

Determine percent composition of alcohol in an unknown solution

Abstract

Vlabs interface has many short problems for solving, for the student. One of them is to determine the percentage of alcohol in a given solution. Few simple concepts are used to solve this problem. Teachers can use this example to demonstrate that, the science students learn in class, are utilized in various job scenarios and occupations later on. Items provided to the student are,

- Weighing scale
- Measuring cylinder
- Conical flask
- A 70% standard solution of alcohol and 1 M alcohol
- Two unknown percentage solutions

Concepts covered

- Students can learn about molarity to v/v percentage conversion,
- Weigh solutions and calculate density
- Drawing a standard graph
- Find m and c values from a $y=mx+c$ line graph
- Finding unknown value from the standard graph

Use the Vlabs interface to measure density of liquids, draw a standard graph and find the composition of unknown solution

Calculate densities of water and known percentage of alcoholic solution

Plot a graph using the experimental points

For plotting a 2D graphing program or use a graph paper to draw a standard / reference graph

x axis is % of alcohol (0-100)
y axis is density value

This yields a straight line plot, for function $y=mx+c$

If experimental points do not fall on a straight line, perform a linear fitting to find values of m and c

Measure the density of the unknown composition solution
From the reference graph, find the % alcohol present in the unknown

Determination of alcohol density

Density of a liquid can be measured by using a specific gravity bottle, pycnometer or hydrometer.

A weighing scale and a volumetric flask measurement is needed to complete this experiment

From the provided standard solutions in the vlabs interface, pour out known volume of standard alcohol solution and measure their weight

An assumption made here is that, volume change is independent of percent concentration

Calculate density with the equation density = mass/volume

Convert 1M concentration to v/v percentage

Common mistakes

Taking alcohol to be denser than water

Thinking with higher percentage alcohol, solution is denser