

Density Discoveries

Student Lab Investigation

Question: Can density of a substance be used as a characteristic property of a substance?

Background Information:

- Mass is the amount of matter in a substance.
- Volume is the amount of space matter occupies.
- Density is the amount of matter in a given space. Density equals mass divided by volume ($d=m/v$).

Hypothesis: Density can/cannot be used as a characteristic property of a substance.
(circle one)

Materials:

Triple Beam Balance
Graduated Cylinder 100mL
Water source
Calculator
2 erasers
2 pieces of chalk
3 lead fishing sinkers
1 ball of clay and plastic cutting knife

Procedure:

1. Calibrate your triple beam balance before each measure.
2. Fill the graduated cylinder with 50mL of water and refill to 50mL for each measurement.
3. Place one half eraser on to the triple beam balance and record the mass in grams on the data chart.
4. Repeat this measurement with one whole eraser and two whole erasers. (Note: Two halves = 1 whole eraser.)
5. Use the triple beam balance to find the mass of the three different lead fishing sinkers and record each measure in grams on the data chart.
6. Use the triple beam balance to find the mass of the chalk samples. You will need to break one piece into two halves. Record the measurements in grams on the data chart.
7. Use the triple beam balance to find the mass of the whole ball of art clay. Then use the plastic knife to cut the whole ball in half. Roll the clay into a sphere and find the mass of half the clay. Finally, cut the half in half. Roll the clay into a sphere to find the volume of one fourth of the clay. Record each measure in grams on the data chart.

8. Use the graduated cylinder to find the volume for each object in the investigation. Record each measurement in cubic centimeters on the data chart.
9. Use your calculator to derive the density of each object. Use the formula $d=m/v$. Record each measurement in grams per cubic centimeter on the data chart.
10. Analyze the data you collected on your data chart to draw a conclusion.
11. Answer the critical thinking questions. Use your data to support your answers.

Density Discoveries Data Chart

Object	Amount	Mass (g)	Volume (cm ³)	Density (g/cm ³)
<i>Pink Eraser</i>	One Half			
	One Whole			
	Two Whole			
<i>Fish Sinkers</i>	Sample Size 1			
	Sample Size 2			
	Sample Size 3			
<i>Chalk</i>	One Half			
	One Whole			
	Two Whole			
<i>Art Clay</i>	Whole Ball			
	One Half			
	One Fourth			

Conclusion: Density is/is not a characteristic property of matter.
(circle one)

Critical Thinking: Record your answers on a separate sheet of paper.

1. How does the density of the larger sample amount compare with the density of the smaller sample amount?
2. Can density be used to identify a substance? Use data from your results to support your answer.
3. What may account for the minor differences in density among the same substance?
4. How does the density of the lead samples differ from the density of the eraser samples?

Teacher Assessment Tools

The Student Lab Investigation Sheet

The lab investigation sheet will serve as a formative assessment as students are recording data and working through the investigation.

The lab investigation sheet can also be used as a summative assessment. Students will need to identify a hypothesis by circling one of the two choices. Either choice is acceptable as a hypothesis. However, the students should conclude that density is a characteristic property of matter in the conclusion of the investigation.

The data chart found in the investigation will be used to assess student ability to record data and apply skills to solve real-world problems. The data will differ slightly among lab groups, but the teacher will be able to assess the reasonableness of the data.

Critical Thinking Questions Answer Key

The critical thinking questions will be used as a summative evaluation of student understanding. The following answer key provides a sample of correct responses.

1. The density of the large sample and the small sample of the same substance is the same or about the same.
2. Yes, density can be used to identify a substance because each sample size of the same substance has the same density.
3. There could be a slight error in reading or calibrating the balance. Students may misread the meniscus. A student may error when typing numbers in the calculator, etc.
4. Lead has a greater density than the eraser.

Goal 3 Standards Checklist

Student Name:	Yes	No
Worked cooperatively with other people with various backgrounds		
Efficiently allocated time and materials to perform the lab investigation		
Demonstrated numerical problem solving skills		
Practiced proper lab safety and procedures		

(A sample checklist for the entire class can be found on the next page.)

Density Discoveries Goal 3 Standards Checklist

NAME	Worked cooperatively with other people with various backgrounds		Efficiently allocated time and materials to perform the lab investigation		Demonstrated numerical problem-solving skills		Practiced proper lab safety and procedures	
	YES	NO	YES	NO	YES	NO	YES	NO
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