Chem 130 *Coastline College*
Fall 2016 *Dupon*

Homework Set 10 Solutions

(Distributed 11/21/16; Due on 11/30/16)

Review Chapter 6 and read Chapters 7 and 15 in Zumdahl and complete the listed questions from the text: Chapter 7: 18, 40, 53, 91, 95; Chapter 15: 22, 34, 43, 46, 62, 69; as well as the following problems:

A. Balance and Identify the type of reaction for each of the equations.

(i) _1_$Al(OH)_3$ + _3_HCl --→ _1_$AlCl_3$ + _3_H_2O ***double replacement***

(ii) __NaN_3 -→ __Na + __N_3 (***already balanced)*** ***decomposition***

(iii) _2_CH_3OH + _3_ O_2 --→ _2_CO_2 + _4_H_2O ***combustion***

(iv) _2_$AgNO_3$ + __$MgCl_2$ --→ _2_AgCl + __$Mg(NO_3)_2$ ***double replacement or precipitation***

(v) __Zn + __ $CuCl_2$ ---→ __$ZnCl_2$ + __Cu ***single replacement***

B. Calculate the molarity of the following solutions:

(i) 7.85 g of $C_9H_8O_4$ in 350 mL of H_2O ***0.0436 moles/0.35 L = 0.125 M***

(ii) 18.3 g of $FeCl_3$ in 500 mL of H_2O ***0.113 moles/0.5 L = 0.226 M***

(iii) 25 mL of 6 M HCl solution diluted to 200 mL ***M1V1 = M2V2 0.75 M HCl***

C. If sulfuric acid is spilled in the lab, it can be neutralized by sprinkling sodium bicarbonate ($NaHCO_3$) on the spill. The reaction is as follows:

$$2\ NaHCO_3(s) + H_2SO_4(aq) \text{ ------> } Na_2SO_4(aq) + H_2O(l) + CO_2(g)$$

If 27 mL of 6.0 M H2SO4 was spilled, how many grams of $NaHCO_3$ must be added to neutralize the acid?

0.027 L * 6 M = 0.162 moles H2SO4; this requires (2)(0.162 moles) = 0.324 moles NaHCO3. 0.324 moles * 84 g/mole = 27.2 grams of NaHCO3

D. Titration of 12.5 mL of HCl solution requires 24.22 mL of a 0.1004 M KOH solution. What is the molarity of the HCl solution?

$$KOH + HCl \text{ ----------> } H_2O + K^+ + Cl^-$$

In titration, moles acid = moles base at the endpoint.
For KOH, 0.02422 L * 0.1004 M = 0.002432 moles KOH
If there are 0.002432 moles HCl: Molarity = $\frac{0.002`432\ moles}{0.0125\ L}$ ***= 0.1945 M HCl***

Problems from Zumdahl:

<u>Chapter 7:</u>

18. (a) $Na_2CO_3 + CuSO_4$ -------> $Na_2SO_4 + \underline{CuCO_3(s)}$
(b) $HCl + AgC_2H_3O_2$ -------> $\underline{AgCl(s)} + HC_2H_3O_2$
(c) no precipitate expected
(d) $3\ (NH4)_2S + 2\ FeCl_3$ -------> $6\ NH_4Cl + \underline{Fe_2S_3(s)}$
(e) $H_2SO_4 + Pb(NO_3)_2$ -------> $2\ HNO_3 + \underline{PbSO_4(s)}$
(f) $3\ K_3PO_4 + 3\ CaCl_2$ -------> $6\ KCl + \underline{Ca_3(PO_4)_2(s)}$

40. (a) $\underline{2\ KOH + H_2SO_4}$ -------> $K_2SO_4 + 2\ H_2O$
(b) $\underline{HNO_3 + NaOH}$ -------> $NaNO_3 + H_2O$
(c) $2\ HCl + Ca(OH)2$ -------> $CaCl2 + 2\ H_2O$
(d) $2\ HClO_4 + Ba(OH)_2$ -------> $Ba(ClO_4)_2 + 2\ H_2O$

53. (a) precipitation (b) oxidation/reduction
(c) precipitation (d) acid/base
(e) oxidation/reduction (f) acid/base
(g) precipitation (h) oxidation/reduction
(i) precipitation

91. (a) $2\ I_4O_9$ -------> $2\ I_2O_6 + 2\ I_2 + 3O_2$ oxidation/reduction or decomposition
(b) $Mg + 2\ AgNO_3$ -------> $Mg(NO_3)_2 + 2\ Ag$ oxidiation/reduction or single displacement
(c) $SiCl_4 + 2\ Mg$ -------> $2\ MgCl_2 + Si$ oxidation/reduction or single displacement
(d) $CuCl_2 + 2\ AgNO_3$ -------> $2\ AgCl + Cu(NO_3)_2$ precipitation or double displacement
(e) $2\ Al + 3\ Br_2$ -------> $2\ AlBr_3$ oxidation/reduction or synthesis/combination

95; YOUR CHOICE

<u>Chapter 15:</u>

22. $\frac{67.1\ g}{67.1\ g + 275\ g} \times 100\% = 19.6\%$

34. (a)3.35 M (b) 1.03 M (c) 0.630 M (d) 4.99 M

43. (a) 4.46×10^{-4} mol(b) 4.58×10^{-3} mol (c) 15.1 mol (d) 0.0545 mol

46. (a) 0.235 g (b) 0.593 g (c) 2.29 g (d) 2.61 g

62. M1V1 = M2V2 (1.25 M)(100 mL) = (12.1 M) ? mL V2 = 10.3 mL

69. $M_A V_A = M_B V_B$ (0.491 M)(27.2 mL) = (0.502 M) ? mL V_B = 26.6 m\\L