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QUESTION 1

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

[10 x 2]

QUESTION 2

- 2.1 A covalent bond is a **sharing** of at least one pair of **electrons** by two non-metal atoms. (2)
- 2.2 A non-polar covalent bond is an **EQUAL sharing of electrons**.
A polar covalent bond is an UNEQUAL sharing of electrons. (2)
- 2.3.1 hydrogen OR chlorine (1)
- 2.3.2 hydrogen chloride OR hydrogen fluoride (1)
- 2.3.3 aluminium oxide (1)
- 2.3.4 hydrogen fluoride (1)
- 2.3.5 hydrogen chloride (1)
- 2.3.6 argon (1)
- 2.3.7 magnesium (1)
- 2.3.8 graphite (1)
- 2.4.1 Homogenous mixture of solute and solvent (Definition 0/2) (2)
- 2.4.2 both have Hydrogen bond IMF
water has on average 4 hydrogen bond IMF per molecule
while NH₃ only has on average 2 hydrogen bond per molecule
therefore more ENERGY is needed to overcome the greater number of hydrogen bonds in water (4)

QUESTION 3

$$\begin{aligned}
 3.1.1 \quad c &= n/v & \checkmark \\
 0,8 &= n/0,1 & \checkmark \\
 n &= 0,08\text{mol} & \checkmark
 \end{aligned}
 \tag{3}$$

$$\begin{aligned}
 3.1.2 \quad n\text{H}_2\text{SO}_4 : n\text{CuO} & \quad n\text{CuO} = m/M & \checkmark \\
 1:1 & \quad 0,08 = m/(63,5 + 16) & \checkmark \\
 0,08:0,08 & \quad m = 6,36 \text{ g} & \checkmark
 \end{aligned}
 \tag{3}$$

3.2 It is a high energy unstable temporary transition state $\checkmark$ between the reactants and the products. $\checkmark$ (2)

3.3 Exothermic $\checkmark$ (1)

3.4 58 kJ $\checkmark\checkmark$ (2)

3.5 -35 kJ $\checkmark\checkmark$ (2)

3.6.1 The rate of the reaction would decrease. $\checkmark$ (1)

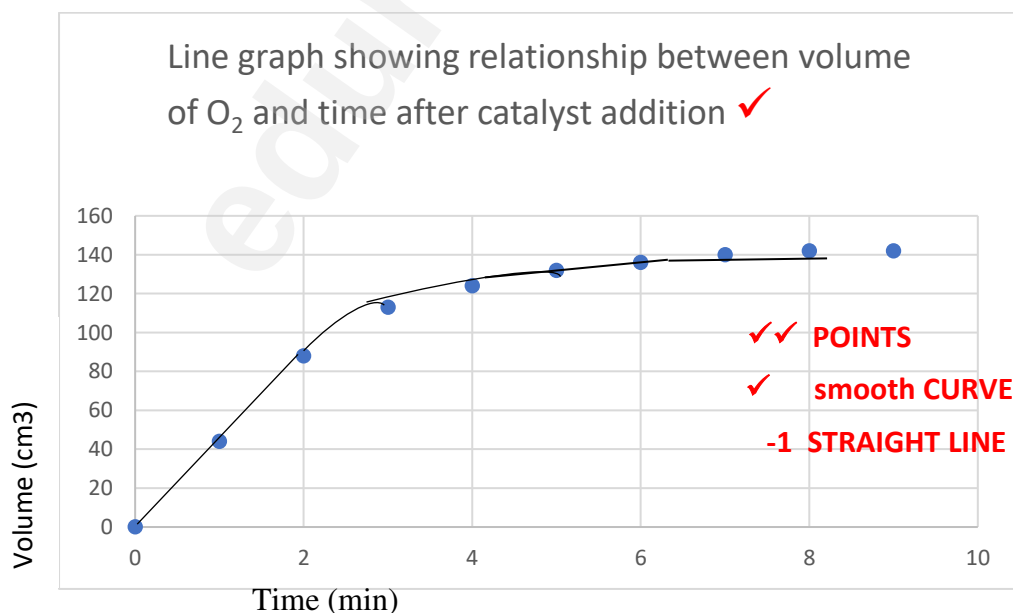
3.6.2 The decreased concentration of H_2SO_4 means fewer molecules per unit volume $\checkmark$ and will result in fewer effective collisions $\checkmark$ between reacting particles per unit time. $\checkmark$ (3)

[17]

QUESTION 4

4.1 A catalyst is a substance that increases the rate of the reaction $\checkmark$ but remains unchanged at the end of the reaction. $\checkmark$ (2)

4.2.1



4.2.2 $\text{Rate}_{\text{ave}} = \Delta V / \Delta t$ ✓ **Downloaded from eduresourceza.com**

$= 88-0 / 2-0$ ✓

$= \underline{44} \text{ cm}^3 \cdot \text{min}^{-1}$ ✓ (4)

[12]

QUESTION 5

5.1 $n = m/M$

$= 1,6/63,5$ ✓

$= 0,025 \text{ mole}$ ✓

$n = V/V_m$ ✓

$0,05 = V/22,4$ ✓

$V = 1.12 \text{ dm}^3$ ✓ (5)

5.2.1 Le Chatelier's principle

When an external stress (change in pressure, temperature or concentration) is applied to a system in chemical equilibrium, ✓ the equilibrium point will change ✓ in such a way as to counteract the stress ✓ (3)

5.2.2 Initially the volume decreases and $\therefore$ increase in concentration ✓ $\therefore$ goes darker ✓ (2)

5.2.3 Stress: Increase pressure ✓

Response: Favour forward reaction ✓

Reason: The forward reaction produces fewer moles of gas, which relieves the stress of high pressure. ✓

Colour: More N_2O_4 therefore Colourless/lightens ✓ (4)

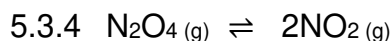
5.3.1 forward reaction endothermic ✓ (1)

5.3.2 stress: increase in temperature ✓

Response: Favour forward (or endothermic) reaction ✓ as shown by decrease in reactant $[\text{N}_2\text{O}_4]$ and increase in product $[\text{NO}_2]$ ✓

Reason: Forward reaction that uses heat ($\therefore$ endothermic), which relieves stress of the increase temperature ✓ (4)

5.3.3 Stress: added NO_2 ✓ (1)



$K_c = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]}$ ✓

$= \frac{(0,6)^2}{(0,2)}$ ✓

$= 1.8$ ✓

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(3)

	ICl_3	I_2	Cl_2
Ratio	2	1	3
Initial (mol) ✓	$n = m / M$ $= 163,5/233,5$ = 0,7 mol	0	0
Change (mol) ✓	- 0,6	+ 0,3	+ 0,9
Equilibrium (mole) ✓	0,1	0,3	0,9
c = n/V mol.dm⁻³ ✓	$0,1/2$ $= 0,05$	$0,3/2$ $= 0,15$	$0,9/2$ $= 0,45$

$$\begin{aligned}
 K_c &= \frac{[\text{I}_2][\text{Cl}_2]^3}{[\text{ICl}_3]^2} \checkmark \\
 &= \frac{(0,15)(0,45)^3}{(0,05)^2} \checkmark \\
 &= 5,47 \checkmark
 \end{aligned}$$

(7)

[30]

QUESTION 6

6.1.1 Silver/Ag electrode ✓✓

(2)

6.1.2 H_2 is reducing agent ✓

(2)

6.1.3 AgNO_3 ✓✓

(2)

6.1.4 ✓temp = 25°C;

✓ both $[\text{H}^+] = 1 \text{ mol.dm}^{-3}$, $[\text{Ag}^+] = 1 \text{ mol.dm}^{-3}$;✓pressure of $\text{H}_{2(g)} = 1 \text{ atm}/101325 \text{ Pa}$

(3)

6.1.5 redox reactions in each half cell are equilibrium reactions ✓

so conditions that will disturb equilibrium will affect E° value ✓ of half-cell and need to be controlled

(2)

- 6.2.1 Prevent rusting ✓, decorative ✓ (2)
- 6.2.2 Electrical energy → chemical potential energy ✓✓ (2)
- 6.2.3 Negative ✓✓ (2)
- 6.2.4 Cathode ✓ (1)
- 6.2.5 Silver/Ag ✓.

✓ $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$ at anode X

This keeps the $[\text{Ag}^+]$ roughly constant/from decreasing ✓

which prevents electroplating process slowing to a stop due to lowering concentration of Ag^+ ✓

OR

if an inert Pt electrode were used, $[\text{Ag}^+]$ would decrease and electroplating process would slow down to a stop ✓ (4)



6.2.7 $I = 900 \text{ mA} = 0,9 \text{ A}$

$t = 10 \times 60 = 600 \text{ s}$

$Q = It = (0,9)(600) = 540 \text{ C}$ ✓✓

$n \text{ e}^- = Q/F = (540) / 96500 = 0,005606 \text{ mol e}^-$ ✓✓*OR

$n \text{ Ag} = n \text{ e}^-$

$m \text{ Ag} = n \times M = (0,005606)(108) = \underline{0,605 \text{ g Ag}}$ ✓✓

*OR $\text{No e}^- = Q/e = (540) / 1,6 \times 10^{-19} = 3,375 \times 10^{21}$

$n \text{ e}^- = \text{No} / N_A = 3,375 \times 10^{21} / 6,02 \times 10^{23} = 0,005606 \text{ mol e}^-$

(6)

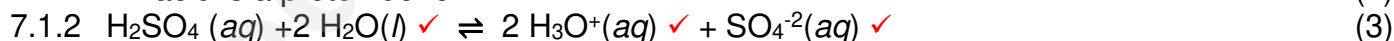


6.3.3 The cryolite reduces the melting point to 950°C , (thereby reducing cost). ✓ (1)

[36]

QUESTION 7

7.1.1 An acid is a proton donor. ✓ (1)



7.1.3 The ethanoic acid ✓ will have a higher pH because it is a weak acid ✓ and only ionises partially so it will have a lower H_3O^+ concentration. ✓ The H_2SO_4 is a strong acid which ionises completely and it is diprotic so it will have a high H_3O^+ concentration ✓ and a low pH. The greater the H_3O^+ concentration the lower the pH (4)

7.1.4 The bulb will shine less brightly if at all. ✓ It is a weak acid, so there will be very few ions ✓ in solution and a low conductivity. ✓ (3)

7.2.1 Solution of known concentration. ✓✓ (2)

7.2.2 $n(\text{NaOH}) = CV$ ✓
 $= (0,5)(0,04)$ ✓
 $= \underline{0,02 \text{ mol}}$ ✓ (3)

7.2.3 $n(\text{CH}_3\text{COOH}) = n(\text{NaOH})$
 $= \underline{0,02 \text{ mol}}$
 $\therefore m(\text{CH}_3\text{COOH}) = n.M_r$ ✓
 $= (0,02)(60)$ ✓
 $= \underline{1,2 \text{ g}}$ ✓ (3)

7.2.4 % mass of CH_3COOH $= 1,2 / 20,8 \times 100$ ✓
 $= \underline{5,77 \%}$ ✓ (2)

7.3.1 Sodium ethanoate / sodium acetate ✓ (1)

7.3.2 The reaction of an ion (from a salt) with water (2)

7.3.3 $\text{pH} > 7$ ✓

The equilibrium lies to the right (fwd reaction is favoured) ✓ or the ethanoate ion is a strong conjugate base causing an excess/increase in OH^- ions; ✓ solution is alkaline. (3)

[27]

QUESTION 8

8.1.1 D ✓ 1

8.1.2 B ✓ 1

8.1.3 A,D,E (any 2) ✓✓ 2

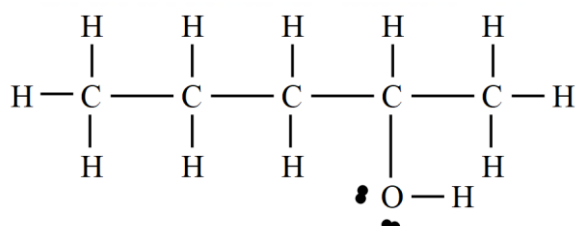
8.1.4 C F ✓✓ 2

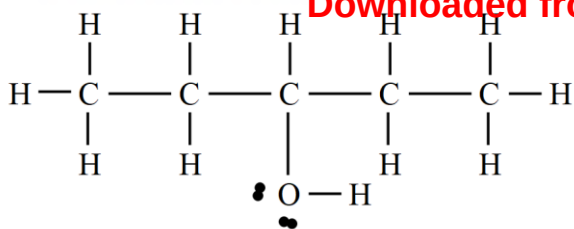
8.2.1 methylbutane ✓✓ 2

8.2.2 ethylbutanoate ✓✓✓ 3

8.2.3 pent-2-ene ✓✓✓ 3

8.3.1

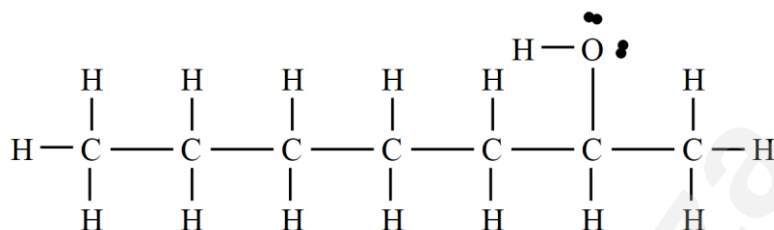




OR 2

8.3.2 Addition ✓ 1

8.4.1



3

8.4.2 Substitution ✓✓ 2

[22]

9.1 C₆H₁₄ ✓✓ 2

9.2 C_nH_{2n} ✓✓ 2

9.3.1 Isomer same molecular formula ✓ different structural formula ✓ 2

9.3.2 No ✓

Have different molecular formula ✓ (and structural formula) 2

9.4 4

$2 \text{C}_6\text{H}_{14} + 19 \text{O}_2 \rightarrow 12 \text{CO}_2 + 14 \text{H}_2\text{O}$ 4

9.5 butene ✓ 2

either 1 or 2 ✓ 2

9.6.1 Add bromine ✓

Hexane mixture remains brown ✓

Hexene mixture goes from brown to colourless ✓ 3

9.6.2 Addition fast Substitution slow ✓✓ 2

[19]