

Measurement of the density of solids

Specification reference: AS Unit 1.1 — Basic physics

THEORY

The density of regularly shaped solids can be determined by measuring their mass, m , and calculating their volume, V . The density, ρ , can then be found using: $\rho = \frac{m}{V}$

APPARATUS

- Various regularly shaped solids both rectangular and circular 30 cm ruler (resolution ± 0.1 cm)
- Vernier calipers/micrometer (resolution ± 0.01 mm)
- Balance (resolution ± 0.1 g/1 g)

Possible objects to include could be steel ball bearings of various sizes, an optical glass/perspex block, blocks of various metals, wood, polystyrene sphere etc.

EXPERIMENTAL METHOD

Determine the mass of the object using the balance. The volume of a rectangle can be found by measuring the length, l , width, w , and height, h . Calculate the volume, V using: $V = l \times w \times h$. The volume of a sphere is found by measuring the diameter to find the radius, r , and then calculate the volume using: $V = \frac{4}{3}\pi r^3$.

In both cases calculate the density using: $\rho = \frac{m}{V}$.

Extension:

This is an excellent opportunity to introduce the concept of uncertainty to the students.

This could be extended to determine the density of irregular objects by putting them in water and measuring the volume of water displaced.

SPACE FOR NOTES

QUESTIONS

1. How is uncertainty propagated when measurements are multiplied together?

2. How can the volume of a sphere be ascertained?

3. How is the uncertainty of a variable calculated if that variable is equal to the power of a measurement taken?

4. How can the volume of an irregularly shaped object be determined?

5. What is interpolation?

DOWNLOADS

- Physics 3 2008 Question 3
- Physics 2012 Task A1
- Physics 3 2013 Task A1
- Experiment Flashcards