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a. ~~cell shown is an electrolysis cell~~ process depicted is the process ~~of treating brine~~

molten brine (NaCl) is passed through an electrolysis cell to decompose NaCl into ~~~~ Na + Cl^- ~~~~. chlorine easily filtered as it enters gaseous form at very high temperatures. the sodium ~~~~ is then mixed with water and with a lack of pressure easily forms NaOH most probably seperated through a filter

b, molten sodium chloride when undergoing in electrolysis ~~~~ decomposes into its base elements of sodium + chlorine, aqeous sodium chloride however produces hydrochloric acid.

molten NaCl is pure NaCl hence why in electrolysis forms Na^+ + Cl^-, ~~~~

$NaCl_{(aq)} \xrightarrow{electrolysis} Na_{(s)} + Cl^-_{(g)}$

$Na^+_{(aq)} + e^- \rightarrow Na_{(s)}$ with the addition of H_2O in an aqeous solution of NaCl electrolysis doesn't target sodium + chlorine ~~~~ rather sodium + oxygen

$4NaCl.2H_2O \xrightarrow{electrolysis} 4Na_{(aq)} + 4HCl_{(aq)} + O_{2(g)}$

the sodium is thus harder to extract as its suspended in hydrochloric acid. hence the electrolysis of molten NaCl is more efficient. however requires alot more energy, each setup requires its own equipment as to handle the reactants + products, however the electrolysis of molten NaCl is more cost effective in industry.

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c.(i) SO_3 = 3×16 + 32.07 SO_2 = 2×16 + 32.07

= 80.07 g/mol. = 64.07 g/mol

0.6 × 64.07 = 38.442. (SO_2 at time A)

0.4 × 80.05 = 32.028 (SO_3 at time A).

K at time A = $[SO_2][SO_3]$

= [38.442][32.028]

= 1231.220376.

(ii) at time B SO_2 & SO_3 have already undergone an equilibrium reaction. due to the conditions provided by a sealed container the equilibrium reaction ~~between~~ of SO_2 & SO_3 is reversed as can be seen in the ~~diagram~~ graph. hence because the equilibrium has changed so must its position have ~~at~~ time B,

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d. (i) reaction presented in d is a Saponification reaction. hence reactant [A] must be the compound OH⁻ (hydroxide) as its a vital component in the making of soap(s)

(ii) no specific equipment needed apart from beakers + measuring devices, all that is needed is to mix the reactants.

Suitable eyewear and gloves must be worn to prevent damage in case of OH⁻ spillage as OH⁻ is highly corrosive if not dilute, standard lab coats and hard leather shoes are also a must + long hair must be tied back (all standard laboratory procedures) in case of spillage it is highly recommended to have an amphiprotic substance at bay to quickly neutralise.

e. limestone is an important substance in the creation of sodium hydrogen carbonate + sodium carbonate. ~~[illegible]~~ It's the cheapest substance that when combusted produces carbonate. and in the overall reaction using limestone is less harmful to the environment than its corresponding sources of carbonate. Whilst it doesn't directly produce CO_3 when combusted simple reactions with CO_2 + O_2 form CO_3, the calcium oxide product also produced from its combustion is also key to another reaction involved in the Solvay process.

By replacing limestone with an alternative could greatly increase costs in the production of sodium carbonate as alternative sources of calcium oxide would also need to be used and overall increasing the hassle in creating the desired compound. the calcium in one of the final products of the solvay process however poses a threat to the environment. It cannot go back to its source or disposed of on land because the concentration ~~composition~~ of calcium ~~of~~ its total output is too high. However ~~the~~ it can be simply diluted and pumped out to ~~the~~ a very large volume of water such as the sea, the calcium originally from the limestone poses no ~~threa~~ threats to marine environments. The use of limestone in the Solvay process proves to be vital ~~of~~ far more economically viable and safer to the environment that the use of other carbonate sources. It's obvious that limestone is very important in the solvay process.

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