Limiting Reactant Problems Answer Key

1. $ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$

$$17.2\,\text{mol ZnO} \times \frac{1\,\text{mol Zn}}{1\,\text{mol ZnO}} = 17.2\,\text{mol Zn(s)}$$

$$43.2\,\text{mol C} \times \frac{1\,\text{mol Zn}}{1\,\text{mol C}} = 43.2\,\text{mol Zn(s)}$$

Zinc oxide is the limiting reactant.

2. $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$

$$5.55\,\text{mol}\,C_6H_{12}O_6 \times \frac{6\,\text{mol CO}_2}{1\,\text{mol C}_6H_{12}O_6} = 33.3\,\text{mol CO}_2\text{(g)}$$

$$34.0\,\text{mol O}_2 \times \frac{6\,\text{mol CO}_2}{6\,\text{mol O}_2} = 34.0\,\text{mol}\,CO_2\text{(g)}$$

Glucose is the limiting reactant. This seems reasonable because oxygen is quite often in abundance.

3. $4C_3H_6(g) + 6NO(g) \rightarrow 4C_3H_3N(g) + 6H_2O(g) + N_2(g)$

$$126\,\text{g C}_3\text{H}_6 \times \frac{\text{mol}}{42.09\,\text{g}} \times \frac{4\,\text{mol C}_3\text{H}_3\text{N}}{4\,\text{mol C}_3\text{H}_6} = 2.99\,\text{mol}\,C_3H_3N\text{(g)}$$

$$175\,\text{g NO} \times \frac{\text{mol}}{30.01\,\text{g}} \times \frac{4\,\text{mol C}_3\text{H}_3\text{N}}{6\,\text{mol NO(g)}} = 3.89\,\text{mol NO(g)}$$

C_3H_6 is the limiting reactant.

4. $CaF_2(s) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HF(g)$

$$10.0\,\text{g CaF}_2 \times \frac{\text{mol}}{78.08\,\text{g}} \times \frac{1\,\text{mol CaSO}_4}{1\,\text{mol CaF}_2} = 0.128\,\text{mol CaSO}_4\text{(s)}$$

$$15.5\,\text{g}\,H_2SO_4 \times \frac{\text{mol}}{98.09\,\text{g}}\,H_2SO_4 \times \frac{1\,\text{mol}\,CaSO_4}{1\,\text{mol}\,H_2SO_4} = 0.158\,\text{mol CaSO}_4\text{(s)}$$

Calcium fluoride is the limiting reactant.

5. $Li_3N(s) + 3H_2O(\ell) \rightarrow 3LiOH(aq) + NH_3(g)$

$$4.87\,\text{g Li}_3\text{N} \times \frac{\text{mol}}{34.83\,\text{g}}\,Li_3N \times \frac{1\,\text{mol NH}_3}{1\,\text{mol Li}_3\text{N}} = 0.140\,\text{mol}\,NH_3\text{(g)}$$

$$7.74\,\text{g H}_2\text{O} \times \frac{\text{mol}}{18.02\,\text{g}}\,H_2O \times \frac{1\,\text{mol NH}_3}{3\,\text{mol H}_2\text{O}} = 0.143\,\text{mol}\,NH_3\text{(g)}$$

Lithium nitride is the limiting reactant.

Limiting Reactant Problems Answer Key (continued)

6. $2Al(s) + 3CuCl_2(aq) \rightarrow 3Cu(s) + 2AlCl_3(aq)$

$$0.25\,g\ Al \times \frac{mol}{26.98\,g} Al \times \frac{2\,mol\ AlCl_3}{2\,mol\ Al} = 9.3 \times 10^{-3}\,mol\ AlCl_3(aq)$$

$$0.51\,g\ CuCl_2 \times \frac{mol}{134.45\,g} CuCl_2 \times \frac{2\,mol\ AlCl_3}{3\,mol\,CuCl_2} = 2.5 \times 10^{-3}\,mol\ AlCl_3(aq)$$

Copper(II) chloride is limiting.

7. $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$

$$33.76\,g\ Zn \times \frac{mol}{65.41\,g} Zn \times \frac{1\,mol\ ZnCl_2}{1\,mol\ Zn} = 0.5161\,mol\ ZnCl_2(aq)$$

$$54.08\,g\ HCl \times \frac{mol}{36.46\,g} HCl \times \frac{1\,mol\ ZnCl_2}{2\,mol\ HCl} = 0.7416\,mol\ ZnCl_2(aq)$$

Hydrogen chloride is in excess. (Zinc is limiting.)

8. $ClO_2(g) + H_2O(\ell) \rightarrow HCl(aq) + HClO_3(aq)$

$$71.00\,g\ ClO_2 \times \frac{mol}{67.45\,g} ClO_2 \times \frac{1\,mol\ HCl}{1\,mol\ ClO_2} = 1.053\,mol\ HCl(aq)$$

$$19.00\,g\ H_2O \times \frac{mol}{18.02\,g} H_2O \times \frac{1\,mol\ HCl}{1\,mol\ H_2O} = 1.054\,mol\,HCl(aq)$$

Chloride dioxide is limiting.