Limiting Reactants

We want to be able to predict the amount of product produced when our reactants react. To do this we need to determine which reactant is the limiting, that is, which of the reactants will we use up first.

1- Balanced chemical equation $C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$

2- Start with one reactant and determine how much of the other is needed.

$$100.0\text{g } C_2H_5OH \cdot \frac{1 \text{ mole } C_2H_5OH}{46.07 \text{ g } C_2H_5OH} \cdot \frac{3 \text{ mol } O_2}{1 \text{ mole } C_2H_5OH} \cdot \frac{32.00 \text{ g } O_2}{1 \text{ mole } O_2} = 208.4 \text{ g } O_2$$

By comparing the amount we need to the amount we have we can determine which reactant we will run out of first. This is the limiting reactant.

3- Using the limiting reactant find the amount of product.

$$100.0\text{g } O_2 \cdot \frac{1 \text{ mole } O_2}{32.00 \text{ g } O_2} \cdot \frac{3 \text{ mol } H_2O}{3 \text{ mole } O_2} \cdot \frac{18.02 \text{ g } H_2O}{1 \text{ mole } H_2O} = 56.31 \text{ g } H_2O$$

Additionally we can calculate the amount of the remaining reactant left over.

$$100.0\text{g } O_2 \cdot \frac{1 \text{ mole } O_2}{32.00 \text{ g } O_2} \cdot \frac{1 \text{ mol } C_2H_5OH}{3 \text{ mole } O_2} \cdot \frac{46.07 \text{ g } C_2H_5OH}{1 \text{ mole } C_2H_5OH} = 47.99 \text{ g } C_2H_5OH$$

100.0g - 47.99g = 52.01g C_2H_5OH

Ex: