Experiment 12: Laboratory Practical Exam

Version 7

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Instructions

- This is a formal test: silence and individual work is required.
- No questions will be answered regarding experimental procedure or calculations.
- Safety rules must be followed at all times.
- Do not share calculators.
- Do not leave room until you hand in your completed test.

Materials

List of Chemicals	amount	Equipment	amount
unknown acid solution	50 mL	25-mL OR 50-mL buret	1
standardized NaOH solution	70 mL	125-mL or 250-mL Erlenmeyer flasks	3 minimum
phenolphthalein solution	2 drops per sample	Beakers (one for waste)	2-3
		small funnel	1
		5-mL pipet	1
		pipet bulb or pump	1
		buret clamp and stand	1
		magnetic bar	1
		magnetic stirring plate	1

Appendix Appendix 8

Techniques

- Technique 5: Using a volumetric pipet
- Technique 22: Titration
  Technique 22: Video Titration

Experimental Procedure

1. Add proper labels and headers to Data Table 1 on the Data and Calculations page (more columns and rows than needed were provided in case you need to void a trial or want to perform more titrations than requested). Record all data, with the correct number of significant figures and units in the table as you perform the experiment.
2. Obtain all the equipment and reagents listed above.
3. The concentration of the NaOH is written on the container. Record it in the space provided above Data Table 1.
4. Record the unknown acid's number in Data Table 2 on the Data and Calculations page.
5. Wash and rinse your equipment using proper laboratory practices.
6. Transfer the standardized NaOH solution into a labeled beaker if it is in a container. Use it to condition the buret. Fill the buret with the NaOH solution. Read and record the initial volume in Data Table 1 just before beginning to titrate.
7. Pour the unknown acid solution into a labeled beaker if it is in a container. Condition the 5-mL pipet with the unknown acid solution.
8. Pipet 5.00 mL of the unknown acid solution into an Erlenmeyer flask using the 5-mL pipet. Add 2 drops of phenolphthalein into the Erlenmeyer flask. Add a magnetic bar.
9. Place Erlenmeyer flask containing unknown acid sample on magnetic stirring plate and titrate it to the phenolphthalein endpoint (pale pink that lasts 30 seconds).
10. Read and record the final volume of the NaOH solution in Data Table 1 after completing the titration.
11. Perform at least two more trials. (Remove magnetic bar using the magnet retriever hanging inside of hood. Rinse with DI water and reuse if needed.)

Clean up/Disposal

1. Dispose of the solutions including any remaining unused acid and base solutions, into the waste container in the hood.
   Note: Do not dispose of the phenolphthalein solution. Leave this bottle at your station.
2. Rinse the buret and the pipet well and place them in the buret and pipet canisters with the tip up.
3. Wash glassware, container(s), and magnetic bar.
4. Return equipment to their proper location.

Calculations

1. Calculate the concentration of the unknown acid solution in each trial. Report results in Data Table 1 with proper number of significant figures and unit of measure, if applicable.
2. Calculate the mean concentration of the unknown acid, the standard deviation, and relative standard deviation. Record results in Data Table 2 with the proper number of significant figures and unit of measure, if applicable.

Equations

The balanced reaction for this titration is: $NaOH\ (aq) +\ HA\ (aq)\ \rightarrow\ H_2O\ (l)\ +\ NaA\ (aq)$

$$Standard\ deviation, s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$$

$$RSD = \frac{s}{\bar{x}} \times 100\%$$

Name: _____   **Date: _____**

Data Table: This table has more columns and rows than you need. Properly label as needed and record all data with the correct number of significant figures and units. Include the calculated concentration of the acid in each trial.

Concentration of NaOH: _____

Data Table 1. Determination of Unknown Acid Concentration

Calculations & Results: Show calculations for the concentration of at least one trial **on the back of this page.** Show calculation of the standard deviation and relative standard deviation of the mean concentration **on the back of this page** (you can use the instructions sheet as scratch paper). Clearly write results in Data Table 2 below.

Data Table 2. Analysis of Unknown Acid Results Summary	
Unknown Acid Number	
Mean Concentration	
Standard Deviation	
RSD	

For Professor's Use Only: Don't write in this table.		
Grading	Percent	Grade
Data Table properly labeled, sig. figs.	10 %	
Concentration of each sample correct, sig. figs. & unit correct	30 %	
Avg. conc. calc. correct, sig. figs. & unit correct	5 %	
Std. dev. calc. correct, sig. figs. & unit correct	10 %	
% RSD calc. correct, sig. figs. & unit correct	5 %	
% Error of Avg. Concentration	30 %	
% RSD <5%	10 %	
Total	**100 %**	