Titration Simulation with Student Generated Data

Kristen Drury
William Floyd High School
Long Island, New York
www.chemisme.com
chemisme@gmail.com
@APchemIsMe
Titration Lab Simulation

For this simulation you will need a computer, chromebook, or laptop, as this may not run correct urge you to try this early in the week (Monday) and it will be graded by Friday.

Download the document attached and either:

- print and write on it, take a picture, upload to canvas
- type on it in a color other than black, upload to canvas
- write on plain paper, take a picture, upload to canvas

Let me know if you have trouble.

I have attached a doc and a pdf. Pick which works for you:

[Titration simulation Lab.docx](#)
[Titration simulation Lab.pdf](#)
Welcome to level 1

Hello! My name is Dr Jay Patel. I'm an analytical chemist and I'll be guiding you through the activities in this level.

In level 1, you'll analyse samples from a river that has been contaminated with acid. You'll perform titration experiments to work out the concentration of acid in the samples.

In each activity you'll be able to collect points. At the end of the level you can restart to improve your skills.
Lorry Crash Causes Acid Spill
Conservation site at risk as nearby river contaminated

Acid Spill Video
Dissociation Explained
**Introduction to Neutralization and NIE**

\[ \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{OH}^- (\text{aq}) \]

\[ \downarrow \]

\[ \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) \]
Titration Explained
Checks for Understanding

1. The phenolphthalein indicator is not affected by the pH of the solution. [ ] True [ ] False

2. The phenolphthalein indicator changes colour close to the point of neutralisation which shows the end-point of the titration. [ ] True [ ] False

3. When adding acid to base the phenolphthalein indicator changes colour from colourless to pink at the end of the titration. [ ] True [ ] False

Hydrochloric acid fully dissociates when dissolved in water.

The pH of water is approximately 7, which means it is neutral.

Acids and alkalis

Comprehension Points: 100 Titrations: level 1

Volume

An indicator helps us to see the ionisation point during a titration experiment by causing a colour change.

An acid and alkali react to form water and salt it is called an acidification reaction.
1. On the fill in the blank section, some key information included:
   a. When an acid and alkali react to form water and salt it is called a 
      __________________ reaction.
   b. An indicator helps us to see the __________________ during a titration 
      experiment by causing a color change.
   c. A titration experiment can be used to determine the _________________ of 
      acid using a known concentration of base.

2. During the **Weighing** section, the + signs indicate large to small chunks of sample. Why did “tare” mean on the balance?

3. During the **Standard Solution** section, move glassware around and be sure to read the information on the left! **Why** would we have to rinse the beaker after transferring the solution?
Weigh the NaOH and prepare a solution.
Rinse the beaker, check the meniscus!
Calculation set up

NaOH(aq) + HCl(aq) → H2O(l) + NaCl(aq)

Calculate the molar mass of NaOH.
Click on each atom in the diagram and complete each row of the table by entering the atomic mass for the selected element (you can refer to the periodic table for help).
Check your answer when you have completed the table.

NaOH

<table>
<thead>
<tr>
<th>Element</th>
<th>Atomic Number</th>
<th>Relative Atomic Mass</th>
<th>Mass per Mole of NaOH (g/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>12</td>
<td>23</td>
<td>40</td>
</tr>
<tr>
<td>Oxygen</td>
<td>8</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>1</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

Alkali concentration

Titration: level 1

To calculate the concentration of the NaOH(aq) solution you will need to calculate the amount, in moles, of NaOH.
Complete the calculation by dragging the correct options into the spaces provided, then check your answer.
Explanation of Calculations

4. During the Alkali concentration section, we are performing calculations that are slightly different than we would in class. First we have to know the molar mass of NaOH and how to calculate the moles (see reference table T if you get stuck). But then you see this screen:

![Image of a screen showing calculations]

We wouldn’t calculate it this way with dm³ because we use Liters. Try you best to find the appropriate pieces to fill the blanks. Your question is:

*If we obtained 10 grams of NaOH (molar mass=40g/mol) and dissolved into 2500mL of water, what is the concentration in M?*

5. During the Preparing for Titration section, why does the pipette have to be rinsed with NaOH solution?
Rinse the pipette and transfer to flask with indicator
Burette set up: Rinse with water, NaOH, and fill at appropriate eye level, while positioning the stopcock.
Time to test the sites!

Do a trial titration first to get an idea of roughly how much solution to add.

Start by reading the initial volume in the burette and recording your answer in the table.

All of your readings should be entered to two decimal places and end in either 0 or 5.

Click the "Help reading a burette" button if you need more information.

7. During the titration experiment section, fill out the data tables in the program and on this worksheet:

<table>
<thead>
<tr>
<th>Sample site B</th>
<th>Trial</th>
<th>1st accurate titration</th>
<th>2nd accurate titration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final reading (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial reading (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume added (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average volume added (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample site C</th>
<th>Trial</th>
<th>1st accurate titration</th>
<th>2nd accurate titration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final reading (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial reading (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume added (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average volume added (cm³)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It changes color!
Calculations and Evaluations

8. During the Titration analysis section, you will get the following screens, which again, is not how we will calculate our values. So, do you best to move the numbers around but then answer the following questions:

a. The formula we use to determine the Molarity of unknown acid is $M_aV_a = M_bV_b$. Using the average volume of 0.10M NaOH at Site B and the volume of HCl titrated was 10.0cm$^3$ (also known as 10.0mL), calculate the Molarity of HCl at Site B.

b. The formula we use to determine the Molarity of unknown acid is $M_aV_a = M_bV_b$. Using the average volume of 0.10M NaOH at Site C and the volume of HCl titrated was 10.0cm$^3$ (also known as 10.0mL), calculate the Molarity of HCl at Site C.

- Concentration values can be converted into pH. Use the data from each sample site along with the water quality standards information to answer the true or false questions.
Additional Levels

Level 2: Aspirin

Welcome to level 2
Hello! My name is Dr. Jay Patel. I'm an analytical chemist and I'll be guiding you through the activities in this level.

In level 2, you'll analyse aspirin tablets to find out whether they contain the correct amount of active ingredient (acetylsalicylic acid). You'll perform titration experiments to work out the concentration of aspirin in the tablets.

In each activity you'll be able to collect points. At the end of the level, you can restart to improve your skills.

Level 3: Hair products

Welcome to level 3
Hello! My name is Dr. Jay Patel. I'm an analytical chemist and I'll be guiding you through the activities in this level.

In level 3, you'll analyse samples from a batch of hair product that is suspected to be fake. You'll perform titration experiments to work out the level of ammonia in the samples.

In each activity you'll be able to collect points. At the end of the level, you can restart to improve your skills.
Additional Level 4: Redox titration of Fe tablets (AP?)
Survey, Certificate, and Downloads

To complete a brief survey about the symposium, and to generate your certificate of attendance, visit:


To Download Resources:


Want to present a webinar next year? Send an email!

AACTwebinar@acs.org