Stoichiometry Review Key

1a) $\frac{2.6 \text{ mol } NH_3}{} \left| \frac{6 \text{ mol } H_2O}{4 \text{ mol } NH_3} \right. = \boxed{3.9 \text{ mol } H_2O}$

b) $\frac{0.362 \text{ mol } O_2}{} \left| \frac{4 \text{ mol NO}}{5 \text{ mol } O_2} \right. = \boxed{0.290 \text{ mol NO}}$

c) $\frac{54.0 \text{ g } NH_3}{} \left| \frac{1 \text{ mol } NH_3}{17.0 \text{ g } NH_3} \right| \frac{5 \text{ mol } O_2}{4 \text{ mol } NH_3} = \boxed{3.97 \text{ mol } O_2}$

d) $\frac{60.0 \text{ g } H_2O}{} \left| \frac{1 \text{ mol } H_2O}{18.0 \text{ g } H_2O} \right| \frac{4 \text{ mol NO}}{6 \text{ mol } H_2O} = \boxed{2.22 \text{ mol NO}}$

e) $\frac{8.96 \text{ g } NH_3}{} \left| \frac{1 \text{ mol } NH_3}{17.0 \text{ g } NH_3} \right| \frac{4 \text{ mol NO}}{4 \text{ mol } NH_3} \left| \frac{30.0 \text{ g NO}}{1 \text{ mol NO}} \right. = \boxed{15.8 \text{ g NO}}$

2. $2SO_3 \longrightarrow 2S + 3O_2$

$\frac{6.0 \text{ mol } SO_3}{} \left| \frac{2 \text{ mol S}}{2 \text{ mol } SO_3} \right| \frac{32.1 \text{ g S}}{1 \text{ mol S}} = \boxed{1.9 \times 10^2 \text{ g S}}$

4. $C + 2Cl_2 \longrightarrow CCl_4$

$\frac{355 \text{ g } CCl_4}{} \left| \frac{1 \text{ mol } CCl_4}{154.0 \text{ g } CCl_4} \right| \frac{2 \text{ mol } Cl_2}{1 \text{ mol } CCl_4} \left| \frac{71.0 \text{ g } Cl_2}{1 \text{ mol } Cl_2} \right. = \boxed{327 \text{ g } Cl_2}$

3. $Na_2SO_4 + BaCl_2 \longrightarrow 2NaCl + BaSO_4$

$\frac{2.50 \text{ mol } Na_2SO_4}{} \left| \frac{2 \text{ mol NaCl}}{1 \text{ mol } Na_2SO_4} \right| \frac{58.5 \text{ g NaCl}}{1 \text{ mol NaCl}} = \boxed{293 \text{ g NaCl}}$

5. $2H_2S + 3O_2 \longrightarrow 2H_2O + 2SO_2$

$\frac{9.0 \text{ g } H_2O}{} \left| \frac{1 \text{ mol } H_2O}{18.0 \text{ g } H_2O} \right| \frac{3 \text{ mol } O_2}{2 \text{ mol } H_2O} \left| \frac{32.0 \text{ g } O_2}{1 \text{ mol } O_2} \right. = \boxed{24 \text{ g } O_2}$

6. a) $\frac{0.316 \text{ g } C_{14}H_{10}O_3S}{} \left| \frac{1 \text{ mol } C_{14}H_{10}O_3S}{258.1 \text{ g } C_{14}H_{10}O_3S} \right| \frac{14 \text{ mol } CO_2}{1 \text{ mol } C_{14}H_{10}O_3S} \left| \frac{22.4 \text{ L } CO_2}{1 \text{ mol } CO_2} \right. = \boxed{0.384 \text{ L } CO_2}$

b) $\frac{16.5 \text{ L } SO_2}{} \left| \frac{1 \text{ mol } SO_2}{22.4 \text{ L } SO_2} \right| \frac{1 \text{ mol } C_{14}H_{10}O_3S}{1 \text{ mol } SO_2} \left| \frac{258.1 \text{ g } C_{14}H_{10}O_3S}{1 \text{ mol}} \right. = \boxed{1.90 \times 10^2 \text{ g } C_{14}H_{10}O_3S}$

7. $C_6H_{12}O_6 + 6O_2 \longrightarrow 6H_2O + 6CO_2$

$$120\text{ g } C_6H_{12}O_6 \left|\frac{1\text{ mol } C_6H_{12}O_6}{180.0\text{ g } C_6H_{12}O_6}\right.\left|\frac{6\text{ mol } O_2}{1\text{ mol } C_6H_{12}O_6}\right.\left|\frac{22.4\text{ L } O_2}{1\text{ mol } O_2}\right. = \boxed{9.01\times10^1\text{ L } O_2}$$

8. $2H_2O \longrightarrow 2H_2 + O_2$

$$8.73\text{ L } H_2 \left|\frac{1\text{ mol } H_2}{22.4\text{ L } H_2}\right.\left|\frac{1\text{ mol } O_2}{2\text{ mol } H_2}\right.\left|\frac{22.4\text{ L } O_2}{1\text{ mol } O_2}\right. = \boxed{4.37\text{ L } O_2}$$

9. $CO_2 + C \longrightarrow 2CO$

$$50.0\text{ L CO} \left|\frac{1\text{ mol CO}}{22.4\text{ L CO}}\right.\left|\frac{1\text{ mol } CO_2}{2\text{ mol CO}}\right.\left|\frac{22.4\text{ L } CO_2}{1\text{ mol } CO_2}\right. = \boxed{25.0\text{ L } CO_2}$$

10. $2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O$

moles CO_2 formed:

$$50.0\text{ g } O_2 \left|\frac{1\text{ mol } O_2}{32.0\text{ g } O_2}\right.\left|\frac{4\text{ mol } CO_2}{5\text{ mol } O_2}\right. = 1.25\text{ mol } CO_2$$

moles CO_2 formed:

$$25.0\text{ g } C_2H_2 \left|\frac{1\text{ mol } C_2H_2}{26.0\text{ g } C_2H_2}\right.\left|\frac{4\text{ mol } CO_2}{2\text{ mol } C_2H_2}\right. = 1.9231\text{ mol } CO_2$$

LIMITING REACTANT IS O_2

$$1.25\text{ mol } CO_2 \left|\frac{44.0\text{ g } CO_2}{1\text{ mol } CO_2}\right. = \boxed{55.0\text{ g } CO_2 \text{ produced}}$$

$$50.0\text{ g } O_2 \left|\frac{1\text{ mol } O_2}{32.0\text{ g } O_2}\right.\left|\frac{2\text{ mol } C_2H_2}{5\text{ mol } O_2}\right.\left|\frac{26.0\text{ g } C_2H_2}{1\text{ mol } C_2H_2}\right. = 16.25\text{ g} = 16.3\text{ g } C_2H_2 \text{ used}$$

$25.0\text{ g } C_2H_2$ (start) $- 16.25\text{ g } C_2H_2$ (used) = $\boxed{8.8\text{ g } C_2H_2 \text{ left}}$

11. $Mg(OH)_2 + 2HCl \longrightarrow MgCl_2 + 2H_2O$

Moles H_2O formed:

$$\frac{5.0\text{ g HCl}}{} \left| \frac{1\text{ mol HCl}}{36.5\text{ g HCl}} \right| \frac{2\text{ mol } H_2O}{2\text{ mol HCl}} = 0.13699\text{ mol } H_2O$$

Moles H_2O formed:

$$\frac{24.0\text{ g } Mg(OH)_2}{} \left| \frac{1\text{ mol } Mg(OH)_2}{58.3\text{ g } Mg(OH)_2} \right| \frac{2\text{ mol } H_2O}{1\text{ mol } Mg(OH)_2} = 0.82333\text{ mol } H_2O$$

HCl is LIMITING REACTANT

$$\frac{0.13699\text{ mol } H_2O}{} \left| \frac{18.0\text{ g } H_2O}{1\text{ mol } H_2O} \right. = \boxed{2.47\text{ g } H_2O \text{ formed}}$$

$$\frac{5.0\text{ g HCl}}{} \left| \frac{1\text{ mol HCl}}{36.5\text{ g HCl}} \right| \frac{1\text{ mol } Mg(OH)_2}{2\text{ mol HCl}} \left| \frac{58.3\text{ g } Mg(OH)_2}{1\text{ mol } Mg(OH)_2} \right. = 3.99\text{ g } Mg(OH)_2 \text{ (used)}$$

$$24.0\text{ g } Mg(OH)_2 \text{ (start)} - 3.99\text{ g } Mg(OH)_2 \text{ (used)} = \boxed{20.0\text{ g } Mg(OH)_2 \text{ left}}$$

12. Stoichiometry – Comparison of the quantities of materials produced and consumed in a chemical reaction

Stoichiometric Ratio – the mole-to-mole ratio of reactants/products in a balanced chemical equation.

Limiting Reactant – the reactant that is completely consumed when a reaction is run to completion.