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(a) ~~It's mercury cell.~~ It's mercury cell. The salt and water (Brine) into electrolysis cell, then the oxidation in the anode $2\text{Cl}^- \rightleftharpoons \text{Cl}_2 + 2\text{e}^-$, the chlorine gas been produced. The cathode only allow Na^+ ^{to go through and} dissolve in amalgam, $2\text{Na/Hg} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2 + 2\text{Hg}$, the NaOH is produced in the water chamber, it produce high purity of NaOH and release H_2 gas, the Hg can be reused. ~~It's~~ It's safety that Cl_2 and H_2 are separated. But this cell ~~is~~ contain mercury which is toxic to damage the environment and cause lung cancer. And the NaOH must crystallise.

(b) • molten sodium chloride only contain two ions: Na^+ , Cl^-

oxidation reaction: ~~At~~ $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$

reduction reaction: $\text{Na}^+ + \text{e}^- \rightarrow \text{Na(s)}$ overall: $\text{Na}^+ + \text{Cl}^- \rightarrow \text{NaCl}$

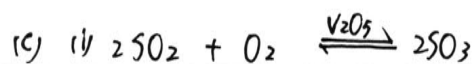
• aqueous sodium chloride contain three ~~ions~~ ^{pieces}: Na^+ , Cl^- , H_2O

The oxidation reaction is always $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$, as Na^+ required ~~there are two a reduction~~ large energy, therefore the reaction not

been occur, then the reduction is $2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$

overall reaction: $\text{NaCl} + \text{H}_2\text{O} \rightarrow \text{H}_2 + \text{NaOH} + \text{Cl}_2$

Therefore the product of ~~is~~ electrolysis aqueous sodium is H_2 , Cl_2 , and OH^-



when at time A . $n(\text{SO}_3) = 0.4 \text{ mol}$, $n(\text{SO}_2) = 0.5 \text{ mol}$

$$\therefore c = \frac{n}{V}$$

$$\therefore C(\text{SO}_3) = \frac{0.4 \text{ mol}}{10 \text{ L}} = 0.04 \text{ M}$$

$$C(\text{SO}_2) = \frac{0.5 \text{ mol}}{10 \text{ L}} = 0.05 \text{ M}$$

$$C(\text{O}_2) = \frac{0.4 \text{ mol}}{10 \text{ L}} = 0.04 \text{ M}$$

$$\therefore K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]} = \frac{0.04^2}{0.05^2 \times 0.04} = 16$$

(ii) when at time B. the moles of SO_3 and SO_2 stay constant

$2\text{SO}_2 + \text{O}_2 \xrightleftharpoons{V_2\text{O}_5} 2\text{SO}_3$, when the moles of SO_3 and SO_2 is the same as time A. The new equilibrium position is formed.

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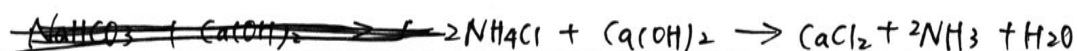
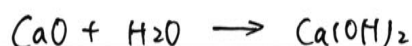
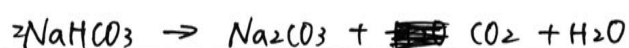
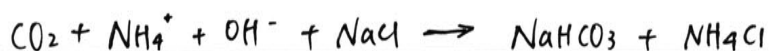
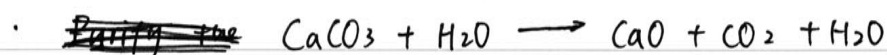
(d) (i) ~~is~~ saponification

reactant A : NaOH

(ii) Hydrolysis then neutralise. Firstly add the water to ~~the~~ ^{coconut oil} then add NaOH to form the soap, after making soap, "salting out" to produce ~~the~~ soap. During the saponification, do not touch and straight use the soap.

(e) • Solvay process is to produce Na_2CO_3 which the main use is glass, to remove the Ca^{2+} , Mg^{2+} in hard water and make chemical

• During the solvay process, CO_2 ^{ammonia} is produce but it can be reused again



∴ The overall reaction is $\text{CaCO}_3 + 2\text{NaCl} \rightarrow \text{CaCl}_2 + \text{Na}_2\text{CO}_3$

• The CaCl_2 is major waste, although it can be transfer to water and reused in solvay process, but the amount of CaCl_2 is still too large

and recently no technology to use the CaCl_2 , and cool the CaCl_2 before transfer to sea water

• As solvay process produce large amount of heat, therefore the thermal pollution

• Noise is also the pollution