

# Science Lessons for Grades 6-8

## “Identification of Unknown Concentration using Standard Curve” (Titration Lesson)

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**Discipline:** Chemistry - Mixtures and Solutions

**Grade:** 6 to 8

### Standards

5.1.B, 5.1.C, 5.3.A, 5.3.B, 5.3.C, 5.3.D, 5.4.A, 4.2.A, 4.3.A, 4.3.C, 4.3.D, 4.4.A

### Purpose/Goal

Understand acid and base chemistry, and its importance in nature. Understand role of indicators in chemistry. Be able to generate standard curve and use it in data analysis. And finally realize that simple methods are used by scientists to identify the unknown.

### Context

Not every acid is corrosive. Concentration is one factor that determines how strong the acid will be. Students should be familiar with the pH scale, density and concentration.

### Preparation

Acetic acid, sodium hydroxide, phenolphthalein, gloves, goggles, plastic cups, transfer pipettes.

Activity sheet with questions about the experiment such as:

1. Describe what you see as you keep adding more base to the acid.
2. What does it mean when the solution turns pink?
3. What do you notice as you work with more concentrated solution? How many drops you have to add what happens?

### Motivation

The purpose of this lesson was more to show students how scientists are able to use what they know to generate a method, in this case the standard curve, to identify the unknown. Explanation of acid base chemistry, indicators as a measure of monitoring reaction progress is a complement to this lesson. Further more this activity reinforces previously learned concepts of concentration, density and pH.

### Description

Lesson should begin with review of previously learned concepts about pH and chemical reactions. Introduction of reactions of acids with bases should follow stressing the reaction product water. Now, concept of an indicator should be introduced, stressing the variety of different indicators and their importance in the monitoring of a reaction progress. Explain that phenolphthalein is an indicator that turns pink once the solution is basic. Ask students question: does the indicator turn the solution pink once all the acid reacted with the base? What happens once excess of the base is added?

After introduction students will proceed with the experiment and add 1.0 M NaOH to four different concentrations of an acid containing 2 drops of the indicator. At the end they will obtain an acid with unknown concentration and do the same titration as above. Students will graph the results of the titration of the known concentrations of the acid and plot number of drops of the base required to turn the solution pink vs. the acid concentration. Once graphing is complete, they must recognize linear nature of the graph. Next, they will estimate (6th grade) or calculate (7th and 8th) unknown concentration of the acid using the number of base drops that was used. This will be followed by a discussion about scientists using simple information to generate methods allowing them determination of the unknown.

### Assessment

Experimental precision and safety. Accuracy of determining the unknown. How well they answer questions on the activity sheet.

**Follow-Up Activities**

Introduction to buffers, which is more on biochemistry and biology side. This will stress importance of stable constant pH in the human body and other biological systems.