

Virtual Chemistry Lab for Acid-base Titration

Recommended grades level(s) 9-12

Time Duration: - 30-50 minutes

Objective(s):

The learner will be able to explore what would happen when acids and bases get mixed and decide which point is equivalence point of acid-base titration.

Materials and/or Resources:

Chemlab project paper

Chemlab description

Chemlab instruction

Download chemlab Visual Basic version

View chemlab Java form

Chemlab feedback form

Background Information:

Hydrogen concentrations vary over a wide range. This is called pH. The pH is the negative log of the hydrogen ion molar concentration. Thus pH is the measure of acidity or basicity. A neutral solution has a pH of 7. pH numbers less than 7 indicate an acidic solution with each unit change indicating a ten times increase in acidity. pH values of greater than seven are basic.

Procedures:

1. First, type your name. At every step, you can go back and forth and modify you experiment.
2. Step 1, choose either an acid or a base solution that you want to put in the flask the concentration and volume of the solution. If you select the “exact” button, the concentration of the solution is the value in the concentration text box – although concentration of this solution in titration is usually unknown. In contrast, if your “random” button, the concentration of the solution, which will be randomly generate the program, may not match the value in the concentration text box. The difference between the value in the text box and the randomly generated concentration can $\pm 25\%$.
3. Step 2, select a standard reagent to fill the burette. If you have chosen an acid s the Erlenmeyer flask in step 1, you should choose a base solution for the buret and vice versa. It is advisable to use a similar concentration of the solution that you used but a lot more volume than that of the solution in step 1.
4. Step 3, choose an indicator for titration. The indicator plays an important role for determining the equivalence point. You want to choose an appropriate one using figure showing color vs. pH of several indicators. If you chose a strong acid and base, the indicator should change at much less than pH 7. For a weak acid and a strong acid should change at much greater than pH 7. For a weak acid and a weak base, it s change near 7.

5. Step 4, you now titrate the solutions by moving the scroll bar instead of opening of the buret to set the drop speed of the solution from the buret. Monitor the change in pH value and the color of solution as well as the change of the volume of the solution when the solution is added to the Erlenmeyer flask. When you reach the expected equivalence point, move the scroll bar to the left to reduce the drop speed of the solution. You may want to add one drop at a time to find the exact point. When you find the equivalence point, record the volume of the solution used and add a few more drops to view the more perfect pH curve of the titration. If you accidentally missed the equivalence point, you can perform the same experiment again by clicking the Restart button.
6. Step 5, view the titration curve from your data. The titration curve can be used for determining the equivalence point like an indicator. The difference between the curve and an indicator is that the titration curve can show how accurately the experiment was performed. The steeper the slope of the titration curve at the equivalence point, the more accurate the data are. During or after titration, you can view the titration curve.
7. Step 6, enter the volume used in step 4 and you can compare the real value of the solution and your data. The equation to determine the concentration of the solution is

$$M_{\text{acid}} \times V_{\text{acid}} = M_{\text{base}} \times V_{\text{base}}$$

8. Now let's start the virtual titration lab.

Development Resources:

http://lrs.ed.uiuc.edu/students/mihyewon/chemlab_experiment.html

