Limiting Reactant Homework

Honors – use .01 from PT

(1) If sodium hydroxide reacts with carbon dioxide to produce sodium carbonate and water, how many grams of water form when 35.0 g of each of the reactants are combined?

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$

35.0 g 35.0 g ? g

$$35.0\text{ g NaOH} \times \frac{1\text{ mol}}{40.01\text{ g}} \times \frac{1\text{ mol } H_2O}{2\text{ mol NaOH}} \times \frac{18.01\text{ g}}{1\text{ mol}} = \boxed{7.88\text{ g } H_2O}$$

$$35.0\text{ g } CO_2 \times \frac{1\text{ mol}}{44.01\text{ g}} \times \frac{1\text{ mol } H_2O}{1\text{ mol } CO_2} \times \frac{18.01\text{ g}}{1\text{ mol}} = 14.3\text{ g } H_2O$$

(2) How many grams of hydrogen are released when 30.0 g of aluminum reacts with 95.0 g of hydrochloric acid?

$$2Al + 6HCl \rightarrow 3H_2 + 2AlCl_3$$

30.0 g 95.0 g ??

$$30.0\text{ g Al} \times \frac{1\text{ mol}}{26.98\text{ g}} \times \frac{3\text{ mol } H_2}{2\text{ mol Al}} \times \frac{2.02\text{ g}}{1\text{ mol}} = 3.37\text{ g } H_2$$

$$95.0\text{ g HCl} \times \frac{1\text{ mol}}{36.46\text{ g}} \times \frac{3\text{ mol } H_2}{6\text{ mol HCl}} \times \frac{2.02\text{ g}}{1\text{ mol}} = \boxed{2.63\text{ g } H_2}$$

(3) How many grams of copper (II) phosphate are formed by the double replacement reaction of 75.0 g of phosphoric acid and 84.0 g of copper (II) sulfate?

$$2H_3PO_4 + 3CuSO_4 \rightarrow 3H_2SO_4 + Cu_3(PO_4)_2$$

75.0 g 84.0 g ??

$$75.0\text{ g } H_3PO_4 \times \frac{1\text{ mol}}{98.00\text{ g}} \times \frac{1\text{ mol } Cu_3(PO_4)_2}{2\text{ mol } H_3PO_4} \times \frac{380.6\text{ g}}{1\text{ mol}} = 146\text{ g } Cu_3(PO_4)_2$$

$$84.0\text{ g } CuSO_4 \times \frac{1\text{ mol}}{158.52\text{ g}} \times \frac{1\text{ mol } Cu_3(PO_4)_2}{3\text{ mol } CuSO_4} \times \frac{380.6\text{ g}}{1\text{ mol}} = \boxed{67.2\text{ g } Cu_3(PO_4)_2}$$