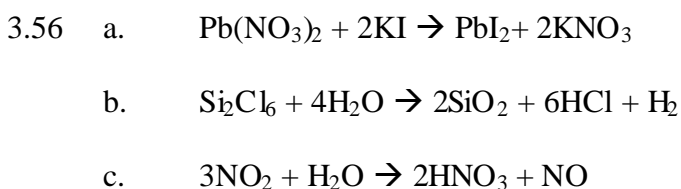
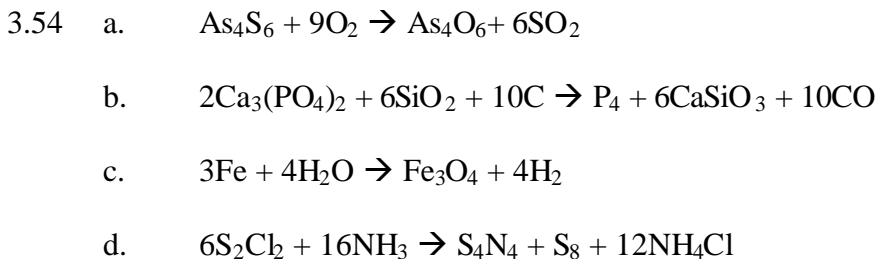
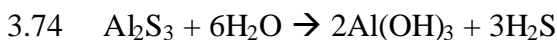


Chemistry 1035 – Spring 2004
Homework #4



$$174\text{g Ag}_2\text{S} \times \frac{1 \text{ mole Ag}_2\text{S}}{247.87\text{g Ag}_2\text{S}} \times \frac{2 \text{ mole AgCl}}{1 \text{ mole Ag}_2\text{S}} \times \frac{143.35\text{g AgCl}}{1 \text{ mole AgCl}} = 201.3\text{g AgCl}$$

$$174\text{g Ag}_2\text{S} \times \frac{1 \text{ mole Ag}_2\text{S}}{247.87\text{g Ag}_2\text{S}} \times \frac{1 \text{ mole H}_2\text{S}}{1 \text{ mole Ag}_2\text{S}} \times \frac{34.08\text{g H}_2\text{S}}{1 \text{ mole H}_2\text{S}} = 23.92\text{g H}_2\text{S}$$



$$158\text{g Al}_2\text{S}_3 \times \frac{1 \text{ mole Al}_2\text{S}_3}{150.17\text{g Al}_2\text{S}_3} \times \frac{3 \text{ mole H}_2\text{S}}{1 \text{ mole Al}_2\text{S}_3} = 3.156 \text{ mole H}_2\text{S}$$

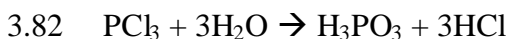
$$131\text{g H}_2\text{O} \times \frac{1 \text{ mole H}_2\text{O}}{18.02\text{g H}_2\text{O}} \times \frac{3 \text{ mole H}_2\text{S}}{6 \text{ mole H}_2\text{O}} = 3.635 \text{ mole H}_2\text{S}$$

Therefore, the Al_2S_3 produces the smaller amount of H_2S – so it is the limiting reagent, and only 3.156 moles of H_2S will be produced. This corresponds to 34.09 gm H_2S .

The amount of H₂O that remains unreacted is determined by first calculating how much of the water reacts with the 158 grams Al₂S₃:

$$158g \text{ Al}_2\text{S}_3 \times \frac{1 \text{ mole Al}_2\text{S}_3}{150.17g \text{ Al}_2\text{S}_3} \times \frac{6 \text{ mole H}_2\text{O}}{1 \text{ mole Al}_2\text{S}_3} \times \frac{18.02g \text{ H}_2\text{O}}{1 \text{ mole H}_2\text{O}} = 113.76g \text{ H}_2\text{O}$$

The unreacted water is: 131 – 113.76 = 17.24 (properly expressed as 17 with the correct number of significant figures).



Theoretical Yield:

$$200g \text{ PCl}_3 \times \frac{1 \text{ mole PCl}_3}{137.32g \text{ PCl}_3} \times \frac{3 \text{ mole HCl}}{1 \text{ mole PCl}_3} \times \frac{36.46g \text{ HCl}}{1 \text{ mole HCl}} = 159.31g \text{ HCl}$$

$$\text{Percentage Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} = \frac{128}{159.31} \times 100\% = 80.3\%$$

3.95 a.
$$\frac{46.0g \text{ AgNO}_3 \times \frac{1 \text{ mole AgNO}_3}{169.91g \text{ AgNO}_3}}{335mL \times \frac{1L}{1000mL}} = 0.808M$$

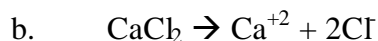
b.

$$57.0g \text{ MnSO}_4 \times \frac{1 \text{ mole MnSO}_4}{151.01g \text{ MnSO}_4} \times \frac{1L \text{ solution}}{0.385 \text{ moles MnSO}_4} = 0.980L \text{ solution}$$

c.

$$1.68mmol \text{ ATP} \times \frac{1 \text{ mole ATP}}{1000mmol \text{ ATP}} \times \frac{1L}{6.44 \times 10^{-2} \text{ mole ATP}} \times \frac{1000ml}{1L} = 26.1mL$$

3.97 a.
$$750mL \times \frac{1L}{1000mL} \times \frac{0.8543 \text{ mole Cu(NO}_3)_2}{1L \text{ solution}} \times \frac{1L \text{ solution}}{2.050 \text{ mole Cu(NO}_3)_2} = 0.312L$$



$$350.0mL \times \frac{1L}{1000mL} \times \frac{2.66 \times 10^{-2} \text{ mole Cl}^-}{1L \text{ solution}} \times \frac{1 \text{ mole CaCl}_2}{2 \text{ mole Cl}^-} \times \frac{1L \text{ solution}}{1.03 \text{ mole CaCl}_2} = 0.00452L$$

$$c. \quad 18.0\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{0.155\text{mole Li}_2\text{CO}_3}{1\text{L solution}} \times \frac{1\text{L solution}}{0.0700\text{mole Li}_2\text{CO}_3} = 0.0399\text{L}$$

3.101

$$38.74\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{0.275\text{mole NaOH}}{1\text{L solution}} \times \frac{1\text{mole NaH}_2\text{PO}_4}{2\text{mole NaOH}} \times \frac{119.98\text{gm NaH}_2\text{PO}_4}{1\text{mole NaH}_2\text{PO}_4} = 0.639\text{gNaH}_2\text{PO}_4$$

- 4.5 a. Figure (2) represents CaCl_2
 b. Figure (3) represents Li_2SO_4
 c. Figure (1) represents NH_4Br

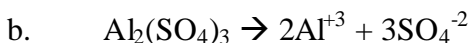


$$3.8\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{1.88\text{mole MgCl}_2}{1\text{L}} \times \frac{1\text{mole Mg}^{+2}}{1\text{mole MgCl}_2} = 0.00714\text{mole Mg}^{+2}$$

$$3.8\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{1.88\text{mole MgCl}_2}{1\text{L}} \times \frac{2\text{mole Cl}^-}{1\text{mole MgCl}_2} = 0.0143\text{mole Cl}^-$$

$$0.00714\text{mole Mg}^{+2} \times \frac{6.022 \times 10^{23} \text{ ions Mg}^{+2}}{\text{mole Mg}^{+2}} = 4.30 \times 10^{21} \text{ ions Mg}^{+2}$$

$$0.0143\text{mole Cl}^- \times \frac{6.022 \times 10^{23} \text{ ions Cl}^-}{\text{mole Cl}^-} = 8.60 \times 10^{21} \text{ ions Cl}^-$$

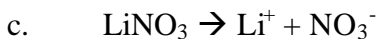


$$345\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{4.22\text{g Al}_2(\text{SO}_4)_3}{1\text{L}} \times \frac{1\text{mole Al}_2(\text{SO}_4)_3}{342.17\text{g Al}_2(\text{SO}_4)_3} \times \frac{2\text{mole Al}^{+3}}{1\text{mole Al}_2(\text{SO}_4)_3} = 0.00851\text{mole Al}^{+3}$$

$$345\text{mL} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{4.22\text{g Al}_2(\text{SO}_4)_3}{1\text{L}} \times \frac{1\text{mole Al}_2(\text{SO}_4)_3}{342.17\text{g Al}_2(\text{SO}_4)_3} \times \frac{3\text{mole SO}_4^{-2}}{1\text{mole Al}_2(\text{SO}_4)_3} = 0.0128\text{mole SO}_4^{-2}$$

$$0.00851\text{mole Al}^{+3} \times \frac{6.022 \times 10^{23} \text{ ions Al}^{+3}}{\text{mole Al}^{+3}} = 5.12 \times 10^{21} \text{ ions Al}^{+3}$$

$$0.0128\text{mole SO}_4^{-2} \times \frac{6.022 \times 10^{23} \text{ ions SO}_4^{-2}}{\text{mole SO}_4^{-2}} = 7.71 \times 10^{21} \text{ ions SO}_4^{-2}$$



$$6.63 \times 10^{21} \text{ units of LiNO}_3 \times \frac{1 \text{ Li}^+}{1 \text{ unit LiNO}_3} = 6.63 \times 10^{21} \text{ ions Li}^+$$

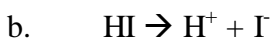
$$6.63 \times 10^{21} \text{ units of LiNO}_3 \times \frac{1 \text{ NO}_3^-}{1 \text{ unit LiNO}_3} = 6.63 \times 10^{21} \text{ ions NO}_3^-$$

$$6.63 \times 10^{21} \text{ Li}^+ \times \frac{1 \text{ mole Li}^+}{6.022 \times 10^{23} \text{ ions Li}^+} = 0.0110 \text{ moles Li}^+$$

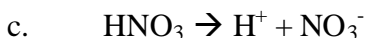
$$6.63 \times 10^{21} \text{ NO}_3^- \times \frac{1 \text{ mole NO}_3^-}{6.022 \times 10^{23} \text{ ions NO}_3^-} = 0.0110 \text{ moles NO}_3^-$$



$$1.4 \text{ L} \times \frac{0.48 \text{ mole HBr}}{1 \text{ L HBr}} \times \frac{1 \text{ mole H}^+}{1 \text{ mole HBr}} = 0.672 \text{ mole H}^+$$



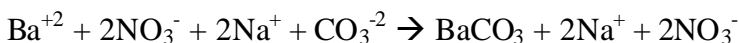
$$47 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1.8 \text{ mole HI}}{1 \text{ L HI}} \times \frac{1 \text{ mole H}^+}{1 \text{ mole HI}} = 0.0846 \text{ mole H}^+$$



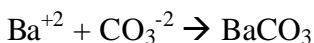
$$425 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.27 \text{ mole HNO}_3}{1 \text{ L HNO}_3} \times \frac{1 \text{ mole H}^+}{1 \text{ mole HNO}_3} = 0.115 \text{ mole H}^+$$



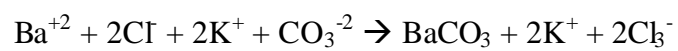
Total ion reaction:



Removing the spectator ions (Na^+ and NO_3^-) give us the total ion reaction:



Because the spectator ions do not directly participate in the net ion reaction, it doesn't really matter what the spectator ions in the reaction are. We could easily have K^+ and Cl^- as the spectator ions, and we would still have the same net ion reaction. Let's rewrite the total ion reaction using K^+ and Cl^- as the spectator ions:



And now rewrite this total ion reaction in terms of the molecular formula reaction equation:

