AP Assorted Review Problems:
Ch1-4

1. How many p, n, e in the zinc-65 *ion*? $^{65}_{30}Zn^{+2}$

   30p, 35n, 28e⁻

2. Balance the equation in an acidic solution:

   $Cu + HNO_3 \rightarrow Cu^{2+} + NO$

   $3(Cu \rightarrow Cu^{+2} + 2e^-)$

   $2(3e^- + 3H^+ + HNO_3 \rightarrow NO + 2H_2O)$

   $3Cu + 6H^+ + 2HNO_3 \rightarrow 3Cu^{+2} + 2NO + 4H_2O$

3. Hydrogen Cyanide is produced industrially from the following reaction. If 5.00×10^3 kg of each reactant is mixed together, determine the mass of each product formed assuming 100% yield.

   $2NH_{3(g)} + 3O_{2(g)} + 2CH_{4(g)} \rightarrow 2HCN_{(g)} + 6H_2O_{(g)}$

4. A compound contains only carbon, hydrogen, nitrogen, and oxygen. Combustion of 0.157 g of the compound produced 0.213 g of CO_2, and 0.0310 g of water. In another experiment, it is found that the compound produces 0.0230 g of NH_3. What is the empirical formula for the compound?

   0.103 g of

5. What is the concentration of aluminum ions in a 0.15 M aluminum sulfate solution?

6. Write the net ionic equation for the reaction between lead(II)nitrate and hydrochloric acid.

7. Write the net ionic equation for the reaction between acetic acid and a solution of barium hydroxide.

8. Assign oxidation states to each atom in $Mg_2P_2O_7$.

3. $5.00 \times 10^3 \text{ kg } NH_3 \times \frac{1000 \text{ g } NH_3}{1 \text{ kg}} \times \frac{1 \text{ mol } NH_3}{17.0 \text{ g } NH_3} \times \frac{2 \text{ mol HCN}}{2 \text{ mol } NH_3} \times \frac{27.0 \text{ g HCN}}{1 \text{ mol HCN}} = 7941 \text{ kg}$

$5.00 \times 10^3 \text{ kg } O_2 \times \frac{1000 \text{ g } O_2}{1 \text{ kg}} \times \frac{1 \text{ mol } O_2}{32.0 \text{ g } O_2} \times \frac{2 \text{ mol HCN}}{3 \text{ mol } O_2} \times \frac{27.0 \text{ g HCN}}{1 \text{ mol HCN}} = 2812 \text{ kg HCN}$

$5.00 \times 10^3 \text{ kg } CH_4 \times \frac{1000 \text{ g } CH_4}{1 \text{ kg}} \times \frac{1 \text{ mol } CH_4}{16.0 \text{ g } CH_4} \times \frac{2 \text{ mol HCN}}{2 \text{ mol } CH_4} \times \frac{27.0 \text{ g HCN}}{1 \text{ mol HCN}} = 8437$

Limiting is O_2

$5.00 \times 10^3 \text{ kg } O_2 \times \frac{1000 \text{ g } O_2}{1 \text{ kg}} \times \frac{1 \text{ mol } O_2}{32.0 \text{ g } O_2} \times \frac{6 \text{ mol } H_2O}{3 \text{ mol } O_2} \times \frac{18.0 \text{ g } H_2O}{1 \text{ mol } H_2O} = 5625 \text{ g } H_2O$

4. $\underset{0.157 \text{ g}}{C_xH_yN_zO_A} + O_2 \rightarrow \underset{0.213 \text{ g}}{CO_2} + \underset{0.031}{H_2O}$

mass of C $= 0.213 \text{ g } CO_2 \times \frac{12.0 \text{ g C}}{44.0 \text{ g } CO_2} = 0.0581 \text{ g C}$ $\frac{0.0581 \text{ g C}}{0.157 \text{ g Comp}} = 37.0\% \text{ C}$

mass of H $= 0.0310 \text{ g } H_2O \times \frac{2.0 \text{ g H}}{18.0 \text{ g } H_2O} = 0.00344 \text{ g H}$ $\frac{0.00344 \text{ g H}}{0.157 \text{ g Comp}} = 2.19\% \text{ H}$

mass of N $= 0.0230 \text{ g } NH_3 \times \frac{14.0 \text{ g N}}{17.0 \text{ g } NH_3} = 0.0189 \text{ g N}$ $\frac{0.0189 \text{ g N}}{0.103 \text{ g}} = 18.3\% \text{ N}$

$\%O = 42.51\% O$

$37.0 \text{ g C} \times \frac{1 \text{ mol}}{12.0 \text{ g}} = \frac{3.08}{1.31} = 2.35 \text{ mol C} \times 3 = 7$

$2.19 \text{ g H} \times \frac{1 \text{ mol}}{1.01 \text{ g}} = \frac{2.17}{1.31} = 1.66 \text{ mol H} \times 3 = 5$

$18.3 \text{ g N} \times \frac{1 \text{ mol}}{14.0 \text{ g}} = \frac{1.31}{1.31} = 1 \text{ mol N} \times 3 = 3$

$42.51 \text{ g O} \times \frac{1 \text{ mol}}{16.0 \text{ g}} = \frac{2.65}{1.31} = 2 \text{ mol O} \times 3 = 6$

$C_7H_5N_3O_6$

5. $Al_2(SO_4)_3 \rightarrow 2Al^{+3} + 3SO_4^{-2}$

$0.15M\ Al_2(SO_4)_3 \times \frac{2M\ Al^{+3}}{1M\ Al_2SO_4} = 0.30M\ Al^{+3}$

6. $Pb(NO_3)_2 + \underset{\text{strong acid}}{2HCl} \rightarrow PbCl_2 + \underset{\text{strong acid}}{2HNO_3}$

$Pb^{+2} + 2NO_3^- + 2H^+ + 2Cl^- \rightarrow PbCl_2 + 2H^+ + 2NO_3^-$

$Pb^{+2} + 2Cl^- \rightarrow PbCl_2$

7. $\underset{\text{weak acid}}{2CH_3COOH_{(aq)}} + \underset{\text{strong base}}{Ba(OH)_{2(aq)}} \rightarrow Ba(CH_3COO)_{2(aq)} + 2H_2O_{(l)}$

$CH_3COOH + OH^- \rightarrow H_2O + CH_3COO^-$

8. $Mg_2P_2O_7$

$Mg = +2$

$O = -2$

$P = +5$