

Measuring the Relative Density of Some Common Solids

1. **Preparation:**
- Remind yourself of the definition of the term “relative density”.
 - See part 4 below.
2. The method suggested here is based on the observations made by Archimedes nearly 2000 years ago (we like to be up-to-date in physics!). For the purposes of this experiment, the principle of Archimedes can be stated as follows

When a body is under water, it experiences an apparent **loss** of weight equal to the weight of the water it displaces.

It can easily be shown that this principle leads to a very simple way of measuring the relative density of a solid which is more dense than water. To do this, we first measure the “real” weight, W of a piece of the solid and then measure the apparent weight, W_A of the same piece of solid when it is completely immersed in pure water. The relative density, R. D. can be calculated from the following equation

$$\text{R.D.} = \frac{W}{W - W_A}$$

3. Use a simple balance, as shown in figure 1. Obtain an equilibrium first with the piece of solid in air then with the same piece of solid immersed in water. This allows us to find the position of the mass, m , corresponding to the *real* weight of the object.

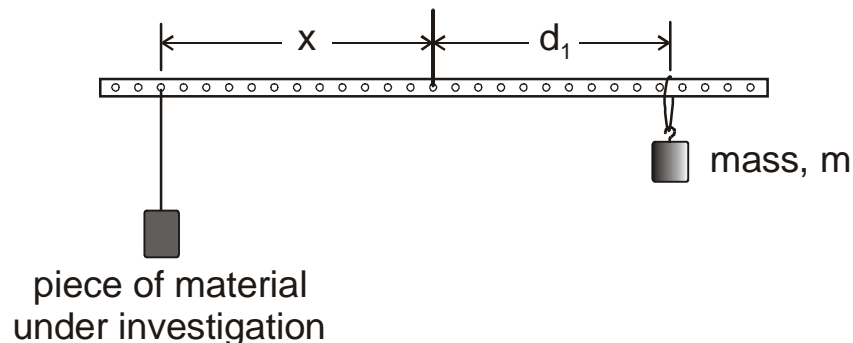


figure 1

Now find the position of the mass, m , corresponding to the *apparent* weight of the object when it is completely immersed in water.

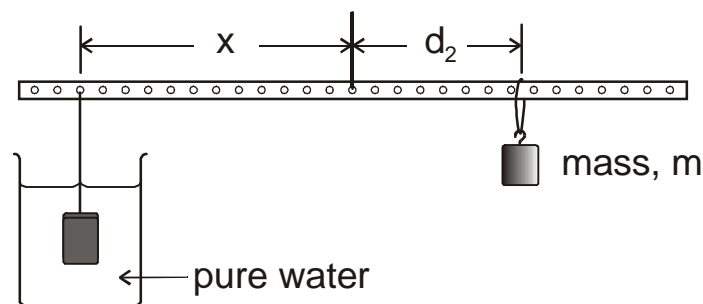


figure 2

4. It is recommended that, for each measurement of R.D., *both m and x remain constant*. By combining the definition of R.D. with the principle of moments you should be able to find an expression for calculating the R.D. of the solid which includes *only* the distances d_1 and d_2 .
5. Your report should include a diagram similar to figure 2 but with arrows representing the forces relevant your analysis.
6. For each value of relative density measured, work out the indeterminacy in the result. Then express your answers in the usual form: R.D. = $x \pm \delta x$ where δx is the indeterminacy.

Also calculate the % indeterminacy for each result.