PLI Worksheet #6
June 11, 2021

1. It takes 83 mL of a 0.45 M NaOH solution to neutralize 235 mL of an HCl solution. What is the concentration of the HCl solution?

2. A 0.5895-g sample of impure magnesium hydroxide is dissolved in 100.0 mL of 0.2050M HCl solution. The excess acid then needs 19.85 mL of 0.1020 M NaOH for neutralization. Calculate the percentage by mass of magnesium hydroxide in the sample, assuming that it is the only substance reacting with the HCl solution.

3. An unknown solid acid is either citric acid or tartaric acid. To determine which acid you have, you titrate a sample of the solid with aqueous NaOH and from this determine the molar mass of the unknown acid. A 0.857g sample requires 26.1 mL of 0.513 M NaOH to consume the acid completely. What is the unknown acid? The appropriate equations are as follows:

Citric acid: $H_3C_6H_5O_{7(aq)} + 3NaOH_{(aq)} \longrightarrow 3H2O_{(l)} + Na_3C_6H_5O_{7(aq)}$

Tartaric acid: $H_2C_4H_4O_{(aq)} + 2\ NaOH_{(aq)} \longrightarrow 2H_2O_{(l)} + Na_2C_4H_4O_{6\ (aq)}$

4. Nitric oxide is made from the oxidation of ammonia. What mass of nitric oxide can be made from the reaction of 8.00 g NH_3 with 17.0 g O_2 given the following, unbalanced equation? If 10.g of NO are obtained, what is the percent yield for the reaction?

___NH_3 + ___O_2 ⟶ ___NO + ___H_2O

5. You are given 100.0 mL of barium hydroxide solution that is of unknown concentration. You perform a titration using 0.045 M HCl and find that you reach the equivalence point of the titration after 30.75 mL of the acid was added. What was the molarity of the original barium hydroxide solution? What was the pH of the original solution?

6. A 12.48 g sample of an unknown metal, heated to 99°C, was then plunged into 50.0mL of 25.0°C water. The temperature of the water rose to 28.1°C. Assuming no loss of energy to the surroundings,

    a. How many joules of energy did the water absorb? (specific heat capacity of water = 4.184 J/(g*K))

    b. How many joules of energy did the metal lose?

    c. What is the specific heat capacity of the metal?

7. How much energy does it take to convert 2.0 g of ice at -9.5°C to steam at 150°C?

    (Water's heat of fusion is 333 J/g; water's heat of vaporization is 2256 J/g. The specific heat capacity of: ice = 2.06 J/gK; water = 4.184 J/gK; steam = 1.86 J/gK)