

Tomasz Kurcon

Titration: Identification of Unknown Concentration using a Standard Curve

Grade: 8th 7th or 6th

Goals

- Understand the role of chemical indicators in a reaction
- Understand that science uses simple methods to find the unknown
- Practice data acquisition and analysis
- Graph a standard curve and use it to estimate concentration of unknown acid.

Materials:

- 4 known acid concentrations (0.1, 0.4, 0.7, 1.0 M Acetic acid)
- Unknown concentration of acetic acid (any concentration will do, but it should lie on the standard curve generated by students ex. 0.55M)
- Indicator (phenolphthalein)
- Base (0.5, 1.0 M NaOH)
- Safety goggles, gloves
- Plastic cups
- Disposable pipettes

Note: It may become tedious for students to count drops if the base is not concentrated. Highly concentrated base should be used only if students have good protection goggles and are mature about handling chemicals. It may take long time to do the experiment if students have to count 100 base drops. It is good to have very low concentration of an acid and 1.0 M base, in this way they will require about 30 drops for the most concentrated acid in the group. This saves time and ensures safety. Volume will have the same effect, the less acid you use the less base students will have to add. Use minimum that will be easy to see. Scale concentrations up to whole numbers for 6th grade.

NJCCS Addressed

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

Introduction:

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?

Analysis and Discussion:

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 and the curve. This will be followed by a discussion about scientists using simple information to generate methods allowing them determination of the unknown.

Acid, Bases and Concentrations

Name:

Acids have pH below ____ while bases are all substances with pH greater than ____.
When a base reacts with an acid in equal quantities what is left is water so the pH after such reaction is _____ .

Indicator in chemistry is a chemical compound that allows a chemist to monitor changes along the reaction progress. Today we will react acid with a base, and will use indicator that will turn pink once solution has extra base in it (meaning all the acid had reacted and you added extra drop of base to see the color and ensure reaction is over). This process is called titration, upon completion of the reaction what will be the pH of the solution? Why?

Materials /group

5 plastic cups
1 disposable pipette
1-3 pieces of paper towel

1. Obtain 10 mL of acid solution with concentration of 1 g/mL make sure you receive 2 drops of an indicator with your acid.
2. One group member will hold the cup over the white paper towel and will slowly swirl it (being careful not to spill). Another person will add the base being extremely careful to put one drop at a time to the acid solution. Another person will count how many drops were added. Each time a drop of base is added you must swirl the solution before you add another.
3. Do it slowly until the solution turns pink. Repeat the same procedure for the remaining concentrations 4, 7, 10 and the one labeled UNKNOWN at the end.

Describe what you see as you keep adding more base to the acid.

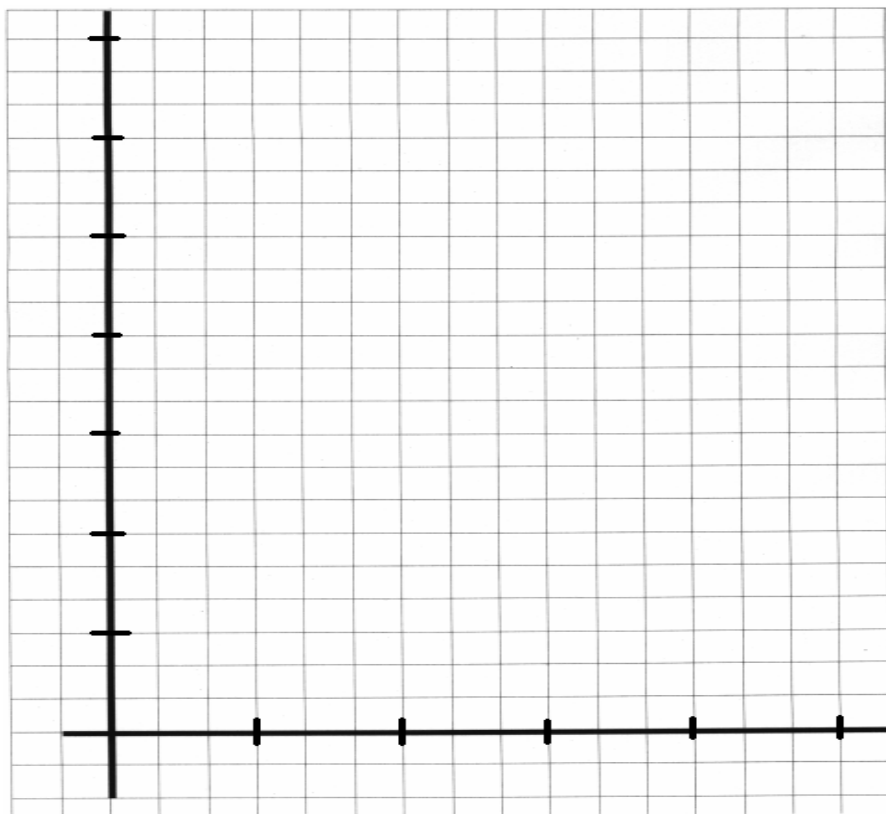
What does it mean when the solution turns pink?

What do you notice as you work with more concentrated solution? How many drops you have to add what happens?

Why?

Concentration of acid	# of drops of base
1	
4	
7	
10	
Unknown	

Once you are done draw a graph of your results, number of drops vs. concentration. Label the point for the unknown U after you connect other points! Using the graph determine the unknown concentration.



What is the unknown concentration of your solution? _____