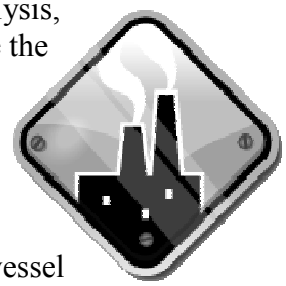
Student Name: _____ Pd. ____ Date: _____

Stoichiometry Mini Project 2

Industrial Production of Chlorine Gas



Chlorine gas is produced on a large scale by several processes (mercury cell electrolysis, diaphragm cell electrolysis, and membrane cell electrolysis), but all of them involve the use of electrical current to separate sodium (or sometimes potassium) chloride into its component elements.

The mercury cell electrolysis process, which is also known as the Castner-Kellner process, is the least energy efficient among the three (as well as the oldest), but it is still employed in nearly 100 facilities around the world. In this process, a reaction vessel continuously filled with brine solution (water saturated with sodium chloride) has electrical anodes made of titanium immersed just below the surface, while a continuously flowing "sheet" of liquid mercury serves as the cathode. The process then proceeds like this:

1. As current passes through the solution, the sodium chloride decomposes.
2. The chlorine atoms combine to form chlorine gas, which bubbles out of solution and is collected by special equipment.
3. The sodium atoms amalgamize (form an alloy with) the mercury cathode. This is not a chemical reaction, but a physical mixture.
4. The mercury-sodium amalgam flows into a secondary reaction chamber where the sodium is allowed to react with water to form sodium hydroxide and hydrogen gas (which bubbles out and is collected by means similar to the chlorine gas).
5. The regenerated mercury is returned to the process.

All three of the products of this process are sold commercially.

Using this information, and any resources you have available to you, determine how many kilograms of each product is produced after 250,000 liters of brine solution are introduced to the system.