TEACHER INFORMATION

Reaction Stoichiometry

OVERVIEW

Your students will find out about acid-base reactions, balanced equations, and mole ratios. They will then generate and investigate researchable questions that utilize the continuous variations method to determine the mole ratio of reactants in an acid-base reaction.

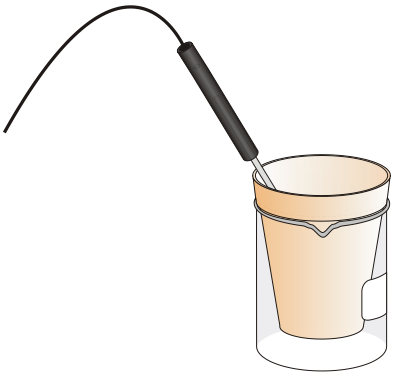

Figure 1

LEARNING OUTCOMES

In this inquiry experiment, students will

- Identify variables, design and perform the experiment, collect data, analyze data, draw a conclusion, and formulate a knowledge claim based on evidence from the experiment.
- Measure the temperature changes of a series of reactions.
- Determine the stoichiometry of a reaction in which the reactants are known but the products are unknown.

CORRELATIONS

IB Topic and Sub-Topic

Topic 1 – Quantitative Chemistry

Sub-Topic 1.3 – Chemical equations

Sub-Topic 1.4 – Mass and gaseous volume relationships in chemical reactions

AP Chemistry Recommended Experiment

Experiment 9: Determination of mass and mole relationship in a chemical reaction

THE INQUIRY PROCESS

Suggested Time to Complete the Experiment

See the section in the introduction, Doing Inquiry Experiments, for more information on carrying out each phase of an inquiry experiment.

	Inquiry Phase	Open Inquiry	Guided Inquiry
I	Preliminary Activity	45 minutes	45 minutes
II	Generating Researchable Questions (Omitted in Guided Inquiry Approach)	10 minutes	0 minutes
III	Planning	15 minutes	15 minutes
IV	Carrying Out the Plan	50 minutes	45 minutes
V	Organizing the Data	10 minutes	10 minutes
VI	Communicating the Results	15 minutes	10 minutes
VII	Conclusion	10 minutes	10 minutes

MATERIALS

Make the following materials available for students to use. Items in bold are needed for the preliminary activity.

TI-Nspire handheld or
computer and TI-Nspire software
data-collection interface
Vernier Temperature Probe
two 10 mL graduated cylinders
two 25 mL graduated cylinders
two 50 mL graduated cylinders
1.00 M acetic acid solution
1.00 M sodium hydroxide solution
three 400 mL beakers
two Beral pipets
Styrofoam cup
others as requested by students

I Preliminary Activity

This inquiry begins with an activity to reinforce prior knowledge of the use of Vernier data-collection technology and to introduce a method for collecting temperature data.

Sample Results

Table 1: The Reaction Between Acetic Acid and Sodium Hydroxide		
Volume NaOH (mL)	Volume $HC_2H_3O_2$ (mL)	Δt (ºC)
10.0	40.0	2.6
15.0	35.0	4.0
20.0	30.0	5.2
25.0	25.0	6.4
30.0	20.0	5.2
35.0	15.0	3.9
40.0	10.0	2.7

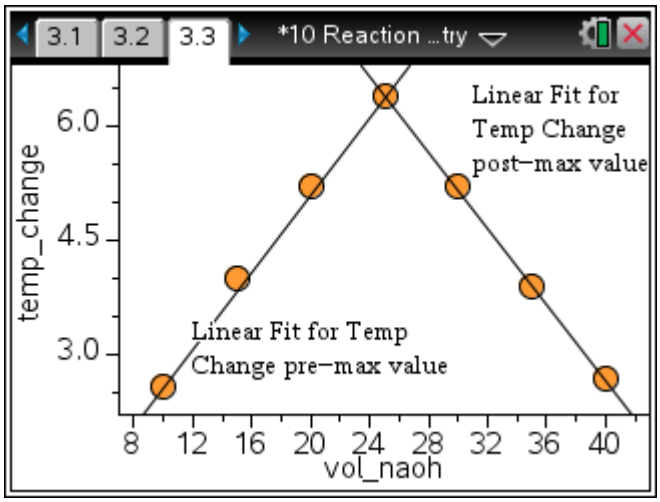

Figure 2 *Temperature change vs. volume of NaOH*

ANSWERS TO QUESTIONS

For Sample Answers to the questions in this lab, please contact Vernier Software and Technology at swnanswers@vernier.com