Laboratory techniques and measurements essay sample

Environment, Water

Purpose: The purpose of this lab is to ensure that students are able to understand how to conduct measurements of length, mass, temperature, density and volume using different measuring devices. Students will also learn how to dilute substances by using simple algebra.

Procedure:

1. Prepare a data table similar to Data Table 1 shown below. 2. Choose any three objects that are shorter than the metric ruler to measure, such as a CD, key, spoon, etc. a. Measure the objects' lengths in centimeters. Estimate to one decimal place. Record the measurements in Data Table 1. b. Measure the objects' lengths in millimeters. Estimate to one decimal place. Record the measurements in Data Table 1. Warm Temperature Measurements

NOTE: If a stove is available, simplify this exercise by bringing the water to a boil in a pot on the stove, instead of in the 100 mL beaker over the burner fuel. 1. Prepare a data table similar to Data Table 2 shown below. 2. Fill a 100 mL beaker with 50 mL of hot tap water. Get the water as hot as possible. 3. Use a thermometer to measure the temperature of the water in the beaker using Celsius units. Record the measurements in Data Table 2. 4. Place the beaker of water on the wire gauze burner stand. 5. Remove the cap from the burner fuel and set it aside. Light the fuel and slip it under the burner stand. Note: when lit, the flame may be barely visible. 6. Bring the water to a full boil and record its temperature. Record the measurement in Data Table 2. 7. Let the water boil for about 5 minutes. Record the temperature in Data Table 2. 8. Extinguish the burner fuel by placing the lid loosely on the can to cut off the air supply. Let the fuel can cool before screwing on the lid. If the lid is screwed on while the fuel is hot, it can create a vacuum and make opening the can difficult in the future. Cold Temperature Measurements

1. Allow the 100 mL beaker to cool. Fill the beaker with cold tap water and then record the water temperature in Data Table 2. 2. Prepare an ice water bath by adding ice to the beaker filled with cold tap water. It may be necessary to pour out some of the water to make room for the ice. 3. Immerse the thermometer in the ice bath and stir gently. Record the temperature in Data Table 2. 4. Let the ice water stand for about 5 minutes. Then record the temperature in Data Table 2. To get an accurate measurement, ice should still be present in the water. Volume Measurements

1. Prepare a data table similar to Data Table 3 shown below. 2. Fill a small test tube with water.

3. Pour the water from the test tube into the 25 mL graduated cylinder. Record the volume of water in Data Table 3. Empty the graduated cylinder.

4. Determine the volume of a thin-stemmed pipet:

a) Completely fill a clean, empty pipet with water.

b) Hold the pipet vertically and add the water drop-by-drop to a graduated cylinder until the water reaches the 1 mL mark. Count the number of drops in 1 mL. Record the data in Data Table 3. c) Squeeze the pipet multiple times to expel all the water into the graduated cylinder and return it to its auxiliary bag. Record the volume reading of the graduated cylinder in Data Table 3.

Mass Measurements

1. Prepare a data table similar to Data Table 4 shown below. 2. When measuring chemicals, the surface of the scale must be protected with paper. The mass of the paper will add to the mass of the object to be measured, so the mass must be eliminated by taring the scale to set the scale to zero. Cut a piece of paper approximately 5 cm x 5 cm in size so it can be placed on the scale. Place this piece of paper on the scale and press the tare button. 3. Choose seven objects to measure. Remember, the scale can weigh a maximum mass of 500 grams or 18 ounces. 4. Record the hypothesized mass of the first object in Data Table 4. 5. Use the scale to measure the mass of the first object. Record the measurement in Data Table 4. Then compare the hypothesis to the actual mass. 6. Repeat the previous steps for each of the remaining objects. Density Measurements

1. Record all measurements in a data table similar to Data Table 5 shown below. 2. Calculate the density of water.

Weigh a dry 25 mL graduated cylinder on the digital scale. Record the mass in Data Table 5. Pour 5 mL of water into the graduated cylinder. Weigh and record the mass of the cylinder and water. Subtract the mass of the empty graduated cylinder from the mass of the graduated cylinder filled with water. The result is the net mass of the water. Calculate the density of the water using the formula d= m/V. Dry the graduated cylinder.

3. Calculate the density of isopropyl alcohol.

Pour 5 mL of isopropyl alcohol into the graduated cylinder. Weigh and record the mass of the cylinder and alcohol. Calculate the alcohol's density using the formula d= m/V.

4. Calculate the density of a saturated salt solution.

Use the digital scale to weigh out 5 g of NaCl, table salt.

Pour the NaCl into the 100 mL beaker and add 12 mL of warm water. Stir the water/salt mixture for several minutes. Then let any undissolved salt settle to the bottom of the beaker. The liquid is now a saturated solution. Use an empty short stem pipet to draw up only the saturated solution. Be careful not to draw up any of the solid NaCl crystals. Measure 5 mL of the saturated solution into an empty graduated cylinder. Draw up two consecutive pipets of saturated solution to reach 5 mL if necessary. Weigh and record the mass of the graduated cylinder and the saturated salt solution. Determine the net mass of the salt solution. Develop a hypothesis as to whether the density of the salt solution should be greater or less then the density of pure water. Record the hypothesis in the Lab Report. Hypothesis: I think the salt solution would have a lesser density due to it being heavier.

Find the density of the salt solution using the formula d= m/V. Compare the results to the hypothesis. 5. All used solutions can be safely poured down the sink. Clean all equipment to be used for the next section. 6. Calculate the density of a small, irregular metal object using the water-displacement method. Record the results in a data table similar to Data Table 6 shown below. a. Fill the graduated cylinder halfway with water. Record the volume of the water in column A. b. Place the metal bolt into the graduated cylinder and record the new water volume in column B. c. Subtract volume A from volume B. Record the value in column B – A. This value represents the volume of the object. d. Weigh the bolt to determine its mass and record the value in Data Table 6. e. Use this mass to determine the bolt's density. Record the value in Data Table 6. f. Calculate the density of the bolt using the formula d= m/V. 7. Use the water displacement method to calculate the density of the magnet. Record the results in Data Table 6.

8. Determine the density of a small, irregular metal object using Archimedes' Principle. a. Determine the mass of the bolt using the scale. Record the value in Data Table 6. b. Add approximately 50 mL of tap water to the 100 mL beaker. c. Place the 100 mL beaker on the scale and press the tare button. The scale should now read zero. d. Tie a piece of string around the metal bolt and gently submerge the bolt in the water. Ensure the bolt does not touch the bottom or the sides of the beaker. e. The scale will now display the mass of the water displaced by the bolt. Remember that 1 g of water equals 1 cc of water (cubic centimeter). The mass reading of the scale in grams is equal to the volume of the bolt in cc. Record this volume under column B – A. 9. Determine the density of the bolt using the bolt's mass and volume measurements. 10. Use Archimedes' Principle to determine the density of the magnet. Remember, the object suspended in the water cannot touch the bottom or the sides of the beaker. 11. Determine density using the calculation method.