$4\,NH_3 + 5\,O_2 \rightarrow 4NO + 6H_2O$

3.25 g $NH_3$ 3.50 g $O_2$

a) What is the limiting reagent? $O_2$

$$3.25\ \text{g}\ NH_3 \left| \frac{1\ \text{mol}}{17.03\ \text{g}\ NH_3} \right. = 0.19\ \text{mol}\ NH_3$$

$$3.50\ \text{g}\ O_2 \left| \frac{1\ \text{mol}}{32\ \text{g}\ O_2} \right. = 0.11\ \text{mol}\ O_2$$

$$\frac{NH_3}{O_2} = \frac{4}{5} = 0.8 \qquad \frac{O_2}{NH_3} = \frac{5}{4} = 1.25$$

$$\frac{0.19}{0.11} = 1.7 \qquad \frac{0.11}{0.19} = 0.57$$

b) How many grams of NO are formed?

$$0.11 \text{ mol } O_2 \left| \frac{4 \text{ mol NO}}{5 \text{ mol } O_2} \right| \frac{30.01 \text{ g NO}}{1 \text{ mol NO}}$$

$= 2.64 \text{ g NO formed}$

If 4.95 g of ethylene ($C_2H_4$) are combusted with 3.25 g of oxygen...

a) what is the limiting reagent? $O_2$

$$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$$

4.95 g  3.25 g

$$\frac{4.95\ \text{g}\ C_2H_4 \mid 1\ \text{mol}\ C_2H_4}{28\ \text{g}\ C_2H_4} = 0.18\ \text{mol}\ C_2H_4$$

$$\frac{3.25\ \text{g}\ O_2 \mid 1\ \text{mol}}{32\ \text{g}\ O_2} = 0.10\ \text{mol}\ O_2$$

b) How many grams of $CO_2$ are formed?

$$0.10 \text{ mol } O_2 \left| \frac{2 \text{ mol } CO_2}{3 \text{ mol } O_2} \right| \frac{44 \text{ g } CO_2}{1 \text{ mol } CO_2}$$

$$= 2.93 \text{ g } CO_2$$

c) How many grams of the excess reagent remain at the end of the reaction?

$$0.10 \text{ mol } O_2 \left| \frac{1 \text{ mol } C_2H_4}{3 \text{ mol } O_2} \right. = 0.033 \text{ mol } C_2H_4 \text{ used}$$

$$\text{mols } C_2H_4{}_i - \text{mols } C_2H_4{}_u$$

$$0.18 \text{ mols} - 0.033 \text{ mols}$$

$$= 0.147 \text{ mols unused}$$

$$0.147 \text{ mols } C_2H_4 \left| \frac{28 \text{ g } C_2H_4}{1 \text{ mol } C_2H_4} \right. = 4.12 \text{ g } C_2H_4$$