

## Limiting Reagent & Percent Yield Practice Worksheet

1. When copper (II) chloride reacts with sodium nitrate, copper (II) nitrate and sodium chloride are formed.

a. Write the balanced equation for the reaction given above:



b. If 15 grams of copper (II) chloride react with 20 grams of sodium nitrate, what is the limiting reagent for the reaction? CuCl<sub>2</sub>

$$15\text{ g CuCl}_2 \left( \frac{1\text{ mole CuCl}_2}{134.45\text{ g}} \right) = \frac{0.112\text{ mole CuCl}_2}{1 \leftarrow \text{coefficient}}$$

$$20\text{ g NaNO}_3 \left( \frac{1\text{ mole NaNO}_3}{85\text{ g}} \right) = \frac{0.235\text{ mole NaNO}_3}{2 \leftarrow \text{coefficient}}$$

c. How much sodium chloride in grams can be formed?

$$0.112\text{ mole CuCl}_2 \left( \frac{2\text{ mole NaCl}}{1\text{ mole CuCl}_2} \right) \left( \frac{58.44\text{ g NaCl}}{1\text{ mole NaCl}} \right) = 13.1\text{ g NaCl}$$

d. How many grams of copper (II) nitrate is formed?

$$0.112\text{ mole CuCl}_2 \left( \frac{1\text{ mole Cu(NO}_3)_2}{1\text{ mole CuCl}_2} \right) \left( \frac{187.57\text{ g Cu(NO}_3)_2}{1\text{ mole Cu(NO}_3)_2} \right) = 21.0\text{ g}$$

e. How much of the excess reagent is left over in this reaction?

$$0.112\text{ mole CuCl}_2 \left( \frac{2\text{ mole NaNO}_3}{1\text{ mole CuCl}_2} \right) \left( \frac{85\text{ g NaNO}_3}{1\text{ mole NaNO}_3} \right) = 19.0\text{ g NaNO}_3 \text{ Used in Reaction}$$

$20\text{ g} - 19\text{ g} = 1\text{ g NaNO}_3 \text{ left over}$

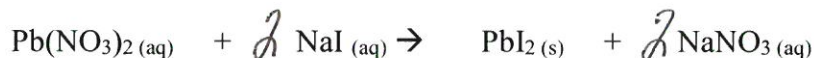
f. If 11.3 grams of sodium chloride are formed in the reaction described in problem #2, what is the percent yield of this reaction?

$$\text{Percent yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100 \text{ percent}$$

$$\frac{11.3\text{ g NaCl}}{13.1\text{ g NaCl}} \times 100 = 86.2\%$$

2. When lead (II) nitrate reacts with sodium iodide, sodium nitrate and lead (II) iodide are formed.

a. Balance the following equation:



a. If I start with 25.0 grams of lead (II) nitrate and 15.0 grams of sodium iodide, what is the limiting reagent for the reaction? Sodium Iodide

$$25 \text{ g Pb}(\text{NO}_3)_2 \left( \frac{1 \text{ mol Pb}(\text{NO}_3)_2}{331.22 \text{ g}} \right) = \frac{0.075 \text{ mol Pb}(\text{NO}_3)_2}{1 \leftarrow \text{coefficient}}$$

$$15 \text{ g NaI} \left( \frac{1 \text{ mol NaI}}{149.89 \text{ g}} \right) = \frac{0.100 \text{ mol NaI}}{2 \leftarrow \text{coefficient}} = 0.05 \text{ mol NaI}$$

b. How many grams of sodium nitrate can be formed?

$$0.100 \text{ mol NaI} \left( \frac{2 \text{ mol NaNO}_3}{2 \text{ mol NaI}} \right) \left( \frac{85 \text{ g NaNO}_3}{1 \text{ mol NaNO}_3} \right) = 8.5 \text{ g NaNO}_3$$

c. How many grams of lead (II) iodide is formed?

$$0.100 \text{ mol NaI} \left( \frac{1 \text{ mol PbI}_2}{2 \text{ mol NaI}} \right) \left( \frac{461 \text{ g PbI}_2}{1 \text{ mol PbI}_2} \right) = 23.1 \text{ g PbI}_2$$

d. How much of the non-limiting reagent will be left over from the reaction in problem #2?

$$0.100 \text{ mol NaI} \left( \frac{1 \text{ mol Pb}(\text{NO}_3)_2}{2 \text{ mol NaI}} \right) \left( \frac{331.22 \text{ g Pb}(\text{NO}_3)_2}{1 \text{ mol Pb}(\text{NO}_3)_2} \right) = 16.6 \text{ g Pb}(\text{NO}_3)_2 \text{ used up in reaction}$$

# started with

$$\rightarrow 25.0 \text{ g} - 16.6 \text{ g Pb}(\text{NO}_3)_2 = 8.40 \text{ grams left over}$$

e. If 6 grams of sodium nitrate are formed in the reaction described in problem #2, what is the percent yield of this reaction?

$$\frac{6 \text{ g NaNO}_3}{8.5 \text{ g NaNO}_3} \times 100 = 71 \%$$