

Chemical Process Explanations and Corrections

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User prompt: sea water cannot be directly taken as it contain impurities. answer is given as (b) and (c) are correct. can you explain

Response: Statement **(a)** is incorrect, which makes **(b) and (c)** the correct pair of statements.

Statement Analysis

- **(a) Sea water can be used directly as a raw material in the extraction of Mg by the Dow process. (Incorrect)** Sea water contains insoluble suspended solid impurities (such as sand and organic debris) as well as unwanted dissolved ions (like calcium and sulphate). If sea water is used directly without pretreatment, these impurities clog processing machinery, contaminate the precipitated $\text{Mg}(\text{OH})_2$, and cause unwanted side reactions during subsequent steps. Therefore, sea water must first undergo filtration and pre-purification before entering the Dow process.
- **(b) In the production of NaOH, the use of membrane cells is more environmentally friendly than the use of mercury cells. (Correct)** Mercury cell technology poses significant environmental and bioaccumulation risks due to potential toxic mercury emissions and waste leakage. Membrane cells eliminate the use of heavy metals entirely and operate with higher energy efficiency, making them vastly superior from an environmental perspective.
- **(c) The efficiency of the Solvay process used to produce Na_2CO_3 can be increased by cooling the ammonification tower. (Correct)** The dissolution of ammonia gas in brine (water) to form ammoniacal brine is an **exothermic reaction**:



According to Le Chatelier's principle, lowering/cooling the temperature of the ammonification tower shifts the equilibrium to the right, significantly increasing the solubility of ammonia gas in the brine solution. Higher ammonia concentration improves the overall yield and efficiency of the subsequent carbonation step.

- **(d) Rh metal is used as a catalyst in the production of H_2SO_4 by the contact process. (Incorrect)** The contact process utilizes vanadium pentoxide (V_2O_5) or platinum (Pt) as catalysts for the oxidation of SO_2 to SO_3 . Rhodium (Rh) is primarily used in catalytic converters for vehicles or industrial processes like acetic acid synthesis (Monsanto/Cativa process), not sulfuric acid manufacture.
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