**IT’S ALL ABOUT DENSITY**

**Introduction:**

Why do some things float in water and others sink? Why do some balloons float in the air and other do not? Investigate the important property of **density** by performing the following lab.

**Background:**

*Density* is defined as the amount of matter that occupies a given unit of space; it can also be though of as the “compactness” of a substance. Dense materials (such as brick or gold) are very heavy for their size whereas less dense substances (such as a big bag of feathers or a filled balloon) are light for their size.

Density is equal to a substance’s mass per unit volume, where *mass* is the amount of matter in an object (measured in grams) and *volume* is the amount of space that an object occupies (measured in milliliters or cubic centimeters). The equation to calculate density is as follows:

 

Density is an intensive physical property of matter‐ that is, it is a property unique to a specific substance no matter what the size of the sample. Density can therefore be used to distinguish one substance from another. The identity of an unknown substance can be determined by measuring its density in the lab. The experimental values for density can be compared to the density recorded in scientific literature and the substance can often be identified.

Determining the density of an object involves measuring the object’s mass and volume and then calculating density. Mass can be measured using a balance. Volume can be measured in several ways. The volume of a liquid substance can be measured using a graduated cylinder. When using a graduated cylinder, accuracy is important. The volume needs to be read at eye level and from the lowest point of the meniscus. The technique used for measuring the volume of a solid, however, depends on the shape of the sample.

The volume of an irregularly shaped solid, however, cannot be measured using a ruler. It must be found indirectly using a method called **water displacement**. Water displacement involves submerging the object into a known volume of water and measuring the volume rise after adding the object. The volume of eater displaced by the solid is equal to the object’s volume (in mL or cm3).

Volume of a cylinder: $V=πr^{2}h$

**Materials:**

Clear liquid 1 Electronic balance

Clear liquid 2 Triple beam balance

Foam block 50 mL graduated cylinder (2)

White block Metric ruler

Metal cylinder Pipette

Rubber stopper Tap water

**Procedure:**

1. Determine the mass and volume of each of the following materials using the appropriate method as outlined in the background section.

Station 1 – Clear Liquid 1

Station 2 – Clear Liquid 2

Station 3 – White block

Station 4 – Foam block

Station 5 – Rubber stopper

Station 6 – Metal cylinder

Record the mass and volume of each substance into the Density Data Table. INCLUDE PROPER UNITS!

Calculate the density of each material.

**Clean‐up:**

Please return all liquids back to their original beakers. DO NOT THROW AWAY! DO NOT POUR DOWN SINK! These materials are to be reused.

**Resources: Densities of Common Substances**

|  |  |  |  |
| --- | --- | --- | --- |
| **Substance**  | **Density (g/cm3)**  | **Substance**  | **Density (g/cm3)**  |
| Ethanol  | 0.789  | Glass  | 2.4 ‐ 2.8  |
| Oil  | 0.86 ‐ 0.93  | Aluminum  | 2.70  |
| Polyethylene plastic  | 0.92  | Fool’s Gold (FeS2)  | 5.0  |
| Water  | 1.000  | Iron  | 7.86  |
| Polystyrene plastic  | 1.06  | Copper  | 8.92  |
| Rubber  | 1.34  | Lead  | 11.3  |
| Silicon  | 2.33  | Gold  | 19.3  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Station #**  | **Name of Object**  | **Mass (g)**  | **Volume (mL or cm3)** | **Density (g/mL or g/cm3)** |
| **1**  | Clear Liquid 1  | Cylinder = Cylinder + liquid = Liquid =  |  |  |
| **2**  | Clear Liquid 2  | Cylinder = Cylinder + liquid = Liquid =  |  |  |
| **3**  | White block  |  | L = W = H = V =  |  |
| **4**  | Foam block  |  | L = W = H = V =  |  |
| **5**  | Rubber stopper (Water displacement method)  |  | Water = Water + stopper = Stopper =  |  |
| **6**  | Unknown Metal (Water displacement method)  |  | Water = Water + metal = Metal =  |  |

**Density Data Table**

**Post Lab Questions:**

Answer the following questions in the space provided below. USE COMPLETE SENTENCES!

1. Rank the materials tested in this lab in order from most dense to least dense.
2. List the items in the lab that would float on water. How did you determine this?
3. If the foam block were cut in half, would its density change? Explain why or why not.
4. How could you determine the density of your own body?
5. Using the resources from pg 3, determine the identity of Clear Liquid 1 and Clear Liquid 2.
6. Using the resources from pg 3, determine the identity of the metal cylinder.
7. What make density an important factor to know about a substance?