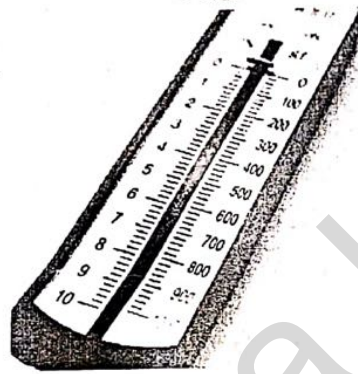
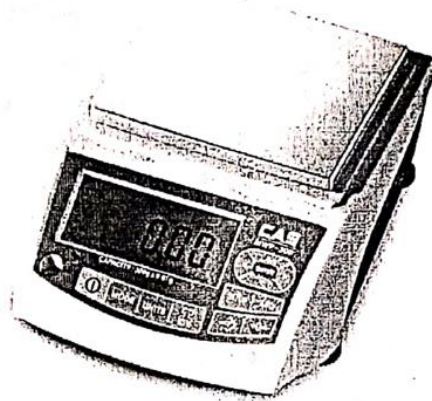


O Level Physics Syllabus Content for CAIE 2019-22 Exams

CHAPTER 4:

MASS, WIGHT AND DENSITY



Syllabus Content

- 4.1 Mass and weight
- 4.2 Gravitational fields
- 4.3 Density

Learning outcomes

Candidates should be able to:

- (a) State that mass is a measure of the amount of substance in a body.
- (b) State that the mass of a body resists change from its state of rest or motion.
- (c) State that a gravitational field is a region in which a mass experiences a force due to gravitational attraction.
- (d) Recall and use the equation $weight = mass \times gravitational\ field\ strength$.
- (e) Explain that weights, and therefore masses, may be compared using a balance.
- (f) Describe how to measure mass and weight by using appropriate balances.
- (g) Describe how to use a measuring cylinder to measure the volume of a liquid or solid.
- (h) Describe how to determine the density of a liquid, of a regularly shaped solid and of an irregularly shaped solid which sinks in water (volume by displacement).
- (i) Define density and recall and use the formula $density = mass/volume$.

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O / AS & A Level Physics

- Mass is a scalar expression that has magnitude only. Unlike weight is a vector measure, that has both magnitude and direction.
- Mass of an object can never be zero, whereas the weight of an object can be zero, if the gravitational force is not applied on the body, such as space.
- The unit of measurement of mass is kilogram (Kg), gram (g) and milligram (mg). Conversely, the measurement unit of weight is Newton (N).
- The balance used in the measurement of mass is pan balance, lever balance, triple-beam balance and so on. On the contrary, spring balance or weighing machine are used to measure the weight.

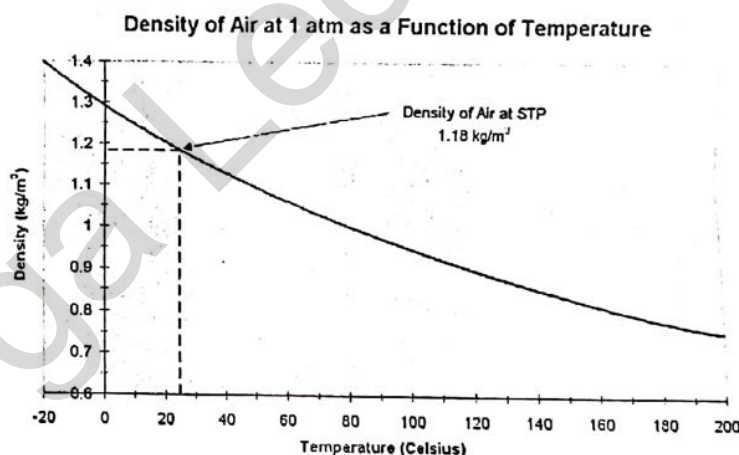
$$W = mg$$

Density:

Density of a substance is defined as the mass per unit volume of the substance.

Density is measured in kg/m^3 (g/cm^3). Density of water = 1 g/cm^3
 = 1000 kg/m^3

Because the mass of a certain body always constant and its volume increase with the temperature rise, therefore the density of its substance decreases as the temperature rises.



Exercises:

- Describe how to determine the density of a liquid.

Answer: The density of a liquid is far easier to measure than that of a solid or gas. The volume of a solid can be difficult to obtain, while the mass of a gas can rarely be measured directly. You can, however, measure the volume and mass of a liquid directly and, for most applications, simultaneously. The most important parts of measuring the density of a liquid are ensuring you calibrate the scale properly and read the volume accurately.

Place the volume-measuring container on the scale. Adjust the scale using manual adjustments or the scale's automatic "tare" function, so the scale reads "0" with the container on it. The container can be anything that has markings that allow volume measurement. In chemistry labs, the most common containers like this are graduated cylinders or beakers.

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Add the liquid to the container and read the volume measurement. Many times, the surface of the liquid will be curved where you are reading the measurement. If the curve is pointing downward, creating a cup shape, read the bottom of the curve. If it points upward, creating a hump shape, read the top of the curve. Record this value.

2. Describe how to determine the density of a regular solid.
3. Describe how to determine the density of an irregular solid.

Regularly shaped solid

The mass is found on a balance and the volume by measuring its dimensions with a ruler.

Irregularly shaped solid, such as a pebble or glass stopper

The mass of the solid is found on a balance. Its volume is measured by one of the methods shown in Figures a. and b. In Figure a. the volume is the difference between the first and second readings. In Figure b. it is the volume of water collected in the measuring cylinder.

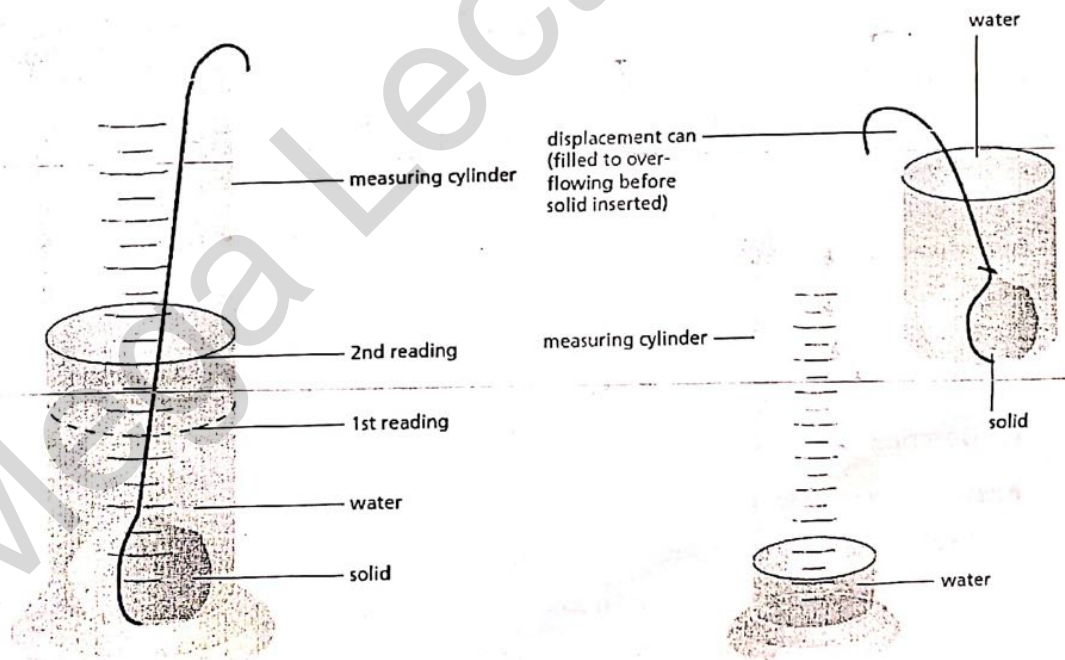


Figure a. Measuring the volume of an irregular solid: method 1 Figure b. Measuring the volume of an irregular solid: method 2

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