

## Molarity and Titrations Handout with Answer Key

### MOLARITY

1. 150.5 grams of HCl are dissolved to make a 1000. mL of HOH. What is the molarity?

2. How many mols are in 450.0 mL of 0.45M NaOH?

3. There is 60.0 mL of 3.0M NaOH. How many grams of HOH can it make?



4. How many mL of 0.93 M NaOH can be made with 324g NaOH?

5. How many mols are in 456.0 mL of 0.87M HCl?

## ANSWER KEY

## MOLARITY ANSWERS:

1.) 4.128 mol HCl

$$\frac{150.5 \text{ g HCl}}{1000 \text{ mL HOH}} \times \frac{1 \text{ mol HCl}}{36.46 \text{ g}} \times \frac{1 \text{ mL HCl}}{0.001 \text{ L HCl}} = 4.128 \text{ mol HCl}$$

2.) 0.203 mol NaOH

$$450.0 \text{ mL NaOH} \times \frac{0.001 \text{ L NaOH}}{1 \text{ mL NaOH}} \times \frac{0.45 \text{ M NaOH}}{1 \text{ L NaOH}} = 0.203 \text{ mol NaOH}$$

3.) 3.24g HOH

$$60.0 \text{ mL NaCl} \times \frac{0.001 \text{ L NaCl}}{1 \text{ mL NaCl}} \times \frac{3.0 \text{ mol NaCl}}{1 \text{ L NaCl}} \times \frac{2 \text{ mol HOH}}{2 \text{ mol NaCl}} \times \frac{18 \text{ g HOH}}{1 \text{ mol HOH}} = 3.24 \text{ g HOH}$$

4.) 10800 mL of 0.93mol NaOH

$$324 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} \times \frac{1 \text{ L NaOH}}{0.75 \text{ mol NaOH}} \times \frac{1 \text{ mL NaOH}}{0.001 \text{ L NaOH}} = 10,800 \text{ mL NaOH of } 0.93 \text{ mol NaOH}$$

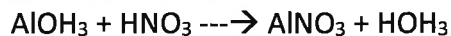
5.) 0.396mol HCl

$$456.0 \text{ mL HCl} \times \frac{0.001 \text{ L HCl}}{1 \text{ mL HCl}} \times \frac{0.87 \text{ mol HCl}}{1 \text{ L HCl}} = 0.396 \text{ mol HCl}$$

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### TITRATIONS

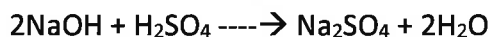
- 1.) In this acid-based titration, 78.22 mL of 0.56M the nitric acid  $\text{HNO}_3$  was completely neutralized by 45.6mL of aluminum hydroxide  $\text{Al}(\text{OH})_3$ . Calculate the concentration of the aluminum hydroxide.



- 2.) 47.6mL of a 0.870M solution of sulfuric acid is used to neutralize 67.1mL of a sodium hydroxide solution. What is the concentration of the sodium hydroxide solution?

- 3.) What is the concentration of a 100.0mL solution of HCl which is neutralized by 55.0mL of a 0.70M solution of  $\text{Ca}(\text{OH})_2$ ?

- 4.) What is the molarity of an NaOH solution if 62.0mL is needed to neutralize 23.0mL of 0.255M  $\text{H}_2\text{SO}_4$ ?



- 5.) A student titrates 34.89mL of HCl to neutralize 28.47mL of a 9.0M NaOH solution. What is the molarity of HCl?

**TITRATIONS ANSWERS:**1.) 0.96 mol  $\text{Al}(\text{OH})_3$ 

$$\frac{78.22 \text{ mL HNO}_3}{45.69 \text{ mL Al}(\text{OH})_3} \times \frac{0.001 \text{ HNO}_3}{1 \text{ mL HNO}_3} \times \frac{0.56 \text{ mol HNO}_3}{1 \text{ L HNO}_3} \times \frac{1 \text{ mol Al}(\text{OH})_3}{1 \text{ mol HNO}_3} \times \frac{1 \text{ mL Al}(\text{OH})_3}{0.001 \text{ L Al}(\text{OH})_3} = 0.96 \text{ mol Al}(\text{OH})_3$$

2.) 1.23 mol NaOH



$$\frac{47.6 \text{ mL H}_2\text{SO}_4}{67.1 \text{ mL NaOH}} \times \frac{0.001 \text{ L H}_2\text{SO}_4}{1 \text{ mL H}_2\text{SO}_4} \times \frac{0.870 \text{ mol H}_2\text{SO}_4}{1 \text{ L H}_2\text{SO}_4} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} \times \frac{1 \text{ mL NaOH}}{0.001 \text{ L NaOH}} = 1.23 \text{ mol NaOH}$$

3.) 0.77 mol HCl



$$\frac{55.0 \text{ mL Ca}(\text{OH})_2}{100.0 \text{ mL HCl}} \times \frac{0.001 \text{ Ca}(\text{OH})_2}{1 \text{ mL Ca}(\text{OH})_2} \times \frac{0.70 \text{ mol Ca}(\text{OH})_2}{1 \text{ L Ca}(\text{OH})_2} \times \frac{2 \text{ mol HCl}}{1 \text{ mol Ca}(\text{OH})_2} \times \frac{1 \text{ mL HCl}}{0.001 \text{ L HCl}} = 0.77 \text{ mol HCl}$$

4.) 0.189 mol NaOH



$$\frac{23.0 \text{ mL H}_2\text{SO}_4}{62.0 \text{ mL NaOH}} \times \frac{0.001 \text{ L H}_2\text{SO}_4}{1 \text{ mL H}_2\text{SO}_4} \times \frac{0.255 \text{ mol H}_2\text{SO}_4}{1 \text{ L H}_2\text{SO}_4} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} \times \frac{1 \text{ mL NaOH}}{0.001 \text{ L NaOH}} = 0.189 \text{ mol NaOH}$$

5.) 7.344 mol HCl



$$\frac{28.47 \text{ mL NaOH}}{34.89 \text{ mL HCl}} \times \frac{0.001 \text{ L NaOH}}{1 \text{ mL NaOH}} \times \frac{9.0 \text{ mol NaOH}}{1 \text{ L NaOH}} \times \frac{1 \text{ mol HCl}}{1 \text{ mol NaOH}} \times \frac{1 \text{ mL HCl}}{0.001 \text{ L HCl}} = 7.344 \text{ mol HCl}$$