Ch 3 Stoichiometry Problems (AP)

(1)

$.750\,g\ Al(OH)_3 \left(\frac{1\,mol\ Al(OH)_3}{78.01\,g}\right)\left(\frac{3\,HCl}{1\,Al(OH)_3}\right)\left(\frac{36.46\,g}{1\,HCl}\right) = 1.05\,g\ HCl$

$.750\,g\ Al(OH)_3 \left(\frac{1\,mol\ Al(OH)_3}{78.01\,g}\right)\left(\frac{3\,H_2O}{1\,Al(OH)_3}\right)\left(\frac{18.02\,g}{1\,H_2O}\right) = .520\,g\ H_2O$

(2) $C + O_2 \longrightarrow CO_2$

$10.0\,g\ C \left(\frac{1\,mol\ C}{12.01\,g\ C}\right)\left(\frac{1\,CO_2}{1\,C}\right)\left(\frac{44.01\,g}{1\,CO_2}\right) = 36.6\,g\ CO_2$

(3) (a) $454\,g\ Fe_2O_3 \left(\frac{1\,Fe_2O_3}{159.7\,g}\right)\left(\frac{2\,Fe}{1\,Fe_2O_3}\right)\left(\frac{55.85\,g}{1\,Fe}\right) = 318\,g\ Fe$

(b) $454\,g\ Fe_2O_3 \left(\frac{1\,Fe_2O_3}{159.7\,g}\right)\left(\frac{3\,CO}{1\,Fe_2O_3}\right)\left(\frac{28.01\,g}{1\,CO}\right) = 239\,g\ CO$

(4) (a) SO_2 = Sulfer di Oxide $CaCO_3$ = Calcium Carbonate
O_2 = Oxygen $CaSO_4$ = Calcium Sulfate
CO_2 = Carbon di oxide

(b) $155\,g\ SO_2 \left(\frac{1\,SO_2}{64.07\,g}\right)\left(\frac{2\,CaCO_3}{2\,SO_2}\right)\left(\frac{100.1\,g}{1\,CaCO_3}\right) = 242\,g\ CaCO_3$

(c) $155\,g\ SO_2 \left(\frac{1\,SO_2}{64.07\,g}\right)\left(\frac{2\,CaSO_4}{2\,SO_2}\right)\left(\frac{136.2\,g}{1\,CaSO_4}\right) = 329\,g\ CaSO_4$

(5.) $95mg\left(\frac{1g}{1000mg}\right) = .095g$ urea urea = NH_2CONH_2

$.095g\left(\frac{1\,urea}{60.06g}\right)\left(\frac{1C_6H_{14}N_4O_2}{1\,urea}\right)\left(\frac{174.2g}{1C_6H_{14}N_4O_2}\right) = .276g\ C_6H_{14}N_4O_2$

$.095g\left(\frac{1\,urea}{60.06g}\right)\left(\frac{1C_5H_{12}N_2O_2}{1\,urea}\right)\left(\frac{132.2g}{1C_5H_{12}N_2O_2}\right) = .209g\ C_5H_{12}N_2O_2$

Limiting Reactants

(6.) $CH_{4(g)} + H_2O_{(g)} \rightarrow CO_{(g)} + 3H_{2(g)}$

Limiting → $995g\ CH_4\left(\frac{1mH_2O}{16.04g}\right)\left(\frac{3H_2}{1H_2O}\right)\left(\frac{2.02g}{1mH_2}\right) = 37.6g\ H_2$ (maximum)

excess → $251.0g\ H_2O$ ($139g\ H_2O$ leftover) $\left(\frac{1mH_2O}{18.02g}\right)\left(\frac{3\,H_2}{1H_2O}\right)\left(\frac{2.02g}{1mH_2}\right) = 845g\ H_2$

(7.) $32.0g\ S_8\left(\frac{1mS_8}{256.6g}\right)\left(\frac{4S_2Cl_2}{1S_8}\right)\left(\frac{135g}{1mS_2Cl_2}\right) = 67.3g\ S_2Cl_2$ (maximum)

Limiting

$71.0g\ Cl_2\left(\frac{1mCl_2}{70.91g}\right)\left(\frac{4S_2Cl_2}{4Cl_2}\right)\left(\frac{135g}{1mS_2Cl_2}\right) = 135g\ S_2Cl_2$

excess

$67.3g\ S_2Cl_2\left(\frac{1mS_2Cl_2}{135g}\right)\left(\frac{4Cl_2}{4S_2Cl_2}\right)\left(\frac{70.91g}{1Cl_2}\right) = 35.7g$ used Cl_2

$71.0g\ Cl_2 - 35.7g$ used $= 35.7g$ left of Cl_2

(8) $100g\ C_7H_6O_3\left(\frac{1C_7H_6O_3}{138.1g}\right)\left(\frac{1C_9H_8O_4}{1C_7H_6O_3}\right)\left(\frac{180.1g}{1C_9H_8O_4}\right) = 130g\ C_9H_8O_4$ (maximum)

Limiting

$100g\ C_4H_6O_3\left(\frac{1C_4H_6O_3}{102.1g}\right)\left(\frac{1C_9H_8O_4}{1C_4H_6O_3}\right)\left(\frac{180.1g}{1C_9H_8O_4}\right) = 176g\ C_9H_8O_4$

excess

$130g\ C_9H_8O_4\left(\frac{1mC_9H_8O_4}{180.1g}\right)\left(\frac{1C_4H_6O_3}{1C_9H_8O_4}\right)\left(\frac{102.1g}{1C_4H_6O_3}\right) = 73.7g$ used

$100g - 73.7g = 26.3g\ C_4H_6O_3$ left over

Percent Yield

9) $1.203_g\ NaBH_4 \left(\frac{1\ mol\ NaBH_4}{37.84_g}\right)\left(\frac{1\ B_2H_6}{2\ NaBH_4}\right)\left(\frac{27.6_g}{1\ B_2H_6}\right) = .4398$ or $\boxed{.440_g\ B_2H_6}$ ← Theo. Yield

$\frac{.295_g\ B_2H_6\ (E.Y.)}{.440_g\ B_2H_6\ (T.Y.)} = .670 \times 100 =$

67.0% percent yield

10) $5.33_g\ SCl_2 \left(\frac{1\ SCl_2}{103.0_g}\right)\left(\frac{1\ S_2Cl_2}{3\ SCl_2}\right)\left(\frac{135_g\ S_2Cl_2}{1\ mol\ S_2Cl_2}\right) = 2.28_g\ S_2Cl_2$ ← Theo. Yield

E.Y. → $\left(\frac{1.19_g}{2.28_g}\right) \times 100 = \boxed{52.2\%}$ ← T.Y.