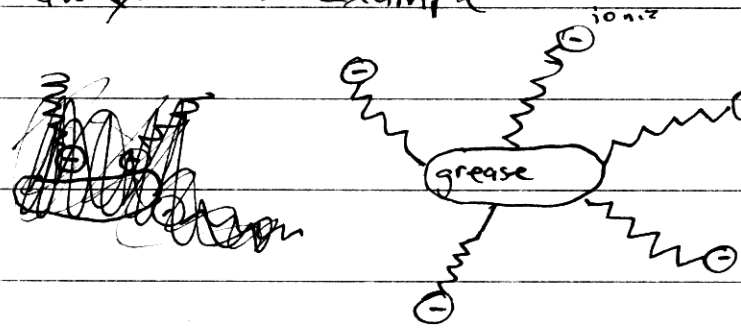
(a)(i) The procedure for making soap. Fats and/or oils are heated in basic solution producing glyceral and salt.

(ii) water is a polar substance and it is not efficient in dissolving or ~~ge~~ carrying grease away, because grease is non-polar. However soap is an emulsifier and its structure allows it to 'stick' to grease and carry it away. For example



The tail which is a hydrocarbon chain is non-polar at the end therefore it sticks to the non-polar grease. The end of the hydrocarbon is ~~acid~~ hydrophobic. Water, soap, and grease is an ~~emul~~ 'emulsion.

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b) $SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons SO_{3(g)}$

0.06	0.05	0
-0.04	-0.02	$+0.04$
0.02	0.03	0.04

$$K = \frac{[SO_3]}{[SO_2][O_2]^{\frac{1}{2}}} = \frac{(0.04)}{(0.02)(0.03)^{\frac{1}{2}}} \quad \text{mol}\,l^{-1} \quad \text{mol}\,l^{-\frac{3}{2}}$$

$$\therefore K = 11.55$$

for $SO_2 + \frac{1}{2}O_2 \rightleftharpoons SO_3$

c) (i) ~~$H_2SO_{4(aq)} + H_2O_{(l)} \rightarrow H_3O^+ + HSO_4^-$~~

$H_2O_{(l)} + H_2SO_{4(aq)} \longrightarrow H_3O^+_{(aq)} + HSO_4^-{}_{(aq)}$

When H_2SO_4 is added to water, it forms an acidic solution which is dissociated into ions.

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(ii)

Oxidising Agent:

$$Cu_{(s)} + H_2SO_{4(aq)} \longrightarrow CuSO_{4(aq)} + H_{2(g)}$$

When H_2SO_4 is added to $Cu_{(s)}$ it acts as an oxidising agent. The copper can be seen to have been oxidised $Cu \longrightarrow Cu^{2+} + 2e^-$ & the H_2SO_4 is reduced with a change in its oxidation no. $2H^+_2 + 2e^- \rightarrow H_2$.

Dehydrating Agent:

$$C_6H_{12}O_{6(s)} \xrightarrow{H_2SO_4} 6C_{(s)} + 6H_2O_{(l)}$$

The conc. H_2SO_4 can be seen here to have taken out the water from the glucose molecule leaving carbon & water.

Precipitating Sulfates:

$$Ba(NO_3)_2 + H_2SO_4 \longrightarrow BaSO_{4(s)} + 2HNO_3.$$

net ionic: $Ba^+_{(aq)} + SO_4^-{}_{(aq)} \longrightarrow BaSO_4{}^-{}_{(s)}$

H_2SO_4 can here to ppte out Ba sulfate. ppte.

(d) ~~we modelled the Haber process. In a sealed vessel, we reacted H_2 from the electrolysis of water and N_2 from~~

(i) We performed an experiment using nitrogen dioxide ~~in~~ in a sealed vessel.

NO_2 was introduced into a sealed vessel.

$$2NO_{2(g)} \rightleftharpoons N_2O_{4(g)}$$

brown colourless.

~~It~~ this was an equilibrium reaction.

(ii) to analyse the equilibrium we ~~f~~ altered the conditions:

we increased the temperature → this resulted in a colourless ~~so~~ gas being formed (N_2O_4) which suggested the increase in temp favoured the forward reaction suggesting exothermic. when we increased the pressure, the

mixture turned a pale brown which was more NO_2 gas being formed. By Le Chateliers principle, the increased pressure favoured the side with fewer molecules. ie the nitrogen dioxide. When we put more NO_2 in the vessel ie increase [reactants] the equilibrium shifted to the right. So by using our knowledge of le Chateliers principle we could analyse the conditions created by the changes in temp / pressure / concentration.

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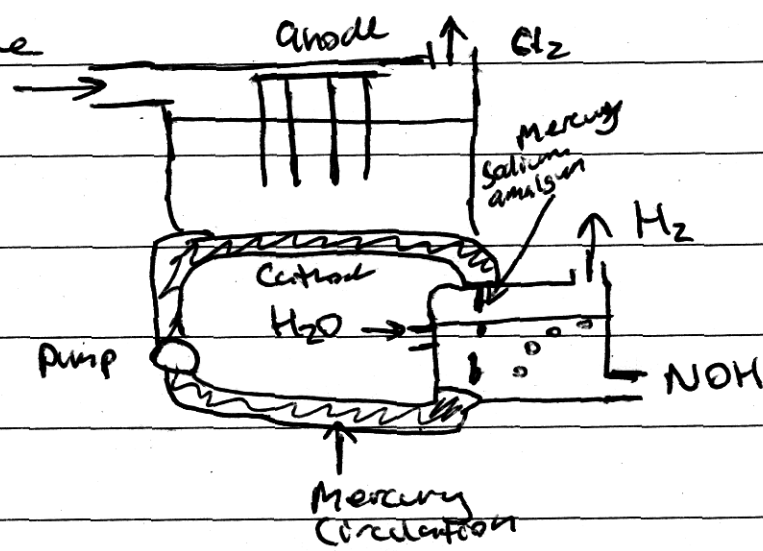
(c) There are many different ways of Conducting the electrolysis of Sodium Hydroxide. These methods include the Mercury cell, Diaphram cell, and finally the developement of the membrane cell.

The Mercury Cell proved an effective Industrial method of producing Sodium Chloride.

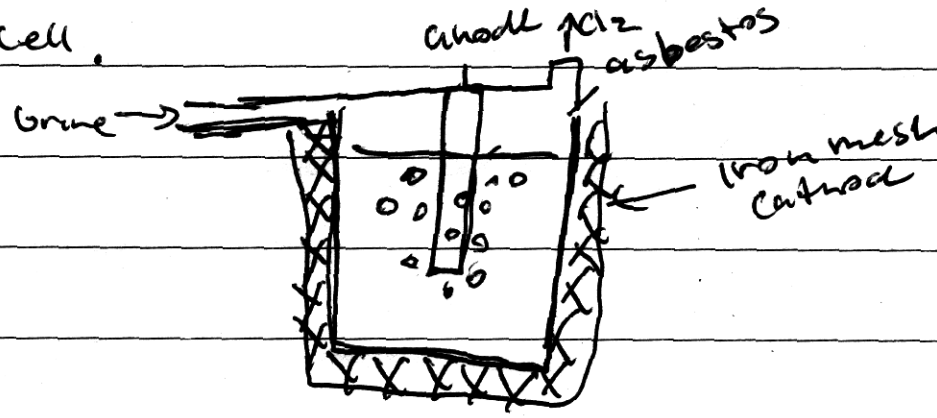


This cell uses electrolysis with a carbon anode and a mercury cathode. The reaction at the anode $2Cl^- \rightarrow Cl_2 + 2e^-$ while the reaction at the cathode was $2Na^+ + 2e^- \rightarrow 2Na$.

The Sodium produced on the surface of the mercury is placed in water where the following reaction takes place. $2NaHg_{(l)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + 2Hg_{(l)} + H_{2(g)}$

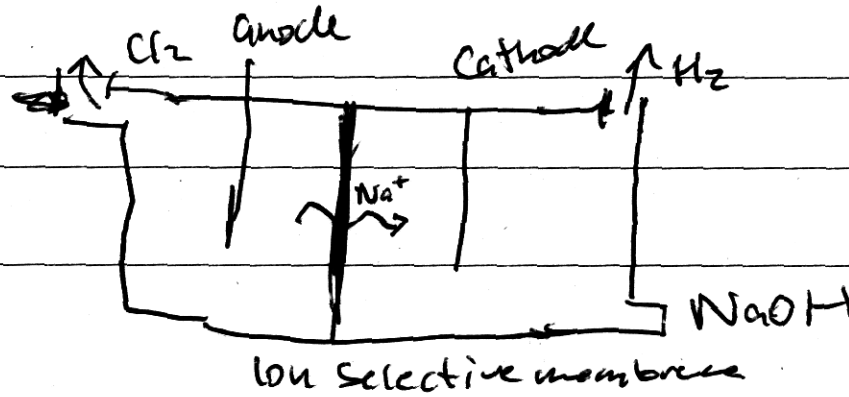
This cell, however, had its problems with Mercury escaping during the mercury cooling process. If the mercury reacted the environment it would act as a poison to living things.

The diaphragm cell was an alternative to the mercury cell.



This cell made NaOH with reasonable purity but the use of asbestos was condemned as it was found to cause cancers in humans.

These earlier problems were avoided with the development of the selective membranes. These polymer membranes are ion selective and are utilized in this cell.



These cells have greatly revolutionised the production of NaOH as they contain little danger to the environment and to workers. Most industories have adopted this method of Sodium hydroxide production.