Name : _____ Date : _____

Limiting Reagent and Percentage Yield

1 Dichlorine monoxide is produced by passing chlorine gas over heated mercury (II) oxide according to the following unbalanced reaction:

$$\_\_\ HgO \longrightarrow \_\_\ Cl_2 + \_\_\ HgCl_2 + \_\_\ Cl_2O$$

Balance the reaction. Suppose the quantity of the reactants is sufficient to produce 0.86 g of Cl_2O, but only 0.71 g is obtained. What is the percentage yield?

2 Consider the following reaction:

$$Be + 2\ HCl \longrightarrow BeCl_2 + H_2$$

The theoretical yield of beryllium chloride was 10.7 g. Suppose the reaction actually yields 4.5 g. What is the percentage yield?

3 Nitrogen and hydrogen at high temperatures are converted to ammonia using the following reaction:

$$N_2 + 3\ H_3 \longrightarrow 2\ NH_3$$

When 400 g of H_2 are added to an excess amount of N_2, 104 g of NH_3 are formed. Calculate the percentage yield.

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Answers

1 Dichlorine monoxide is produced by passing chlorine gas over heated mercury (II) oxide according to the following unbalanced reaction:

$$\_\_\ HgO \longrightarrow \underline{2}\ Cl_2 + \_\_\ HgCl_2 + \_\_\ Cl_2O$$

Balance the reaction. Suppose the quantity of the reactants is sufficient to produce 0.86 g of Cl_2O, but only 0.71 g is obtained. What is the percentage yield?

$$\text{Percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100 = \frac{0.86\ \text{g}}{0.71\ \text{g}} \times 100 = 83\%$$

2 Consider the following reaction:

$$Be + 2\ HCl \longrightarrow BeCl_2 + H_2$$

The theoretical yield of beryllium chloride was 10.7 g. Suppose the reaction actually yields 4.5 g. What is the percentage yield?

$$\text{Percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100 = \frac{4.5\ \text{g}}{10.7\ \text{g}} \times 100 = 42\%$$

3 Nitrogen and hydrogen at high temperatures are converted to ammonia using the following reaction:

$$N_2 + 3\ H_3 \longrightarrow 2\ NH_3$$

When 400 g of H_2 are added to an excess amount of N_2, 104 g of NH_3 are formed. Calculate the percentage yield.

$$400\ \text{g}\ H_2 \times \frac{1\ \text{mol}\ H_2}{2\ \text{g}\ H_2} \times \frac{2\ \text{mol}\ NH_3}{3\ \text{mol}\ H_2} \times \frac{17\ \text{g}\ NH_3}{1\ \text{mol}\ NH_3} = 2267\ \text{g}\ H_2\ \text{(theoretical)}$$

$$\text{Percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100 = \frac{104\ \text{g}}{2267\ \text{g}} \times 100 = 4.5\%$$