Chemistry
Unit #2—Measurement

Investigation of Measurement

Introduction

In general, you are quite familiar with measurements, as almost any occupation requires measurements of some kind. Carpenters measure boards for cutting, nurses measure blood pressure in patients, tailors measure fabric for garments, and advertising executives measure the public's acceptance of their sales pitches. You will therefore undoubtedly be utilizing measurement in your chosen career, regardless of the field you enter.

Measurement plays a particularly large role in science. In their studies, scientists gather data, and to do this they use measurements. Scientists measure the concentration of gases in the atmosphere, the growth of organisms under varying conditions, the rate of biochemical reactions, the distance of stars from the earth, and an innumerable number of other things. As measurements form the basis of scientific inquiry, they are deserving of in-depth analysis in lab.

In a scientific experiment, the investigator examines the effects of variations in the independent variable on the dependent variable through measurements. For example, let's assume a biologist is studying the effect of temperature on plant growth. She sets up several different temperature conditions, and grows groups of plants from seedlings in each condition. When the experiment ends, she must compare plant growth in the plants from different temperatures. But how should she do this? Should she just look at the plants and decide which grew the best? Should she pick up the plants and "feel" which ones have the greatest mass? Of course not. She would use some sort of quantitative measurement, such as measuring the height of each plant's stem in centimeters or determining the total plant biomass in grams. Whichever measurement she chooses, she would need to utilize an instrument to make it.

Purpose

In this lab, you will make measurements of several objects and convert units.

Procedure 1: Length and Width

1. Estimate the length and width of the following items, in meters, using only your eyes of the classroom whiteboard. Record into data table.
2. Using a 1 meter long piece of string, measure the length and width of the classroom whiteboard. Record in data table.
3. Now use a meter stick to make the same measurements as in #2. Record in data table.

Procedure 2: Temperature

1. Measure the temperature of 100 mL of tap water in Celsius. Record in a data table.
2. Measure the temperature of 200 mL of tap water in Celsius. Record in a data table.

Procedure 3: Mass

1. Place a coin directly on the balance and find its mass. Record in a data table.
2. Repeat with a different coin. Record in a data table.

Procedure 4: Density

1. Find the mass of the object. Record in a data table.
2. Find the volume of the object. Record in a data table.

Calculations for Procedure 1: Length

1. Convert the measurements taken with the meter stick for the classroom whiteboard into centimeters, kilometers, and millimeters using dimensional analysis and conversion factors.
2. What is the area for the classroom whiteboard that you measured for the lab in centimeters, kilometers, and millimeters?
3. What is the perimeter for the classroom whiteboard that you measured for the lab in centimeters, kilometers, and millimeters?

Calculations Procedure 2: Temperature

1. Is the temperature the same for the water in each beaker? Explain.
2. Convert the temperature of the water from each beaker into Kelvins.
3. Convert the temperature of the water from each beaker in Fahreinheit.

Calculations and Analysis for Procedure 3: Mass

1. Convert the mass of each coin to kilograms, milligrams, and centigrams using dimensional analysis and conversion factors.

Calculations Analysis for Procedure 4: Density

1. Calculate the density for the object.