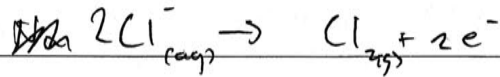


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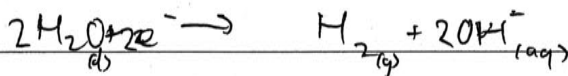
a) - Mercury cell

- Brine is electrolysed in the electrolysis cell, where the anode reaction occurs:

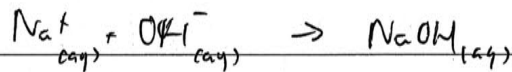


- and aqueous Na^+ ion is dissolved in the flowing mercury

- aqueous Na^+ is then ~~deposited~~ passed through the decomposer, where the cathode reaction occurs:



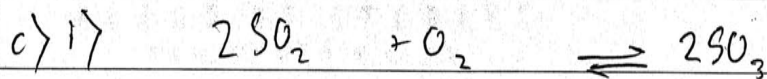
The product OH^- ion then forms with Na^+ in mercury



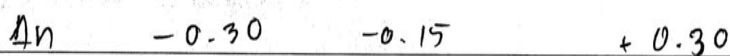
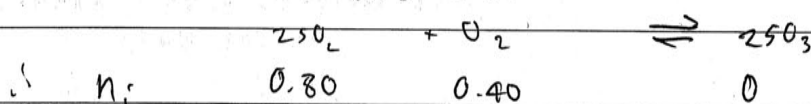
- and so sodium hydroxide is extracted.

b)	Molten NaCl	aqueous NaCl (concentrated)
anode	$2\text{Cl}^-_{(l)} \rightarrow \text{Cl}_{2(g)} + 2e^-$	$2\text{Cl}^-_{(aq)} \rightarrow \text{Cl}_{2(g)} + 2e^-$
cathode	due to lack of H_2O $\text{Na}^+_{(l)} + e^- \rightarrow \text{Na}_{(s)}$	due to presence of H_2O $2\text{H}_2\text{O} + 2e^- \rightarrow \text{H}_{2(g)} + 2\text{OH}^-_{(aq)}$
overall	$2\text{Cl}^-_{(l)} + 2\text{Na}^+_{(l)} \rightarrow \text{Cl}_{2(g)} + 2\text{Na}_{(s)}$	$2\text{Cl}^-_{(aq)} + 2\text{H}_2\text{O}_{(l)} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)} + 2\text{OH}^-_{(aq)}$

i. Though both are similar in anode reaction, there are differences in cathode reaction, where, due to lack of $H_2O(l)$, solid $Na(s)$ is formed in electrolysis of molten $NaCl$.



$$K = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$$



10 L



∴ ~~at~~ $q = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$

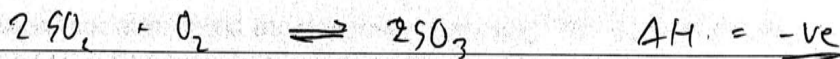
$$= \frac{[3.0]^2}{[5.0]^2[2.5]}$$

$$= 0.144$$

$$\approx 0.14 \quad \text{at time A}$$

K_{eq} constant at time A is 0.14.

ii) The temperature could have been lowered.



The forward reaction is exothermic.

- By reducing the temperature of the ~~system~~ system, the eqm, according to Le Chatelier's principle, would counteract the changes applied to it. Therefore, the system could release heat to counteract the drop of temperature, thus the exothermic reaction

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is favoured, and so is the forward reaction. Thus, more SO_3 is produced and the ~~concn~~ mole of SO_2 decreased, eqn shifts to the right.

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Start here.

d) i) - reactant A - sodium ~~hydroxide~~ hydroxide

- saponification

ii) - Safety: ^{conc} sodium ^{hydroxide} is caustic and so gloves should be worn when handling it

- oil ^{and 70 ml of} are placed in a big test tube
(olive oil)

- ~~200~~ 200 mL of ^{hot} water bath is prepared

- the excess sodium chloride (around 20 mL) is added to the test tube and the test tube is put in the hot water bath.

- The mixture is stirred for 10 minutes.

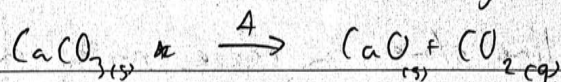
- the ^{small} concentrated NaCl solution is then added.

- The soap is then further stirred until all the soaps has precipitated out

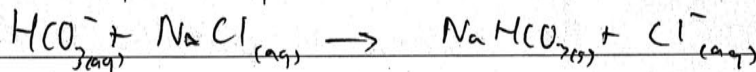
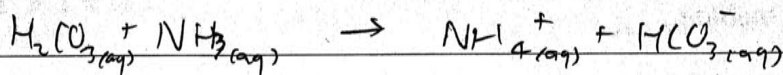
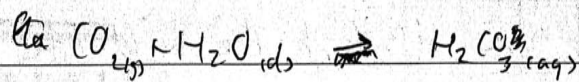
- The soap is taken out and dried.

- safety! water bath is used to prevent the oil from ~~lighting up~~
as the oils can possibly be volatile, though unlikely

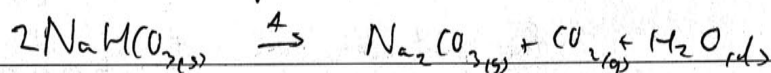
e) Importance: - Limestone is used to generate CO_2



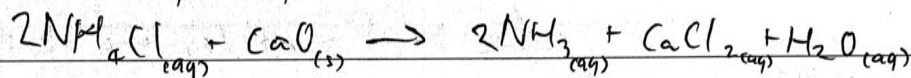
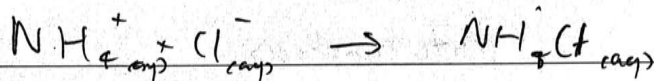
which is used to produce sodium bicarbonate



and ~~heated~~ heated to produce sodium carbonate



the CaO is also used to recover ammonia



Thus, limestone is a vital part of the Solvay process, as it is not only used for production of $\text{Na}_2\text{CO}_3(\text{s})$, but also for recycling of $\text{NH}_3(\text{aq})$ which is also used in the production.

- By using limestone, there are both positive and negative environmental impact.

- positive

- assist in recycling of ammonia.

- CaO obtained from generating CO_2 can be used to recycle ammonia from ammonium ion.

Thus, there is no need of using more ammonia

- also, there is no need to dispose ammonia, which is ~~po~~ toxic to the environment

- causes respiratory problems if inhaled.

- however, there is also the bad environmental impact

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- mining of limestone

- mining of limestone can cause noises and ^{increase in} particles in the air

- the noise can disturb the wild life around the mining area

- the increase in particles in the air is also bad for various organisms

- the particles can clog up the plant's leaf, ^{and stomata} preventing the plant's respiration and also hindering the photosynthesis

- the small particles are bad to breathe in.

- mining in sensitive area can also cause instability of land, and so, collapse

Thus, the ^{location of the} mine must be considered to minimise the impact to the environment

You may ask for an extra Writing Booklet if you need more space.