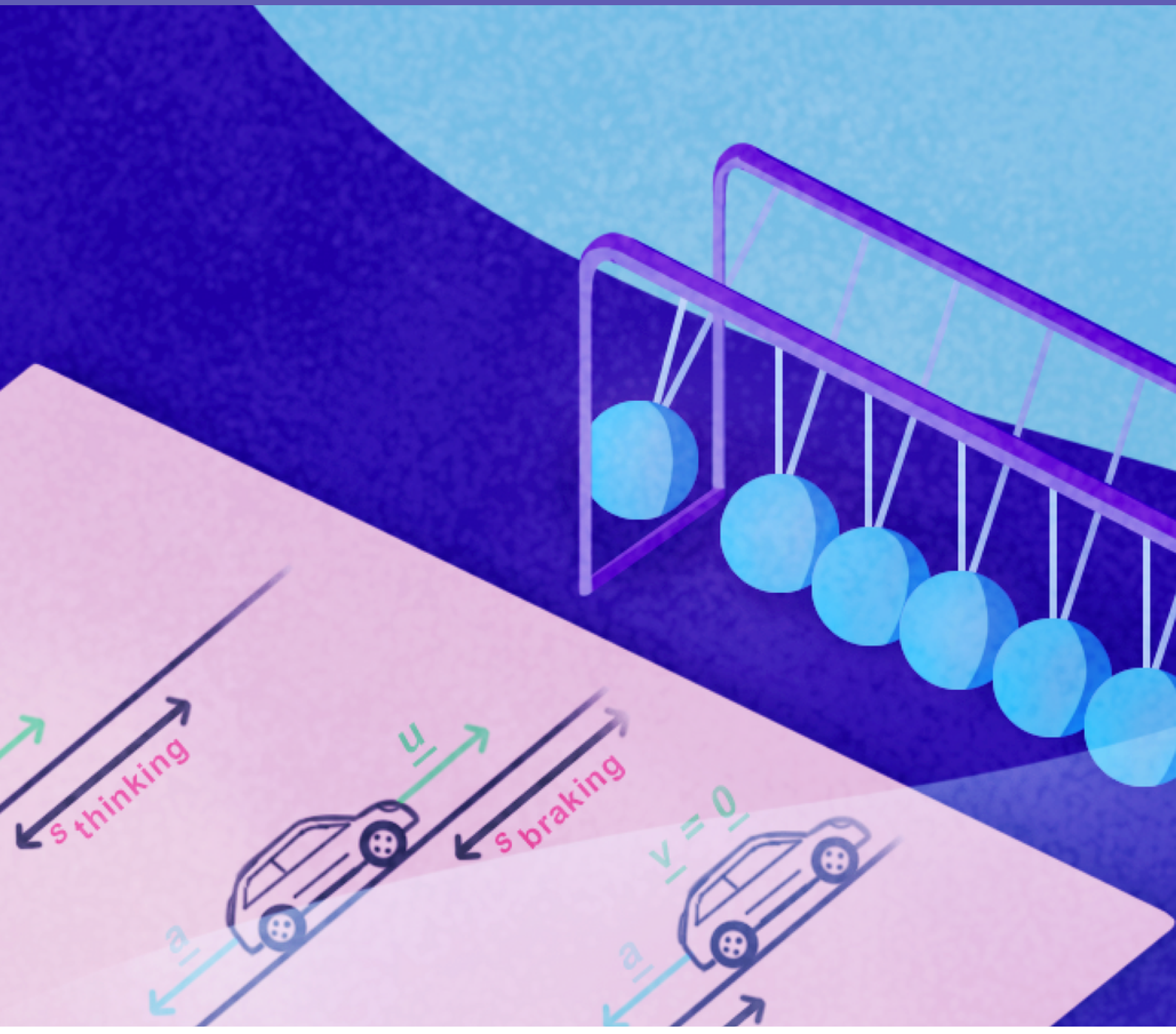
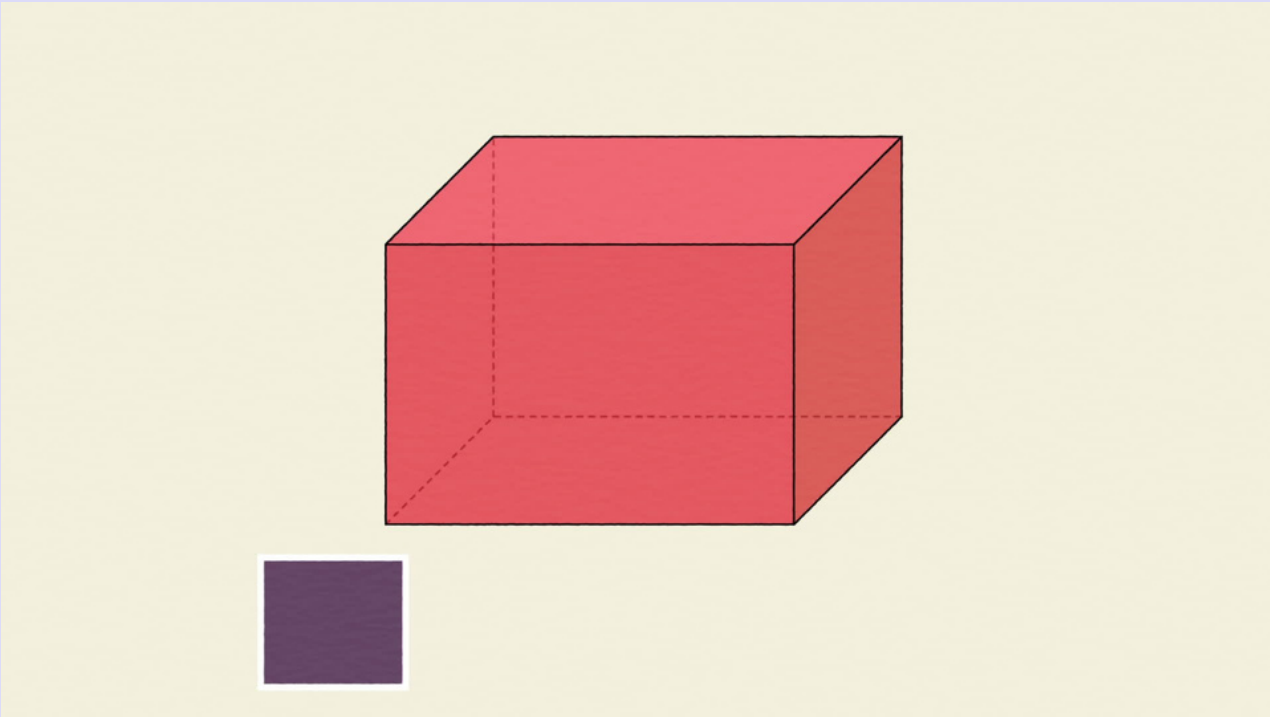
OUP Physics

# What Experiments Measure Density?



# About this video



OUP PHYSICS

## What Experiments Measure Density?

Measuring density is helpful in all walks of life. How do we do it and what are the calculations?

### Key question:

What is density, what is its relation to volume and mass and how can the density of solids, liquids and irregular solids be quantified through experimentation?

### Key vocabulary:

mass | experiments | volume | density | regular solids | formulae

liquids | cuboid | displacement can | irregular solids | measuring cylinder

### Learning intention:

Learn about the method of measuring the density of regular solids, irregular solids and liquids through different experimental procedures.

# After watching

## Activity 1: Graphic organizer

Students are to use the *Controlled Experiment* graphic organizer to understand the concepts of the different experiments shown in the video.

## Activity 2: Measuring density

Students will investigate experimentally the relationship between the mass and volume of regular solids, plot a graph to calculate density, and analyze and interpret the data gathered.

Students are given the formula for calculating density, D=m/V, and discuss the following hypothesis: “As the volume of the material increases, the mass will also increase”. They need to take into consideration that the greater the volume of the object the greater the number of atoms present which results in the object having greater mass.

**Materials:**

- Six regular objects of the same material but different volumes
- a half-metre ruler
- and a top pan balance

**Procedure:**

1. Select the smallest object. Measure the length, breadth, and height using a half-meter rule. Record the results in cm in a suitable table.
2. Repeat each of these measurements of length, breadth, and height and calculate the average.
3. Using the average values of length, breadth, and height, calculate the volume of the object using: Volume = length x breadth x height. Record the volume in cm3 in the table.
4. Place the object on the top pan balance. Record the mass in g in the table.
5. Repeat the procedure for the other five objects and record the values in the table

Students plot a graph of mass in g on the y-axis against volume in cm3 on the x-axis. They then draw a line of best fit through the points. Students calculate the gradient of the graph and hence the density of the object. The gradient of the graph = m/V = density. Students write a conclusion on the results and confirm whether the hypothesis was correct. They will also include a paragraph on the cause of the error (The main cause of error in this experiment is the measurement of length, breadth, and height, which can be kept to a minimum by repeating each measurement and calculating the average).

## Support (to help struggling learners):

Students can analyze the relation between density, volume, and mass and answer the following question:
*What is the density of a cube of sugar weighing 11.2 grams measuring 2 cm on a side?*

## Extension activity:

Students prepare the lab experiment for investigating experimentally the relationship between the mass and volume of liquids and analyze and interpret the data gathered. They can use one graduated cylinder where they add 50 cm3 each time up to 300 cm3 for 6 results.