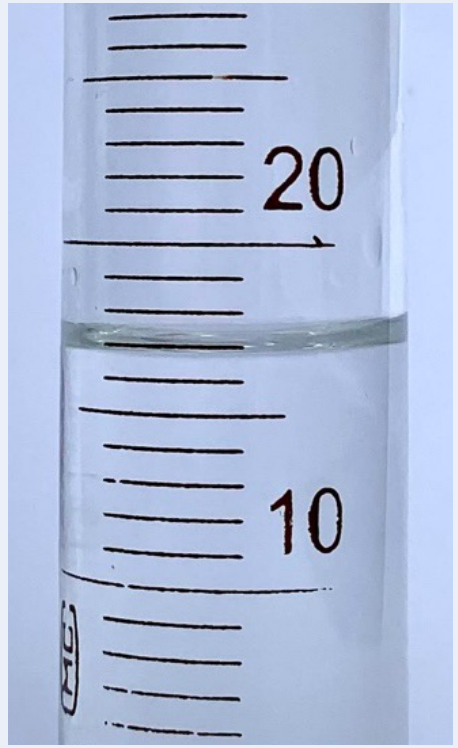
Measuring Density

Answer the questions below.



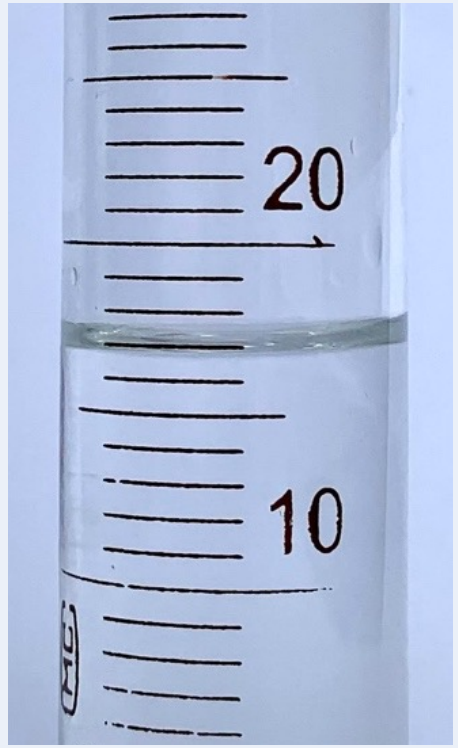
1. Define density.
   Mass per unit volume
2. State the formula to calculate the volume of a cube.
   $\mathbf{V = lbh}$
3. Which state of matter has the lowest density?
   Gas
4. State the volume shown in this image.
   17 mL
5. Convert this volume into litres.
   0.017 L

Do Now

Measuring Density

Do Now:

1. Define density.
2. State the formula to calculate the volume of a cube.
3. Which state of matter has the lowest density?
4. State the volume shown in this image.
5. Convert this volume into litres.



Drill:

1. State the formula to calculate area of a circle.
2. Calculate the area of one end of this cylinder.
3. Calculate the volume of this cylinder.

Radius = 2 cm

10 cm

Do Now

Measuring Density

Read Now:

Density is the mass per unit volume, calculated using the mass of a substance divided by its volume. For regularly shaped solids, such as cubes, cuboids and cylinders, we can use mathematical formula to calculate their volumes. For irregularly shaped solids we must use a different method, as these formulae do not apply. We can use a piece of equipment called a Eureka can to measure how much liquid is displaced when the object is placed into it. You can think about this like when you get into the bath and the water rises. If the bath was full to the top and you got into it, the volume of water that spilled out of the bath would be equal to your volume.

1. Define density.
2. Describe how to calculate the volume of a regularly shaped solid.
3. Give an example of a regularly shaped solid.
4. Name the piece of equipment that can be used to measure the volume of liquid displaced by an irregularly shaped solid.
5. This paragraph describes how to measure the volume of different solids. How could you measure the volume of a liquid?

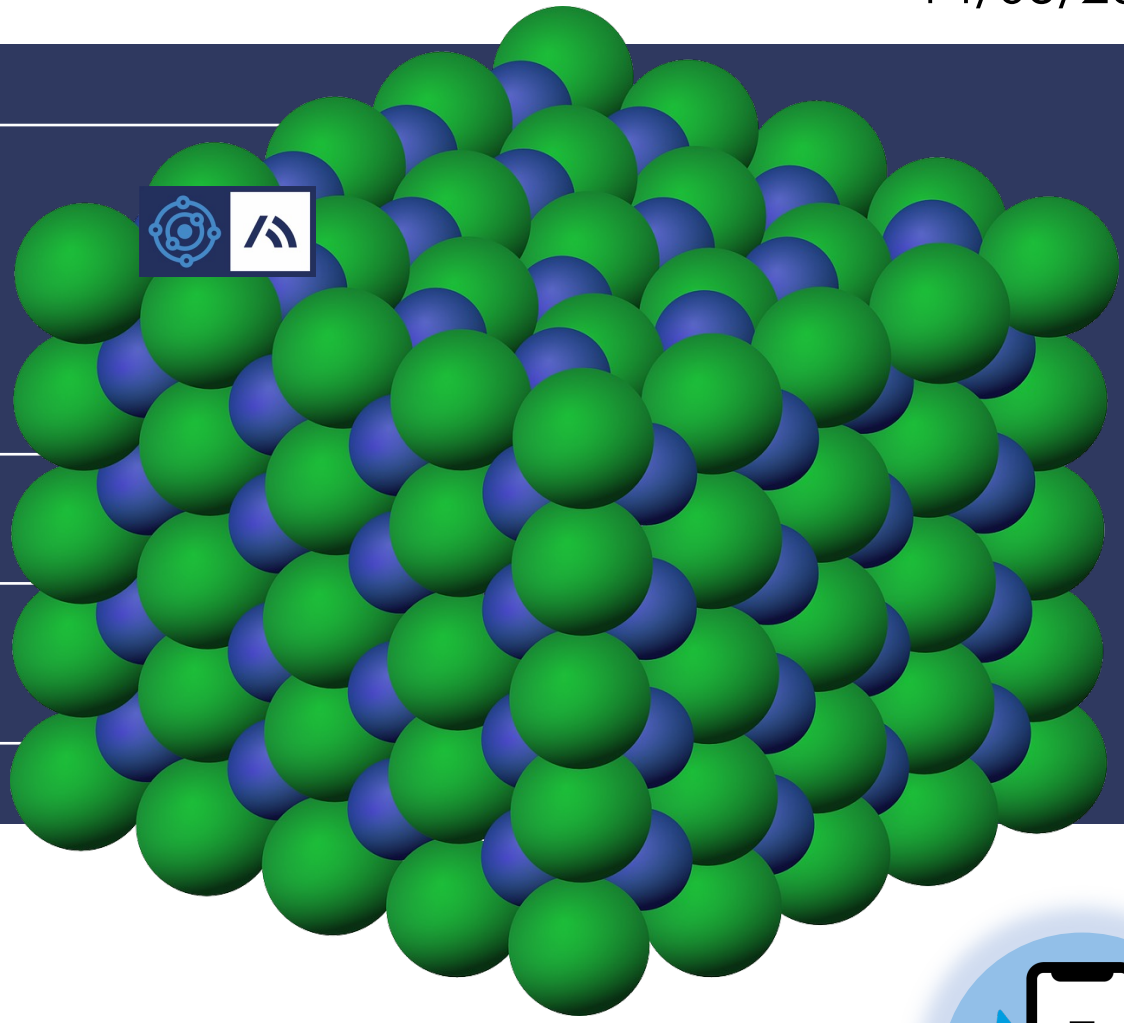
Do Now

14/03/2024

Measuring Density

P4.1.3

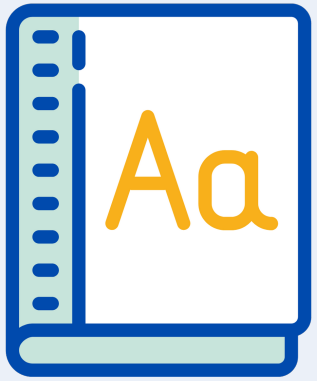
Science
Mastery



Following this lesson, students will be able to:

- Describe how to measure density of an irregularly shaped solid
- Measure volume accurately
- Compare the methods for measuring the densities of an irregular and a regularly shaped solid

Key Words:



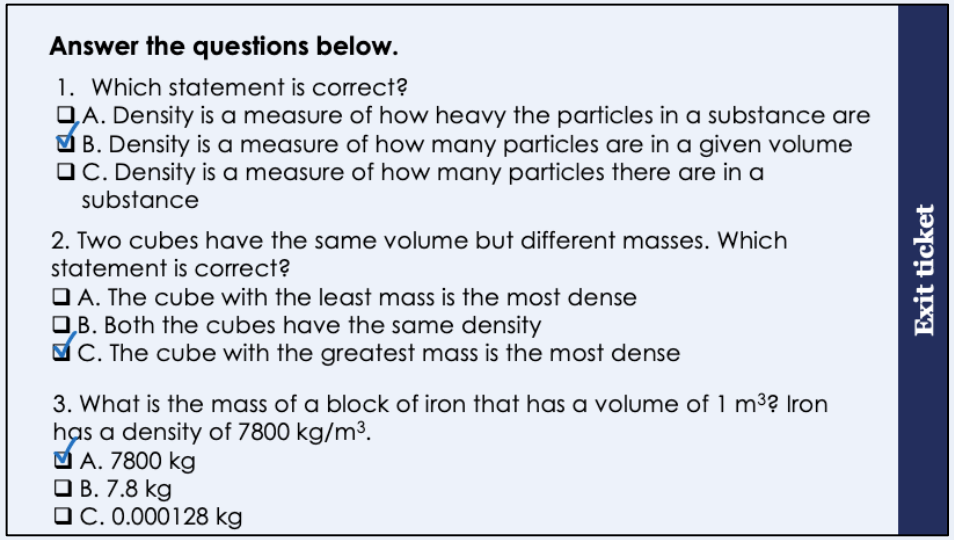
density	**mass**	**volume**	**regular**
irregular	**displacement**	**Eureka can**	

Lesson Objectives

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.



Answer the questions below.

1. Which statement is correct?
   - ☐ A. Density is a measure of how heavy the particles in a substance are
   - ☑ B. Density is a measure of how many particles are in a given volume
   - ☐ C. Density is a measure of how many particles there are in a substance

2. Two cubes have the same volume but different masses. Which statement is correct?
   - ☐ A. The cube with the least mass is the most dense
   - ☐ B. Both the cubes have the same density
   - ☑ C. The cube with the greatest mass is the most dense

3. What is the mass of a block of iron that has a volume of 1 m^3? Iron has a density of 7800 kg/m^3.
   - ☑ A. 7800 kg
   - ☐ B. 7.8 kg
   - ☐ C. 0.000128 kg

Exit ticket

Fix-it

Measuring Density

What is the equation to calculate density?

What measurements would need to be taken to calculate density?

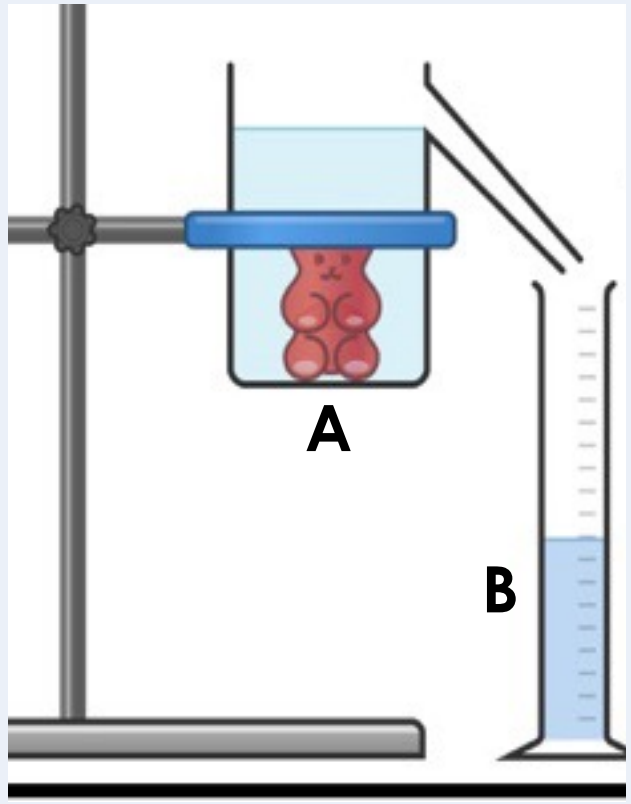
How would you take these measurements?

Talk Task

Using a displacement/eureka can

If an object has an **irregular shape**, the volume can be measured using a **displacement can**, or **Eureka can**.

1. Fill the displacement can (A) with water and wait until the water stops running out of the spout.
2. Place a graduated cylinder (B) under the spout.
3. Carefully lower the irregular object into the displacement can, collecting the displaced water in the graduated cylinder.



The **displaced** water in the cylinder occupies the same amount of space as the irregular object. **The volume of water in the graduated cylinder is equal to the volume of the object!**

Which statements do you agree with?

The displacement method only works for irregularly shaped solids

The displaced volume of water is equal to the volume of an object

Mass is measured using a balance

Density = mass x volume

Talk Task

Drill

1. State the equation that links density, mass and volume.
2. Name the piece of apparatus used to measure mass.
3. Describe how to calculate the volume of a regularly shaped solid.
4. Describe how a displacement/eureka can is used to measure the volume of an irregularly shaped solid.
5. List any units that could be used to measure mass.
6. List any units that could be used to measure volume.
7. Describe how to read the measurement of a liquid.

Check for understanding

Drill answers

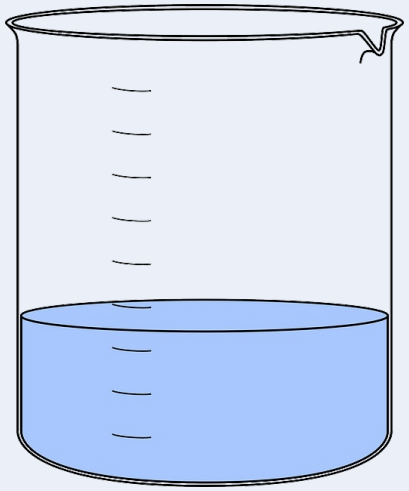
1. $\rho = \frac{m}{V}$
2. balance
3. using the formula V = lbh
4. The displacement can is filled with water, before the object is added. The volume of water displaced from the eureka can is equal to the volume of the object.
5. kg, g
6. L, mL
7. Measure at eye level, reading from the bottom of the meniscus

Check for understanding

I: Describe: *to recall facts, events or processes in an accurate way*

Example question:

Describe how to determine the density of a liquid.

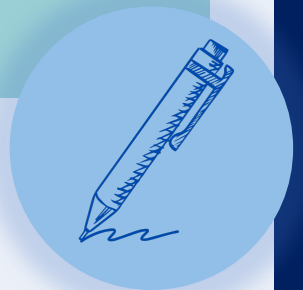


Model answer:

- Measure the **volume** using a **measuring cylinder**
- Measure the **mass** of the empty measuring cylinder using a **mass balance**
- Measure the mass of the measuring cylinder when the liquid is in it and **subtract** the mass of the empty cylinder
- Use the equation **density = mass/volume**

To 'describe', your answer should:

- Use **bullet points.**
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.

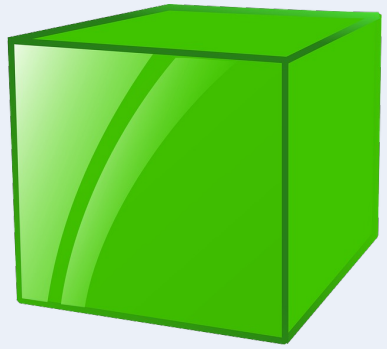


Writing like a scientist

We: Describe: *to recall facts, events or processes in an accurate way*

Example question:

Describe how to determine the density of a regularly shaped object.

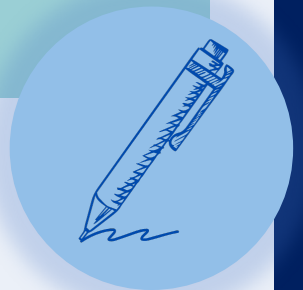


Model answer:

- Measure the **mass** of the object using a **mass balance**
- Calculate the **volume** using its dimensions (V=lbh)
- Use the equation **density = mass/volume**

To 'describe', your answer should:

- Use **bullet points.**
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.



Writing like a scientist

You: Describe: *to recall facts, events or processes in an accurate way*

Example question:

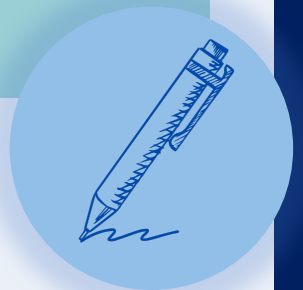
Describe how to determine the density of an irregularly shaped object.

Model answer:

- Measure the **mass** of the object using a **mass balance**
- Part fill a measuring cylinder with water and place next to a **displacement can or Eureka can**
- Add the object to the measuring cylinder and measure the **volume** of water **displaced**.
- This is the **volume of the object**
- Use the equation **density = mass/volume**

To 'describe', your answer should:

- Use **bullet points.**
- Include each step of the process in a **logical order.**
- Use **keywords** throughout the answer
- Stay **focused** on the question.



Writing like a scientist

Answer the questions below.

1. Which measurement is taken using a displacement or eureka can?

- ☐ A. Density
- ☐ B. Mass
- ☑ C. Volume

2. Which statement is correct?

- ☑ A. The volume of water displaced by an irregularly shaped object is the same as the volume of the object
- ☐ B. The volume of water left in the eureka can is the same as the volume of the object
- ☐ C. Using the volume of water displaced by an object only works for irregularly shaped objects

3. What is the density of an object with mass 5 g that displaced 25 cm^3 of water?

- ☐ A. 125 g/cm^3
- ☑ B. 0.2 g/cm^3
- ☐ C. 5 g/cm^3

Exit ticket

Feedback

Lesson P4.1.3	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link. Thank you!