General Chemistry I
PLI #6
Thursday,10June 2020

1. **Vanillin, the dominant flavoring in vanilla, contains C, H, and O. When 1.05 g of thus substance is completely combusted, 2.43 g of CO_2 and 0.50 g of H_2O are produced. What is the empirical formula of vanillin?**

2. **A mixture of N_2(g) and H_2(g) reacts in a closed container to form ammonia, NH_3(g). The reaction ceases before either reactant has been totally consumed. At this stage, 3.0 mol N_2, 3.0 mol H_2, and 3.0 mol NH_3 are present. How many moles of N_2 and H_2 were present originally?**

3. **A mixture containing $KClO_3$, K_2CO_3, $KHCO_3$, and KCl was heated, producing CO_2, O_2, and H_2O gases according to the following equations:**

$$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$$

$$2KHCO_3(s) \rightarrow K_2O(s) + H_2O(g) + 2CO_2(g)$$

$$K_2CO_3(s) \rightarrow K_2O(s) + CO_2(g)$$

The KCl does not react under the conditions of the reaction. If 100.0 g of the mixture produces 1.80 g of H_2O, 13.20 g of CO_2, and 4.00 g of O_2, what was the composition of the original mixture? (Assume complete decomposition of the mixture.)

4. **Give the oxidation number of each element in the following compounds:**
   a. **BrO_3^-:**
   b. **H_2SO_4:**
   c. **CrO_4^{2-}:**
   d. **$LiAlH_4$:**

5. **Your friend has heard that she can make ethanol by reacting C_2H_4 with H_2O under acidic conditions, but she's not sure how much of each starting material she needs. So she randomly mixes 101.7 g of C_2H_4 with 55.19 g of H_2O.**

$$C_2H_4 + H_2O \rightarrow C_2H_6O$$

   a. **What is the theoretical yield of ethanol in mL (ethanol density = 0.789 g/mL)?**

b. **How much (mass) excess reactant remains?**

6. **Complete and balance the following molecular equations, and then write the net ionic equation for each (note in past answer keys, we have written H^+ in net ionic equations, but it is more correct to write H_3O^+ instead. H^+ doesn't actually exist itself in solution):**

   a. $HBr(aq) + NH_3(aq) \rightarrow$

   b. **Aqueous hydrochloric acid and sodium acetate**

   c. **Aqueous perchloric acid and aqueous strontium hydroxide**

7. **Starting with solid sucrose, $C_{12}H_{22}O_{11}$, describe how you would**
   a. **Prepare 250 mL of a 0.250 M sucrose solution**

   b. **Prepare 350.0 mL of 0.100 M $C_{12}H_{22}O_{11}$ starting with 3.00 L of 1.50 M $C_{12}H_{22}O_{11}$.**