# <u>CHAPTER SEVEN</u> <u>DENSITY AND CAPILLARITY</u>

### **Density:**

• If we divide the mass of an object by its volume, we get what we call its density. The density of a body or an object is therefore defined as its mass per unit volume. In short,

Density = <u>mass</u>.

volume

• The unit of density of is  $g/cm^3$  or density is measured in  $g/cm^3$ .

# Finding the density of a regularly shaped object:

- Objects such as the cube, cuboid, cylinder and the sphere are examples of objects having regular shapes. In order to determine the density of any of such objects, one must go through the following steps:
- 1. The mass or the weight of the object is determined, by using a weighing machine or a spring balance.
- 2. Since the body has a regular shape, its dimensions (i.e. the length, the breadth and the height) can be measured by using a ruler or a tape.
- 3. Using these dimensions, the volume of the object can be calculated.
- 4. The mass is then divided by the volume to get the density.

# Finding the density of an irregularly shaped object:



 $V_1$  = the initial volume of water in the measuring cylinder

 $V_2$  = the final volume of water after the immersion (or the putting) of the stone into the water. The volume of stone =  $V_2 - V_1$ .

Objects such as a stone or a piece of rock, are examples of irregularly shaped objects. To determine the density of any of such objects, one must go through the following steps:

- 1. The mass or the weight of the object must first be determined, using a weighing machine or a spring balance.
- 2. To determine the volume of the object, we first put water into a measuring cylinder, and the volume of water within the measuring cylinder is noted.
- 3. The object is attached to a thread, and then immersed into the water within the measuring cylinder, and the new volume of the water is also noted.
- 4. The difference between the first and the second volumes of water within the measuring cylinder, gives us the volume of the object (stone).
- 5. The mass is then divided by the volume to get the density.

#### Question 1

A body has a mass of 50g and a volume of 10cm<sup>3</sup>. Find its density.

Solution Mass = 50g and Volume =  $10 \text{cm}^3$ Density =  $\frac{mass}{volume} = \frac{50}{10}$ = 5 g/cm<sup>3</sup>.

#### Question 2 A stone has a weight of 20g and a volume of $10cm^3$ . Determine its density.

Solution Mass = 20g and Volume =  $10cm^3$ Density = mass = <u>20</u> = 2 g/cm<sup>3</sup>... volume 10

### Reasons why a body 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 the object will float in water. But if the density of the object is greater than that of water, then it will sink in water. For this reason, an object such as a stone will sink in water since its density is greater than that of 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.

- 1. <u>Cohesion (cohesive) force</u>: 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 offorces act between the molecules of water, so as to bind or bring them together.
- 2. <u>Adhesion (adhesive) force</u>: 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 glass molecules

# The wetting of glass:

- When a substance such as water is put 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, the 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 is 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:

