

Lesson 2: Determining Density

Science Focus Question

Is density a characteristic property of matter?

Equipment

1. Electronic Balance: used to measure the mass of an object or substance. Always remove red spacer and zero scale before using. Never put heavy objects on balance.

Getting Started

What do you think the difference is between mass and volume? _____

Reading: Useful Calculations

- 1) Why can milliliters and cubic centimeters be used interchangeably when measuring the volume of objects and substances?

- 2) What equipment is used to measure the volume of liquids?

- 3) How can you measure the volume of a regular object, such as a block?

- 4) What method do we use to measure the volume of an irregular shaped solid?

5) What is density and what units do we measure it in?

Inquiry 2.1

Measuring the Mass and Volume of Water

- A. What is the unit of measure for the graduated cylinder? _____
- B. What is the maximum volume it can measure? _____
- C. What is the minimum volume it can measure? _____
- D. What does each line represent on the graduate cylinder? _____

Class procedure for finding the density of 50mL of water.

Results

Calculating Density Table

A	B	C	D	E	F
Volume of Water (ml)	Mass of Graduated Cylinder (g)	Mass of Graduated Cylinder & Water (g)	Mass of Water (g)	Mass of 1 ml of Water (g)	Density (g/ml)
			(C - B)	(D / A)	(F = E)
10mL					
25mL					
50mL					
67mL					
90mL					
?mL					

Analysis: Graphing your results

Create a line graph in the space below that shows the mass for each volume of water you measured. Place the volume on the x-axis and the mass on the y-axis. Be sure to provide a title for your graph and label the axes with the proper units.

Laboratory Questions

- 1) Does changing the volume of water change the mass of 1 ml of water?

- 2) Does changing the mass of water change the mass of 1 ml of water?

- 3) What is the density of water in grams per ml? _____

- 4) Does changing the mass or volume of water change its density?

Inquiry 2.2

Comparing the Densities of Different Substances

Before you begin determining the densities of the 3 different substances, predict their order of density, from least dense to the most dense. Be sure to give a reason for your predictions. _____

Results

Table 1: Comparing Different Substances

Substance	Length (cm)	Width (cm)	Height (cm)	Volume (cm³)	Mass (g)	Density (g/cm³)
White Plastic Block						
Aluminum Block						
Clear Plastic Block						

Laboratory Question

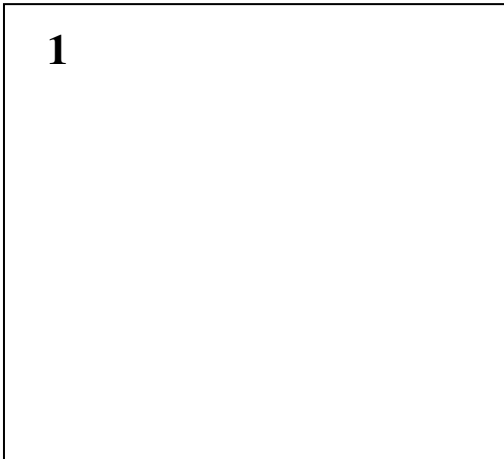
- 1) Are the densities of the substances the same or different? Provide an example from this investigation to support your answer. _____

Inquiry 2.3

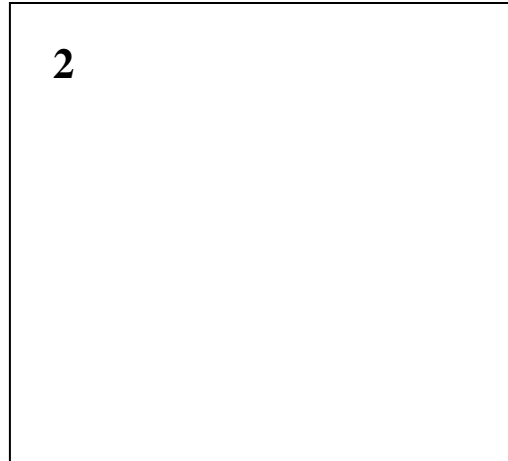
Measuring the Densities of Irregular Objects

Create a labeled diagram of the procedure used to find the density of irregular objects in this inquiry.

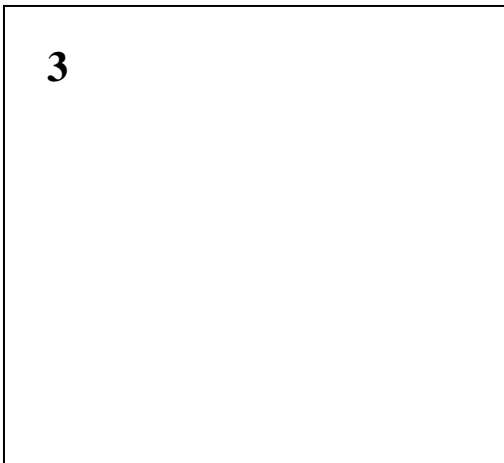
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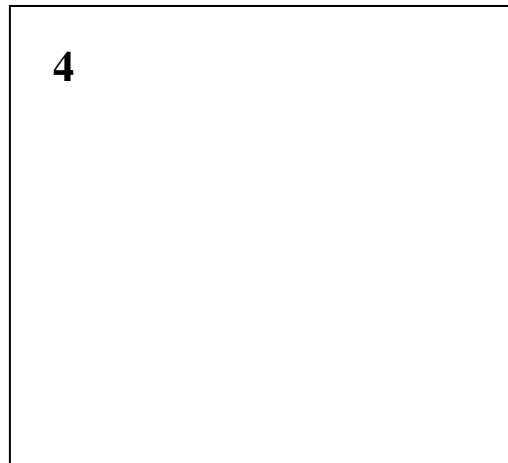
2



3



4



Results

Create a table to record your measurements and calculations for the densities of the steel screw, copper cylinder and nylon spacer.

Class Data Table: Densities of objects

Object	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Average
White Plastic Block									
Aluminum Block									
Clear Plastic Block									
Steel Screw									
Copper Cylinder									
Nylon Spacer									

Laboratory Questions

1) Are any of the blocks from Inquiry 2.2 or objects from inquiry 2.3 made from the same substance? How did you reach this conclusion? Support your answer with evidence. _____

2) How do the densities of the substances compare with the density of water? _____

Analysis

Use your group’s measurements of mass and volume for all the objects (**white plastic block, clear plastic block, aluminum block, steel screw, copper cylinder and nylon spacer**) to place them onto your graph of the mass and volume of water. Be sure to label each object.

Inquiry 2.4

Comparing Densities of Objects Made from the Same Material

The first portion of this inquiry is a demonstration by your science teacher. Complete the following as explained in the demonstration.

Prediction

Do you predict the density of the aluminum cylinder will be **greater**, **less** or the **same** as the density of the aluminum block? Explain your answer.

Object	Volume (ml)	Mass (g)	Density (g/ml)
Aluminum Block			
Aluminum Cylinder			

What is the mass of 1 cm^3 of aluminum? _____

Laboratory Questions

- 1) If you knew the mass and density of an object, explain how you could find the volume of that object. _____

- 2) Complete the following table using the given information to determine the missing data. Be sure to label your numbers with the proper units.

Object	Volume	Mass	Density
1	27ml	16.2g	
2		72.0g	9.0g/ml
3	9ml		1.5g/ml

- 3) Does changing the shape or amount of a substance change its density? Why or why not? Use evidence from this inquiry to support your answer.

- 4) How could you use density to identify the substance from which an object is made? _____

Reading: Density as a Characteristic Property

- 1) What is a characteristic property?

2) Is a characteristic property affected by the amount or shape of a substance?
Give an example. _____

3) Based on your results from this lesson, do you think aluminum or steel would be better for building an airplane? Why? _____

Reading: Mass or Weight?

1) If you were to travel to the moon, would your mass change? Why or why not?

2) How about your weight, would it change if you traveled to the moon? Explain why or why not. _____

Reading: Archimedes' Crowning Moment

1) Pretend you are Archimedes. Create a procedure you could use to compare the density of a crown with the density of gold?
