Pg. 365 #13ab

$$M = \frac{0.25\ mol}{0.075\ L} = 3.3M$$

$$M = \frac{1.75\ mol}{0.75\ L} = 2.3M$$

Pg. 365 #13cd

$$\frac{35.0\ g\ CH_3COONa}{} \times \frac{1\ mol\ CH_3COONa}{83.05\ g} = 0.421\ mol$$

$$M = \frac{0.421\ mol}{1.25\ L} = 0.337M$$

$$\frac{75\ g\ CuSO_4 \bullet 5H_2O}{} \times \frac{1\ mol\ CuSO_4 \bullet 5H_2O}{249.72\ g} = 0.30\ mol$$

$$M = \frac{0.30\ mol}{1.0\ L} = 0.30M$$

Pg. 365 #15

$M = \frac{n}{V}$ $\quad n = MV \quad$ $n = (1.20)(1.5) = 1.8\ mol$

$M = \frac{n}{V}$ $\quad n = MV \quad$ $n = (0.0015)(0.025) = 3.8 \times 10^{-5}\ mol$

$M = \frac{n}{V}$ $\quad n = MV \quad$ $n = (0.35)(0.125) = 0.044\ mol$

Pg. 365 #17

$$n = MV$$

$$n = (0.75)(2.5) = 1.9\ mol$$

$$\frac{1.9\ mol\ H_2SO_4}{} \times \frac{98.09\ \text{g}}{1\ mol\ H_2SO_4} = 190\ g$$

$$n = MV$$

$$n = (0.050)(0.0752) = 0.0038\ mol$$

$$\frac{0.0038\ mol\ CH_3COOH}{} \times \frac{60.06\ \text{g}}{1\ mol\ CH_3COOH} = 0.23\ g$$

$$n = MV$$

$$n = (16)(0.25) = 4.0\ mol$$

$$\frac{4.0\ mol\ HNO_3}{} \times \frac{63.02\ \text{g}}{1\ mol\ HNO_3} = 250\ g$$

Pg. 365 #19ab

$$V = \frac{n}{M}$$

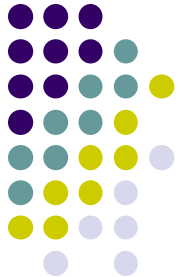
$$V = \frac{0.15\ mol}{0.750\ M} = 0.20\ L$$

$$V = \frac{n}{M}$$

$$\frac{35.5\ g\ H_3PO_4}{}\ \frac{1\ mol\ H_3PO_4}{98.00\ g} = 0.362\ mol$$

$$V = \frac{0.362\ mol}{0.750\ M} = 0.483\ L$$

Pg. 366 #27ab

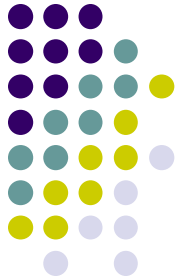


$$3\ Ca(NO_3)_2\ (aq)\ +2\ Na_3PO_4\ (aq) \longrightarrow Ca_3(PO_4)_2\ (s)\ +\ 6\ NaNO_3\ (aq)$$

$$2.7\ mol\ Na_3PO_4 \times \frac{1\ Ca_3(PO_4)_2}{2\ Na_3PO_4} = 1.4\ mol\ Ca_3(PO_4)_2$$

$$0.75\ mol\ Ca(NO_3)_2 \times \frac{6\ NaNO_3}{3\ mol\ Ca(NO_3)_2} = 1.5\ mol\ NaNO_3$$

Pg. 366 #27cd



$$3\ Ca(NO_3)_2\ (aq)\ +2\ Na_3PO_4\ (aq) \longrightarrow Ca_3(PO_4)_2\ (s)\ +\ 6\ NaNO_3\ (aq)$$

$$\frac{0.225\ mol\ Ca(NO_3)_2}{L} \times \frac{1.45\ L\ Ca(NO_3)_2}{} \times \frac{2\ Na_3PO_4}{3\ Ca(NO_3)_2} = 0.218\ mol\ Na_3PO_4$$

$$\frac{0.500\ mol\ Ca(NO_3)_2}{L} \times \frac{0.125\ L\ Ca(NO_3)_2}{} \times \frac{1\ Ca_3(PO_4)_2}{3\ Ca(NO_3)_2} \times \frac{310.3\ g}{1\ mol\ Ca_3(PO_4)_2} = 6.46\ g\ Ca_3(PO_4)_2$$

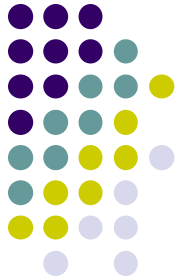
Pg. 366 #27ef

$$3\ Ca(NO_3)_2\ (aq)\ +2\ Na_3PO_4\ (aq)\longrightarrow Ca_3(PO_4)_2\ (s)\ +\ 6\ NaNO_3\ (aq)$$

$$\frac{0.50\ mol\ Ca(NO_3)_2}{L}\times\frac{0.0150\ L\ Ca(NO_3)_2}{}\times\frac{2\ Na_3PO_4}{3\ Ca(NO_3)_2}\times\frac{1\ L}{0.25\ mol\ Na_3PO_4}=0.020\ L$$

$$\frac{2.0\ mol\ Na_3PO_4}{L}\times\frac{0.0500\ L\ Na_3PO_4}{}\times\frac{3\ Ca(NO_3)_2}{2\ Na_3PO_4}\times\frac{1}{0.0500\ L\ Ca(NO_3)_2}=3.0\ M\ \ Ca(NO_3)_2$$

Pg. 366 #28ab



$$2\ NaOH\ (aq)\ +\ H_2SO_4\ (aq) \longrightarrow Na_2SO_4\ (aq)\ +\ 2\ H_2O\ (\ell)$$

$$3.6\ mol\ H_2SO_4 \times \frac{1\ Na_2SO_4}{1\ H_2SO_4} = 3.6\ mol\ Na_2SO_4$$

$$0.025\ mol\ NaOH \times \frac{2\ H_2O}{2\ NaOH} = 0.025\ mol\ H_2O$$

Pg. 366 #28c

$$2\ NaOH\ (aq)\ +\ H_2SO_4\ (aq) \longrightarrow Na_2SO_4\ (aq)\ +\ 2\ H_2O\ (\ell)$$

$$M = \frac{n}{V} \qquad 0.125 = \frac{n}{2.50} \qquad n = 0.313\ mol\ H_2SO_4$$

$$0.313\ mol\ H_2SO_4 \times \frac{2\ NaOH}{1\ H_2SO_4} = 0.626\ mol\ NaOH$$

Pg. 366 #28d

$$2\ NaOH\ (aq)\ +\ H_2SO_4\ (aq) \longrightarrow Na_2SO_4\ (aq)\ +\ 2\ H_2O\ (\ell)$$

$$M = \frac{n}{V} \qquad 0.050 = \frac{n}{0.025} \qquad n = 0.00125\ mol\ NaOH$$

$$0.00125\ mol\ NaOH \times \frac{1\ Na_2SO_4}{2\ NaOH} = 6.25\times10^{-4}\ mol\ Na_2SO_4$$

$$6.25\times10^{-4}\ mol\ Na_2SO_4 \times \frac{142.05\ g}{1\ mol\ Na_2SO_4} = 0.089\ g$$

Pg. 366 #28e

$$2\ NaOH\ (aq)\ +\ H_2SO_4\ (aq) \longrightarrow Na_2SO_4\ (aq)\ +\ 2\ H_2O\ (\ell)$$

$$M = \frac{n}{V} \qquad 0.750 = \frac{n}{0.0255} \qquad n = 0.0191\ mol\ NaOH$$

$$0.0191\ mol\ NaOH \times \frac{1\ H_2SO_4}{2\ NaOH} = 0.00955\ mol\ H_2SO_4$$

$$0.00955\ mol\ H_2SO_4 \qquad V = \frac{n}{M} = \frac{0.00955}{0.250} = 0.0382\ L$$

Pg. 366 #28f

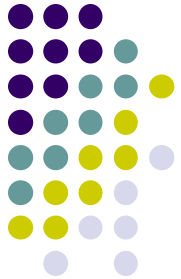
$$2\ NaOH\ (aq)\ +\ H_2SO_4\ (aq) \longrightarrow Na_2SO_4\ (aq)\ +\ 2\ H_2O\ (\ell)$$

$$M = \frac{n}{V} \qquad 0.125 = \frac{n}{0.03572} \qquad n = 0.00447\ mol\ H_2SO_4$$

$$0.00447\ mol\ H_2SO_4 \times \frac{2\ NaOH}{1\ Na_2SO_4} = 0.00893\ mol\ NaOH$$

$$0.00893\ mol\ NaOH \qquad M = \frac{n}{V} = \frac{0.00893}{0.04820} = 0.185\ M$$

Pg. 366 #29ab



$$2KMnO_4 + 16HCl \longrightarrow 2MnCl_2 + 5Cl_2 + 8H_2O + 2KCl$$

$$\frac{0.250\ mol\ HCl}{L} \times \frac{0.0150\ L\ HCl}{} \times \frac{8\ H_2O}{16\ HCl} = 0.00188\ mol\ H_2O$$

$$\frac{1.85\ mol\ MnCl_2}{} \times \frac{2\ KMnO_4}{2\ MnCl_2} \times \frac{1\ L}{0.150\ mol\ KMnO_4} = 12.3\ L$$

Pg. 366 #29cd

$$2KMnO_4 + 16HCl \longrightarrow 2MnCl_2 + 5Cl_2 + 8H_2O + 2KCl$$

$$\frac{0.525\ mol\ KCl}{L} \times \frac{0.125\ L\ KCl}{} \times \frac{16\ HCl}{2\ KCl} \times \frac{L}{2.50\ mol\ HCl} = 0.210\ L$$

$$\frac{0.250\ mol\ KMnO_4}{L} \times \frac{0.01560\ L\ KMnO_4}{} \times \frac{16\ HCl}{2\ KMnO_4} \times \frac{1}{0.02220\ L\ HCl} = 1.41\ M$$

Pg. 366 #29ef

$$2KMnO_4 + 16HCl \longrightarrow 2MnCl_2 + 5Cl_2 + 8H_2O + 2KCl$$

$$\frac{2.5\ mol\ HCl}{L} \times \frac{0.125\ L\ HCl}{} \times \frac{5\ Cl_2}{16\ HCl} \times \frac{22.414\ L}{1\ mol\ Cl_2} = 2.2\ L\ Cl_2$$

$$\frac{0.750\ mol\ HCl}{L} \times \frac{0.0150\ L\ HCl}{} \times \frac{5\ Cl_2}{16\ HCl} \times \frac{22.414\ L}{1\ mol\ Cl_2} = *0.0788\ L\ Cl_2\ *$$

$$\frac{0.550\ mol\ KMnO_4}{L} \times \frac{0.0120\ L\ KMnO_4}{} \times \frac{5\ Cl_2}{2\ KMnO_4} \times \frac{22.414\ L}{1\ mol\ Cl_2} = 0.370\ L\ Cl_2$$

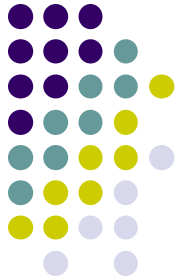
Pg. 366 #30a

$$K_2CO_3\ (aq)\ +\ 2\ CH_3COOH\ (aq) \longrightarrow 2\ CH_3COOK\ (aq)\ +\ H_2O\ (\ell) + CO_2\ (g)$$

$$M = \frac{n}{V} \qquad 0.150 = \frac{n}{0.0250} \qquad n = 0.00375\ mol\ CH_3COOH$$

$$0.00375\ mol\ CH_3COOH \times \frac{1\ H_2O}{2\ CH_3COOH} = 0.00188\ mol\ H_2O$$

Pg. 366 #30b



$$K_2CO_3\ (aq)\ +\ 2\ CH_3COOH\ (aq) \longrightarrow 2\ CH_3COOK\ (aq)\ +\ H_2O\ (\ell) + CO_2\ (g)$$

$$17.5\ mol\ CH_3COOK \times \frac{1\ K_2CO_3}{2\ CH_3COOK} = 8.75\ mol\ K_2CO_3$$

$$M = \frac{n}{V} \qquad 0.210 = \frac{8.75}{V} \qquad V = 41.6\ L\ K_2CO_3$$

Pg. 366 #30c

$$K_2CO_3\ (aq)\ +\ 2\ CH_3COOH\ (aq) \longrightarrow 2\ CH_3COOK\ (aq)\ +\ H_2O\ (\ell) + CO_2\ (g)$$

$$M = \frac{n}{V} \qquad 0.750 = \frac{n}{0.0752} \qquad n = 0.0564\ mol\ K_2CO_3$$

$$0.0564\ mol\ K_2CO_3 \times \frac{2\ CH_3COOH}{1\ K_2CO_3} = 0.113\ mol\ CH_3COOH$$

$$M = \frac{n}{V} \qquad 1.25 = \frac{0.113}{V} \qquad V = 0.0904\ L\ CH_3COOH$$

Pg. 366 #30d

$$K_2CO_3\ (aq)\ +\ 2\ CH_3COOH\ (aq) \longrightarrow 2\ CH_3COOK\ (aq)\ +\ H_2O\ (\ell) + CO_2\ (g)$$

$$M = \frac{n}{V} \qquad 0.250 = \frac{n}{0.01850} \qquad n = 0.00463\ mol\ K_2CO_3$$

$$0.00463\ mol\ K_2CO_3 \times \frac{2\ CH_3COOH}{1\ K_2CO_3} = 0.00926\ mol\ CH_3COOH$$

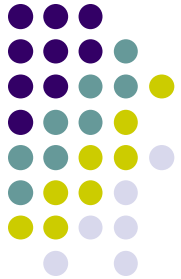
$$\frac{0.250\ M\ CH_3COOH}{L} \times \frac{0.01850\ L}{1} \times \frac{2\ CH_3COOH}{1\ K_2CO_3} \times \frac{1}{0.01015\ L} = 0.911\ M$$

Pg. 366 #30e

$$K_2CO_3\ (aq)\ +\ 2\ CH_3COOH\ (aq) \longrightarrow 2\ CH_3COOK\ (aq)\ +\ H_2O\ (\ell) + CO_2\ (g)$$

$$\frac{1.5\ M\ \ CH_3COOH}{L} \times \frac{0.105\ L}{1} \times \frac{1\ CO_2}{2\ CH_3COOH} \times \frac{22.414\ L}{1\ mol\ \ CO_2} = 1.8\ L$$

Pg. 366 #30f



$$K_2CO_3\ (aq)\ +\ 2\ CH_3COOH\ (aq) \longrightarrow 2\ CH_3COOK\ (aq)\ +\ H_2O\ (\ell) + CO_2\ (g)$$

limiting reactant:

$$\frac{0.350\ M\ K_2CO_3}{L} \times \frac{0.0250\ L}{1} \times \frac{1\ CO_2}{1\ K_2CO_3} \times \frac{22.414\ L}{1\ mol\ CO_2} = 0.196\ \text{L}$$

$$\frac{0.250\ M\ CH_3COOH}{L} \times \frac{0.0250\ L}{1} \times \frac{1\ CO_2}{2\ CH_3COOH} \times \frac{22.414\ L}{1\ mol\ CO_2} = *0.0700\ \text{L}*$$

Pg. 367 #58

$$Mg\ (s)\ +\ 2\ HCl\ (aq) \longrightarrow MgCl_2\ (aq)\ +\ H_2\ (g)$$

$$0.2000 L\ HCl \times \frac{3.00\ M\ \ HCl}{L} \times \frac{1\ mol\ H_2}{2\ mol\ HCl} = 0.300\ mol\ H_2$$

$$PV = nRT \qquad V = \frac{nRT}{P} = \frac{(0.300\ mol)(0.0821)(300.15\ K)}{(\frac{720\ torr}{760\ torr})}$$

$$= 7.80\ L$$