Chem 123L Lab #2

John Lawson
partnered with Jett Chan
TA: Lingzi Ma
Section 003

January 24 2017

The goal of this lab was to successfully measure the concentration of alcohol in a sample of wine provided. This is accomplished by reacting the alcohol present in the sample with Potassium Dichromate, which produces free Cr^{3+} ions in the following reaction:

$$3C_2H_5OH + 2K_2Cr_2O_7 + 8H_2SO_4 \rightarrow$$
$$2Cr_2(SO_4)_3 + 3CH_3COOH + 2K_2SO_4 + 11H_2O$$

The concentration of Cr^{3+} ions produced can be assesed by optical tests passing light through the solution, which in turn can be used to estimate the alcohol concentration of the sample in question. For our experiment, several known standards of alcohol were also tested in order to produce an expected baseline for Cr^{3+} produced based on alcohol content, which is then applied to determine the alcohol content of our unknown.

The experimental procedure used for this experiment was outlined in the CHEM 123L lab manual, experiment #2. All steps were followed without deviation.

Results

Unknown Wine Sample: D (2mL)
[Dichromate Solution]: 0.015 M in 5M H_2SO_4, 20mL
Absorbance λ: 575 nm

Sample	Colour after heating	Measured Absorbance
blank	orange	0.000
2/8 (mL Ethanol/Water)	slightly lighter orange	0.058
4/6 (mL Ethanol/Water)	orange	0.112
6/4 (mL Ethanol/Water)	yellow to green	0.178
8/2 (mL Ethanol/Water)	light green	0.239
10/0 (mL Ethanol/Water)	light green	0.278
Diluted Wine Sample	light green (closer to 8/2 than 10/0)	0.210

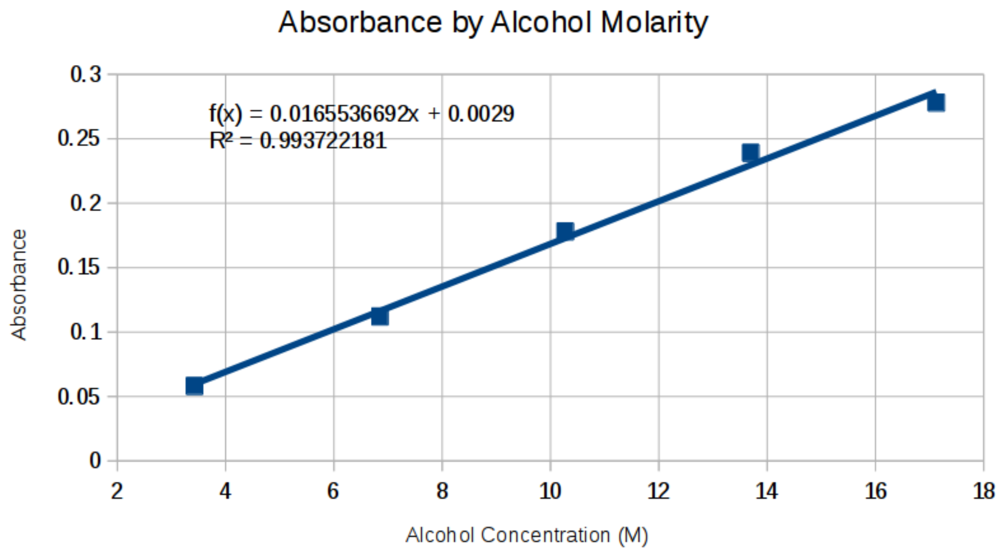

Figure 1: Absorbance by Molar Concentration

Based on the best fit line above, the concentration of the sample measured can be estimated as 0.109 M. Since the sample was diluted from 1 mL to 100 mL for measurement, the alcohol

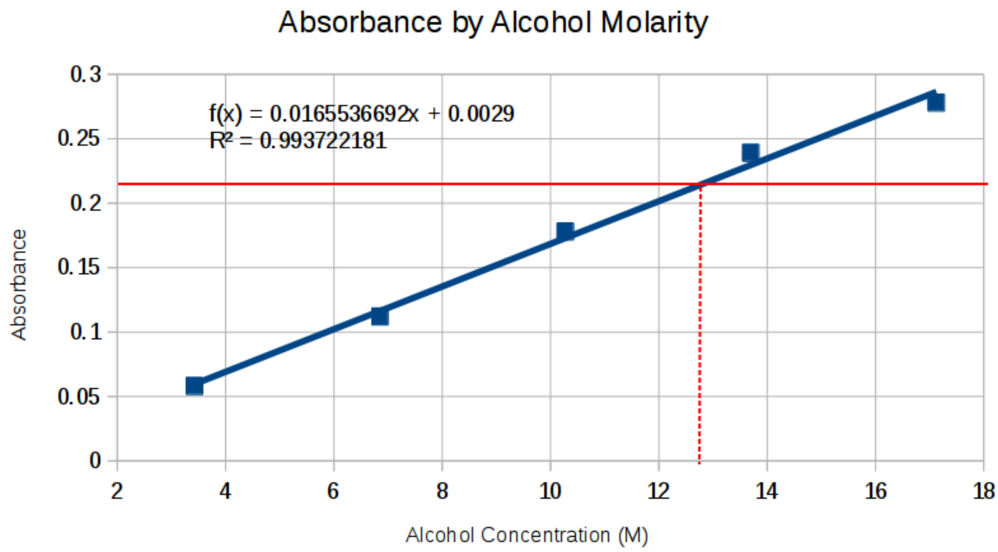

Figure 2: Absorbance by Molar Concentration Estimate of unknown

The foundations of the rigorous study of *analysis* were laid in the nineteenth century, notably by the mathematicians Cauchy and Weierstrass. Central to the study of this subject are the formal definitions of *limits* and *continuity*.

Let D be a subset of $\mathbf{R}$ and let $f\colon D \to \mathbf{R}$ be a real-valued function on D. The function f is said to be *continuous* on D if, for all $\epsilon > 0$ and for all $x \in D$, there exists some $\delta > 0$ (which may depend on x) such that if $y \in D$ satisfies

$$|y - x| < \delta$$

then

$$|f(y) - f(x)| < \epsilon.$$

One may readily verify that if f and g are continuous functions on D then the functions $f + g$, $f - g$ and $f.g$ are continuous. If in addition g is everywhere non-zero then f/g is continuous.