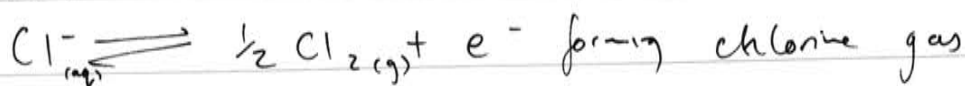


Start here.

32) a) cell - mercury cell

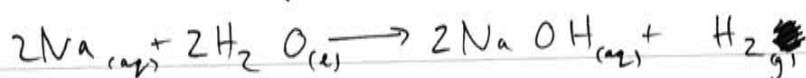
- brine is pumped into the cell & the  $\text{Cl}^-$  reacts with ~~water~~ at the anode



- the Na forms an amalgam with the mercury  $\text{Na(Hg)}$

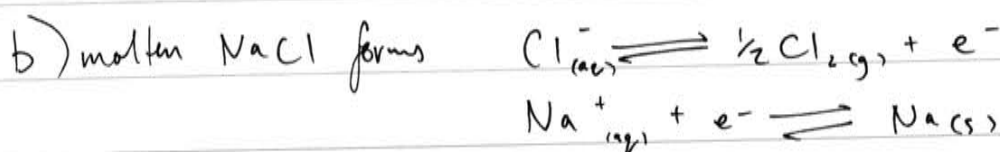
& is carried to the decomposer

- at the decomposer the Na reacts with the water

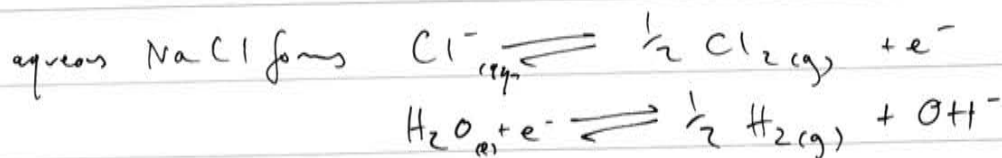


forming the desired product NaOH & ~~water~~ also hydrogen gas.

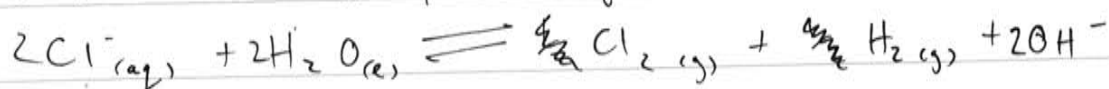
- the mercury is then pumped around again to repeat the process



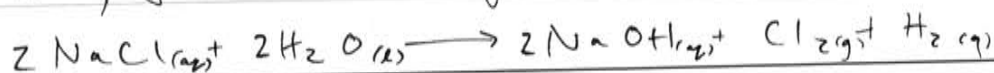
when molten there is high enough concentration for both the Na & the Cl to react, which means that the Na cannot form NaOH with ~~the~~ <sup>water</sup> ~~the~~



- because ~~there is~~ it is aqueous there is less Na. ∴ the  $E_0$  value is lowered to  $\text{H}_2\text{O}$ , which forms ~~an~~  $\text{OH}^-$  ions



allowing for NaOH to form:



- in other NaCl forms  $\text{Cl}_2(\text{g})$  &  $\text{Na}^+$  because there is ~~also~~ a high enough concentration for both to react, however we do not get the desired product

- aqueous NaCl forms  $\text{Cl}_2(\text{g})$  &  $\text{H}_2(\text{g})$  &  $\text{OH}^-$  ions, because there is a lower conc. of Na in solution & it is more difficult to react  $\therefore$  water reacts instead. This enables the desired ~~low~~ product NaOH to form.

c) i)  $K = \frac{[\text{products}]}{[\text{reactants}]}$

$$2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$$

$$= \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 \times [\text{O}_2]}$$

$$= \frac{[5]^2}{[3]^2 \times [1.5]}$$

$$= 1.85185 \dots$$

$$= 1.85$$

ii) the change in the graph is a change of temperature

$2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$  is an exothermic reaction therefore the temperature ~~increased~~ decreased as we see a rise in  $\text{SO}_3$  which means the  $\rightleftharpoons$  is pushing to the right to try & restore itself by creating more heat.

by doing so it minimises the impact of the drop in temperature & a ~~new~~  $\rightleftharpoons$  is restored.

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Start here.

Q32) d) i) reaction type - saponification  
reactant A - NaOH

ii) carried out in a school laboratory:

- 1) ~~measure~~ place <sup>100-L of</sup> vegetable oil in a beaker
- 2) place 100-L of NaOH into beaker as well
- 3) place on a hot plate & stir
- 4) a white / yellowish scum forms as the product or the soap

safety precautions - wear gloves & goggles

→ NaOH can be irritating to the skin & eyes

→ contents of the beaker can occasionally spit

- wear heat gloves when handling hot plate & ensure the hot plate is <sup>cool</sup> before touching to ensure you don't burn yourself.

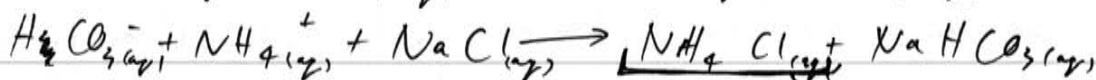
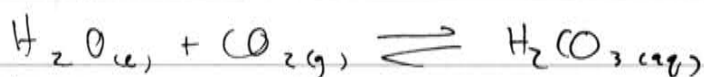
- in a school laboratory high quality oils & excess NaOH is ~~not~~ used. There is often large amounts of NaOH left unreacted & there is no attempt to remove the glycerol.

e) Limestone is an integral part of the solvay process. Limestone is used both ~~in~~ in the carbonator of the solvay process & in the recovery of ammonia.

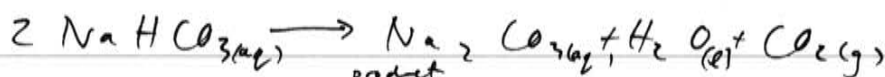
the limestone is broken up in the kiln to  $\text{CaO}$  &  $\text{CO}_2$



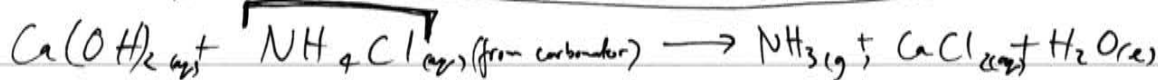
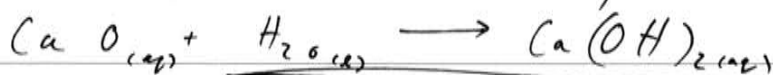
The  $\text{CO}_2$  is then used in the carbonator to form  $\text{NaHCO}_3$



→ the  $\text{NaHCO}_3$  is then converted into  $\text{Na}_2\text{CO}_3$



→ furthermore the limestone  $\text{CaO}$  is used to convert  $\text{NH}_4\text{Cl}$  back to  $\text{NH}_3$  in the ammonia recovery



→ limestone is therefore a highly important part of the solvay process.

- yet it has significant detrimental environmental impacts. The  $\text{CaCl}_2$  formed in the ammonia recovery from the limestone is a waste product. It can be used to de-ice roads however is most often dumped. However it must be disposed of in large bodies of water or in the ocean, because it can cause a build up of  $\text{CaCl}_2$  in waterways forming a solid precipitate. This can lead to excess  $\text{Ca}^{2+}$  ions & increased hardness of

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water in waterways. Furthermore limestone must be  
mined in large amounts for use in the solvay process.  
This mining ~~process~~ is very damaging to the environment.  
It damages & destroys ecosystems & can cause  
land subsidence which are potentially dangerous.  
Mining causes the destruction of landscape & of other  
significant resources such as land to grow crops &  
fragile ecosystems.

~~The solvay process~~

Limestone is an integral part of the solvay process,  
yet it has highly detrimental environmental effects.

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