Supply of Various Chemicals in Dr. Raitono's Lab

Sodium Chloride	100.0 g
Silver Nitrate	100.0 g
Potassium chlorate	100.0 g
Sodium dihydrogen phosphate	100.0 g
Calcium hydroxide	100.0 g
Sodium Carbonate	100.0 g

1. Pure silver metal can be made using the reaction shown below:

$$Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$$

How many grams of copper metal will be needed to use up all of the $AgNO_3$ in Dr. Raitano's lab?

In the table it states there are 100.0 g of silver nitrate ($AgNO_3$). We need to start with 100.0 g of $AgNO_3$ and convert it to grams of copper.

Here is how

$$100.0\text{ g } AgNO_3 \times \frac{1\text{ mole } AgNO_3}{169.872\text{ g } AgNO_3} \times \frac{1\text{ mole Cu}}{2\text{ mole } AgNO_3} \times \frac{63.546\text{ g Cu}}{1\text{ mole Cu}} = 18.70\text{ g Cu}$$

2. The LeBlanc process, shown below, is the traditional method of manufacturing sodium hydroxide. Using the amounts of chemicals available in Dr. Raintano's lab, the maximum number of moles of NaOH that can be produced is?

$$Na_2CO_3(aq) + Ca(OH)_2(aq) \rightarrow 2NaOH(aq) + CaCO_3(s)$$

The key in this problem is the word MAXIMUM. We know from this that it is a limiting reactant problem. This means we have to do the stoichiometry twice for each reactant and figure out which gives us the least amount of product.

$$100.0\text{ g } Na_2CO_3 \times \frac{1\text{ mole } Na_2CO_3}{105.988\text{ } Na_2CO_3} \times \frac{2\ mole\ NaOH}{1\ mole\ Na2CO3} = 1.89\text{ mole NaOH}$$

$$100.0\text{ g } Ca(OH)_2 \times \frac{1\text{ mole } Ca(OH)2}{74.092\text{ g } Ca(OH)2} \times \frac{2\ mole\ NaOH}{1\ mole\ Ca(OH)2} = 2.70\text{ mole NaOH}$$

Since 1.89 mole NaOH < 2.70 mole of NaOH

1.89 mole NaOH is the MAXIMUM amount that you can make

3. Pure O_2 gas can be generated from the decomposition of potassium chlorate ($KClO_3$):

$$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$$

If half of the $KClO_3$ in the lab is used and 12.8 g of oxygen gas are produced, the percent yield of this reaction is?

It says in this problem that HALF of the $KClO_3$ is used so that means only 50.0 g of $KClO_3$

$$50.0 \text{ g } KClO_3 \times \frac{1 \text{ mole } KClO_3}{122.548 \text{ g } KClO_3} \times \frac{3 \text{ mole } O_2}{2 \text{ mole } KClO_3} \times \frac{32.00 \text{ g } O_2}{1 \text{ mole } O_2} = 19.58 \text{ g } O_2$$

Now to find % yield

$$\frac{12.8 \text{ g}}{19.58 \text{ g}} \times 100 = 65.37\%$$