Unit 5 Problem Set

1) $\frac{25.2\ g\ Na_2SO_4 \times \frac{mol}{142\ g}}{1.6\ L} = 0.11\ M$

2) $\frac{0.400\ g\ NaCl \times \frac{mol}{58.44\ g}}{0.1\ L} = 0.0684\ M$

3) Information needed

$\frac{10.0\ g\ C_2H_5OH}{100\ g\ solution}$

$10.0\ g\ C_2H_5OH \times \frac{mol}{46.06\ g} = 0.2171\ mol$

$100\ g\ soln. \times \frac{mL}{0.982\ g} \times \frac{1\ L}{1000\ mL} = 0.1018\ L$

$\frac{0.2171\ mol}{0.1018\ L} = 2.13\ M$

4) $\frac{x\ g\ H_2SO_4}{100\ g\ soln} \times 100\%$ is what we want to solve.

$18.3M\ H_2SO_4 \rightarrow \frac{18.3\ mol\ H_2SO_4}{1\ L\ soln.} \times \frac{1\ mL}{1.83\ g} \times \frac{1\ L}{1000\ mL} = \frac{1\ mol\ H_2SO_4}{100\ g\ soln.}$

$\frac{1\ mol\ H_2SO_4}{100\ g\ soln.} \times \frac{98.09\ g\ H_2SO_4}{1\ mol} \times 100\% = 98.09\%\ H_2SO_4$

5) a. $1.5 \times 10^{21}\ L \times \frac{4.0 \times 10^{-12}\ g\ Au}{mL} \times \frac{1000\ mL}{L} = 6.0 \times 10^{12}\ g\ Au$

b. The concentration of Au ($2.0 \times 10^{-11}\ M$) is too low and it would be too difficult and expensive to isolate it.

6) $0.035\ L \times 1.5\ mol\ KNO_3 \times \frac{101.1\ g}{mol} = 5.30775\ g\ KNO_3$

$\frac{5.3078\ g\ KNO_3}{X} \times 100\% = 96.3\%\ KNO_3$

7) $\frac{0.895 \times 5.42\ g\ NiCl_2 \times \frac{mol\ NiCl_2}{129.6\ g}}{0.25\ L} = 0.150M\ NiCl_2$

8) $M_1V_1 = M_2V_2$

$(1.20\,M)(V_1) = (0.150\,M)(500\,mL)$

$= 62.5\,mL$

9) $M_1V_1 = M_2V_2$

$(0.250\,M)(15.00\,mL) = M_2(500.0\,mL)$

$M_2 = 7.5 \times 10^{-3}\,M$

10) $$\frac{(0.03\,L \times 0.66\,\frac{mol}{L}) + (0.04\,L \times 0.54\,\frac{mol}{L})}{0.070\,L}$$

$$\frac{0.0198\,mol + 0.0216\,mol}{0.070\,L} = 0.59\,M$$

1 mol H_2SO_4 : 2 mol KOH

11) $$50.0\,\cancel{mL}\,KOH \times \frac{1\,\cancel{L}}{1000\,\cancel{mL}} \times \frac{0.754\,\cancel{mol\,KOH}}{\cancel{L}} \times \frac{1\,\cancel{mol}\,H_2SO_4}{2\,\cancel{mol\,KOH}} \times \frac{L\,H_2SO_4}{0.467\,\cancel{mol}} = 0.0404\,L$$

$\downarrow$

$40.4\,mL$

12) $3CaCl_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6HCl$

2 mol H_3PO_4 : 3 mol $CaCl_2$: 3 mol Ca^{2+}

$$0.010\,\cancel{L}\,CaCl_2 \times \frac{0.16\,\cancel{mol}\,CaCl_2}{\cancel{L}} \times \frac{2\,\cancel{mol}\,H_3PO_4}{3\,\cancel{mol}\,CaCl_2} \times \frac{L\,H_3PO_4}{0.42\,\cancel{mol}} = 0.0025\,L$$

$2.5\,mL$ of $0.42\,M$ H_3PO_4

13) $2HCl(aq) + Ca(OH)_2(s) \rightarrow CaCl_2(aq) + 2H_2O(l)$

2 mol HCl : 1 mol $Ca(OH)_2$

$$\frac{2.86\,g\,Ca(OH)_2 \times \frac{1\,mol\,Ca(OH)_2}{74.1\,g} \times \frac{2\,mol\,HCl}{1\,mol\,Ca(OH)_2}}{0.0296\,L} = 2.61\,M\,HCl$$

14) $3LiOH + H_3AsO_4 \rightarrow 3H_2O + Li_3AsO_4$

3 mol LiOH : 1 mol H_3AsO_4

$$\frac{0.065\,L\,LiOH \times \frac{0.250\,mol\,LiOH}{L} \times \frac{1\,mol\,H_3AsO_4}{3\,mol\,LiOH}}{0.035\,L} = 0.155\,M\,H_3AsO_4$$

15) a. nitrous acid
b. perchloric acid
c. hydrocyanic acid
d. calcium chloride hexahydrate
e. Sulfuric acid
f. bromic acid
g. hydroiodic acid
h. hydrogen sulfide
i. Ammonia
j. carbon monoxide
k. hypoiodous acid
l. barium chlorite

16) a. H_2SO_3
b. $Al_2(SO_4)_3 \cdot 4H_2O$
c. H_2Se
d. H_2CO_3
e. HBr
f. $Mg(ClO_3)_2$
g. $SiCl_4$
h. H_3AsO_4
i. H_3PO_4
j. K_2HPO_4

17) $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

☑ Balanced

1 mol $AgNO_3$: 1 mol $NaCl$

$0.00997\,\text{L}_{NaCl} \times \frac{0.752\ \text{mol NaCl}}{1\ \text{L}} = 0.007497\ \text{mol NaCl}$

$0.007497\ \text{mol NaCl} \times \frac{1\ \text{mol}\ AgNO_3}{1\ \text{mol NaCl}} \times \frac{169.9\ \text{g}\ AgNO_3}{\text{mol}} = 1.273\ \text{g}\ AgNO_3$

$\frac{1.273\ \text{g}\ AgNO_3}{1.356\ \text{g}} \times 100\% = 93.9\%\ AgNO_3$