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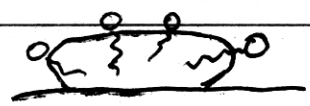
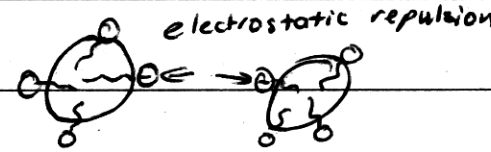
a)(i) Saponification is the process of breaking down oils and fats to form a fatty acid and (most commonly) glycerol. The fatty acid is then neutralised to form a salt which is the soap.

(ii) Soap can be considered to include two main parts. An anionic hydrophilic 'head' which readily dissolves in water and a hydrophobic long chain hydrocarbon tail. The hydrophobic tail readily dissolves in oil, effectively solubalising the fat or oil as shown



the oil particle is lifted by soap ions



The resulting solution similar to an emulsion has oily particles evenly distributed throughout water, the electrostatic repulsion does not allow the oil particles to reform.

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Secondly the soap is a surfactant and reduces the surface tension of water. This allows soapy water to more easily 'wet' dirt particles allowing them to be easily removed.

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

	$SO_{2(g)}$	$\frac{1}{2}O_{2(g)}$	$SO_{3(g)}$
before reaction	0.06 M	0.05 M	0 M
at equilibrium	0.02 M	0.03	0.04 M

$$K = \frac{[0.04]}{[0.02][0.03]^{\frac{1}{2}}}$$

$$K = 11.54700538$$

$$= 11.55$$

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c.) i.) When Sulfuric Acid is added to water it dissociates to form a H^+ and HSO_4^- ions: (or more correctly, Hydronium and HSO_4^- ions)

$$H_2SO_{4(l)} \longrightarrow H^+ + HSO_4^- \qquad \Delta H = -90\ kJ/mol$$

Which is the same as: $H_2SO_{4(l)} + H_2O_{(l)} \longrightarrow H_3O^+ + HSO_4^-$

ii.) Sulfuric Acid is a strong oxidising agent for example it is the oxidant that removes two electrons when it is added to some magnesium:

$$H_2SO_{4(aq)} + Mg_{(s)} \longrightarrow H_2SO_{4(aq)} + Mg^{2+} + 2e^-$$

Another property of H_2SO_4 is that it is a dehydrating agent. This is demonstrated in the production of ethene from ethanol:

$$C_2H_5OH_{(l)} \xrightarrow{H_2SO_4} H_2O_{(l)} + C_2H_{4(g)}$$

A water molecule is removed to produce the Alkene.

The sulfate in H_2SO_4 precipitates some metal ions, such as Barium and Calcium out of solution: $Ba(NO_3)_{2(aq)} + H_2SO_{4(aq)} \longrightarrow BaSO_{4(s)} + 2HNO_{3(aq)}$

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~~Solution the~~

~~If more added more reactants~~.

(d)(i) We used a reaction between acetic acid and water. $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O$. ~~We used an indicator~~ To do this we placed a Methyl orange indicator in the water of a beaker and then proceeded to add acetic acid. The waters colour was observed as yellow ~~red~~. We then added more acetic acid and found the colour to shift to red.

(ii) By observing the colour of the indicator we were able to observe ~~the~~ qualitatively, the colour change in the ~~the~~ Solution. By ~~adding heat~~ heating the solution we were able to watch the red wate turn to yellow. This was due to the reaction being exothermic and therefore the addition of heat shifted the equilibrium to the left. We also observed that by adding more acetic acid we were able to shift the equilibrium back to the right. This made the solution more acidic and the colour of the solution therefore went back to red.

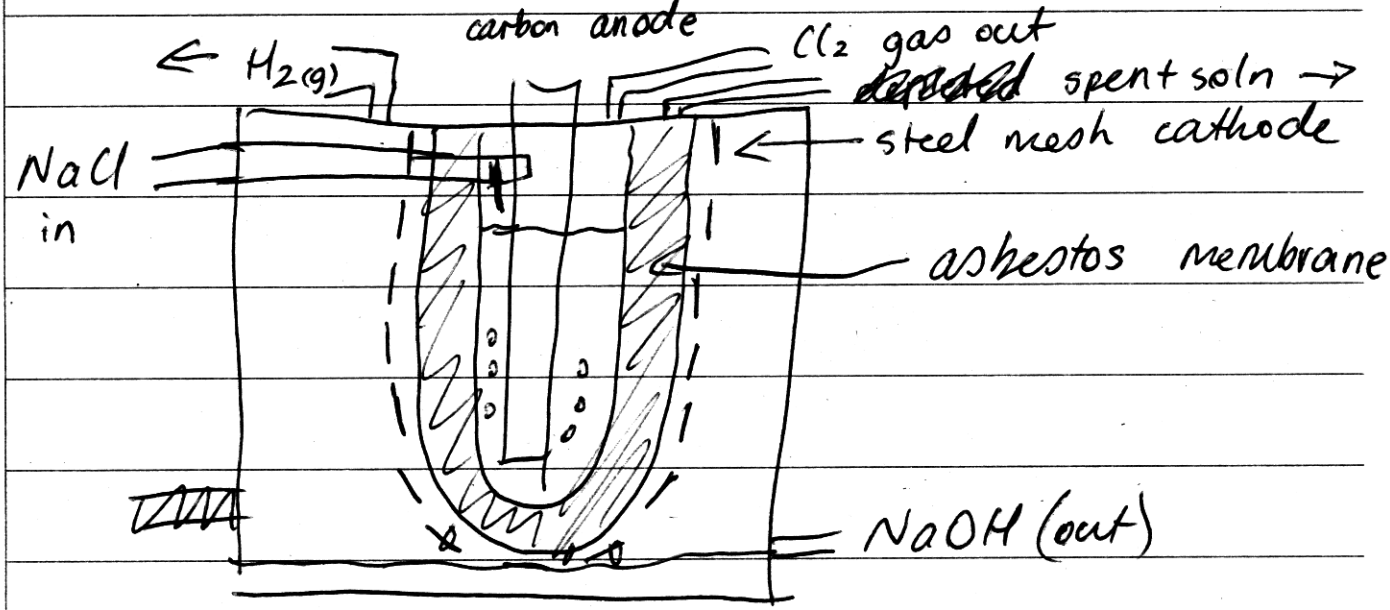
(e) Early methods to produce NaOH were using the mercury cell and the Nelson diaphragm cell. Problems with the release of Mercury resulted in the decreased use of this method. The Nelson diaphragm cell uses an askestos

~~membrane~~ diaphragm.
~~diaphragm~~ which can lead to health problems in people ie asbestosis → a type of lung cancer.

~~the two~~

Nelson diaphragm cell.

~~(membrane)~~



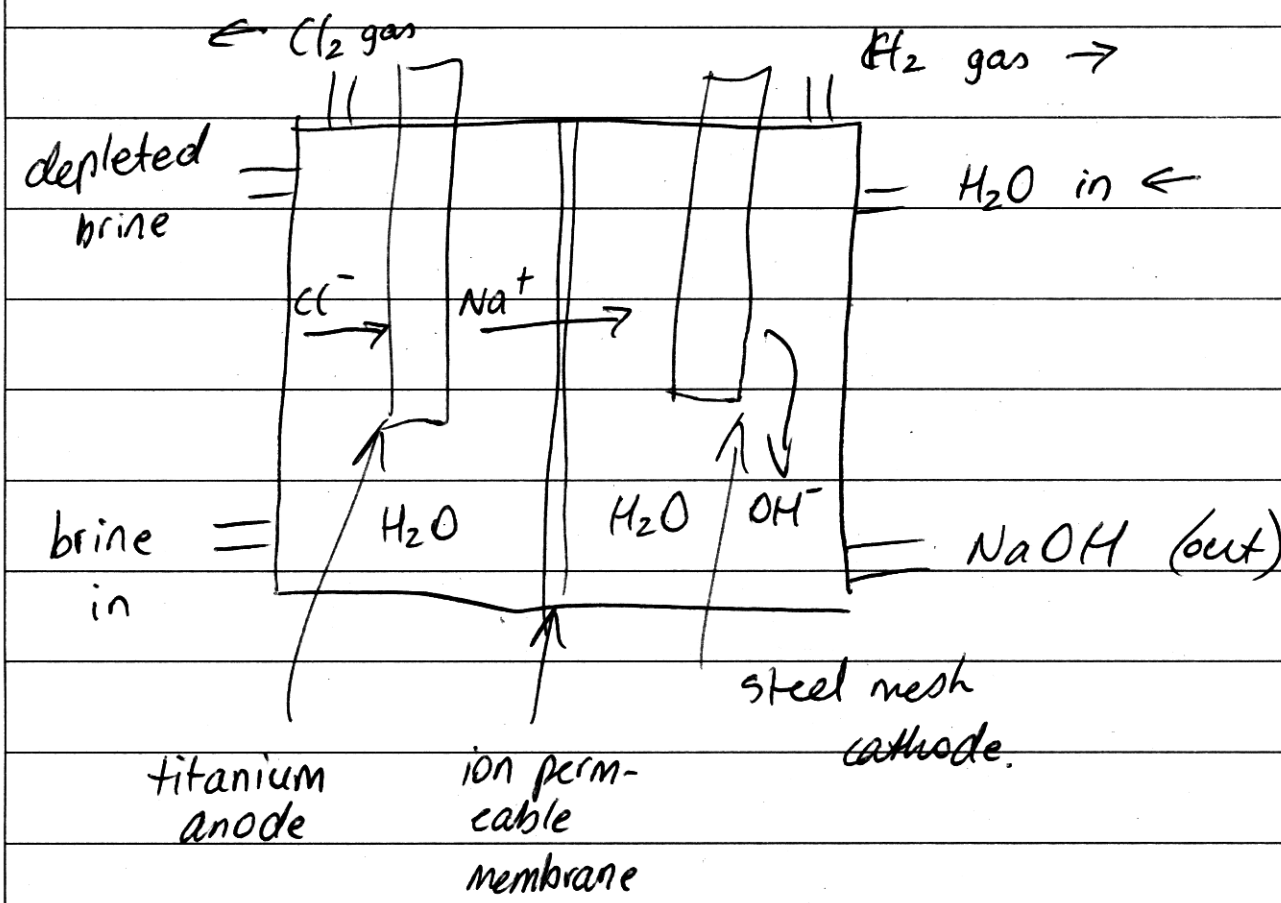
at the anode; ~~2Cl⁻ → H₂~~

$$2Cl^- \rightarrow Cl_2 + 2e^-$$

at the cathode: $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

due to the environmental difficulties, other alternatives were researched and developed.

the membrane cell.



this cell has the same anode and cathode reactions as the Nelson cell.

anode: $2Cl^- \rightleftharpoons Cl_2 + 2e^-$

cathode: $2H_2O + 2e^- \rightarrow H_2(g) + 2OH^-$

overall, Na^+ ions from the brine pass through the membrane (which doesn't let Cl^- or OH^- past.) ~~then~~ Na^+

continued. →

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Na^+ ions combine with OH^- ions producing Sodium hydroxide

$$Na^+ + OH^- \rightarrow NaOH.$$

this method produces a very pure NaOH solution and is another reason why it is used over the other 2 methods. the changes have come from people being more aware of environmental pollution. No harmful materials are used in this process. (ie Mercury in the mercury cell ~~can lead to this~~ can be released into waterways resulting in bioaccumulation in the food chain resulting in higher concentrations in the food that humans eat. (ie mercury poisoning.) unreacted materials in the membrane cell can be recycled.