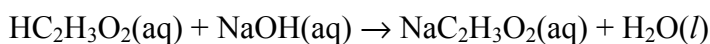


**WKS**  
**Solution Stoichiometry 2**

Name Answer Key  
Period \_\_\_\_\_

1. 34.57 mL of HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> (acetic acid) solution of unknown concentration is used to neutralize 25.19 mL of NaOH (sodium hydroxide) with concentration 0.4295 M according to the following balanced equation:



- a. How many moles of acetic acid are used?

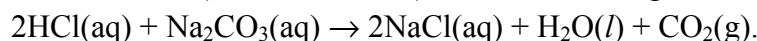
$$? \text{ mol HC}_2\text{H}_3\text{O}_2 = 25.19 \text{ mL NaOH} \times \frac{0.4295 \text{ mol NaOH}}{1000 \text{ mL NaOH}} \times \frac{1 \text{ mol HC}_2\text{H}_3\text{O}_2}{1 \text{ mol NaOH}} = \boxed{0.01082 \text{ mol HC}_2\text{H}_3\text{O}_2}$$

0.01082 mol NaOH

- b. What is the concentration of the acetic acid solution, in M?

$$M_{\text{HC}_2\text{H}_3\text{O}_2} = \frac{0.01082 \text{ mol HC}_2\text{H}_3\text{O}_2}{34.57 \text{ mL}} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = \boxed{0.3130 \text{ M HC}_2\text{H}_3\text{O}_2}$$

2. When 321 mL of HCl (hydrochloric acid) solution of unknown concentration reacts with Na<sub>2</sub>CO<sub>3</sub> (sodium carbonate), it forms NaCl (sodium chloride), water, and 11.1 g of CO<sub>2</sub> (carbon dioxide):



- a. How many moles of HCl are used in the reaction?

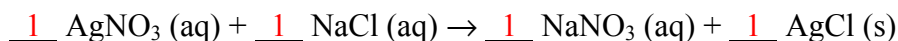
$$? \text{ mol HCl} = 11.1 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.01 \text{ g CO}_2} \times \frac{2 \text{ mol HCl}}{1 \text{ mol CO}_2} = \boxed{0.504 \text{ mol HCl}}$$

0.252 mol CO<sub>2</sub>

- b. What was the concentration of the HCl solution, in M?

$$M_{\text{HCl}} = \frac{0.504 \text{ mol HCl}}{321 \text{ mL}} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = \boxed{1.57 \text{ M HCl}}$$

3. Gravimetric analysis is a method of determining the concentration of a compound in solution by measuring the mass of a precipitate. In one experiment, 1.18 g AgCl precipitates when 25.0 mL of AgNO<sub>3</sub> solution reacts with excess NaCl solution in the following reaction:



- a. Balance the equation.  
b. How many moles of AgNO<sub>3</sub> were reacted?

$$\text{MM}(\text{AgCl}) = 107.87 \text{ g} + 35.45 \text{ g} = 143.3 \text{ g/mol}$$

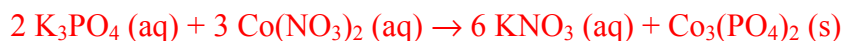
$$? \text{ mol AgNO}_3 = 1.18 \text{ g AgCl} \times \frac{1 \text{ mol AgCl}}{143.3 \text{ g AgCl}} \times \frac{1 \text{ mol AgNO}_3}{1 \text{ mol AgCl}} = \boxed{8.23 \times 10^{-3} \text{ mol AgNO}_3}$$

8.23 × 10<sup>-3</sup> mol AgCl

- c. What is the concentration of AgNO<sub>3</sub> solution, in M?

$$M_{\text{AgNO}_3} = \frac{8.23 \times 10^{-3} \text{ mol AgNO}_3}{25.0 \text{ mL}} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = \boxed{0.329 \text{ M}}$$

4. For the double replacement reaction described here, 57.2 mL of potassium phosphate solution of unknown concentration is needed to completely react with 40.0 mL of 0.650 M of cobalt(II) nitrate to produce aqueous potassium nitrate and solid cobalt(II) phosphate.
- a. Write and balance the equation



- b. Determine the number of moles of potassium phosphate used.

$$? \text{ mol K}_3\text{PO}_4 = 40.0 \text{ mL Co}(\text{NO}_3)_2 \times \frac{0.650 \text{ mol Co}(\text{NO}_3)_2}{1000 \text{ mL Co}(\text{NO}_3)_2} \times \frac{2 \text{ mol K}_3\text{PO}_4}{3 \text{ mol Co}(\text{NO}_3)_2} = \boxed{0.0173 \text{ mol K}_3\text{PO}_4}$$

$\underbrace{\hspace{15em}}_{0.0260 \text{ mol Co}(\text{NO}_3)_2}$

- c. What is the concentration of the potassium phosphate solution, in M?

$$M_{\text{K}_3\text{PO}_4} = \frac{0.0173 \text{ mol K}_3\text{PO}_4}{57.2 \text{ mL K}_3\text{PO}_4} \times \frac{1 \text{ mL}}{1 \times 10^{-3} \text{ L}} = \boxed{0.303 \text{ M K}_3\text{PO}_4}$$