CHEM 210 Lab 6: Acid-Base Titration
Pre-lab Exercise (3 points)

Name:_____

Date:_____

This pre-lab assignment is due <u>on paper</u> at the start of your lab.

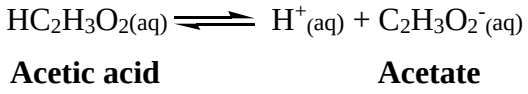
1. What is the general chemical equation for an acid-base neutralization reaction?

2. What is the function of the acid-base indicator, phenolphthalein, in this experiment?

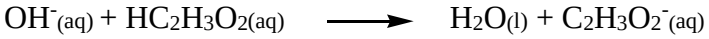
3. What volume of 0.100 M NaOH is needed to neutralize 25.00 mL of 0.0532 M acetic acid? Use the correct number of significant figures and show your calculations for full credit.

CHEM 210 Lab 6: Acid-Base Titration

Introduction:
In this experiment you will perform the experimental titration of acetic acid ($HC_2H_3O_2$) with sodium hydroxide (NaOH) and analyze the titration data to determine the average molar concentration of the acid. Acetic acid is a weak acid which gives vinegar its sour taste. Acetate ion is the conjugate base of acetic acid. Sodium hydroxide is a strong base.



When NaOH is added during titration, the acetic acid will neutralize OH^- added.



You can use the end point volume of NaOH (V_B) from each titration and the molarity (M_B) of the standard NaOH solution to calculate the molarity (M_A) of the original acetic acid solution using the equation, $M_AV_A = M_BV_B$. V_A is the volume of the acetic acid used (25.00 mL in this experiment).

SAFETY PRECAUTIONS

If skin contact occurs with any solutions, wash the affected area thoroughly with soap and water. Clean up all spills immediately. All solutions may be safely disposed down the sink. Safety goggles must be worn at all times in the laboratory.

EXPERIMENTAL PROCEDURE

Running the Experiment

1. Obtain, in a dry beaker, about 100 mL of an aqueous acetic acid solution.
2. Rinse a 25-mL pipet with this solution and pipet 25.00 mL into a 150-mL beaker.
3. Use a graduated cylinder to add about 25 mL of distilled water.
4. Add 2-3 drops of phenolphthalein indicator.
5. Place a stir bar into the beaker and obtain a magnetic stirrer/hot plate.
6. Rinse and fill a 50-mL buret with standardized NaOH.
7. Position the acetic acid solution beaker on the magnetic stirrer.
8. Position the NaOH buret ready for titration.
9. Turn on the magnetic stirrer and adjust the stirring rate to a moderate speed (without splashing). **Do not turn on the heat!**
10. Add NaOH in small aliquots of 0.5 mL. After each addition, allow solution to mix thoroughly. The phenolphthalein color change from colorless to pink will aid you when nearing the equivalence point.

11. Decrease the volume of your NaOH additions to 0.05 - 0.1 mL when the pink streaks become more persistent. Record where the permanent color change **(pale pink)** has occurred. This is the equivalence point.
12. When the titration is complete, rinse the beaker and fill the buret if necessary.
13. Repeat the titration one more time with another 25- mL samples of acetic acid.

DATA ANALYSIS

Use the equivalence point volume (V_B) from each titration and the molarity (M_B) of the standard NaOH solution to calculate the average molarity (M_A) of the original acetic acid solution using the equation,

$$\mathbf{M_A V_A = M_B V_B}$$

The volume of acetic acid used (V_A) is 25.00 mL in this experiment. Carefully watch significant figures in this calculation. Report your result and show the calculation. Find out the actual molarity from the instructor and calculate percent error.

$$\text{Percent error} = \frac{|\,Literature\ Value - Experimental\ Value\,|}{\text{Literature Value}} \times 100\%$$

CHEM 210 Lab 6: Acid-Base Titration Worksheet (12 points)

Name: _____ Date: _____

_____

_____

(3 points)

	Trial 1	**Trial 2**
mL NaOH added at the end point		
Molar concentration of standard NaOH		
Calculated acetic acid concentration		
Average acetic acid concentration		

(3 points) Sample calculations for one trial:

The actual molarity of acetic acid: _____ M

(3 points) Calculate the percent error for the average acetic acid molarity relative to the actual value.

Percent error =

(3 points) Briefly describe at least one source of error that could explain the difference between your calculated concentration and the actual value.