2)

5.4.2 methyl orange ✓

5.4.3 NH_4OH is a weak base and HNO_3 is a strong acid.

H_2O

$\text{NH}_4\text{NO}_3 \rightarrow \text{NH}_4^+(\text{aq}) + \text{NO}_3^-(\text{aq})$ ✓

$\text{NH}_4^+ + \text{H}_2\text{O} \rightleftharpoons \text{NH}_3 + \text{H}_3\text{O}^+$ ✓ ✓

Excess H_3O^+ ions ✓, therefore a weak acidic salt. (4)

5.5.1 $n = c.V$ ✓ ($c=n/V$)

$= 0,8 \times 0,05$ ✓

$= 0,04$ mol of HCl ✓ (3)

5.5.2 $n = c.V$

$= 0,5 \times 0,02$

$= 0,01$ mol of NaOH ✓ ✓

Therefore 0,01 mol of HCl neutralised (excess).

Mols of HCl that reacted with $\text{MgO} = (0,04 - 0,01)$ (c.o.e from 5.5.1)

$= 0,03$ mol of HCl ✓

Mol ratio: $\text{MgO} : \text{HCl}$

1 : 2

0,015 : 0,03 ✓

Mass of MgO $m = n \times M$

$= 0,015 \times 40,3$ ✓

$= 0,6045$ g of MgO ✓

% of MgO in tablet = pure/impure $\times 100$

$= 0,6045/0,96 \times 100$

$= 62,97\%$ ✓ (7)

OR Assume 100% purity

$$n = m/M$$

$$= 0,96/40,3$$

$$= 0,02382134 \text{ mol of MgO}$$

But only 0,015 mol of MgO in tablet

$$\% \text{ of MgO in tablet} = 0,015/0,02382134 \times 100$$

$$= 62,97\%$$

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QUESTION 6

6.1 Aqueous solutions of ions (aq, $1 \text{ mol} \cdot \text{dm}^{-3}$) ✓

Gases (g, 1 atm) ✓

Temperature (at 25°C) ✓ (3)

6.2.1 $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{Cl}^-(\text{aq})$ ✓✓ (2) (-1 if double arrow)

6.2.2 HCl is a strong (monoprotic) acid OR HCl ionises completely. ✓

The $[\text{Cl}^-]$ OR $[\text{HCl}] = 1 \text{ mol} \cdot \text{dm}^{-3}$ ✓ (2)

6.3.1 NO ✓ (1)

6.3.2 There are no chloride ions ✓✓

ethanoic acid is a weak acid OR ethanoic acid only ionises partially. ✓ (2)

6.4 Electrons ✓ PLATINUM ✓ (2)

6.5 $\text{Ni} | \text{Ni}^{2+}(\text{aq}, 1 \text{ mol} \cdot \text{dm}^{-3})$ ✓✓ || $\text{Cl}_2(1 \text{ atm}) | \text{Cl}^-(\text{aq}, 1 \text{ mol} \cdot \text{dm}^{-3})$ ✓ | Pt ✓ at 25°C ✓ (5)

6.6 $E^\ominus_{\text{cell}} = E^\ominus_{\text{oxidising agent}} - E^\ominus_{\text{reducing agent}}$ ✓

$$= 1,36 - (-0,25) \text{ ✓}$$

$$= + 1,61 \text{ V} \text{ ✓ (3)}$$

6.7 INCREASES ✓✓ (2)

6.8 KNO_3 ✓ (1)

6.9 DECREASES ✓ (1)

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QUESTION 7

7.1.1 non-polar covalent bond/ pure covalent bond ✓ (1)

7.1.2 ionic bond ✓ (1)

7.2.1 London Forces ✓ (1)

7.2.2 Ionic Bond/ electrostatic forces of attraction between cation and anion. ✓ (1)

7.3 sodium iodide. ✓ (1)



7.4.1 Bromine is non-polar ✓ and hexane is non-polar ✓. These two will dissolve ✓ and sodium iodide is ionic. ✓ Bromine will not dissolve in the ionic aqueous solution. Bromine and Hexane have weak London forces that will not dissolve in an ionic solution.

7.4.2 iodine gas ✓ (1) - cannot give formula

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QUESTION 8

8.1 electrical energy ✓ is converted into chemical energy ✓ (2)

8.2 Improve electrical conductivity by forming more ions in solution. ✓✓ (2)

OR to make the solution a better electrolyte

8.3.1 chromium is a stronger reducing agent than gold ✓ ∴ will also be oxidised ✓

Gold is a weaker reducing agent than Cu and falls as sludge/mud ✓

8.3.2 Copper ions - stronger oxidising agent than the Cr ions ✓ and would therefore rather be reduced. ✓ The Cr ions remain in solution. ✓ (3)

8.4.1 GAINED ✓ REDUCTION ✓ (2)

8.4.2 $n = m/M$

$$n = 19,6/63,5$$

$$= 0,30866 \text{ mol} \checkmark$$



$$1 : 2 \checkmark$$

$$\text{Electrons: } n \text{ e}^- = 0,30866 \times 2 = 0,6173 \text{ mol} \checkmark$$

$$q = nF = 0,6173 \times 96\,500$$

$$= 59569,45 \text{ C} \checkmark$$

$$q = It \checkmark$$

$$59569,45 = I (36 \times 60 \checkmark)$$

$$I = 27,58 \text{ A} \checkmark \quad (7)$$

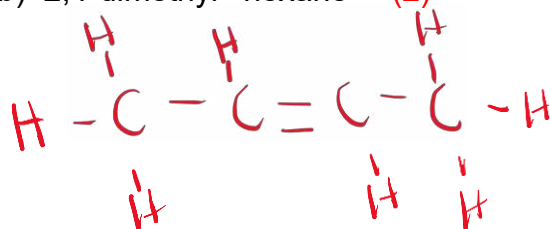
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QUESTION 9

9.1 a) 1-bromo✓(-2-)methylpropane✓ (2)

b) 2,4-dimethyl✓hexane✓ (2)

9.2



✓ (2)

9.3 pentane✓-2,3-diol. ✓ (2)

9.4 haloalkanes. ✓(1)

9.5 carboxyl group✓ (1)

9.6 A✓ (1)

9.7.1 pentanoic acid✓ (1)

9.7.2 the functional isomer of F as it is a carboxylic acid and has two sites for hydrogen bonding forces or a greater number of hydrogen bonds. ✓

Ethyl propanoate has dipole-dipole forces. ✓

The hydrogen bonds are stronger than dipole-dipole ✓

And therefore more energy is needed to overcome the stronger IMF between pentanoic acid. ✓ (4)

COE from 9.7.1

9.8.1 hydrolysis ✓ $\text{CH}_2(\text{OH})\text{CH}(\text{CH}_3)\text{CH}_3$ ✓ + NaBr ✓ (3)9.8.2 dehydrohalogenation ✓ $\text{CH}_2\text{C}(\text{CH}_3)\text{CH}_3$ ✓ + HBr ✓Or $\text{CH}_2\text{C}(\text{CH}_3)\text{CH}_3$ ✓ + $\text{NaBr} + \text{H}_2\text{O}$ ✓ (3)

9.9.1 It is an alkene and it is non-polar. It has weak London Forces✓ and has a boiling point lower than room temperature. ✓ (2)

9.9.2 $\text{C}_4\text{H}_8 + 6\text{O}_2 \rightarrow 4\text{CO}_2 + 4\text{H}_2\text{O}$ ✓ formulae of reactants✓ formulae of products✓balancing

9.9.3 chemical potential energy✓ into thermal energy✓

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TOTAL: 200 MARKS

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