

Mass in Space

Measure mass and volume to compare materials.

SC.8.P.8.3 "Explore and describe the densities of various materials through measurement of their masses and volumes."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each measurement unit and circle each phrase that tells how to calculate or compare density. These marks will help you connect mass, volume, and density.

Equal-Size Samples

- ① Density describes how much mass is packed into a certain volume. To investigate it, a lab team measured several equal-size solid samples. They found each sample's mass with a balance in grams. They found volume by measuring length, width, and height in centimeters, then multiplying those three measurements to get cubic centimeters.
- ② The table shows the team's measurements. Because every sample had a volume of 10 cm³, differences in mass are easy to compare. In general, divide mass by volume to calculate density. A density written as g/cm³ tells how many grams of matter fill one cubic centimeter. Use measured numbers, not appearance, to compare materials.

MEASUREMENTS OF EQUAL-SIZE SAMPLES

Material	Mass (g)	Volume (cm ³)
Pine wood	5	10
Acrylic plastic	12	10
Aluminum	27	10
Copper	89	10

- ③ A material with a larger density has more mass in the same volume, so it is more tightly packed. Density is a property that can help identify a material, but a single measurement may have error. Carefully reading the balance and ruler, using matching units, and repeating trials make a density comparison more reliable.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 How did the lab team measure the volume of each solid sample?

2 Calculate the density of the acrylic plastic sample. Show the division and include units.

3 Which sample has the greatest density? Use its mass and volume to support your answer.

4 Order the four materials from least dense to most dense. Explain why the mass values can be used for this comparison.

A rectangular mystery block has a mass of 54 g. Its length is 3.0 cm, width is 2.0 cm, and height is 1.5 cm. Complete the table, then write one sentence explaining what its density means. Then measure two real solid rectangular blocks made of different materials with your teacher. Use a zeroed balance to record each mass in grams and a ruler to record its length, width and height in centimeters. On extra paper make Material / Mass / Length / Width / Height / Volume / Density rows; calculate each volume and density from your readings. Compare the measured densities in one sentence. Keep these actual measurements separate from the supplied mystery-block table.

QUANTITY	MEASUREMENT

PART 1 • READ AND MARK

Underline each measurement unit and circle each phrase that tells how to calculate or compare density. These marks will help you connect mass, volume, and density. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	How did the lab team measure the volume of each solid sample?	They measured length, width, and height in centimeters and multiplied the three measurements to find volume in cubic centimeters.
2	Calculate the density of the acrylic plastic sample. Show the division and include units.	$12 \text{ g} \div 10 \text{ cm}^3 = 1.2 \text{ g/cm}^3$.
3	Which sample has the greatest density? Use its mass and volume to support your answer.	Copper. Its density is $89 \text{ g} \div 10 \text{ cm}^3 = 8.9 \text{ g/cm}^3$, the greatest value.
4	Order the four materials from least dense to most dense. Explain why the mass values can be used for this comparison.	Pine wood, acrylic plastic, aluminum, copper. All samples have the same volume, so the sample with more mass has greater density.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Mass | 54 g

Length | 3.0 cm

Width | 2.0 cm

Height | 1.5 cm

Volume | 9.0 cm^3

Density | 6.0 g/cm^3

Its density means that each cubic centimeter of the block has a mass of 6.0 g.

Accept correct calculations with equivalent unit notation. For the open task, accept 9 cm^3 for volume and 6 g/cm^3 for density, with a sentence that correctly connects density to mass in one cubic centimeter.

Teacher supplies two solid, non-hollow rectangular blocks of different materials, such as wood and acrylic, a gram balance, centimeter ruler and calculator. Check squared edges and no cavities; avoid irregular or hollow samples for this ruler method. Demonstrate zeroing and reading precision, then have each learner take or accessibly read actual measurements. Volume = length $\times$ width $\times$ height; density = measured mass / measured volume in g/cm^3 . Verify calculations against the actual records, accepting approximate values and reasonable measurement uncertainty; do not substitute the fictional table values. Materials need not have equal volumes because density uses each measured volume. ACS What is Density? supports ruler volume and balance mass measurements:

<https://www.acs.org/middleschoolchemistry/lessonplans/chapter3/lesson1.html> .