1. (6 Pts) Complete and balance each of the following:
   a. $3\text{HCl}(aq) + \text{Al(OH)}_3(aq) \rightarrow 3\text{H}_2\text{O} + \text{AlCl}_3$
   b. $\text{Na}_2\text{CO}_3(aq) + 2\text{HCl}(aq) \rightarrow \text{H}_2\text{CO}_3 + 2\text{NaCl}$

2. (3 Pts) What volume of 12.6 M HCl must be added to enough water to prepare 5.00 liters of 3.00 M HCl?
   \[ M_1 V_1 = M_2 V_2 \]
   \[ (12.6 \text{ M})(V_1) = (3.00 \text{ M})(5.00 \text{ L}) \]
   \[ V_1 = 1.19 \text{ L} \]

3. (4 Pts) How many grams of Ca(OH)$_2$ are contained in 1500 mL of 0.0250 M Ca(OH)$_2$ solution?
   \[ 1500 \text{ mL} \quad 0.0250 \text{ mol Ca(OH)}_2 \quad 0.00740965 \text{ g Ca(OH)}_2 \]

4. (4 Pts) What is the molarity of 600 mL of solution containing 6.72 grams of sulfuric acid?
   \[ 600 \times 10^{-3} \text{ L} \quad \frac{6.72 \text{ g}}{98.0869 \text{ g/mol}} = 0.114 \text{ mol H}_2\text{SO}_4 \]

5. (8 Pts) If 20.0 mL of 0.010 M H$_3$PO$_4$ solution is completely neutralized by 60.0 mL of Ca(OH)$_2$ solution, what is the molarity of the Ca(OH)$_2$ solution? (Hint: start with a balanced chemical equation)
   \[ 2\text{H}_3\text{PO}_4(aq) + 3\text{Ca(OH)}_2(s) \rightarrow 6\text{H}_2\text{O(l)} + \text{Ca}_3(\text{PO}_4)_2 \]
   \[ 20.0 \text{ mL} \quad 0.010 \text{ mol} \]
   \[ 60.0 \text{ mL} \quad \frac{? \text{ mol}}{? \text{ L}} \]
   \[ 60.0 \times 10^{-3} \text{ L} \quad \text{Ca(OH)}_2 \]
   \[ 20.0 \times 10^{-3} \text{ L} \quad \text{H}_3\text{PO}_4 \]
   \[ 0.010 \text{ mol} \quad \text{H}_3\text{PO}_4 \quad 3 \text{ mol/L Ca(OH)}_2 \quad = 0.0050 \text{ mol/L Ca(OH)}_2 \]
1. (6 Pts) Complete and balance each of the following:
   a. $3 \text{HBr(aq)} + ____ \text{Al(OH)}_3(\text{aq}) \rightarrow 3 \text{H}_2\text{O} + \text{AlBr}_3$
   b. $2 \text{HCl(aq)} + _____ \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow 2\text{NaCl} + \text{H}_2\text{CO}_3 \rightarrow 2\text{H}_2\text{O} + \text{CO}_2(\text{g})$

2. (3 Pts) What volume of 11.6 M HCl must be added to enough water to prepare 6.00 liters of 5.00 M HCl?

\[ V_1 = \frac{M_1 V_1}{M_2} = \frac{(11.6 \text{ M})(1.00 \text{ L})}{(5.00 \text{ M})} = 2.58 \text{ L} \]

3. (4 Pts) How many grams of Ca(OH)$_2$ are contained in 1800 mL of 0.0350 M Ca(OH)$_2$ solution?

\[ 1800 \text{ mL} \times 0.0350 \text{ mol Ca(OH)}_2 = 74.096 \text{ g Ca(OH)}_2 \]

4. (4 Pts) What is the molarity of 700 mL of solution containing 9.72 grams of sulfuric acid?

\[ \frac{9.72 \text{ g}}{98.08 \text{ g/mol}} = 0.1416 \text{ mol/L} \]

5. (8 Pts) If 30.0 mL of 0.010 M $\text{H}_3\text{PO}_4$ solution is completely neutralized by 70.0 mL of Ba(OH)$_2$ solution, what is the molarity of the Ba(OH)$_2$ solution? (Hint: start with a balanced chemical equation)

\[ 2\text{H}_3\text{PO}_4(\text{aq}) + 3\text{Ba(OH)}_2(\text{aq}) \rightarrow 6\text{H}_2\text{O} + \text{Ba}_3(\text{PO}_4)_2(\text{s}) \]

\[ \frac{30.0 \text{ mL}}{0.010 \text{ mol}} \]

\[ \frac{70.0 \text{ mL}}{2 \text{ mol}} \]

\[ \frac{0.00642 \text{ mol}}{1 \text{ L}} \]

\[ \frac{3 \text{ mol}}{1 \text{ L}} \]

\[ \frac{1500 \text{ mL}}{1 \text{ L}} \]

\[ \frac{2 \text{ mol}}{1 \text{ L}} \]

\[ \frac{1 \text{ L}}{8 \text{ mol}} \]