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### Unit 5 Problem Set

$$1) \frac{25.2 \text{ g Na}_2\text{SO}_4 \times \frac{\text{mol}}{142 \text{ g}}}{1.6 \text{ L}} = 0.11 \text{ M}$$

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

3) Information needed

$$\frac{10.0 \text{ g C}_2\text{H}_5\text{OH}}{100 \text{ g solution}}$$

$$10.0 \text{ g C}_2\text{H}_5\text{OH} \times \frac{\text{mol}}{46.06 \text{ g}} = 0.2171 \text{ mol}$$

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

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

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$c_1 V_1 = c_2 V_2$  (8)  
②

4)  $\frac{x \text{ g H}_2\text{SO}_4}{100 \text{ g soln}} \times 100\%$  is what we want to solve.

$18.3 \text{ M H}_2\text{SO}_4 \rightarrow \frac{18.3 \text{ mol H}_2\text{SO}_4}{1 \text{ L soln.}} \times \frac{1 \text{ mL}}{1000 \text{ mL}} \times \frac{1 \text{ L}}{1 \text{ L}} = \frac{1 \text{ mol H}_2\text{SO}_4}{100 \text{ g soln.}}$

$\frac{1 \text{ mol H}_2\text{SO}_4}{100 \text{ g soln.}} \times \frac{98.09 \text{ g H}_2\text{SO}_4}{1 \text{ mol}} \times 100\% = 98.09\% \text{ H}_2\text{SO}_4$

5) a.  $1.5 \times 10^{21} \text{ L} \times \frac{4.0 \times 10^{-12} \text{ g Au}}{1 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 6.0 \times 10^{12} \text{ g Au}$

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

6)  $0.035 \text{ L} \times \frac{1.5 \text{ mol KNO}_3}{1 \text{ L}} \times \frac{101.1 \text{ g}}{1 \text{ mol}} = 5.30775 \text{ g KNO}_3$   
 $\frac{5.3078 \text{ g KNO}_3}{5.7 \text{ g}} \times 100\% = 96.3\% \text{ KNO}_3$

7)  $0.895 \times \frac{5.42 \text{ g NiCl}_2}{129.6 \text{ g}} = 0.150 \text{ M NiCl}_2$   
 $\frac{0.150 \text{ M}}{0.25 \text{ L}} \times 0.25 \text{ L} = 0.0375 \text{ mol}$

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$$8) M_1 V_1 = M_2 V_2$$

$$(1.20 M)(V_1) = (0.150 M)(500 \text{ mL})$$

$$= 62.5 \text{ mL}$$

$$9) M_1 V_1 = M_2 V_2$$

$$(0.250 M)(15.00 \text{ mL}) = M_2(500.0 \text{ mL})$$

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

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

$$0.0198 \text{ mol} + 0.0216 \text{ mol} = 0.59 \text{ M}$$

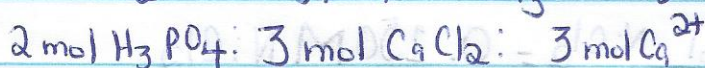
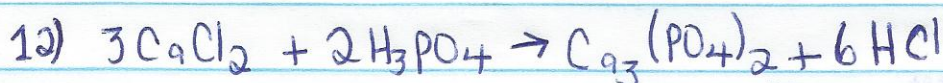
$$0.070 \text{ L}$$



$$11) 50.0 \text{ mL KOH} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.754 \text{ mol KOH}}{\text{L}} \times \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol KOH}} \times \frac{1 \text{ L H}_2\text{SO}_4}{0.467 \text{ mol}} = 0.0404 \text{ L}$$

$$\downarrow$$

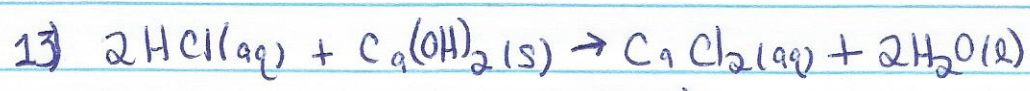
$$40.4 \text{ mL}$$



$$0.010 \text{ L CaCl}_2 \times \frac{0.16 \text{ mol CaCl}_2}{\text{L}} \times \frac{2 \text{ mol H}_3\text{PO}_4}{3 \text{ mol CaCl}_2} \times \frac{1 \text{ L H}_3\text{PO}_4}{0.42 \text{ mol}} = 0.0025 \text{ L}$$

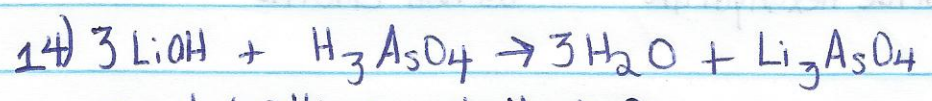
$$\downarrow$$

$$2.5 \text{ mL of } 0.42 \text{ M H}_3\text{PO}_4$$



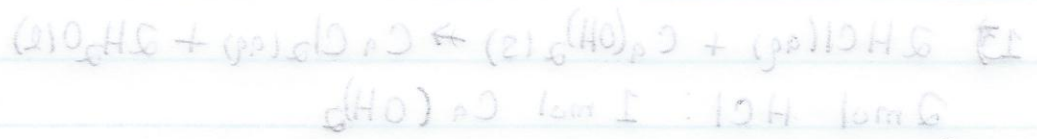
2 mol HCl : 1 mol  $\text{Ca}(\text{OH})_2$

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



3 mol LiOH : 1 mol  $\text{H}_3\text{AsO}_4$

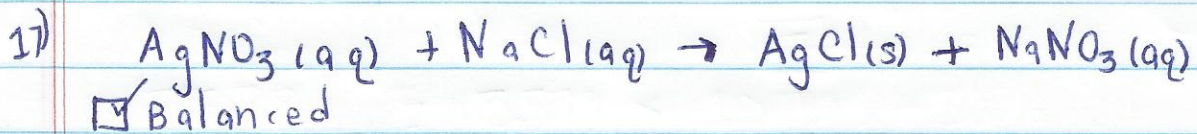
$$\frac{0.065\text{L} \times \frac{0.25\text{ mol LiOH}}{\text{L}} \times \frac{1\text{ mol H}_3\text{AsO}_4}{3\text{ mol LiOH}}}{0.035\text{L}} = 0.155\text{M H}_3\text{AsO}_4$$



(5)

- 15) a. Nitrous acid -  $\text{HNO}_2$   
 b. perchloric acid -  $\text{HClO}_4$   
 c. hydrocyanic acid -  $\text{HCN}$   
 d. calcium chloride hexahydrate -  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$   
 e. Sulfuric acid -  $\text{H}_2\text{SO}_4$   
 f. bromic acid -  $\text{HBrO}_3$   
 g. hydroiodic acid -  $\text{HI}$   
 h. hydrogen sulfide -  $\text{H}_2\text{S}$
- i. Ammonia -  $\text{NH}_3$   
 j. carbon monoxide -  $\text{CO}$   
 k. hypiodous acid -  $\text{HOI}$   
 l. barium chlorite -  $\text{BaClO}_2$

- 16) a.  $\text{H}_2\text{SO}_3$   
 b.  $\text{Al}_2(\text{SO}_4)_3 \cdot 4\text{H}_2\text{O}$   
 c.  $\text{H}_2\text{Se}$   
 d.  $\text{H}_2\text{CO}_3$   
 e.  $\text{HBr}$   
 f.  $\text{Mg}(\text{ClO}_3)_2$   
 g.  $\text{SiCl}_4$   
 h.  $\text{H}_3\text{AsO}_4$   
 i.  $\text{H}_3\text{PO}_4$   
 j.  $\text{K}_2\text{HPO}_4$



1 mol  $\text{AgNO}_3$  : 1 mol  $\text{NaCl}$

$$0.00997 \text{ mol NaCl} \times 0.752 \text{ mol NaCl} = 0.007497 \text{ mol NaCl}$$

$$0.007497 \text{ mol NaCl} \times \frac{1 \text{ mol AgNO}_3}{1 \text{ mol NaCl}} \times \frac{169.9 \text{ g AgNO}_3}{1 \text{ mol}} = 1.273 \text{ g AgNO}_3$$

$$\frac{1.273 \text{ g AgNO}_3}{1.356 \text{ g}} \times 100\% = 93.9\% \text{ AgNO}_3$$