Labster

Virtual Lab Manual

Titration: Neutralize an acid lake contamination

Synopsis

Counting potatoes in a bag would be pretty easy. You can feel, see, and touch the potatoes. Now imagine counting the amount of acid in a water sample. How would you do that? In this simulation, you will embrace the power of the titration technique. With appropriate lab apparatus, a chemical indicator and a base solution, you can determine the concentration of any acid.

Assemble the apparatus for titration

A successful experiment starts with good preparation. You will need a burette, a stand, a clamp and a flask to begin the titration procedure. Proper assembly of the apparatus is paramount to a successful titration. In this simulation, we will help you ace the assembly process so that once you go to the real-life lab, you will be able to recognize and explain the function of each part of the apparatus used in the titration technique.

Performing titration

Once the assembly is complete, you are ready to drop the base! The best thing about this simulation is that you can perform the titration multiple times. But in science, many repetitions doesn't always lead to improved accuracy. You have to figure out how many times you should repeat the experiment to achieve an accurate result. You also have the freedom to experiment with multiple indicators, various sample and titrant volumes.

Analyzing the titration results

Analyzing the titration results requires an understanding of the basic stoichiometry concept. You can try to do the analysis yourself or let us guide you through the analysis, where you'll go through the method of determining the concentration of the acid step-by-step.

Will you be able to perform the titration and calculate the acid concentrations?

Learning Objectives

At the end of this simulation, you will be able to...

- Assemble the apparatus required for titration
- Describe the function of each part of the titration apparatus
- Explain the general steps of a colorimetric acid-base titration and its uses
- Perform a titration experiment
- Describe the role of the 3 main reagents used in a titration: sample, titrant, and indicator
- Explain what is the endpoint of a titration and the role of the indicator
- Explain why the use of high-precision volumetric material is essential for a titration
- Calculate the concentration of the titrated solution from the results of the titration experiment

Techniques in Lab

- Acid-base titration

Theory

Titration

Titration is a technique to measure the concentration of an acid or alkali in a sample, by comparing it to the concentration of an alkali or acid in a standard solution.

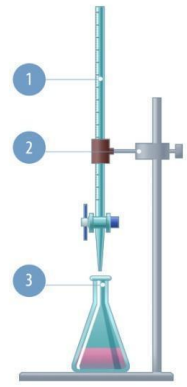

Figure 1: Titration apparatus. 1: The burette is filled with a standard solution; 2: A clamp holds the burette; 3: The flask contains a solution of unknown concentration and indicator.

Glossary for titration simulation

- Acid: species that donates a proton in aqueous solution.
- Accurate titration: carefully performed titration that is carried out after the rough titration is performed.
- Alkali: species that accepts a proton in aqueous solution
- Concordant titre: the volume of two or more titres that are similar in quantity (less than a 0.10 mL difference between each other).
- Dilution: the process of reducing the concentration of a solute in solution, usually by mixing it with more solvent.
- End-point: a physical change in the solution as determined by the indicator.
- Indicator: a dye or mixture of dye that marks the end-point of the titration.
- Titration: a technique to measure the concentration of acid or alkali in a sample, by comparing it to the concentration of alkali or acid in a standard solution
- Titre: the total volume of solution added to reach the end-point of the titration.
- Rough titration: it is used along with the first titration to get an approximation volume that is needed to reach the end-point.
- Standard solution: a solution in which the concentration of solute in mol dm^{-3} is known accurately.

Unit Conversion

The International System of Units (SI) is a globally agreed on system of units. Some commonly used units are not defined as part of the International System of Units (SI). The table below helps you to convert the unit you encounter in the simulation.

Name	Symbol	Quantity	Equivalent SI unit
liter	l or L	volume	1 L = 1 dm^3 = 0.001 m^3 = 1000 cm^3 = 1000 ml
molar	M	molarity or molar concentration	1 M = 1 mol/L = 1 mol/dm^3 = 10^3 mol/m^3