

CHEM 120
Fall 2009
Quiz 5

Name: _____

1. (15 Points) Fill in the blanks. If a compound is soluble in water, write "Y" in the Solubility column, but if it is not soluble write "N". Note that the presence of waters of hydration does not affect the compound's solubility.

Name	Chemical Formula	Solubility
copper(II) phosphate	$\text{Cu}_3(\text{PO}_4)_2$	N
manganese(IV) oxide	MnO_2	N
boron trifluoride	BF_3	-----
lithium carbonate	Li_2CO_3	Y
potassium cyanide	KCN	Y
mercury(I) chloride	Hg_2Cl_2	N
antimony triiodide	SbI_3	-----
silver(I) acetate	$\text{AgC}_2\text{H}_3\text{O}_2$	N

2. (9 Points) How much calcium chloride dihydrate, in grams, is needed to prepare a 250.0-ml solution where the $[\text{Cl}^-]$ is 0.125 M? The molar mass of calcium chloride dihydrate is 147.02 g/mole.

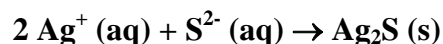
Determine the amount of the calcium compound needed using the volume and the concentration of the solution. Note that calcium chloride dihydrate ($\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$) has two Cl per formula unit.

$$250.0 \times 10^{-3} \text{ L} \left(\frac{0.125 \text{ mole Cl}^-}{1 \text{ L}} \right) \left(\frac{1 \text{ mole CaCl}_2 \cdot 2\text{H}_2\text{O}}{2 \text{ mole Cl}^-} \right) \left(\frac{147.02 \text{ g CaCl}_2 \cdot 2\text{H}_2\text{O}}{1 \text{ mole CaCl}_2 \cdot 2\text{H}_2\text{O}} \right) = 2.30 \text{ g CaCl}_2 \cdot 2\text{H}_2\text{O}$$

To prepare this solution one needs 2.30 g $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$.

3. Consider the balanced chemical equation: $2 \text{AgNO}_3 (\text{aq}) + \text{Na}_2\text{S} (\text{aq}) \rightarrow \text{Ag}_2\text{S} (\text{s}) + 2 \text{NaNO}_3 (\text{aq})$.

a. (3 Points) Write the net ionic equation for this chemical reaction.



b. (10 Points) What volume of a 0.100 M Na_2S solution, in ml, is required to exactly react with 27.85 ml of a 0.163 M AgNO_3 solution?

Determine the volume of the Na_2S solution from the stoichiometry of the reaction and the volume and concentration of the AgNO_3 solution.

$$27.85 \times 10^{-3} \text{ L} \left(\frac{0.163 \text{ mole AgNO}_3}{1 \text{ L}} \right) \left(\frac{1 \text{ mole Na}_2\text{S}}{2 \text{ mole AgNO}_3} \right) \left(\frac{1 \text{ L}}{0.100 \text{ mole Na}_2\text{S}} \right) \left(\frac{1000 \text{ ml}}{1 \text{ L}} \right) = 22.7 \text{ ml Na}_2\text{S solution}$$

One needs 22.7 ml of a 0.100 M Na_2S solution to completely react with 27.85 ml of a 0.163 M AgNO_3 solution.

c. (10 Points) If the reaction described in part *b* actually gives 0.556 g of Ag_2S , what is the percent yield for the reaction? The molar mass of Ag_2S is 247.805 g/mole.

First determine the amount of Ag_2S formed in the reaction.

$$27.85 \times 10^{-3} \text{ L} \left(\frac{0.163 \text{ mole AgNO}_3}{1 \text{ L}} \right) \left(\frac{1 \text{ mole Ag}_2\text{S}}{2 \text{ mole AgNO}_3} \right) \left(\frac{247.805 \text{ g Ag}_2\text{S}}{1 \text{ mole Ag}_2\text{S}} \right) = 0.562_4 \text{ g Ag}_2\text{S}$$

Now determine the % yield.

$$\% \text{ yield} = \frac{\text{actual amount}}{\text{theoretical amount}} \times 100 = \frac{0.556 \text{ g}}{0.562_4 \text{ g}} \times 100 = 99\%$$

This reaction goes in 99% yield.

Note: another place where one sometimes sees % yield written with all its significant figures is when the yield is greater than about 99%. In this case, one could write the % yield as 98.9%.