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Q28.

a) i) Saponification is the proces used in the manufacture of soap. where fats & oils are choped to added to Brine to produce soap.

ii)

~~A Soap is also is also used by~~ Soap is used by people ~~the~~ for personal hygiene, made to remove dirt & grim. It contains a hydrophilic end & ~~a~~ hydrophobic end. The ~~hydrophob~~ hydrophobic end contains a long hydrocarbon chain which attaches it self to the dirt & grim. The hydrophilic acid ~~is~~ contains the $-COO^-$ which is soluble in water, ~~thus~~ therefore soluble to water.

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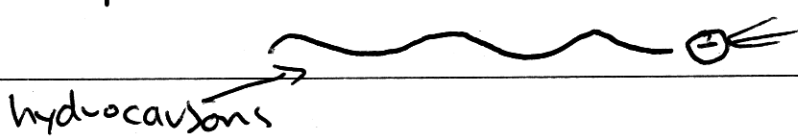
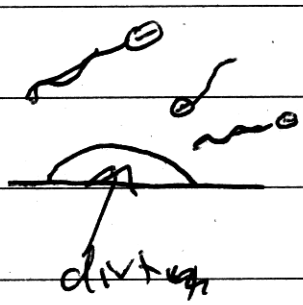
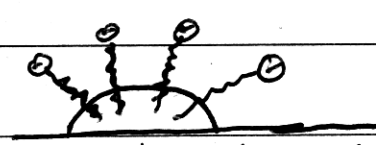
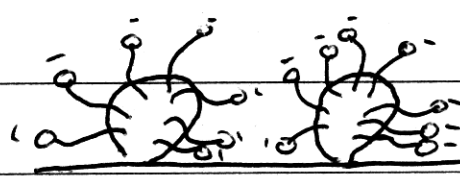
The soap molecule is also known as a ~~tapp to tap~~ tadpole, The tadpole structure :



Acts as a bridge between the water and the dirt. ~~Many~~ The hydrophobic end attaches itself to the dirt, ~~with~~ & the ionic end is projected outwards, therefore there is a ~~electro~~ electrical charge of the dirt substance, which stops it from joining. ~~The~~ This allows the dirt to lift of & be cleaned







∴ Causing the substance to be cleaned easier

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(b) $2SO_2 + O_2 \rightarrow 2SO_3$

$[SO_2] = 0.06$

$[O_2] = 0.05$

$[SO_3] = 0.04$

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

$$= \frac{0.04^2}{0.06^2 \times 0.05}$$

$$= 8.89$$

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

and then often:

$$HSO_4^-{}_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + SO_4^{2-}{}_{(aq)}$$

When H_2SO_4 (conc.) is added to water, the reaction taking place is an ionisation one, and often occurs in two steps as outlined above

(ii) Many of the uses of ~~Sulphu~~ Sulfuric acid are founded on the fact that it behaves as a very effective oxidising agent, dehydrating agent and ~~precip~~ can also bring about precipitation reactions

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Now, as a dehydrating agent, it effectively converts ethanol to ethene. It is such an effective dehydrating agent because of its very strong and indeed vigorous affinity ~~for~~ for water:

$$C_2H_5OH \xrightarrow[\text{(conc.)}]{H_2SO_4} C_2H_4 + H_2O$$

As an oxidant it is also very effective as it easily recieves electrons. In the below equation it is oxidising Carbon:

$$C_{(s)} + H_2SO_{4(aq)} \rightarrow CO_{2(g)} + SO_{2(g)} + H_2O_{(g)}$$

Moreover, it is also used as an oxidant in the lead acid battery used in cars. There, it oxidises Pb to Pb^{2+} ions.

H_2SO_4, is also used in many instances to form precipitates. This is due to the sulfate (SO_4^{2-}) ions:

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$Ba^{2+}_{(aq)} + SO_4^{2-}_{(aq)} \rightarrow BaSO_{4(s)}$

$Pb^{2+}_{(aq)} + SO_4^{2-}_{(aq)} \rightarrow PbSO_{4(s)}$

Thus, sulfuric acid can be seen as a very effective dehydrating agent, oxidant and also can be used to precipitate sulfates.

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(d)(i) Two tubes containing the equilibrium solutions of $NO_2 \rightleftharpoons N_2O_4$ were obtained and tested under different temperatures. One tube was immersed in 70°C beaker of water while the other was immersed in a 20°C beaker of water. The colour change in the solutions were then recorded down.

(ii) The equilibrium reaction of $NO_2 \rightleftharpoons N_2O_4$ could be observed through the glass tubes where increasing the temperature of one tube a shift in equilibrium could be seen towards the right, which produced the darker coloured N_2O_4. The other tube where the temperature was decreased the equilibrium could be seen shifting towards the left, as to produce more of the lighter coloured NO_2 gas. Therefore it can be seen that with a change in temperature a shift in equilibrium occurs in the reaction to produce more of one substance and less of the other.

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c) The first cell to produce NaOH was the Diaphram cell. it used Ti and Fe @ the anode and cathode. This used a aspestos membrane which had 2 main problems and they were ~~the~~ that the asbestos was harmful to the human reperitory system and that the ions ~~had~~ were able to travel both ways through the aspestos making the yeild less and causing some impurities. ~~the~~

The second method was the Mercury cell this used liquid mercury to carry the Na⁺ the main problems with this cell was that the Hg was expensive and also the fact that there was some leakage of it and it was harmful to the environment.

the third cell was the membrane cell which is a modified version of the original diaphram cell the main difference is that ~~the cell~~ it uses a polymer membrane which lets

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two advantages are :) that it is not harmful to the human body and also the membrane has a coating which stops the back flow of ions increasing the purity & yeild of NaOH.