Grade 12 Chemistry 2016 Memo

QUESTION 1

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

QUESTION 2

2.1.1 A series of compounds having the same functional group and the same general formula, each member differing from the previous by CH_2.

2.1.2 an atom or group of atoms that form the centre of chemical activity in the molecule.

2.2.1.1 Alkenes

2.2.1.2 Carboxylic acids

2.2.1.3 Alkenes

2.2.2.1 Chlorine (chloro or halo)

2.2.2.2 Hydroxyl

2.2.2.3 Carboxyl

2.2.3 G: Pentanoic acid

H: 2-methylpropene

2.2.4.1

2.2.4.2 Esterification/ elimination

2.2.4.3 To act as a dehydrating agent

To act as a catalyst

2.2.5 $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

2.2.5.1 $n = \frac{m}{M} = \frac{108}{44} =$ **2,46 mol**

2.2.5.2 $C_3H_8 : O_2$

$m(O_2) = \frac{2,46}{1} \times 5 =$ **12,3 mol**

$v = 12,3 \times 22,4 =$ **275,52 dm^3**

2.2.5.3 $C_3H_8 : CO_2$

1 : 3

$n(CO_2) = 2,46 \times 3$

$= 7,38$ mol of CO_2

$m = nM = 7,38 \times 44$

= **324,72 g of CO_2**

2.2.5.4 Total volume of oxygen = 275,52 + 67,2

= **342,72 dm^3**

$\frac{342,72}{22,4}$

= **15,3 mol O_2**

mol $C_3H_8 = \frac{15,3}{5}$

$= 3,06$ mol

∴ extra $C_3H_8 = 3,06 - 2,46$

= **0,6 mol**

$m = nM = 0,6 \times 44$

= **26,4 g of C_3H_8**

2.2.6.1 Molecules with the same molecular formula, but different structural formulae.

2.2.6.2 Methylpropane

2.2.6.3 Methylpropane

- has a smaller surface area than butane
- smaller electron cloud density and ∴ fewer points of contact
- intermolecular forces are ∴ weaker
- ∴ lower boiling point

2.2.7.1 Functional isomer: Compounds with the same molecular formula but different functional groups.

2.2.7.2 Draw functional isomer. (methyl butanoate OR ethyl propanoate will do)

2.2.8.1 Elimination, addition, substitution

2.2.8.2 Condensation (dehydration)

QUESTION 3

3.1 The rate of the forward reaction equals the rate of the reverse reaction.

3.2 No. Both the reactions are still taking place and there is a presence of both.

3.3 $K_C = \frac{[HI]^2}{[H_2][I_2]}$

3.4 $K_C = \frac{17^2}{2,5^2} = \mathbf{46,24}$

3.5 When an external stress is applied to a system in chemical equilibriums, the equilibrium point will change in such a way as to reduce the stress.

3.6.1 [HI] increases

- Forward reaction is favoured
- due to the exothermic reaction being promoted.

3.6.2 Purple colour fades

- [I] decreases
- because forward reaction is favoured
- thus I_2 is used up.

3.7 None because the number of moles are equal for reactants and products.

3.8.1 0-20 s; 35-40 s; 55-70 s

3.8.2 - $[H_2]$ was increased

- forward reaction favoured

- $[H_2]$ and $[I_2]$ decrease

- so [HI] increases to counteract stress

3.8.3.1 Increase

3.8.3.2 Same

3.8.3.3 Same

QUESTION 4

4.1 Iodine – molecules

Diamond – atoms

Magnesium oxide – ions

Hydrogen fluoride – molecules

Iron – positive nuclei and delocalised electron

4.2 Iodine – Van der Waals forces (London forces)

Diamond – covalent bonding forces

Magnesium oxide – coulombic forces OR ionic bonding forces

Hydrogen fluoride – hydrogen bonds

Iron – metallic bonds

4.3.1 Water is a polar substance, while diesel and petroleum are non-polar

4.3.2 $KMnO_4$ is an ionic solid which is soluble in the polar water, but insoluble in the non-polar petroleum and diesel.

4.3.3 Iodine

QUESTION 5

5.1 An acid is a proton donor

5.2 $HF + H_2O \rightarrow H_3O^+ + F^-$

5.3 HF is a weak acid; $K_a = 7{,}2 \times 10^{-14}$ which means that HF is only partially ionised.

5.4.1 $CO_3^{2-} + H_2O \rightleftharpoons HCO_3^- + OH^-$

5.4.2 base acid / CO_3^{2-} HCO_3^-

acid base / H_2O OH^-

QUESTION 6

6.1.1 Bromocresol green is BLUE in base. Adding base OH^- causes $[H_3O^+]$ to decrease. There is a shift to the right and solution turns blue.

6.1.2 $NH_4OH + HCl \rightleftharpoons NH_4Cl + H_2O$

At end point:

Moles NH_4OH = moles HCl

i.e. $C \times \frac{20}{1000} = 0{,}062 \times \frac{22}{1000}$

$\therefore [NH_4OH] = 0{,}068 \text{ mol.dm}^{-3}$

6.1.3 $NH_4Cl \rightarrow NH_4^+ + Cl^-$

NH_4^+ hydrolyses:

$NH_4^+ + H_2O \rightarrow NH_3 + H_3O^+$

$\therefore$ solution is slightly acidic

6.1.4 Indicatior A (pH range corresponds with pH at end point)

QUESTION 7

7.1 $Mg/Mg^{2+}//Ag^+/Ag$

7.2 25°C

7.3 $Mg \rightarrow Mg^{2+} + 2e^-$

7.4 Magnesium

7.5 $E^{\ominus}_{cell} = E^{\ominus}_{cathode} - E^{\ominus}_{anode}$

$E^{\ominus}_{cell} = 0{,}8 - (-2{,}37) =$ **3,17 V**

7.6 $I = \frac{P}{V} = \frac{6W}{3V} =$ **2A**

7.7 Although the voltage is sufficiently large, the current is probable too small due to the large internal cell resistance. Also, reaction rate is too low to supply sufficient electrons to produce a large enough current.

QUESTION 8

8.1 Sodium chloride solution

8.2 $2Cl^- \rightarrow Cl_2 + 2e^-$

8.3.1 The second reaction $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

8.3.2 Na^+ is a very weak oxidising agent and will not be reduce to Na.

The $[H^+]$ at a pH of 7 is too low (10^{-7} $mol.dm^{-3}$) to make the third reaction a reasonable choice.

8.4 $2NaCl + 2 H_2O \rightarrow 2NaOH + H_2 + Cl_2$

8.5 Chlorine – bleach

Sodium hydroxide – soap-making

Hydrogen – Haber process for ammonia

QUESTION 9

9.1.1 Decrease

9.1.2 no effect

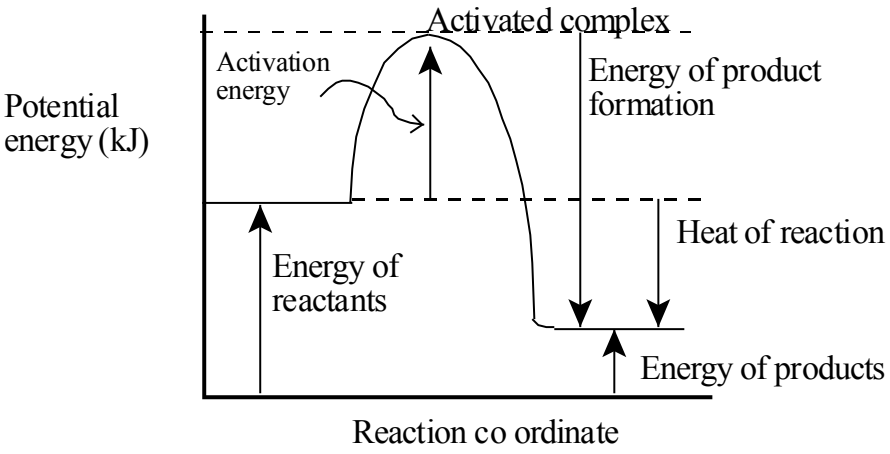
9.1.3 Decrease

9.1.4 Increase

9.1.5 Increase

9.1.6 Decrease

9.2 next page . . . . . .


Activated complex
Activation energy
Energy of product formation
Potential energy (kJ)
Heat of reaction
Energy of reactants
Energy of products
Reaction co ordinate