Name : _____ Date : _____

Limiting & Excess Reagents

1. Given the following reaction:

$$\_\_\_ I_2O_5\ (g) + \_\_\_ CO\ (g) \rightarrow \_\_\_ CO_2 + \_\_\_ I_2\ (g)$$

Balance the reaction.

(a) Suppose 80 grams of I_2O_5 reacts with 28 grams of CO. Determine the limiting reagent and the mass of I_2 produced.

(b) Suppose only 0.15 moles of I_2 were produced. What is the mass of I_2?

2. Consider the following reaction: $CO + 2\ H_2 \rightarrow CH_3OH$

2.5 g of H_2 reacts with 30 L of CO at STP. What is the limiting reagent? What is the mass of CH_3OH produced? How much excess reagent is left over?

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Answers

1. Given the following reaction:

$$\_\_\_ \ I_2O_5\ (g) + \underline{\ 5\ }\ CO\ (g) \rightarrow \underline{\ 5\ }\ CO_2 + \_\_\_ \ I_2\ (g)$$

Balance the reaction.

a. Suppose 80 grams of I_2O_5 reacts with 28 grams of CO. Determine the limiting reagent and the mass of I_2 produced.

$$80\ g\ I_2O_5 \times \frac{1\ mol\ I_2O_5}{333.8\ g\ I_2O_5} \times \frac{1\ mol\ I_2}{1\ mol\ I_2O_5} \times \frac{253.8\ g\ I_2}{1\ mol\ I_2} = 60.8\ g\ I_2$$

$$28\ g\ CO \times \frac{1\ mol\ CO}{28.01\ g\ CO} \times \frac{1\ mol\ I_2}{5\ mol\ CO} \times \frac{253.8\ g\ I_2}{1\ mol\ I_2} = 50.7\ g\ I_2$$

Since CO produces the least amount of I_2, it is the limiting reagent. The mass of I_2 is 50.7 g.

b. Suppose only 0.15 moles of I_2 were produced. What is the mass of I_2?

$$0.15\ mol\ I_2 \times \frac{253.8\ g\ I_2}{1\ mol\ I_2} = 38.7\ g\ I_2$$

2. Consider the following reaction: $CO + 2\ H_2 \rightarrow CH_3OH$

2.5 g of H_2 reacts with 30 L of CO at STP. What is the limiting reagent? What is the mass of CH_3OH produced? How much excess reagent is left over?

$$2.5\ g\ H_2 \times \frac{1\ mol\ H_2}{2\ g\ H_2} \times \frac{1\ mol\ CH_3OH}{2\ mol\ H_2} \times \frac{32\ g\ CH_3OH}{1\ mol\ CH_3OH} = 20\ g\ CH_3OH$$

$$30\ L\ CO \times \frac{1\ mol\ CO}{22.4\ L\ CO} \times \frac{1\ mol\ CH_3OH}{1\ mol\ CO} \times \frac{32\ g\ CH_3OH}{1\ mol\ CH_3OH} = 42.9\ g\ CH_3OH$$

H_2 is the limiting reagent. 20 g of CH_3OH is produced. Let us calculate the remaining amount of CO.

$$2.5\ g\ H_2 \times \frac{1\ mol\ H_2}{2\ g\ H_2} \times \frac{1\ mol\ CO}{2\ mol\ H_2} \times \frac{22.4\ L\ CO}{1\ mol\ CO} = 14\ L\ CO\ used$$

30 L CO − 14 L CO = 16 L CO remains.