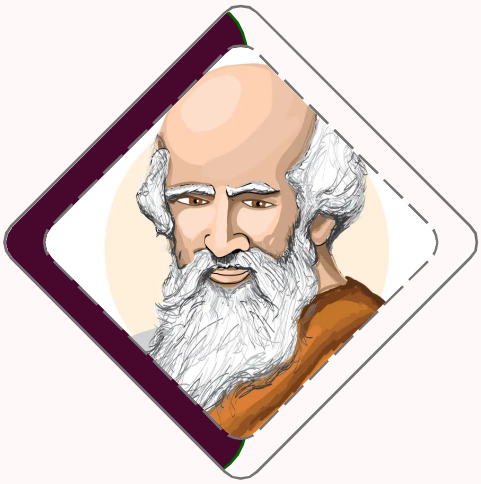
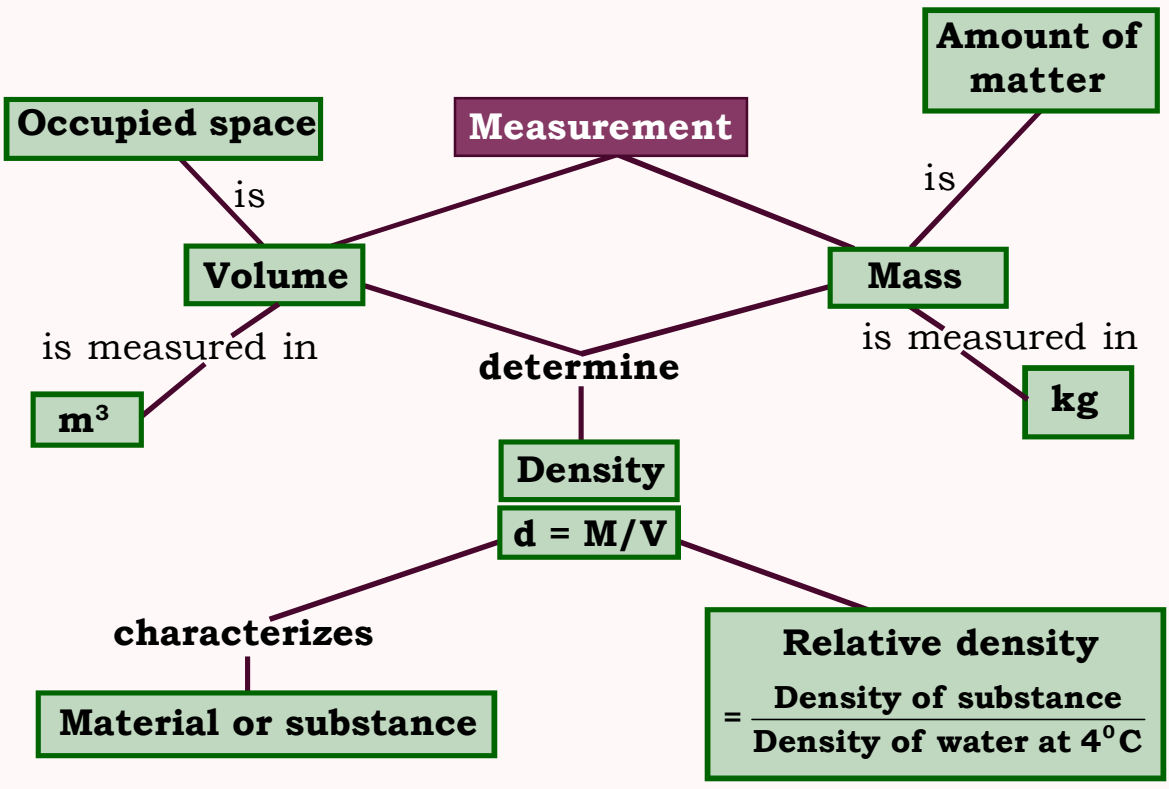
Chapter

1 MEASUREMENTS

Archimedes of Syracuse (c. 287 – c. 212 BC) was a prominent Greek physicist, engineer, inventor, and astronomer. He's celebrated for his significant contributions to various fields, particularly physics. He's renowned for his discovery of the principle of buoyancy (Archimedes' Principle), which explains why objects float or sink when submerged in a fluid. He used this principle to determine the density of materials, including the purity of gold in a crown commissioned by Hiero II, the king of Syracuse.



CONCEPT MAP



CONCEPT 1.1

Measurement:

A measurement is the action of measuring something, or some amount of stuff. So, it is important to measure certain things right, distance, time, and accuracy are all great things to measure. By measuring these things or in other words, by taking these measurements we can better understand the world around us. Measurements can also allow us to make decisions based on the outcome of the measurement. By this reasoning measurements are extremely important because they shape the way we think and interact every day.

MASS:

1. Mass is the quantity of matter which a body contains. This is the same wherever the body is. It is measured in kg.
2. There are three states of matter: solid, liquid and gas - all of these contain atoms and/or molecules that make up the mass of the object.
3. If my mass was 65 kg. This would be true wherever I went in the universe. Just because I travelled to the moon wouldn't make the number of atoms and molecules in my body change... it would be the same... just as my dress-size would! My mass would remain at 65 kg.

Mass Always Stays the Same!!

WEIGHT:

1. The force that acts on the mass of an object because of gravity is called its weight. Therefore weight is a force and is measured in newtons.
2. Weight is the force of gravity acting on a mass that is positioned in a gravitational field. This changes with the strength of the gravitational field.
3. There is an equation that links mass to weight in a gravitational field:

$$w = mg$$

w = the weight (in newton)

m = the mass of the object (in kilogram)

g = the gravitational field strength at the position where the mass is placed (N/kg)

4. On Earth g = 10 N/kg. Therefore my weight is 650 Newtons.
5. This is only true whilst I stay on Earth. On the moon, I would be very light and jumping would be very easy. This is because g (Moon) is only 1.67 N/kg. I would weigh a sixth of what I did on Earth, but it wouldn't mean I was any thinner. I'd still have all those atoms and molecules that make up my mass!

Mass and Its Units:

Mass is the quantity of matter in an object

SI Units : kg (kilograms)
1 Gram(g) = 1000 mg
1 Kilogram(kg) = 1000 g

Weighing scales **are used to measure mass**

Examples

Joey weight 28 kgs

A bag of 5 kgs of apples

Difference between mass and weight

An object's **mass is** the **quantity of matter** in that object.

For an object of 1 kg
Mass on earth = 1 kg
Mass in space = 1 kg
Mass on moon = 1 kg

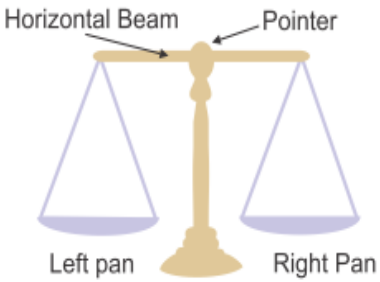
An object's **weight** is how hard **gravity is pulling on it.**

For an object of mass 1 kg
Weight on earth=1×9.8 kgw
Weight in space = 1×0 kgw
Weight on moon = 1×0.16kgw

Difference between mass and weight:

Mass

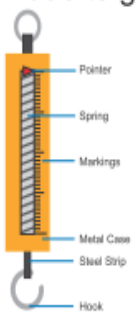
- Mass is the **quantity** of matter contained in a body.
- The mass of an object **does not change** from place to place.
- **SI unit of mass = kilogram (kg)**
  Other smaller units are gram(g) and milligram(mg)



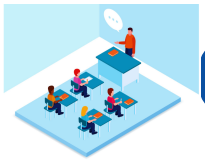
- **Beam balance** is used to measure mass

Weight

- Weight is the **force** with which **earth attracts the body** towards its centre.
- The **weight** of a body is **not constant**. It differs from place to place.
- **SI unit of weight = Newton (N)**
- Formula to find weight of body :
  W = m × g
  where m = mass of the body,
  g = acceleration due to gravity



- **Spring balance** is used to measure weight



CLASSROOM DISCUSSION QUESTIONS

CDQ 1.1

1. What is the SI unit for measuring mass?

(A) Newton (N)
(B) Kilogram (kg)
(C) Gram (g)
(D) Milligram (mg)

2. Which equation links mass to weight in a gravitational field?

(A) w = mg
(B) w = kg
(C) w = m/g
(D) w = m + g

3. What is the gravitational field strength on Earth?

(A) 9.8 N/kg (B) 10 N/kg
(C) 11.2 N/kg (D) 12 N/kg

4. What is the weight of an object with a mass of 50 kg on Earth?

(A) 500 N (B) 50 N
(C) 5 N (D) 0.5 N

5. What is the mass of an object measured in kilograms if its weight is 980 N on Earth?

(A) 98 kg (B) 98 g
(C) 980 kg (D) 9800 kg

6. Which statement correctly defines mass?

(A) Mass is the force exerted by gravity on an object.
(B) Mass is measured in newtons.
(C) Mass is the quantity of matter in an object.
(D) Mass varies with location.

7. How does mass differ from weight?

(A) Mass is measured in newtons, while weight is measured in kilograms.
(B) Mass is the same everywhere, while weight varies with location.
(C) Mass is the force exerted by gravity, while weight is the quantity of matter in an object.
(D) Mass is the quantity of matter in an object, while weight is the force exerted by gravity on an object.

8. What is the mass of an object weighing 700 N on Earth's surface?

(A) 70 kg
(B) 70 g
(C) 7 kg
(D) 7 g

9. Which statement about mass is true?

(A) Mass changes with location.
(B) Mass is the same everywhere.
(C) Mass is measured in newtons.
(D) Mass is the force exerted by gravity.

10. What is the weight of an object with a mass of 10 kg on the moon?

(A) 100 N
(B) 1.67 N
(C) 16.7 N
(D) 166.7 N

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

CONCEPT 1.2

Measurement of Mass:

Beam balance:

We measure mass of an object by comparing it with a standard mass. Normally, we use a beam balance to measure mass. The commonly used beam balance is shown in Figure. This balance consists of a horizontal beam supported at its centre with two similar pans suspended at equal distances from the centre of the beam.

The object to be weighed is placed on one of the pans. The standard weights are then placed on the other pan till both the pans are balanced and the beam is horizontal once again. The mass of the object is equal to the sum total of the standard weights used.

PHYSICAL BALANCE:

Physical Balance and its Parts: A physical balance is used when a greater degree of accuracy is required. For example, for finding the mass of a piece of gold or diamond. Also a physical balance is used in school laboratories for finding relative-density, masses etc. (See Fig. 1.6). A physical balance is enclosed in a glass case so that air current does not affect the measurement.

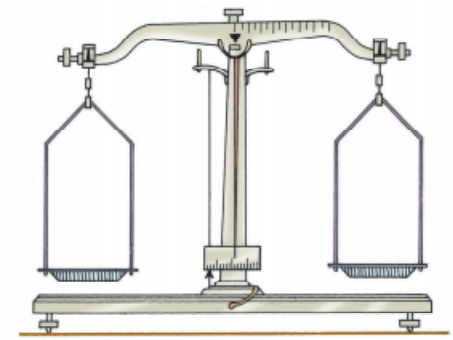


Fig. 1.5. A Beam Balance.

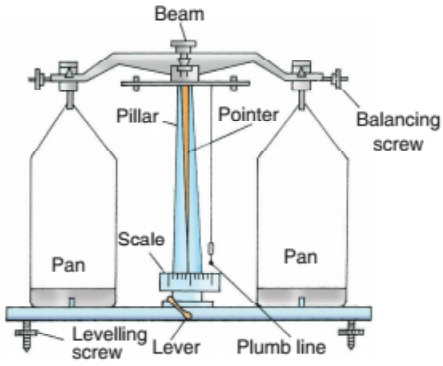


Fig. 1.6. Physical Balance.

The main parts of a physical balance are:

1. Levelling screws
2. Plumb line
3. Pans
4. Pointer
5. Adjustment knob
6. Balancing screws

Levelling screws: Adjustment of these screws make the base of the balance horizontal.

Plumb line: Indicates whether the balance is horizontal. In the horizontal position of the balance, the plumb line remains aligned with the pointed end of the knob fixed to the pillar.

Pans: The object to be weighed is placed in the left pan. The weights are placed in the right pan with the help of forceps.

When the balance is not in use, the pillar supporting the beam is lowered and the pans rest on wooden supports.

Pointer: When the balance is in the horizontal position, the pointer remains on the central zero mark of the scale.

Adjustment knob: Turning the knob raises the beam. The pans are also raised from their support and the pointer swings equally on either side of the central zero mark on the scale.

The object and weights are then placed in their respective pans.

Balancing screws: Adjustment of the balancing screws ensures that the pointer swings equally on either side of the zero mark.

Measurement of Weight:

For measuring mass of an object in the laboratory you are provided with a weight box which contains masses of 1g, 2g, 5g, 10g, 20g, 50g and 100g. (See Figure). For more accurate measurements, milligram weights are also provided.

A body whose mass is to be measured is kept in the left hand pan of the balance and equivalent weights are placed on right hand pan so that the beam should be horizontal. Total weights in the right pan are counted and this is the mass of the given body.

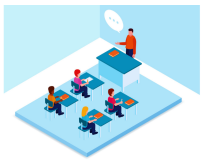
Spring balance:

A spring balance is used to measure the weight of a body at a given place. It consists of a steel spring enclosed in a metallic case. The body to be weighed is attached to the lower end of the spring balance. A pointer is attached to the lower end of the spring balance. A pointer is attached to the lower end of the spring. It rest against the scale graduated on the case.

spring balance

Measurement of weight of an object with a spring balance:

- We check that when there is no load on the pan, the pointer reads zero.
- When the body to be weighed is placed on the pan, the spring gets elongated due to the weight of the body.
- The position of the pointer on the scale thus gives the weight of the body.



CLASSROOM DISCUSSION QUESTIONS

CDQ 1.2

1. **Which instrument is commonly used to measure mass by comparing it with a standard mass?**
   (A) Spring balance
   (B) Physical balance
   (C) Thermometer
   (D) Stopwatch
2. **What is the purpose of levelling screws in a physical balance?**
   (A) To adjust the position of the pans
   (B) To ensure the base of the balance is horizontal
   (C) To measure the weight of an object
   (D) To enclose the balance in a glass case
3. **What part of a physical balance indicates whether the balance is horizontal?**
   (A) Plumb line
   (B) Adjustment knob
   (C) Pointer
   (D) Levelling screws
4. **In a beam balance, where is the object to be weighed placed?**
   (A) On the pointer
   (B) On the balancing screws
   (C) On one of the pans
   (D) On the adjustment knob
5. **Which component of a beam balance helps in ensuring that the beam is horizontal?**
   (A) Levelling screws
   (B) Adjustment knob
   (C) Balancing screws
   (D) Plumb line
6. **What is the function of the pointer in a beam balance?**
   (A) To measure mass
   (B) To indicate the weight of the object
   (C) To ensure the base is horizontal
   (D) To rest against the scale graduated on the case
7. **What is the purpose of the spring in a spring balance?**
   (A) To adjust the weight of the object
   (B) To measure the mass of the object
   (C) To enclose the balance in a metallic case
   (D) To get elongated due to the weight of the object
8. **How is the weight of an object measured with a spring balance?**
   (A) By adjusting the pointer
   (B) By placing the object on the pan
   (C) By elongating the spring
   (D) By using a weight box
9. **What is the reading on the pointer when there is no load on the pan of a spring balance?**
   (A) Zero (B) One
   (C) Ten (D) It varies
10. **What is the function of the weight box provided in the laboratory?**
    (A) To measure the mass of the spring balance
    (B) To measure the weight of the object
    (C) To measure the mass of an object using a beam balance
    (D) To provide standard weights for measuring the mass of objects

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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CONCEPT 1.3

DENSITY:

Objects of the same size may have different masses, and objects of the same mass may have different sizes. This is because different kinds of material have different densities. Density is the property of a body that tells about the arrangement of molecules in a given material. It is defined as mass per unit volume.

If a body of mass M units has a volume of V units, then:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} \quad \Rightarrow \quad D = \frac{M}{V}$$

The SI unit for density is kg m^{-3}, and its CGS unit is g cm^{-3}.

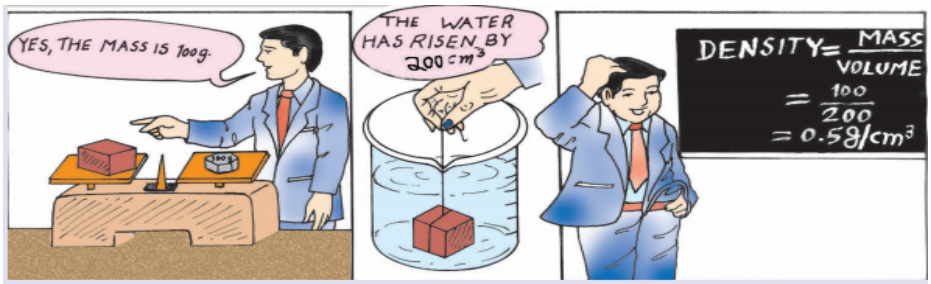
1 g cm^{-3} = 1000 kg m^{-3}

$\Rightarrow$ 1 CGS unit of density = 1000 SI units of density

If the density of water in the CGS system is 1gcm^{-3}, then it is 1000kgm^{-3} in SI system. The density of an object can be found experimentally by measuring its mass and volume. Its mass can be measured with a physical balance, while its volume can be measured using a measuring cylinder. The density can be calculated on the basis of these two quantities. A specific gravity bottle can be used to find the density of a liquid.

Determination of Density of a Solid by Using a Measuring Cylinder:

To find the density of a solid its mass and volume are required. The mass (M) of the solid is determined using a physical balance. To find the volume of the solid, a measuring cylinder with a fixed volume of water is taken and the volume of water is noted. Let the volume of water be V_1. The solid is tied to a string and is lowered into the measuring cylinder such that it is completely immersed in water. The new level of water (V_2) is noted. The difference in the levels of water $V = V_2 - V_1$ gives the volume of the solid. Knowing the mass and volume of the solid, the density of the solid can be determined using the formula D = M/V.



Determination of Density of a Liquid Using a Specific Gravity Bottle:

The specific gravity bottle or the density bottle is a small glass bottle having a close fitting ground glass stopper at its neck. The stopper has a small capillary tube.

When the bottle is completely filled with a liquid, excess liquid rises through the capillary tube and drains out, which ensures that equal volumes of different liquids fill the bottle.

First, a clean empty density bottle with stopper is weighed in a physical balance and its mass (m_1) is determined. Then it is filled with distilled water and the stopper is inserted. The bottle is wiped from outside so that it is dry. Its mass (m_2) is measured using a physical balance. Next, the water is poured off and the bottle is dried. Now the bottle is filled with the given liquid and its mass is measured (m_3). The density of the liquid is calculated as follows:

Mass of empty bottle = m_1
Mass of empty bottle + water = m_2
Mass of empty bottle + liquid = m_3
Mass of only water = $m_2 - m_1$
Volume of 1 g of water = 1 cm^3
Volume of water = $(m_2 - m_1)$ cm^3
Volume of bottle = $(m_2 - m_1)$ cm^3
Volume of liquid = Volume of water = $(m_2 - m_1)$ cm^3
Mass of only liquid = $m_3 - m_1$
Density of liquid
= Mass of liquid/Volume of liquid = $m_3 - m_1/(m_2 - m_1)$.
This will be in g/cm^3.

The density of liquids and gases changes with change in temperature. With the rise in temperature, the density decreases and vice versa. The convection currents in liquids and gases are formed due to the decrease in their density with the rise in temperature.

Relative density:

The density of a substance is compared with the density of water, to give a number called the relative density of the substance.

$$\text{Relative density of a substance} = \frac{density\ of\ a\ substance}{density\ of\ water}$$

It is just a number, with no unit.
From the general values of densities of iron and water.

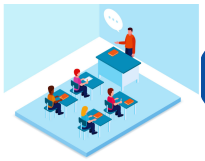
$$\text{Relative density of iron} = \frac{7800}{1000} = 7.8$$

It means that a certain volume of iron has 7.8 times the mass of the same volume of water.

Fig. 1.13. A relative density bottle.

Determination of Relative Density of a Liquid:

The relative density of a liquid is determined by using a relative density bottle (Fig. 1.13). It is a small bottle made of glass. It has a stopper with a fine hole. This bottle is used for finding the mass of equal volumes of liquids.



CLASSROOM DISCUSSION QUESTIONS CDQ 1.3

1. What is density defined as?
(A) Volume per unit mass
(B) Mass per unit volume
(C) Length per unit volume
(D) Volume per unit length

2. What is the SI unit for density?
(A) grams per cubic centimeter (g/cm^3)
(B) kilograms per square meter (kg/m^2)
(C) kilograms per cubic meter (kg/m^3)
(D) grams per cubic meter (g/m^3)

3. How is the volume of a solid determined using a measuring cylinder?
(A) By measuring its length
(B) By measuring its width
(C) By measuring the difference in water levels before and after immersion
(D) By measuring the height of the solid

4. What is used to ensure that equal volumes of different liquids fill a specific gravity bottle?
(A) A capillary tube
(B) A stopper with a fine hole
(C) A ground glass stopper
(D) A measuring cylinder

5. How is the density of a liquid calculated using a specific gravity bottle?
(A) Density = $(m_3–m_2) / (m_2 – m_1)$
(B) Density = $m_3 / (m_2 – m_1)$
(C) Density = $m_3–m_1 / (m_2 – m_1)$
(D) Density = $m_3 / (m_3 – m_1)$

6. What happens to the density of liquids and gases with a rise in temperature?
(A) It increases
(B) It remains constant
(C) It decreases
(D) It fluctuates unpredictably

7. What does the relative density of a substance compare?
(A) Its volume to the volume of water
(B) Its mass to the mass of water
(C) Its density to the density of water
(D) Its length to the length of water

8. What does a relative density of 7.8 for iron indicate?
(A) Iron has 7.8 times the volume of water
(B) Iron has 7.8 times the density of water
(C) Iron has 7.8 times the mass of water
(D) Iron has 7.8 times the length of water

9. What is the relative density of a substance with the same density as water?
(A) 0.1 (B) 1
(C) 10 (D) 100

10. How is the mass of equal volumes of liquids determined using a relative density bottle?
(A) By using a ground glass stopper
(B) By finding the difference in water levels
(C) By weighing the bottle with the liquid
(D) By measuring the diameter of the bottle

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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CONCEPT 1.4

Floating and Sinking:

Why do Bodles Sink or Float in Liquids?

As we have seen above that if a piece of cork is placed in water, it rises and floats on the surface of water. But a piece of stone or a piece of iron sinks down in the water. However, the buoyant force acts on both the cork and the stone. Then why does the cork float and the stone sink down?

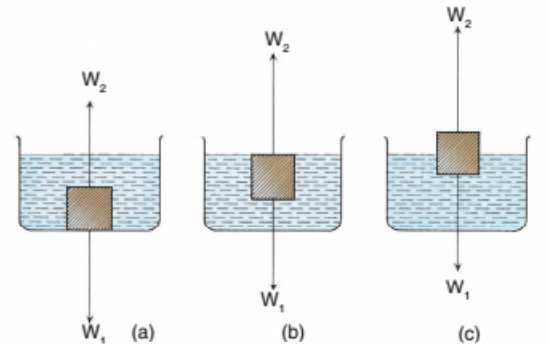


Fig. 1.16. Conditions of floatation of a body.

You know that when a body is immersed in a liquid, two forces act on it, first the weight of the body, say, W1, acting downward and the buoyant force, say, W2 acting upwards. Hence, the body will move in the direction of the resultant of these two opposite forces. We have the following three conditions:

1. The weight of the body is greater than the buoyant force. If the weight W_1 of the body is greater than the buoyant force W_2, the body will sink down [See Fig1.16(a)].

2. The weight of the body is equal to the buoyant force. In this condition the body will just float below the surface of the liquid as in Fig. 1.16(b). In this case the weight of displaced fluid is equal to the weight of the body.

3. The weight of the body is less than buoyant force. In this case, the weight of the body is less than the buoyant force, that is, upthrust is more than the weight of the body and hence, body will float partially immersed in the liquid [See Fig. 1.16(c)].

Therefore, when:

1. $W_1 > W_2$ – The body sinks down.
2. $W_1 = W_2$ – The body just floats.
3. $W_1 < W_2$ – The body floats partially immersed.

Principle of Floating:

Thus, by the conditions of floating and sinking of a body we conclude that, a body will float in a liquid if the weight of the liquid displaced by it, is equal to its own weight. This is called the principle of floatation.

Suppose, a body of volume V is floating in a liquid of density d. Let the volume of displaced liquid is v and density of the body is D.

Thus, Mass of the body = Volume × Density = V×D

$\therefore$ Weight of the body = (mass × gravity) = (V×D)×g
Mass of displaced liquid = (volume × density) = (v×d)
Weight of displaced liquid = (mass × gravity) = (v×d) × g
Now, according to the principle of floatation,
Weight of the body = weight of the liquid displaced
$V \times D \times g = v \times d \times g$
i.e., $V \times D = v \times d$
or $\frac{V}{v} = \frac{d}{D}$

$$\frac{\text{Volume of Floating Body}}{\text{Volume of Displaced Liquid}} = \frac{\text{Density of Liquid}}{\text{Density of Body}}$$

Some Applications of Principle of Floatation:

1. **Why ships keep afloat while a nail of iron sinks.** The volume of displaced seawater by a ship is more because the base of a ship is larger compared to a nail and, hence, the buoyant force increases and becomes equal to the weight of the ship. Thus, a ship floats in the seawater (Fig. 1.17). In case of a nail, the volume of displaced water is less and, therefore, the upthrust is less than the weight of the nail. This is why a nail sinks down.

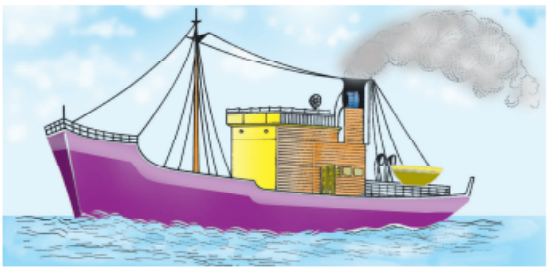


Fig. 1.17. A ship floats in the seawater.

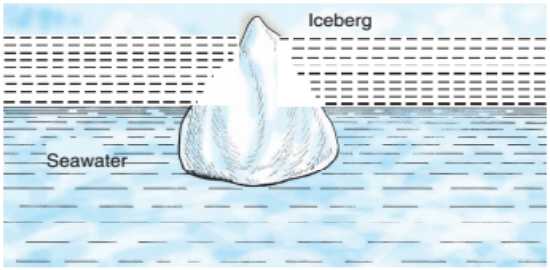


Fig. 1.18. An Iceberg floats in seawater.

2. **Icebergs float in seawater.** Large pieces or blocks of ice floating in seawater are called icebergs. The density of ice is about 0.9 g/cm^3, a little less than the density of seawater which is about 1.02 g/cm^3, Therefore, an iceberg floats in seawater (Fig. 1.18).

3. **Hydrometer.** The hydrometer is a device based on principle of floatation to read the density of the liquid. (Fig. 1.19). Some special hydrometers are designed to test whether a battery is fully charged or whether milk is pure or not.

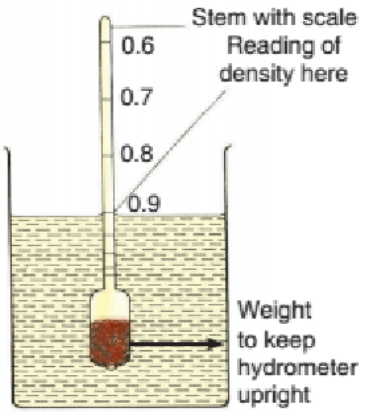
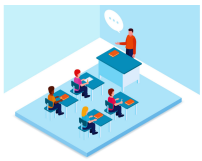


Fig 1.19. A hydrometer used to read the density directly



CLASSROOM DISCUSSION QUESTIONS

CDQ 1.4

1. What causes a body to sink in a liquid?

(A) When the weight of the body is less than the buoyant force

(B) When the weight of the body is equal to the buoyant force

(C) When the weight of the body is greater than the buoyant force

(D) When the buoyant force is greater than the weight of the liquid

2. In what condition does a body just float below the surface of the liquid?

(A) When the weight of the body is less than the buoyant force

(B) When the weight of the body is equal to the buoyant force

(C) When the weight of the body is greater than the buoyant force

(D) When the upthrust is equal to the weight of the liquid

3. According to the principle of floatation, what condition must be met for a body to float in a liquid?

(A) The weight of the liquid displaced by the body must be less than its weight

(B) The weight of the liquid displaced by the body must be equal to its weight

(C) The weight of the liquid displaced by the body must be greater than its weight

(D) The weight of the liquid displaced by the body must be equal to its volume

4. How is the volume of a floating body related to the density of the liquid and the density of the body?

(A) Volume = Density of Liquid / Density of Body

(B) Volume = Density of Body / Density of Liquid

(C) Volume = Density of Body × Density of Liquid

(D) Volume = Density of Liquid - Density of Body

5. Why do ships float while iron nails sink?

(A) Because ships have a greater density than iron nails

(B) Because the buoyant force on ships is greater due to their larger base

(C) Because iron nails have a greater volume than ships

(D) Because the weight of ships is less than the weight of iron nails

6. What causes icebergs to float in seawater?

(A) Icebergs have a lower density than seawater

(B) Icebergs have a higher density than seawater

(C) Icebergs have a smaller volume than seawater

(D) Icebergs have a greater weight than seawater

7. What principle is a hydrometer based on?

(A) Principle of buoyancy

(B) Principle of gravity

(C) Principle of density

(D) Principle of weight

8. How does a hydrometer function?

(A) By measuring the weight of the liquid

(B) By measuring the volume of the liquid

(C) By measuring the density of the liquid

(D) By measuring the temperature of the liquid

9. Why do some hydrometers float in liquids?

(A) Because their density is less than that of the liquid

(B) Because their density is greater than that of the liquid

(C) Because their weight is less than that of the liquid

(D) Because their weight is greater than that of the liquid

10. What does the density of icebergs indicate compared to seawater?

(A) Icebergs have a density equal to seawater

(B) Icebergs have a density less than seawater

(C) Icebergs have a density greater than seawater

(D) Icebergs have a density proportional to seawater

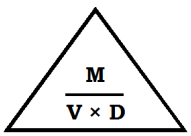
MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

1 Ⓐ Ⓑ Ⓒ Ⓓ	2 Ⓐ Ⓑ Ⓒ Ⓓ	3 Ⓐ Ⓑ Ⓒ Ⓓ	4 Ⓐ Ⓑ Ⓒ Ⓓ	5 Ⓐ Ⓑ Ⓒ Ⓓ
6 Ⓐ Ⓑ Ⓒ Ⓓ	7 Ⓐ Ⓑ Ⓒ Ⓓ	8 Ⓐ Ⓑ Ⓒ Ⓓ	9 Ⓐ Ⓑ Ⓒ Ⓓ	10 Ⓐ Ⓑ Ⓒ Ⓓ

C.D.F. CONCEPTS, DEFINITIONS AND FORMULAE

1. The mass is the measure of quantity of matter contained in the body.
2. The gravitational pull acting on a body is called weight of the body. OR

   The force with which the body is attracted towards the earth is called the weight of the body.
3. The SI unit of mass is kilogram (kg).
4. The SI unit of weight is newton (N).
5. Beam balance is used to measure mass of body.
6. A physical balance is used to measure the weight of a body at a given place.
7. The density of a substance is defined as the mass per unit volume of that substance.
8. The SI unit of density is kg/m^3.
9. The density of gases and liquids varies with the change in temperature.
10. The relative density (R.D.) of a substance is defined as the ratio of the density of the substance to the density of water.
11. The variations in the density of gases and liquids with temperature result convection currents in liquids and gases.
12. A hydrometer is a device used to measure density of liquids.
13. Density = $\frac{mass}{volume}$
14. Volume = $\frac{mass}{dens}$
15. Mass = volume × density
16. Density of water = 1,000 kg/m^3 = 1 g/cm^3.
17. Relative density = $\frac{density\ of\ substance}{demsity\ of\ water} = \frac{mass\ of\ substance}{mass\ of\ same\ volume\ of\ water}$



To find the one you want, cover up that letter in the triangle and the remaining letters show you the formula.

ADVANCED WORKSHEET

Single Correct Answer Type (S.C.A.T)

1. The SI unit of mass is

(A) Newton

(B) Kilogram

(C) Newton/kg

(D) Gram

2. The SI unit of weight is:

(A) Kilogram

(B) Newton

(C) Newton metre

(D) Kilometre

3. The SI unit of density is:

(A) Gram/metre^3

(B) Kilogram/metre^3

(C) Gram/cm^3

(D) Kg/cm^3

4. The process of heat transfer for that involves the movement of a liquid or a gas is called.

(A) Convection

(B) Conduction

(C) Radiation

(D) None of these

5. When a substance is heated its density:

(A) Increases

(B) Decreases

(C) Remains same

(D) None of these

6. When a gas is heated, it expands and becomes:

(A) Lighter

(B) Heavier

(C) No change

(D) None of these

7. The convection currents in air are formed due to:

(A) Variation in temperature

(B) Variation in mass

(C) Variation in weight

(D) None of these

8. The mass is a:

(A) Scalar quantity

(B) Vector quantity

(C) Absolute quantity

(D) None of these

9. The mass is measured by:

(A) A beam balance

(B) A spring balance

(C) Micro balance

(D) None of these

10. A hydrometer is used to measure:

(A) Density

(B) Mass

(C) Weight

(D) R.D.

11. We use a beam balance to measure

(A) Weight

(B) mass

(C) Force

(D) Body

12. The density of aluminium is 2.7 g/cm^3. Its density in kg/m^3 is

(A) 27 kg/m^3

(B) 2700 kg/m^3

(C) 270 kg//m^3

(D) 27000 kg/m^3

13. To determine the density of a solid, we have to determine its

(A) Mass and area

(B) Weight and area

(C) Mass and volume

(D) Weight and volume

14. When a fluid is heated, it expands and becomes

(A) Lighter

(B) Heavier

(C) No change

(D) None of these

15. A body of density 5.34 g/cm^3 in water (density 1.0 g/cm^3) will

(A) Float

(B) Sink

(C) Rise

(D) None of these

16. When a substance is heated its density

(A) Increases

(B) Decreases

(C) Remains same

(D) None of these

17. _____ is a fundamental quantity which is measured using a beam balance

(A) Mass

(B) Density

(C) Weight

(D) Amount

18. The _____ of a body reduces at very high altitudes.

(A) Length

(B) Weight

(C) Mass

(D) Force

19. The reference standard for a kilogram is the one kilogram mass of ____.

(A) A platinum - iridium alloy

(B) Brass

(C) A platinum - silver alloy

(D) A silver - iridium alloy

20. Which one is a scalar quantity amongst the following?

(A) Weight

(B) Mass

(C) Force

(D) Displacement

21. The instrument used for measuring weight is _____

(A) Physical balance

(B) Micrometre

(C) Spring balance

(D) Beam balance

22. The physical factors to which density is related are _____

(A) Mass and weight

(B) Mass and volume

(C) Weight and volume

(D) Mass and area

23. Water has maximum density at _____

(A) 0^0C

(B) 4^0C

(C) 100^0C

(D) 10^0C

24. The factor on which the working of a spring balance depends is ____

(A) Speed of wind

(B) Tides

(C) Earth's gravitational force

(D) Direction of wind

25. The units used to measure fundamental quantities are called _____ units.

(A) Fundamental

(B) Basic

(C) Vector

(D) Scientific

26. Kilogram-force is the non-SI unit of _____

(A) Weight

(B) Density

(C) Energy

(D) Relative density

27. The symbol used to denote density is _____

(A) Ω

(B) α

(C) ρ

(D) μ

Multi Correct Question (M.C.Q)

28. Which of the following statements are TRUE?

(A) The quantity of matter contained in a body is called its weight

(B) The gravitational pull acting on a body is called its mass

(C) The mass remains constant at all places

(D) The SI Unit of mass is newton

29. Which of the following statements are FALSE?

(A) Physical balance is used to measure weight of a body

(B) The SI unit of relative density is g/cm^3

(C) The density of water is less than the density of wood

(D) The wood or a cork floats in water.

30. Which of the following statements are FALSE?

(A) Equal masses of iron and common salt have same volume

(B) The density of water is $1g/cm^3$ in the SI unit

(C) The SI unit of relative density is g/cm^3

(D) Multiplying relative density by 100, we get density of the liquid in kg/m^3

Comprehension Passage (C.P.T)

Passage-I

Relative density is a comparison of the density of a substance to the density of water. It is given by the formula:

$$\text{Relative Density} = \frac{\text{Density of substance}}{\text{Density of water}}$$

Water has a standard density of 1 g/cm^3 at 4^oC.

31. A block of plastic has a relative density of 0.8. What will happen when it is placed in water?

(A) It will dissolve

(B) It will float

(C) It will sink

(D) It will neither float nor sink

32. Which of the following is an application of the concept of relative density?

(A) Measuring temperature

(B) Building submarines

(C) Calculating speed

(D) Producing electricity

33. What is the relative density of a substance that has a density of $3g/c^3$?

(A) 0.3

(B) 1.3

(C) 3

(D) Cannot be determined

Matrix Matching Type (M.M.T.)

SET-I

Column - I

34. Mass

35. Weight

36. Relative density

37. Purity of milk

Column - II

(A) Lactometer

(B) Hydrometer

(C) Physical balance

(D) Weighing machine

(E) Newton

SET-II

Column-I

38. Density

39. Relative Density

40. Volume

41. SI Unit of Mass

Column-II

(A) No unit

(B) kg/m^3

(C) m^3

(D) kg

(E) Depends on shape and size

Assertion Reason Type (A.R.T.)

(A) Both Assertion and Reason are true, and the Reason is the correct explanation of the Assertion

(B) Both Assertion and Reason are true, but the Reason is not the correct explanation of the Assertion

(C) Assertion is true, but the Reason is false

(D) Assertion is false, but the Reason is true

42. Assertion (A): The unit of mass is newton.

Reason (R): Newton is the SI unit of force, and weight is a force.

43. Assertion (A): Relative density has no unit.

Reason (R): It is the ratio of density of a substance to the density of water.

44. Assertion (A): Mass of a body remains constant everywhere in the universe.

Reason (R): Mass is the amount of matter contained in a body.

45. Assertion (A): Weight of an object is zero at the centre of the Earth.

Reason (R): Gravitational force becomes zero at the centre of the Earth.

46. Assertion (A): The unit of density in SI is kg/m^3.

Reason (R): Density is mass per unit volume.

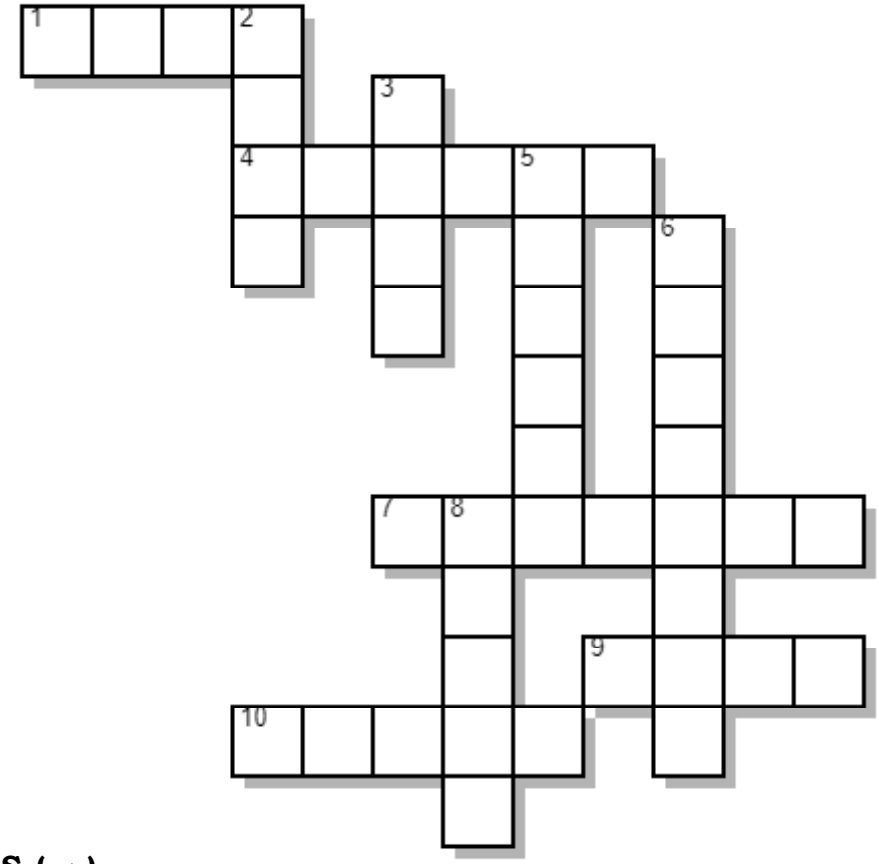
Integer Type Question (I.T.Q.)

47. A block has a mass of 200 g and a volume of 50 cm^3. Find its density in g/cm^3.

48. A body weighs 60 N on Earth. Its weight on the Moon is 1/6th of that on Earth. What is its weight (in N) on the Moon?

49. A liquid has a density of 800 kg/m^3. Find its relative density. (Take density of water as 1000 kg/m^3)

Puzzle Time



ACROSS (→)

1. The balance used to measure mass is _____.
4. Weight of a body is measured by _____ balance.
7. Mass per unit volume is called _____.
9. The quantity of matter in a body is called _____.
10. Relative density has no _____.

DOWN (↓)

2. _____ never changes from place to place.
3. CGS unit of mass is _____.
5. The unit of weight is _____.
6. _____ balance is used for accurate measurement of mass.
8. Weight of a body is due to _____.