# **Chapter Seven**

## **Density And Capillarity**

- If we divide the mass or the weight of an object by its volume, we get what we call density.

- The density of a body or an object is therefore defined as its mass per unit volume.

- In short, Density =  $\frac{Mass}{Volume}$ .

## Finding the density of an object with a regular shape:

- Objects such as the cube, cuboid, cylinder and the sphere are examples of objects having regular shapes.

- In order to find the density of such an object one must go through these steps:

- (1) The mass or the weight of the object must be determined by using a weighing machine.
- (2) Since the body has a regular shape, its dimensions such as the length, breadth and the height can be measured using a ruler or a tape.
- (3) We then determine the volume, using the length, breadth and height i.e. Volume = length  $\times$  breadth  $\times$  height.
- (4) The mass is then divided by the volume to get the density.

#### Reason why an object may sink or float in water:

- If the density of an object is less than the density of water, and that object is placed in water, then it will float in the water.

- But if the density of the object is greater than that of water, and it is placed in water, then it will sink in the water.

- For this reason, an object such as a stone will sink when it is placed in water, since its density is greater than that of the water.

- Also an item such as a piece of plywood will float in water, because its density is less than that of water.

#### Liquid surface in contact with solids:

- When a liquid is put into a container, two types of force of attraction act and these are the cohesion and the adhesion forces.

#### Cohesion (cohesive) force:

- This is the type of attractive forces which act between the molecules of the same type, or a particular type of substance.

- For example, this type of force acts between the molecules of water, so as to bind or bring them together.

## Adhesion (adhesive) force:

- This is the type of attractive force which acts between the molecules of two different substances.

- For example, if water is put into a drinking glass, adhesive forces will act between the water molecules and the molecules of the glass.

#### The wetting of glass:

- When a substance such as water is placed on the surface of glass, the water will spread on the surface of the glass.

- Because water is able to spread on the surface of the glass, water is said to wet glass.

- But when a liquid such as mercury is placed on the surface of glass, the mercury will not spread on the surface of the glass.

- Because the mercury was not able to spread on the surface of the glass, we say that mercury does not wet glass.

#### Capillarity:

- This is the ability of a liquid to rise or fall within a capillary tube.
- A capillary tube is a very small glass tube, which has a hole in its middle.

#### Capillary rise or elevation:

- This refers to the rise of a liquid in a capillary tube, when the capillary tube is placed in the liquid.



- Capillary elevation or rise only occurs in liquids which wet glass, such as water. **Capillary depression:** 



- If a capillary tube is placed in a liquid which does not wet glass such as mercury, the level of mercury within the capillary tube will fall below the surface of mercury within its container.

- The fall of a liquid such as mercury within a capillary tube, is referred to as capillary depression.

#### **Questions**:

- (1) Define the density of a body.
  - Ans:
  - It is defined as its mass per unit volume.
- (2) How will you determine the density of an object which is in the shape of a cuboid? Ans:
- I will first use a weighing machine to find the weight of the object.
- The length, breadth and height of the cuboid is then determined or measured.
- We then calculate the volume.
- We finally divide the mass by the volume to get the density.
- (3) A boy placed a toy gun into water, but it sank into the water. Why is this so? Ans:
- This is so because the density of the toy is greater than that of the water.