Name _____

Date _____ Period _____

Comparing Different Brands of Vinegar

PROBLEM ██

Do all brands of vinegar contain the same concentration of acetic acid?

**INTRODUCTION** ██

Vinegar contains acetic acid. It is possible to measure the concentration of acid in vinegar by titrating it with a base of known concentration. In this laboratory investigation, you will compare the concentration of acid in two brands of vinegar by titrating them with sodium hydroxide.

MATERIALS (*per group*) ██████████████████████████████████

Beakers [2]; buret clamp; buret; flask; graduated cylinder; medicine dropper; phenolphthalein; ring stand; sodium hydroxide [0.5 M]; vinegar [? M]

PROCEDURE ██

1. Select one of the brands of vinegar and record the brand name of the vinegar in the data table on the next page.

2. Measure 10 mL of the vinegar with a graduated cylinder. Transfer it to a flask. Add two drops of phenolphthalein with a medicine dropper. Note the color. Record the volume of the vinegar.

3. Pour about 100 mL of 0.5 M sodium hydroxide into a beaker. Set up a ring stand with a buret clamp and a buret. Make sure the buret is closed. Fill the buret about 1 cm past the zero mark (the top mark) with sodium hydroxide from the beaker. Put the beaker under the buret. Withdraw enough sodium hydroxide from the buret to remove the air from the tip of the buret and to bring the fluid level down to the graduated portion of the buret.

4. Examine the buret and record the initial volume of the sodium hydroxide in the data table on the next page.

5. Hold the flask containing the vinegar under the buret. Run sodium hydroxide slowly into the vinegar, mixing occasionally by swirling. When the color of the vinegar begins to change on contact with the sodium hydroxide, add the sodium hydroxide one drop at a time until one final drop causes a complete and permanent color change. Note the color.

6. Record the final volume of the sodium hydroxide in the buret in the data table on the next page. Calculate the amount of sodium hydroxide used by subtracting the initial volume from the final volume. Record the result.

7. Determine the concentration of the vinegar (M_a) using the relationship $M_a \times V_a = M_b \times V_b$.

8. Repeat step 4 through step 7 two more times for a total of three trials. If necessary, add more sodium hydroxide to the buret and record a new initial volume.
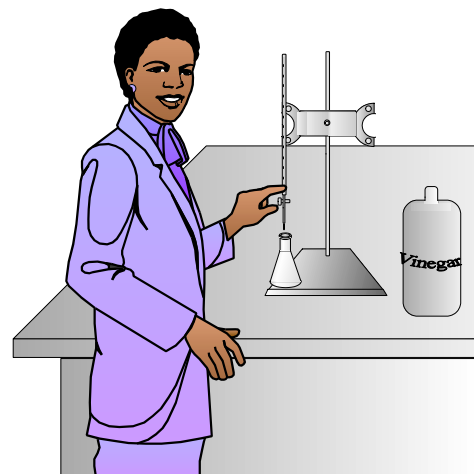
9. Find the average concentration of the vinegar by adding the results of the three trials and dividing by 3.

10. Repeat the entire procedure using the other brand of vinegar.

OBSERVATIONS

		Brand of Vinegar					
		First Trial	Second Trial	Third Trial	First Trial	Second Trial	Third Trial
VOLUME of VINEGAR							
SODIUM HYDROXIDE	Initial volume						
	Final volume						
	Amount used						
Concentration of Vinegar							
Average Concentration of Vinegar							

CONCLUSIONS

1. What is the purpose of the phenolphthalein in this investigation? _____

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2. Do all brands of vinegar contain the same concentration of acetic acid? How do the

concentrations of the two brands of vinegar compare? _____

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3. How would you determine if household products such as ammonia, milk, or orange juice

are acids or bases? How would you measure their concentrations? _____

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