

# Chemistry 12

## Lab 20G Acid-Base Titration

Preparation and Standardization of Acid and Base Solutions, and Testing of Unknowns

NAME \_\_\_\_\_

Partner \_\_\_\_\_

DATE \_\_\_\_\_ BLOCK \_\_\_\_\_

### Pre-Lab Questions:

1. Write the formula equation for the neutralization reaction between hydrochloric acid and sodium hydroxide solution. Include phase subscripts.

\_\_\_\_\_

2. Write the corresponding net ionic equation for the reaction in question #1.

\_\_\_\_\_

3. Write the net ionic equation for the reaction between acetic acid and sodium hydroxide solution.

\_\_\_\_\_

4. When performing titrations, why is it not necessary to wash **and dry** the flask in which the titration will take place? (In other words, excess water in the flask doesn't matter.)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. What is the function of the indicator phenolphthalein in the titration?

\_\_\_\_\_

\_\_\_\_\_

6. The point during a titration at which the number of moles of  $H^+$  and the number of moles of  $OH^-$  is the same as in the balanced neutralization equation is called what?

\_\_\_\_\_

7. It takes 37.54 mL of 0.200 M NaOH to neutralize 25.00 mL of unknown M HCl. Showing your work, calculate the molarity of the acid.

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NAME \_\_\_\_\_

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**Part 1:** Follow the procedure as found on page 254 of the lab text.

Molar mass of oxalic acid dihydrate = \_\_\_\_\_ g / mol

Mass of oxalic acid dihydrate needed to make 250.0 mL of 0.0500 M solution. Show your work.

= \_\_\_\_\_ g

- follow the steps in Part 1 but don't bother with weighing a small beaker. Using the electronic balances, "tare" the balance with a plastic weighing tray on it, and then add the appropriate mass of powdered acid to the tray.
- transfer all of the dry acid to either a 250 mL volumetric flask or a 250 mL graduated cylinder. Rinse the plastic tray with distilled water and transfer this liquid into the flask as well. Half fill the flask or cylinder and swirl until the dry acid is dissolved. Then fill the flask or cylinder to exactly 250.0 mL

**Part 2:** Standardization of an Unknown NaOH Solution

- Follow the procedure as given on pages 254 and 255 of the lab book. You do NOT need a stoppered bottle for the NaOH solution.

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
buret reading before titration					
buret reading after titration					
volume of NaOH used					
Average volume NaOH		← (average your two closest volumes)			

Questions:

1. Given the mass of oxalic acid dihydrate that you used in Part 1, what was the molarity of the 250 mL sample of the acid?
2. How many moles of oxalic acid dihydrate are present in each 25.0 mL sample?
3. Considering the fact that oxalic acid is a diprotic acid, how many mole of NaOH are needed to neutralize the acid from question #1?
4. What is the molarity of the NaOH solution used?

### Part 3: Determination of the Molar Mass of an Unknown Solid Acid

Identifying letter of unknown acid = \_\_\_\_\_

	mass of unknown acid	starting volume of NaOH	final volume of NaOH	volume of NaOH used
Trial #1				
Trial #2				

Average mass of unknown acid used = \_\_\_\_\_ g

Average volume of NaOH used = \_\_\_\_\_ mL

Questions:

1. From the average volume of NaOH used, calculate the number of moles of NaOH used to neutralize the unknown acid.
  
  
  
  
  
  
  
  
  
  
2. Assuming that the unknown acid is monoprotic, how many moles of the unknown acid must be in the sample?
  
  
  
  
  
  
  
  
  
  
3. From the mass of unknown acid used and the number of moles of acid from question #2, calculate the molar mass of the unknown acid.

**Table 2:** Molarity of NaOH = \_\_\_\_\_ M

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
buret reading before titration					
buret reading after titration					
volume of NaOH used					
Average volume NaOH		← (average your two closest volumes)			

1. Calculate the moles of NaOH from the average volume used in Part 1 and the given molarity.
2. What is the ratio of  $\text{OH}^-$  in NaOH to  $\text{H}^+$  in  $\text{CH}_3\text{COOH}$  in the balanced neutralization reaction?  
\_\_\_\_\_
3. Calculate the molarity of the vinegar sample.
4. Calculate the mass of acetic acid in 1 L of solution.  
(Refer to the Post Lab discussion on page 238.)
5. Calculate the percentage of acetic acid in the vinegar.
6. By law, vinegar must be not less than 4% by mass acetic acid. Did your sample meet this specification?