



Connected Chemistry

Acids & Bases Unit

Lesson 7: Titration for Acid-Base Combinations



Student's Lesson at a Glance

Lesson Summary

This lesson contains three activities. Following a brief Connecting Activity, students engage in lessons that use computer simulations to show what happens to different combinations of weak and strong acid and bases on the submicroscopic level. The goal of this lesson is to examine how different combinations of titrants and titrands affect the equivalence point. From their observations, students sketch graphs from the simulations.

SWBAT (Students Will Be Able To)

- Identify the components of a titration curve
- Use a titration curve to determine the acidity or basicity of the titrand and titrants used in a titration experiment

Essential Vocabulary

Keep a list of all important words from this lesson. This list, in addition to the lists from other lessons, will make studying easier and improve scientific communication skills. The essential vocabulary from the unit is in **bold**. Additional words that will expand your scientific vocabulary are in *italics*.

**CCC Reminder**

- Make sure that you clearly understand the difference between the classifications of strong and weak acids and bases. It may be helpful to review what these substances look like from the submicroscopic level in Lesson 4 and 5 of the unit.
- The equivalence point of a strong acid or a strong base will occur at a pH of 7. For combinations of weak acids and strong bases, weak bases and strong acids, and weak acids and weak bases, the equivalence point does not have to occur at a pH of 7.
- This simulation will require you to switch between views of different graphs. One graph will be a molecular count over time. The other graph will be pH vs the volume of the titrant. In these simulations you will need to add base (titrant) to acid (titrand).

Notes

Homework

Upcoming Quizzes/Tests



Activity 1: Connecting

Prior to this activity, you have either generated your own titration curve or have been given an example of a titration curve by your teacher for a strong base of known concentration into a strong acid of unknown concentration. When doing titration labs, chemists may select to use different known and unknown acid and bases.

1. The reaction in the titration lab showed a strong acid and strong base reacting together. What other combinations of acids and bases can be used? Fill in the first column in table below with other possible combinations.
2. If the equivalence point for a strong acid and base is pH of 7, do you think the other combinations you came up with above will have the same equivalence point? Fill in your predictions for the other combinations that you wrote down in the second column below.

Combination:	pH Equivalence Point Prediction:
Strong Acid + Strong Base	7

3. Explain how you made your predictions for pH.

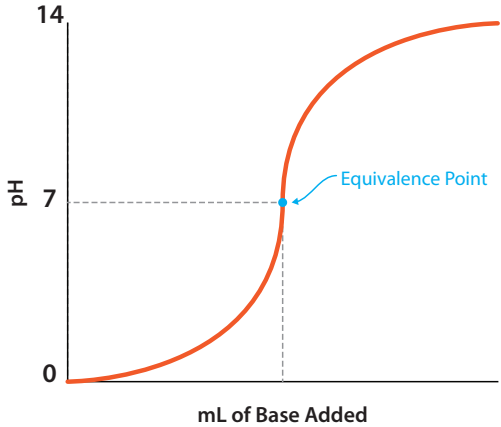


Activity 2: Titration Simulation

Weak Base into Strong Acid: Use Simulation 6, Set 2

4. What is the difference at the submicroscopic level between a weak base and a strong base?

- Add the weak base to the strong acid. Keep adding until you have just passed the equivalence point of the reaction.
- Once you are finished, sketch the titration graph you have generated.

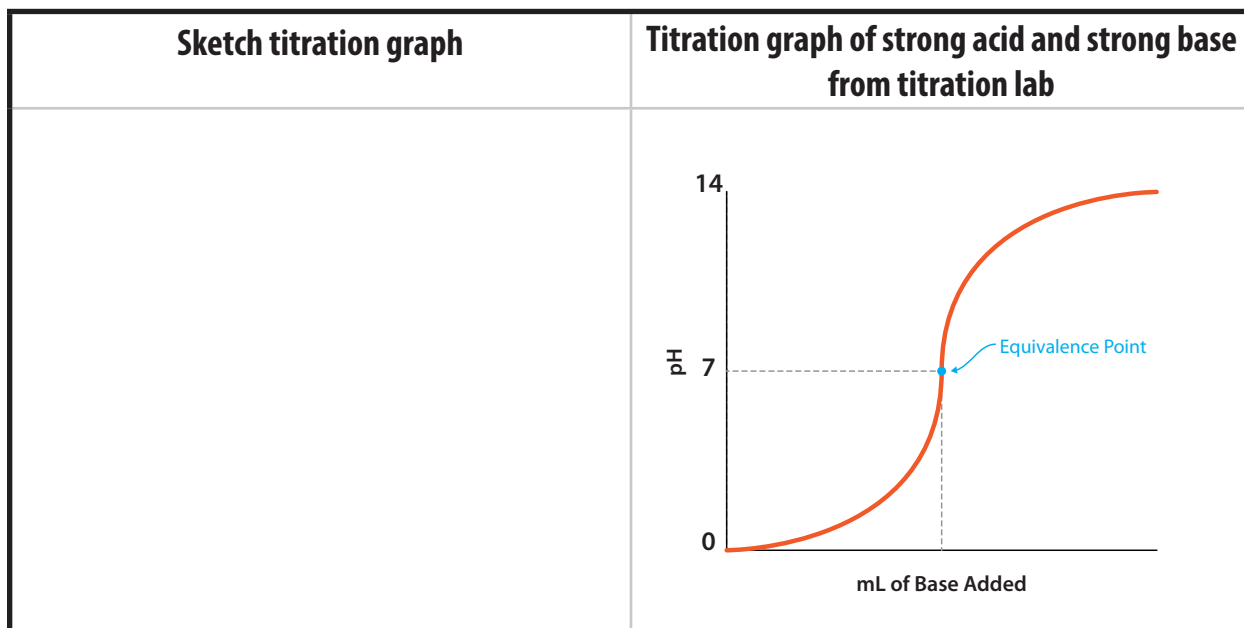
Sketch titration graph	Titration graph of strong acid and strong base from titration lab
	

5. Compare this titration curve to the curve from the strong acid and base. What is different?

**Strong Base into Weak Acid:** Use Simulation 6, Set 3

6. What is the difference at the submicroscopic level between a weak acid and a strong acid?

- Add the strong base to the weak acid. Keep adding until you have just passed the equivalence point of the reaction.
- Once you are finished, sketch the titration graph you have generated.



7. Compare this titration curve to the curve from the strong acid and base. What is different?



Activity 3: Capstone Activity

You and your group will be given time to answer the question below and provide evidence to support your claim. You will then discuss your group's answer with the class. You may also use drawings to support your claim. Be prepared to defend your answers with evidence you have gained from past activities. You may also use drawings from your past activities to support your claim.

8. What is the relationship between concentration and pH?

9. Does a weak acid always have a higher pH than a strong acid? *Support your claim with evidence.*

10. What is the final pH in a neutralization reaction of a strong acid and strong base? What does that mean about the number of H_3O^+ and OH^- ions in the solution after neutralization?



Sketch your prediction of what neutralization looks like on a submicroscopic level.

Sketch a submicroscopic picture of a neutralized HCl and NaOH solution	Describe sketch
Key	

11. Assume you start off with 10 mL of a 1.0 M hydrochloric acid solution. If the concentration of the acid solution is greater than that of the base solution, will you add more or less than 10 mL of the sodium hydroxide base solution in neutralization reaction?
