

**Physical Quantities & Measurements****Short Notes****Keywords**

**Density:** Mass contained in a unit volume of a substance

**Mass:** The amount of matter contained in a substance

**Volume:** The amount of space occupied by a substance

**Eureka can:** A container with a spout positioned below the top of the container

**Hydrometer:** An instrument to measure relative density of Liquids

**Buoyancy:** An upward force exerted by a fluid

**Plimsoll marks:** Ships travel in different densities of water, seawater or freshwater. So for safety loading of the ship under different sea conditions plimsoll lines are provided which show maximum height of the ship that should be under water.

**Chapter at Glance**

- The density is defined as the amount of mass contained per unit volume of a substance.
  - The density of irregular solids is measured using a graduated measuring cylinder and eureka can
  - Measuring density of Liquids using o graduated measuring cylinder  

$$\rho = \frac{m_2 - m_1}{V}$$
 where,  $m_2$  is mass of the cylinder with the liquid,  $m_1$  is mass of the cylinder and  $V$  is volume of the liquid.
  - Measuring density of gases using a measuring flask  

$$\rho = \frac{m_2 - m_1}{V}$$
 where  $m_2$  is mass of the flask with the air whose density needs to be measured,  $m_1$  is mass of the flask and  $V$  is fixed volume of the flask.
- 
- The relative density of a liquid can be determined by using a special bottle called the relative density bottle.
  - Solids have a greater density than liquids and liquids have greater density than gases. This is because the atoms in a solid are tightly packed, those in Liquids are comparatively mobile and the ones in gases are free to move randomly.
  - A hydrometer is a device based on principle of floatation to read the relative density of the liquid directly.
  - The proximity of atoms of an object decides the change in its density depending on various physical factors like pressure, temperature, etc.
  - The particles of a gas move randomly in all directions with a high speed. When we cool a gas, its density increases. When the gas is heated, its volume increases and density decreases.

**Physical Quantities & Measurements****DPP - 1**

Tick the correct option.

1. Different objects have (same, different) densities.
2. How compact the mass of a substance is depends on its (volume, density).
3. Eureka cans are also called (distance, displacement) vessels.
4. Density of a substance can be obtained by (dividing, multiplying) its relative density by the density of water
5. Density of water is (minimum, maximum) at 4°C.

Fill in the blanks.

6. Density shall be ..... if the volume of an object is more for a given mass,
7. To find density we first measure ..... and ..... and then divide the two.
8. Beam balance is used to measure the ..... of an object.
9. Eureka cans are based on ..... principle.
10. .... and ..... are known as fluids.
11. Relative density of a substance is the ratio of the mass of any volume of the substance to the mass of an equal ..... of water.
12. The ..... of atoms and molecules of an object tells us about its density.
13. The difference in the densities of different Layers of Liquids or gases set up ..... currents in them.

Write T for true and F for false statement. Correct the false statement.

14. Density is a chemical property of matter.
15. A ship loaded with cargo submerges more in sea water than in river water.
16. A lactometer is a device based on principle of floatation to read the relative density of the liquid directly.
17. When a liquid or a gas is heated, its density decreases, and when cooled, its density increases.

**Physical Quantities & Measurements****DPP - 2**

Name the following.

1. Mass of an object in a given volume
2. Formula for calculation of density of a substance
3. Standard unit of density
4. The principle according to which the amount of water displaced by an object is equal to its volume
5. Standard unit of relative density
6. Another term used for relative density
7. Two examples where hydrometers are used
8. Three factors affecting density

Define the following terms.

9. Density
10. Eureka can
11. Hydrometer
12. Buoyancy
13. Plimsoll marks

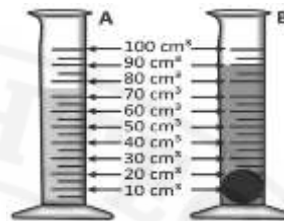
Give reason for the following.

14. There are two boxes, one is made of metal and the other is made of cardboard but they have different weights.
15. Swimming in seawater is much easier than in fresh water.
16. An iceberg which is ice in its solid state floats on water
17. Plimsoll lines or marks are provided in ships.
18. Substances found in solid state are considered to be denser.
19. There is almost no change in the density of solids with increase or decrease in temperature but a large change in the densities of liquids and gases

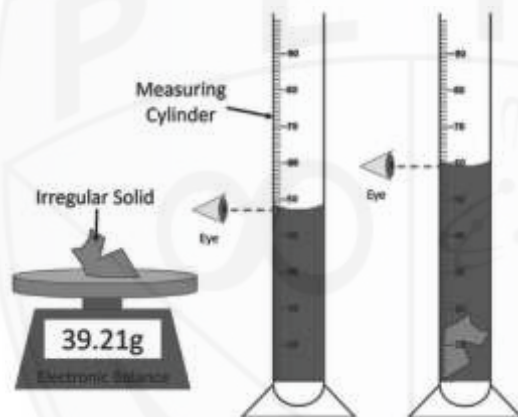
**Physical Quantities & Measurements** **DPP - 3**

Picture based questions.

1. Identify the device shown in the picture. What is it used for?



2. Calculate the volume of the solid from the picture given above.
3. Calculate the density of the above irregular solid from the data that you can collect from the above picture.



4. Identify the device and briefly describe how it is used to measure the volume of a given solid.
5. Identify the device shown below and label the parts (glass bottle, capillary tube and stopper). Briefly explain how the bottle works to measure the density of a given liquid.

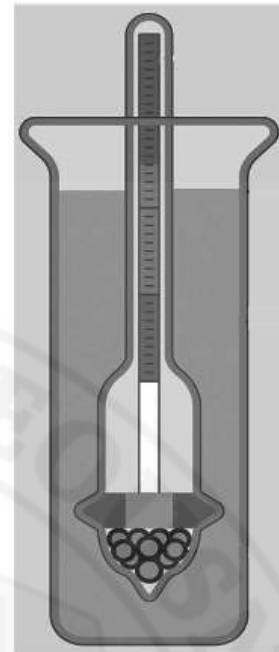
6. Shown below is a submarine that is underwater and another that is floating on the water. How this is possible for the submarine can float as well as sink in the water?



7. How is a hydrogen balloon as the one shown below able to rise up in the air?



8. Observe the given image and fill in the blanks.
  - a) The given device is a .....
  - b) A hydrometer reads the ..... density of the liquid directly.
  - c) It is based on the principle of .....
  - d) It is usually made of glass and consists of a cylindrical stem and a bulb weighed with ..... or ..... shots to make it float upright.
  - e) The liquid to be tested is poured into a tall jar and the ..... is gently lowered into the liquid until it ..... freely.
  - f) The point at which the surface of the liquid touches the ..... of this device is noted.



**Solve the following numericals.**

9. Half a kilo of salt occupies a volume 0.250 L. What is the density of salt?
10. The density of a liquid is  $0.3 \text{ g/cm}^3$ . What is the mass of  $60 \text{ cm}^3$  of the liquid?
11. Which one is greater?  $2 \times 10^{-3} \text{ kg/cm}^3$  or  $2 \times 10^{-2} \text{ mg/cm}^3$
12. The water level in a measuring cylinder rises by 15 mL when an object weighing 105 g is slowly immersed in it. Find its density.
13. A container filled with  $80 \text{ cm}^3$  of liquid weighs 110 g, the weight of the container is 90 g. Find the density of the liquid.
14. The relative density of glass is 2.5. If the density of water is  $1 \times 10^3 \text{ kgm}^{-3}$ , calculate the density of glass in SI units.
15. The mass of an empty RD bottle is 26.4 g. Its mass is 38.4 g when filled with water and 35.76 g when filled with a liquid. Find the relative density of the Liquid.
16. A block of iron with dimensions 6.5 cm by 3.2 cm by 5.5 cm weighs 892 g. Calculate the density of iron.

**Answer the following.**

17. What do you mean by that the density of a material is  $1 \text{ kg/m}^3$ ?
18. State the Archimedes principle.
19. What does it mean when we say that relative density of gold is 19.3?
20. Determine whether candle wax should float or sink in water. Also state the reason.
21. Ships are made of steel or aluminum alloy which are denser than water. Then, how are they made to float in water?