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a) Mercury Cell.

Brine (NaCL) is pumped into the cell (usually sourced from salt water from the sea; cheap). The anode in this cell is mercury which runs down a small slope as a liquid. The cathode is Plutonium plates positioned close to the running mercury. This cell works as an electrolytic cell, ~~and is used for [illegible] is reduced~~ used in the production of Sodium hydroxide (NaOH).

~~$Na^+ + 2CL^- + OH^- + H^+ \rightarrow NaOH +$~~

$2NaCL + 2H_2O \rightarrow 2NaOH + CL_2 + H_2$

b) Molten sodium chloride is electrolysed with the absense of H_2O, & so doesen't form NaOH.

$NaCL \rightarrow Na^+ + CL^-$

Aqueous sodium chloride is NaCL + H_2O, and so forms NaOH, when NaCL is split into Na^+ & CL^-, & H_2O is split into OH^- & H^+.

$2NaCL + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$

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c) i) $2SO_2 + O_2 \longrightarrow 2SO_3$

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

$2SO_3$ - 0.3 moles
$2SO_2$ - 0.5 moles
O_2 - 0.4 moles

$K = \frac{[0.03]^2}{[0.05]^2[0.04]}$

$2SO_3$ - ~~0.015 M~~ 0.03 M
$2SO_2$ - ~~0.025 M~~ 0.05 M
O_2 - 0.04 M

$K = 9$

ii) One of the conditions that affects the equilibrium would of changed. eg (temp, pressure etc) In this case, the rise in yield of SO_3 could have been caused by an increase in pressure. (3moles : 2 moles) so equilibrium moves to right to compensate for increase in pressure. But because the total moles of the equilibrium cannot change, the rise in yield of SO_3, is proportional to the decrease in yield of SO_2.

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d) (i) Saponification

A - alkanoic acid. (alcohol)

(ii) By adding an oil (eg olive oil, vegetable oil) with an alcohol in an evaporating basin. A catalyst is used (H_2SO_4), and the mixture is heated until it turns solid. Goggles need to be worn to protect the eyes from spitting substance (acid). Gloves should be worn when handling the end product, and when combining substances, as H_2SO_4 is a strong acid. Hair must be tied back as to prevent it lighting on fire. Equipment must not be touched until sufficient cooling time has passed.

e) $CaCO_3$ is an important substance in the production of the Solvay process. limestone is a good source of $CaCO_3$, and is relatively pure in its natural state. limestone is an abundant substance on earth, and so it's very cheap. However, the process to break down $CaCO_3$ requires alot of energy (heat energy). As well as this, the mining of limestone can devestating effects on the environment. During the mining process the top layer of vegetation (above the source of limestone) needs to be cleared. This can be huge areas, which may be home to a range of plants and animals. Not only this,

after mining occurs, the geography of that natural habitat changes. The mining process & the transportation of the heavy stone also used alot of energy, and the combustion of fossil fuels.

$$CaCO_3 \longrightarrow CaO + CO_2$$

Also, CaO can be harmful to the environment. It is a waste product in the Solvay process, and is usually dumped into the ocean or lakes, which can ~~have effects~~ effect the natural habitat of these aquatic areas.

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