Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Density: Solids vs. Liquids

**Purpose**

The purpose of this lab is to explore the fundamental concept of density.[[1]](#endnote-2)

**Procedure**

 **Materials**

1. Containers with different 7. Wood chips (3)

Volumes and shapes (5) 8. Granite rocks (3)

1. Balance 9. Pieces of coal (3)
2. Graduated cylinder 10. Pieces of quartz (3)
3. Funnel 11. Pieces of tape (5)
4. Paper towels 12. Pen
5. Calculator 11. Ruler

**Sequence of Steps**

![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()\*Which is denser: solid matter or liquid matter? Is there a difference? Consider these questions and form your hypothesis. Write your hypothesis under “observations” on page 3.

**Part 1: Density of Water**

1. Evaluate the 5 containers you have. Predict which will hold the largest volume of water, from greatest volume to least volume.
2. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Using the tape and a pen, label all five containers A-E. (A should indicate the container with the greatest volume, and E should be the lowest volume.)
3. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Using the scale, determine the mass of the empty containers and record your data in Table 1. Determining the Density of a Liquid Substance.
4. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Fill each cup with water and determine the mass of the filled container to the nearest gram. Record your data in Table 1.
5. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Subtract the mass of the empty container from the mass of the filled container. This will give you the mass of the water. Record the mass of the water in Table 1.
6. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Using the graduated cylinder, determine the volume of water for each container. Record your data in Table 1.
7. Determine the density of water by using the density formula, and record your data in Table 1.

Density = mass/volume

**![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Part 2: Density of Solid Objects**

1. Estimate the volume of each sample by using the “*formula method”* for regular shaped objects and record data in Table 2. Determining the density of solid objects.

***Example:*** *To find the volume of a rectangular object, the formula is: Volume= (base) x (height) x (width)*

1. Fill the graduated cylinder with water to 50mL.

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1. Find the volume of an object using the “*water displacement method”* and record your data on Table 2.
2. Note that the water is at 50mL
3. Carefully drop the solid object into the graduated cylinder of water. Determine the new level of the water.
4. Subtract from this number the original level (50mL). This will indicate how much water was displaced by the solid object.
5. The amount of water displaced = the volume of the object.

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1. Using the same formula you used in Part 1 of this lab, calculate the density for each piece of solid matter. Record data in Table 2.

**![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()**

**Observations**

**\*Hypothesis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Table 1. Determining the density of a liquid substance.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Container | Mass of Empty Container (g) | Mass of Container & Water (g) | Mass of Water (g) | Volume of Water (mL) | Density of Water (g/mL) |
| A |  |  |  |  |  |
| B |  |  |  |  |  |
| C |  |  |  |  |  |
| D |  |  |  |  |  |
| E |  |  |  |  |  |

Table 2. Determining the Density of solid objects.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name of Solid Object | Mass (g) | Volume using Formula (cm3) | Volume using Water Displacement (cm3) | Density using Formula  | Density using Water Displacement  |
| Wood Chip 1 |  |  |  |  |  |
| Wood Chip 2 |  |  |  |  |  |
| Wood Chip 3 |  |  |  |  |  |
| Granite 1 |  |  |  |  |  |
| Granite 2 |  |  |  |  |  |
| Granite 3 |  |  |  |  |  |
| Coal 1 |  |  |  |  |  |
| Coal 2 |  |  |  |  |  |
| Coal 3 |  |  |  |  |  |
| Quartz 1 |  |  |  |  |  |
| Quartz 2 |  |  |  |  |  |
| Quartz 3 |  |  |  |  |  |

1. Based on your experiment, what was the average density of the water?
2. Which solid object was the densest?

1. What are some factors that lead to coming up with varying densities of water each time?
2. What are some things you could do next time to acquire more accurate data?
3. Were your predictions correct on the volume of water the container would hold? What are some things that might have thrown you off?
4. What are the two methods we used to determine the volume of a solid object?
	1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. In your opinion, which method do you think is the most accurate way for determining the volume of a solid object? Explain.
6. Why did some objects float when you placed them in water and others sink?
7. What did you discover about the density of solids vs. liquids?
8. Based on this information, do you accept or reject your hypothesis?

 (accept = your hypothesis was right, reject = your hypothesis was wrong)

1. How is density used in agriculture? Think creatively and develop two examples where density could be important to agriculturists.
1. Prescott, Diane (2008).Density, Lab. *Atwater High School*. [↑](#endnote-ref-2)