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Memo Trials 2024 P2

1.1 B✓✓ 1.2 D✓✓ 1.3 C✓✓ 1.4 D✓✓ 1.5 C✓✓ 1.6 B✓✓ 1.7 A✓✓ 1.8 C✓✓ 1.9 C✓✓ 1.10 B✓✓
[20]

2.1.1 Cu ✓ 2.1.2 CH₄ or CO₂ ✓ 2.1.3 CuO ✓ 2.1.4 CO₂ ✓ 2.1.5 CH₄ or CO₂ ✓ (5)

2.2 A polar molecule where the electrons are unevenly distributed (or one atom in the bond has a higher eneg than the other) resulting in positive and negative charged ends in the molecule. ✓✓ (2)

2.3 H₂O ✓ (1)

2.4 hydrogen bonds ✓ (1)

2.5 An intermolecular force is a *force* of attraction between molecules, ions, or atoms of noble gases. ✓✓ (2)

2.6 When an H atom is bonded to a small, highly eneg **atom**✓ the shared pair is pulled towards **that** atom resulting in a small + charge on the H end✓
The result is an electrostatic force of attraction towards the lone pair ✓ of an adjacent molecule (3)

2.7 H₂O will condense first✓ as it has stronger imf's ; H bonds✓ and a higher bpt than CO₂ which has weaker London forces✓ between molecules. Due to the stronger H bonds between H₂O molecules it will condense at a higher temperature. ✓ (4)

2.8.1 mCuO = 84% x 15 = 12,6 g ✓

$$n_{\text{CuO}} = \frac{m}{M} \text{✓eqn} = \frac{12,6}{(63,5+16)} \text{✓M} = 0,1585 \text{ mol } \checkmark$$

$$n_{\text{CH}_4} = \frac{V}{V_M} \text{✓eqn} = \frac{1,8}{22,4} = 0,08036 \text{ mol}$$

1 mol CH₄ : 4 mol CuO

0,08036 mol CH₄ : 0,3214 mol CuO

CuO is limiting reagent ✓

4 mol CuO : 4 mol Cu ✓ratio used

0,1585 mol CuO : 0,1585 mol Cu

mCu = 0,1585 x 63,5 = 10,06 g Cu ✓ (8)

$$2.8.2 \quad \% \text{ yield} = \frac{\text{Actual}}{\text{theoretical}} \times 100$$

$$= \frac{7,45}{10,06} \times 100 \text{ ✓coe}$$

$$= 74,06\% \checkmark (2)$$

[28]

3.1 as the change in concentration per unit time of either a reactant or product ✓✓ (2)

3.2(a) equal to ✓ (1) 3.2(b) decreasing ✓ (1)

3.2(c) mole quantity of **Al** = to mole quantity of **AlCl₃** ✓
substances always react in a fixed proportion by mass ✓ (2)

3.2(d) zero ✓ (1)

3.3.1 aqueous chlorine ✓ as there is still some **Al** left over at the completion of the reaction. ✓ (2)

3.3.2 15 or 20 min as the graph x axis shifted. ✓ (1)

3.3.3 ave rate = $\Delta \text{mass} / \Delta \text{time}$ ✓ = $x - 10 / 20 - 0$ ✓ = 730 mg ✓ (3) (coe from 3.3.2)
or 550mg

3.3.4 [Cl₂] higher in exp 1 ✓; there is a greater number of particles per unit volume. ✓
Increased number of effective collisions per unit time ✓
Hence reaction rate of exp 1 is higher ✓ (4)

3.3.5 $n(\text{Cl}_2) = c \times V = 0,1 \times 0,4 = 0,04 \text{ mol}$ ✓

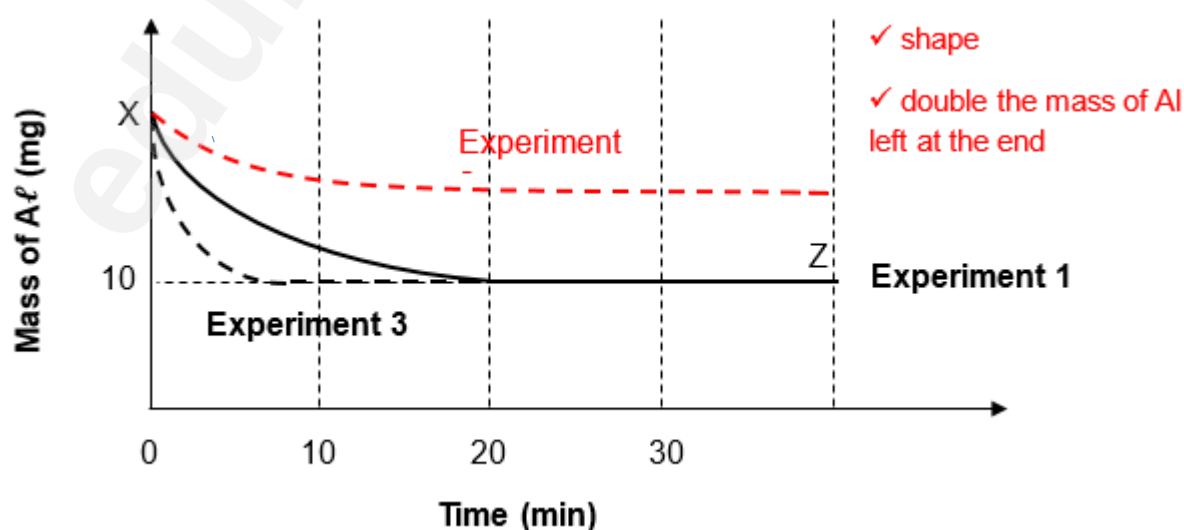
$$n(\text{AlCl}_3) = \frac{2}{3} (0,04) = 0,027 \text{ mol} \checkmark$$

$$m = n \times M = 0,027 \times 133,5 = 3,56 \text{ g} \checkmark$$

$$\% \text{ yield} = \frac{\text{actual}}{\text{theory}} \times 100$$

$$0,9 = \frac{\text{actual}}{3,56} \checkmark \quad \text{actual mass of AlCl}_3 = 3,2 \text{ g} \checkmark (5)$$

3.3.6 (i)



(ii) increase the temperature ✓✓ (2)

[26]

4.1.1 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. ✓ (3)

4.2.1 2 minutes ✓ (1)

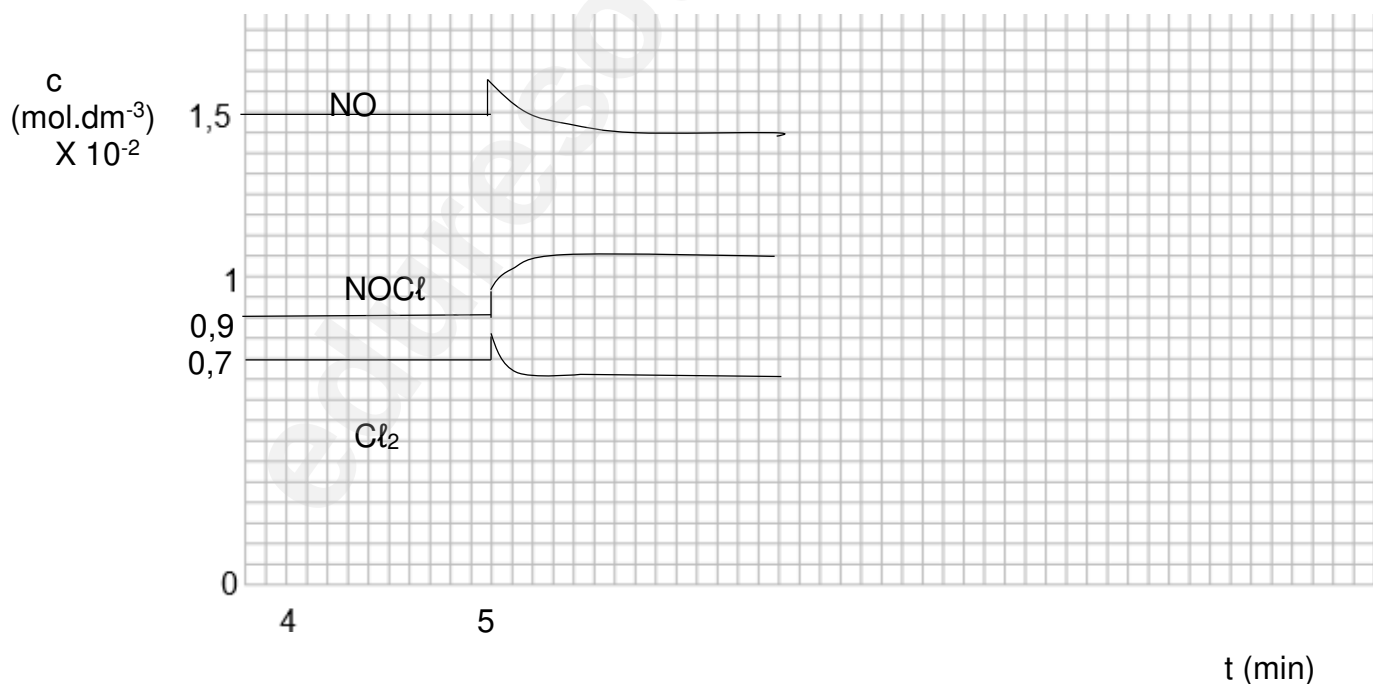
4.2.2 Increase in temperature ✓✓ (2)

4.2.3 An increase in temperature increases the average kinetic energy ✓ of all particles in the closed system ✓
 This increases the number of collisions per unit time ✓,
 Thus increasing the number of effective collisions per unit time ✓
 Increasing both the fwd and rev reaction rates. (4)

4.2.4 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)

4.2.5 The forward reaction rate is favoured and increases more (than the reverse reaction rate) ✓
 The forward reaction must be endothermic ✓ as if the temperature of the system is increased; the reaction that absorbs the excess energy is favoured ✓ (3)

4.3



Labelled axes ✓ $\times 10^{-2}$ ✓ flat lines for all substances from 4 to 5 min ✓
 All peak at 5 min ✓ NOCl increases ✓ and flattens ✓ NO and Cl_2 both decrease ✓
 and then flatten ✓ (8)

$$\begin{aligned}
 4.4.1 \quad n &= \frac{m}{M} \checkmark \\
 &= \frac{0,858}{65,5} \checkmark \text{molar mass} \quad (1,5 \times 57,2\% = 0,858) \\
 &= 0,0131 \text{ mol} \checkmark
 \end{aligned} \tag{3}$$

$$\begin{array}{ll}
 4.4.2 \quad \text{NOCl} & : \text{NO} & \text{NOCl} & : \text{Cl}_2 \\
 1 & : 1 \checkmark & 2 & : 1 \checkmark \\
 0,0131 & : 0,0131 & 0,0131 & : 0,0066
 \end{array}$$

$$\begin{aligned}
 c &= \frac{n}{V} \text{ and } V = 1 \text{ dm}^3, \\
 \therefore [\text{NO}] &= 0,0131 \text{ mol.dm}^{-3} \checkmark \text{ and } [\text{Cl}_2] = 0,0066 \text{ mol.dm}^{-3} \checkmark
 \end{aligned} \tag{4}$$

$$4.4.3 \quad 42,8\% \times 1,5 = 0,642 \text{ g} \checkmark$$

$$\begin{aligned}
 c &= \frac{m}{M.V} \checkmark \\
 &= \frac{0,642}{(65,5).(1)} \checkmark \\
 &= 0,0098 \text{ mol.dm}^{-1} \checkmark
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 4.4.4 \quad K_c &= \frac{[\text{NO}]^2 . [\text{Cl}_2]}{[\text{NOCl}]^2} \checkmark \checkmark \\
 &= \frac{(0,0131)^2 . (0,0066)}{(0,0098)^2} \checkmark \text{coe} \checkmark \text{coe} \\
 &= 0,0118 \checkmark
 \end{aligned} \tag{5}$$

[39]

5.1.1 The acids become stronger as you go down Group VII. $\checkmark$
 This is due to the increasing size of the halogen $\checkmark$ (atomic radius / ionic radius)
 which makes the H-X bond weaker $\checkmark$ $\therefore$ easier to donate a proton. $\checkmark$ (3)

5.1.2 An acid which only ionizes partially in aqueous solution $\checkmark \checkmark$ (2)

5.1.3 Hydrofluoric acid $\checkmark$ (1)

5.1.4 HCl $\checkmark$
 HCl greater K_a value $\therefore$ stronger acid $\checkmark$
 Strong acids ionise completely in an aqueous solution. $\checkmark$
 $\therefore$ more H_3O^+ and Cl^- ions in solution to conduct $\checkmark$ (4)
 (or just "more ions available to conduct")

5.2.1 sodium hydroxide $\checkmark$ (1)

5.2.2 the point where an acid and a base have reacted $\checkmark$
 so neither is in excess $\checkmark$ (2)

5.3.1 $\text{HNO}_2 + \text{NaOH} \rightarrow \text{NaNO}_2 + \text{H}_2\text{O}$ $\checkmark \checkmark$ (2)

5.3.2 phenolphthalein ✓

Strong base + weak acid ✓

∴ end point is in basic region ✓ (3)

5.3.3 $n(\text{NaOH}) = c \times V = 0.12 \times 34.5 \times 10^{-3} = 4.14 \times 10^{-3} \text{ mol}$ ✓

$n(\text{HNO}_2) = 4.14 \times 10^{-3} \text{ mol}$ mole ratio (1:1) ✓

$c(\text{HNO}_2) = n / V = 4.14 \times 10^{-3} / 25 \times 10^{-3} = 0.166 \text{ mol.dm}^{-3}$ ✓ (3)

5.3.4 $\text{NO}_2^- + \text{H}_2\text{O} \rightarrow \text{HNO}_2 + \text{OH}^-$ ✓

NO_2^- is the strong conjugated base of the weak acid HNO_2 and will undergo hydrolysis ✓

∴ $[\text{OH}^-]$ increases ✓, $[\text{H}_3\text{O}^+]$ decreases,
pH increases i.e. basic: $\text{pH} > 7$ ✓

(4) [25]

6.1 Chemical potential energy to Electrical potential energy. ✓ (1)

6.2 Cell Y ✓ (1)

6.3 Cu^{2+} ✓ (1)

6.4 Oxidation is the loss of electrons. ✓ (1)

6.5 Zinc / Zn ✓ (1)

6.6 Negative ✓ - Cathode ✓ (2)

6.7 Redox ✓ (1)

6.8 involves a transfer of electrons. ✓✓ (2)

6.9 $\text{Zn(s)} / \text{Zn}^{2+}(\text{aq}, 1 \text{ mol.dm}^{-3}) // \text{Cu}^{2+}(\text{aq}, 1 \text{ mol.dm}^{-3}) / \text{Cu(s)}$ at 25°C
✓ ✓ ✓ ✓ (4)

6.10 Iodine is not a conductor. ✓ (1) [15]

7.1 Pt ✓ (1) 7.2 completing the circuit. ✓

maintaining electrical neutrality in the half-cells ✓ (2)

7.3 hydrogen gas ✓ (1)

7.4 $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$ ✓ (1)

7.5 REMAINS THE SAME ✓ (1)

7.6 the concentration of the acid is not changed therefore no stress on the system ✓ (1)
[7]

8.1 $E^{\circ}_{\text{cell}} = E^{\circ}_{\text{cathode}} - E^{\circ}_{\text{anode}}$ ✓
 $2,89 = E^{\circ}_{\text{cathode}} - (-1,66)$ ✓
 $E^{\circ}_{\text{cathode}} = 2,89 - 1,66$
 $E^{\circ}_{\text{cathode}} = 1,23 \text{ V}$ ✓
 Oxygen gas ✓ (4)

8.2 $\text{O}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}$ ✓✓ (2)

8.3 Reaction reached equilibrium. / (In each half cell) the rate of oxidation is equal to rate of reduction. / Rate of the forward reaction is equal to the rate of the reverse reaction. ✓✓ (2)

8.4 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
 Number of moles of electrons = $0,10 \times 2$ ✓
 Number of moles of electrons = 0,2 moles
 $Q = n \times F$ ✓
 $Q = 0,2 \times 96500$ ✓
 $Q = 19300 \text{ C}$
 $Q = I \times t$
 $t = 19300/3$ ✓
 $t = 6433,33 \text{ seconds}$ ✓ (5) [13]

9.1 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 CH_2 unit ✓ (2)

9.2 Alkenes ✓ (1)

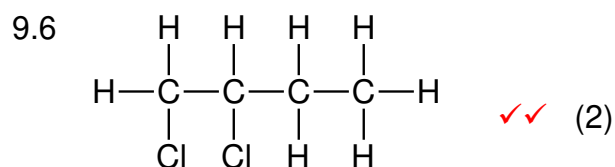
9.3 A compound in which there is at least one double and/or triple bond ✓ between carbon atoms. ✓ (2)

9.4

- Add bromine water ✓
- Bromine water decolourises when added to an unsaturated compound and bromine water does not decolourise when added a saturated compound ✓
- Rapid decolourisation of bromine water is a positive result for an alkene/unsaturated compound/ but-1-ene ✓ (3)

9.5.1 Addition ✓ (1)

9.5.2 Substitution ✓ (1)



9.7 Heat / UV light ✓ (1)

9.8 Propane ✓ (1)

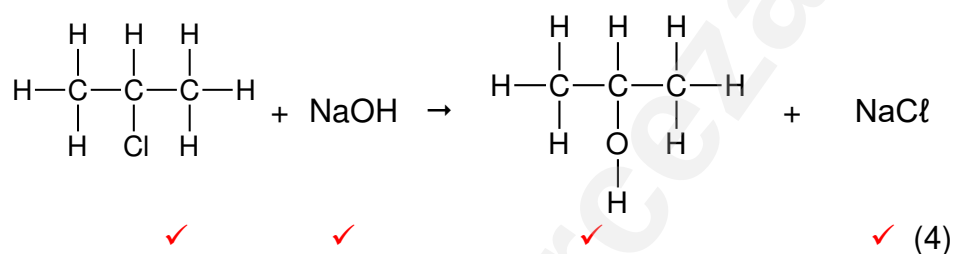
9.9 HCl OR hydrogen chloride ✓ (1)

9.10.1 Type: elimination ✓

Specific name: dehydrohalogenation ✓ (2)

9.10.2 propene ✓✓ (2)

9.10.3



9.10.4



[27]

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