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Grade 12

Physical Science Prelim Paper II

27 July 2016

MEMO

QUESTION 1:

1.1 B

1.2 D

1.3 C

1.4 B

1.5 B

1.6 C

1.7 B

1.8 A

1.9 C

1.10 A

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QUESTION 2:

2.1 A weak force of attraction between molecules✓ or between the atoms of a noble gas✓ (2)

2.2.1 London forces✓✓ (or Momentary – induced dipole forces) (2)

2.2.2 Ionic bond✓✓ (2)

2.2.3 $\Delta EN = 2,5 - 2,1 = 0,4$ ✓

Polar✓ covalent bond✓ (3)

2.2.4 CaCO_3 ✓

Ionic bond is stronger than weak IMF's✓ (2)

2.3.1

δ^-
 $\text{F} \text{ --- } \text{C} \text{ --- } \text{F}$
 δ^-
 δ^-

δ^-
 $\text{F} \text{ --- } \text{C} \text{ --- } \text{F}$
 δ^-
 δ^-

✓ single bonds

✓ polarity

(2)

2.3.2 Symmetrical charge distribution around the carbon atom✓✓ (tetrahedral shape✓)
(Doesn't have a slightly positive end to the molecule) (2)

2.3.3 CH_3F has dipole-dipole✓ forces between its molecules

CF_4 has London forces✓ between its molecules

Dipole-dipole forces are stronger✓ than London forces

More energy is required to overcome the dipole-dipole forces✓ (4)

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QUESTION 3:

3.1.1 Directly proportional✓✓

(As mass of AgNO_3 increases, mass of AgCl increases✓) (2)3.1.2 (a) AgNO_3 ✓ (1)3.1.2 (b) KCl ✓ (1)3.1.3 AgCl : $n = \frac{m}{M} = \frac{52}{143,5} = 0,36235 \text{ mol}$ ✓ $\text{KCl} : \text{AgCl}$

1 : 1

 $c = \frac{n}{V} = \frac{0,36235}{0,2} = 1,81 \text{ mol. dm}^{-3}$ ✓ (4)

3.2.1 Catalyst✓

Increase in rate of reaction✓ (2)

3.2.2 Any two of:

Concentration of acid✓

Surface area of zinc pieces✓

Mass of zinc pieces

Initial temperature

(Temperature – will increase, exothermic reaction) (2)

3.2.3 Concentrated acid will produce rapid reaction in both test tubes✓

Effect of catalyst won't be clear✓

Reactants may splash out effecting concentration

Acid burns (2)

3.3.1 $n = \frac{m}{M} = \frac{0,5}{2} = 0,25 \text{ mol}$ ✓ $\text{average rate} = \frac{\Delta n}{\Delta t} = \frac{0,25}{240} = 1,04 \times 10^{-3} \text{ mol. s}^{-1}$ ✓ (4)

3.3.2 (a), (b), (c) On Answer Sheet 2 (6)

3.4.1 Increases✓ (1)

3.4.2 More particles per unit volume✓

More collisions✓

More successful collisions per unit time✓ (3)

3.4.3 X✓✓ (2)

QUESTION 4:

4.1 Dynamic chemical equilibrium✓ (1)

4.2 For every 1 mol of A✓ used, 2 mols of B is used✓ (2)

4.3 According to LCP:

A temperature increase favours endothermic reaction✓ to use up the heat energy✓

From the graph, the forward reaction is favoured✓

Therefore the forward reaction is endothermic✓ (4)

4.4 [Product] increases✓, [Reactants] decreases✓

$$K_c = \frac{[Products]}{[Reactants]} \quad \text{INCREASES}✓ \quad (3)$$

$$4.5 \quad K_c = \frac{[AB_2]✓}{[A].[B]^2✓} \quad (2)$$

4.6

	A	B	AB₂
At 4 mins	0,66	0,42	0,30
Used / Formed	-0,16✓	-0,32✓	+0,16
At $\equiv m$	0,50	0,10✓	0,46✓

$$K_c = \frac{[AB_2]}{[A].[B]^2} = \frac{(0,46)}{(0,5).(0,1)^2} = 92✓ \quad (5)$$

4.7 B is added✓ (1)

4.8 UNCHANGED✓

No change in temperature✓ (2)

4.9 Mixture becomes blue✓✓✓ (2)

4.10 On Answer Sheet 3 (6)

4.11 On Answer Sheet 4 (3)

QUESTION 5:

5.1.1 A proton donor✓✓ (2)

5.1.2 A weak acid ionises✓ only partially✓ in water (2)

5.1.3 It can donate more than one proton✓ (1)

5.2.1 A solution of known concentration✓✓ (2)

5.2.2 $n = c \cdot V = (0,2) \cdot (0,3 \text{ ✓}) = 0,06 \text{ mol ✓}$
 $m = n \cdot M = (0,06) \cdot (56 \text{ ✓}) = 3,36 \text{ g ✓}$ (4)

5.2.3 Phenolphthalein✓
 H_3PO_4 is a weak acid✓, KOH is a strong base✓ (3)

5.2.4 $\text{H}_3\text{PO}_4(\text{aq}) + 3\text{KOH}(\text{aq}) \rightarrow \text{K}_3\text{PO}_4(\text{aq}) + 3\text{H}_2\text{O}(\text{l})$
 $n_b = c_b \cdot V_b = (0,2) \cdot (0,015) = 0,003 \text{ mol ✓}$

H_3PO_4	:	KOH
1	:	3
0,001✓	:	0,003

 $c_a = \frac{n_a}{V_a} = \frac{0,001}{0,020 \text{ ✓}} = 0,05 \text{ mol} \cdot \text{dm}^{-3} \text{ ✓}$ (4)

5.3.1 A reaction of a salt with water✓ where water itself is decomposed✓ (2)

5.3.2 $\text{NH}_4\text{NO}_3(\text{s}) \rightarrow \text{NH}_4^+(\text{aq}) + \text{NO}_3^-(\text{aq})$
 NH_4^+ ion will react with water molecules✓
 $\text{NH}_4^+ + \text{H}_2\text{O} \rightarrow \text{NH}_3 + \text{H}_3\text{O}^+ \text{ ✓}$
 $[\text{H}_3\text{O}^+]$ increases✓, pH decreases✓ (4)

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QUESTION 6:

6.1 Chemical✓ to electrical✓ (2)

6.2 1 mol.dm^{-3} ✓ (1)

6.3 $\text{HCl} \checkmark \checkmark (\text{KCl})$ (2)

6.4 Co (2)

6.5 $\text{Cl}_2 + 2e^- \rightarrow 2\text{Cl}^-$ ✓✓ (2)

6.6 $\text{Co} \rightarrow \text{Co}^{2+} + 2e^-$ ✓
 $\text{Cl}_2 + \text{Co} \rightarrow 2\text{Cl}^- + \text{Co}^{2+}$ ✓✓ (3)

6.7 Cobalt to Chlorine✓
 (Anode to Cathode) (1)

6.8 ✓ ✓ ✓
 $\text{Co (s)} \mid \text{Co}^{2+} (1 \text{ mol. dm}^{-3}) \parallel \text{Cl}^- (1 \text{ mol. dm}^{-3}) \mid \text{Cl}_2 (\text{g}) \mid \text{Pt (s)}$ (3)

6.9 $\text{emf} = E_{\text{cath}}^{\circ} - E_{\text{an}}^{\circ} = 1,36 \checkmark - (-0,28 \checkmark) = 1,64 \text{ V} \checkmark$ (3)

6.10 $\text{Cl}_2 + \text{Co} \rightarrow 2\text{Cl}^- + \text{Co}^{2+}$
 Increasing $[\text{Co}^{2+}] \checkmark$ will favour the reverse reaction✓ decreasing the emf✓ (3)

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QUESTION 7:

7.1 $\text{NaCl} \checkmark (\text{aq})$ (1)

7.2 $\text{Y} \checkmark$ (1)

7.3 $2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^- \checkmark \checkmark$ (2)

7.4 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^- \checkmark$
 $2\text{Cl}^- + 2\text{H}_2\text{O} \rightarrow \text{Cl}_2 + \text{H}_2 + 2\text{OH}^- \checkmark \checkmark$ (3)

7.5 Na^+ is a weaker oxidising agent than $\text{H}_2\text{O} \checkmark$
 H_2O molecules are more easily reduced at the cathode $\checkmark$ (2)

7.6 $Q = I \cdot t = (4000) \cdot (150 \checkmark) = 600\,000 \text{ C} \checkmark$
 $n_{\text{e}^-} = \frac{Q}{F} = \frac{600\,000}{96\,500} = 6,2176 \text{ mol} \checkmark$
 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
 $\text{e}^- \quad : \quad \text{Cl}_2$
 $2 \quad : \quad 1$
 $6,2176 : \quad 3,1088 \checkmark$
 $m = n \cdot M = (3,1088) \cdot (71) = 220,73 \text{ g} \checkmark$ (5)

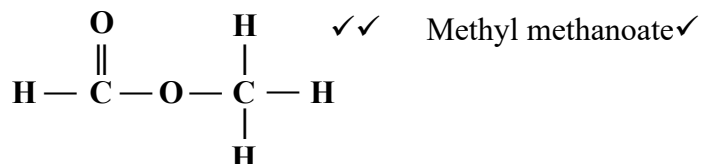
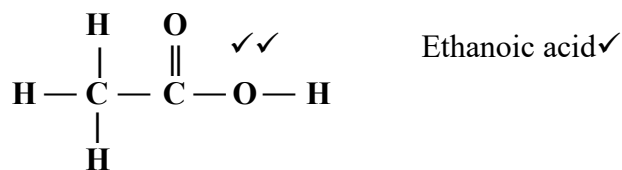
7.7 The membrane only allows Na^+ ions to pass through $\checkmark \checkmark$ (2)

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QUESTION 8:

8.1.1 Compounds having the same molecular formula✓ but different structural formulae✓ (2)

8.1.2



(6)

8.1.3 Functional isomers✓

They have different functional groups✓ (2)

8.2.1 Esters✓ (1)

8.2.2 Alcohol = ethanol✓ Acid = propanoic acid✓ (2)

8.2.2 $\text{CH}_3\text{CH}_2\text{COOH}$ ✓✓ (2)

8.2.3 Sulphuric acid✓ H_2SO_4 (1)

8.3.1 Functional group✓✓ (type of compound, IMF's) (2)

8.3.2 Sample 1✓ (1)

8.3.3 Pent-2-ene molecules are non-polar, IMF are London forces✓

Pentan-2-ol has hydrogen bonds✓ between its molecules

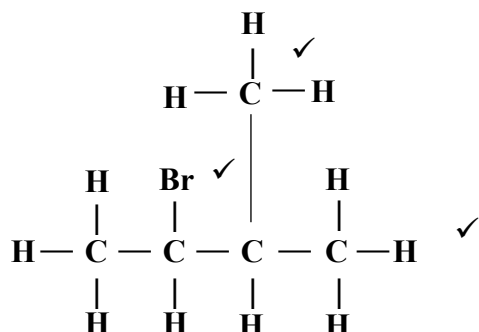
Hydrogen bonds are stronger✓ (3)

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QUESTION 9:

9.1 Haloalkanes✓ (alkyl halides) (1)

9.2



(3)

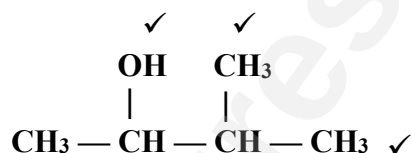
9.3.1 Elimination✓ (dehydrohalogenation) (1)

9.3.2 Heat✓ (1)

9.3.3 methyl✓ but-2-ene✓ (2-methyl but-2-ene) (2)

9.4.1 Substitution✓ (1)

9.4.2



(3)

9.5 $2\text{C}_5\text{H}_{10} + 15\text{O}_2 \rightarrow 10\text{CO}_2 \checkmark + 10\text{H}_2\text{O} \checkmark$ ✓balanced (3)

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