CLASS- 7   SUBJECT-PHYSICS

CHAPTER-1   PHYSICAL QUANTITIES AND MEASUREMENT

NOTES-

- In physics a physical quantity is any physical property that can be quantified ,that is ,it can be measured using numbers.
- Examples of physical quantities are mass, amount of substance ,length ,time ,temperature ,electric current, force, velocity, density etc.
- MASS-The mass of a body is the quantity of matter contained in a body regardless of its volume or any force acting on it.
- Unit of mass-SI-Kilogram(kg) and CGS-gram(g)
- WEIGHT-The weight of a body is the force with which every object is attracted towards its centre.
- Unit of weight-SI-NEWTON(N)
- The weight of a body changes with acceleration due to gravity.
- Weight is Zero at the centre of the earth.
- VOLUME-The space occupied by an object is called its volume.
  The S.I. unit of volume is cubic metre(m^3)
- A smaller unit of volume is cubic centimeter(cm^3)and cubic decimeter(dm^3)
- To take out the volume of irregular shape objects we use the help of MEASURING CYLINDER.
- The volume of an irregular lamina is measured by using a graph paper.
- SPEED-The distance covered or travelled by a body in one second is called the speed of the body.
  The S.I.unit of speed is metre /second(ms^{-1})
  The formula to take out speed=Distance travelled/Time taken
- DISTANCE-Distance is a numerical measurement of how far apart objects or points are.
  The S.I. unit of distance is meter(m)
- TIME-The duration in which all things happen ,or a precise instant that something happens.
  The S.I. unit of time is second(s).

- TIME=DISTANCE/SPEED.
- MATTER-A matter is that has mass and occupies space.
- ATOM-It is the smallest unit of an element.
- ELEMENT-A substance that cannot be broken down into simpler components by any non-nuclear chemical reaction.
- MOLECULE-The smallest unit of matter is known as a molecule .It exists freely in nature.
- A collection of atoms of either similar or different elements form a molecule.
- TEMPERATURE-It is the degree of hotness or coldness of any substance.KELVIN(K) is the SI unit of temperature.
- DENSITY-It is defined as mass per unit volume.
  D=M/V
  S.I. unit of density is kgm^{-3}.In C.G.S. System gcm^{-3}
- The density of liquids and gases decreases or increases with the rise or fall in temperature.
- Water has a distinct or different nature.
  (a) water contracts on heating from 0^0c to 4^oc and expands on heating above 4^0c.
  (b)The density of water is maximum at 4^0c.It decreases when it is cooled from 4^0c to 0^0c or it is heated above 4^0c.
- LENGTH-It is measurement of straight –line- distance between two points along an object.
  S.I. UNIT-metre(m).

Points to Remember

- ➤ The mass of a body is the quantity of matter contained in a body regardless of its volume or any force acting on it.
- ➤ The weight of a body is the force with which every body is attracted towards its centre.
- ➤ The unit of mass in S.I. system is kilogram (kg). Higher units of mass are quintal and metric tonne.
- ➤ The weight of body changes with acceleration due to gravity.
- ➤ Weight is zero at the centre of the earth.
- ➤ Mass per unit volume of a substance is called density of the body.

- The unit of density in S.I. system is kg m^{-3} and gcm^{-3} in C.G.S. system.
- The density in S.I. system is 1000 × numerical value in C.G.S. system.
- The density of liquids and gases decreases or increases with the rise or fall in temperature.
- The cycle of upward and downward movements of the fluid form currents in the medium which are known as convectional currents.

A. Objective Questions

1. Write true or false for each statement

(a) The S.I. unit of volume is litre.
Answer. False.
The S.I. unit of volume is cubic metre.

(b) A measuring beaker of capacity 200 ml can measure only the volume. 200 ml of a liquid.
Answer. True.

(c) cm^2 is a smaller unit of area than m^2 .
Answer. True.

(d) Equal volumes of two different substances have equal masses.
Answer. False.
Equal volumes of two different substances have different masses.

(e) The S.I. unit of density is g cm .
Answer. False.
The S.I. unit of density is Kg m .

(f) 1 g cm = 1000 kg m .
Answer. True.

(g) The density of water is maximum at 4°C.
Answer. True.

(h) The speed 5 ms is less than 25 km h .
Answer. True.

(i) The S.I. unit of speed is ms .
Answer. True

2. Fill in the blanks

(a) l m = <u>10^6</u> cm

(b) The volume of an irregular solid is determined by the method of <u>displacement of liquid</u>.

(c) Volume of a cube = <u>(one side)</u>

(d) The area of an irregular lamina is measured by using <u>a graph paper</u>.

(e) Mass = density × <u>volume</u>.

(f) The S.I. unit of density is <u>kgm^3</u>.

(g) 1 g cm^{-3}= <u>1000</u> kgm-^{3}.

(h) 36 km h^{-1} = <u>10</u> ms^{-1}.

(i) Distance travelled d = <u>speed v</u> × time t.

3. Match the following

Column A	Column B
(a) **Volume of a liquid**	(i) kg m^{-3}
(b) **Area of a leaf**	(ii) m^3
(c) **S.I. unit of volume**	(iii) graph paper
(d) **S.I. unit of density**	(iv) m s^{-1}
(e) **S.I. unit of speed**	(v) measuring cylinder

Ans.

Column A	Column B
(a) Volume of a liquid	(v) measuring cylinder
(b) Area of a leaf	(iii) graph paper
(c) S.I. unit of volume	(ii) m^3
(d) S.I. unit of density	(i) kg m^{-3}
(e) S.I. unit of speed	(iv) m s^{-1}

B. Short/Long Answer Questions

Question 1.
Define the term volume of an object.
Answer:
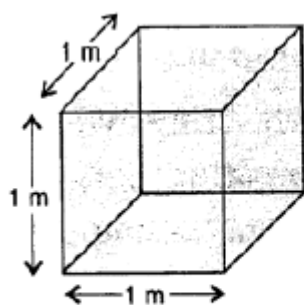The space occupied by an object is called its volume.

Question 2.
State and define the S.I. unit of volume.
Answer:
S.I. unit of volume – The S.I. unit of volume is cubic metre. In short form, it is written as m^3.
One cubic metre is the volume of a cube of each side 1 metre as shown in figure below i.e., 1 m = 1 m × 1 m × 1 m.

Unit one metre³ (or 1 m³)

Question 3.
How will you determine the volume of a cuboid ? Write the formula you will use.
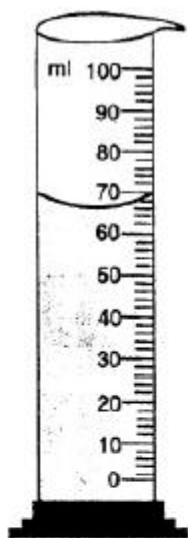**Answer:**
Volume of a cuboid = length × breadth × height.

Question 4.
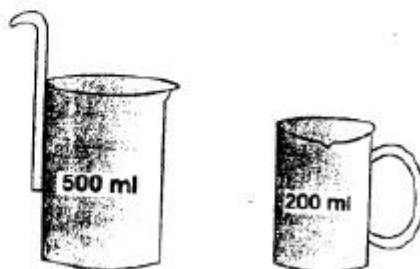Name two devices which are used to measure the volume of an object. Draw their neat diagrams.
Answer:
Two devices that are used to measure the volume of an object are :
(i) Measuring cylinder and
(ii) Measuring beaker.

Measuring cylinder

Measuring beakers

Question 5.

How can you determine the volume of an irregular solid (say a piece of brass) ? Describe in steps with neat diagrams.

Answer:

To measure the volume of a piece of stone.

Take a piece of brass, a measuring cylinder, fine thread of sufficient length and some water.

Place a measuring cylinder on a flat horizontal surface and fill it partially with water. Note the reading of the water level

very carefully. Now tie the piece of brass with a thread and dip it completely into water. We see that the level of water

rises. Note the reading of the new water level.
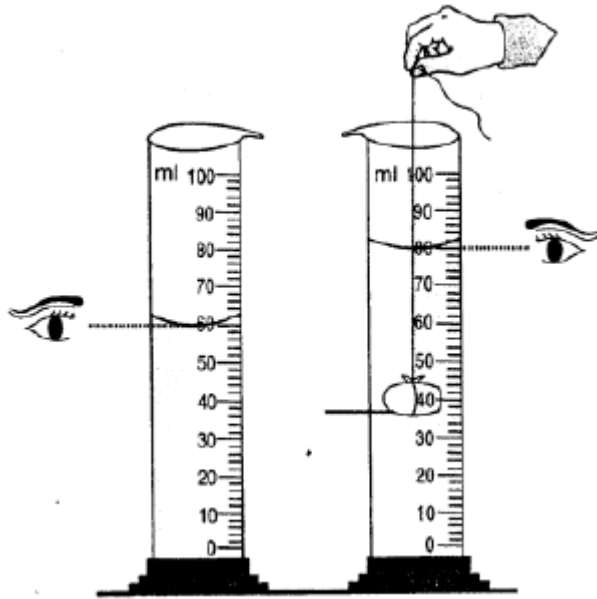
The difference in the two levels of water gives the volume of the piece of brass

Initial level of water = 60 ml

Level of water when brass is immersed = 80 ml

∴ Volume of water displaced = 80 ml – 60 ml = 20 ml

∴ Volume of the piece of brass = 20 cm^3

Note : 1 ml = 1 cm^3

Question 6.
You are required to take out 200 ml of milk from a bucket full of milk. How will you do it ?

Answer:
By using the measuring beaker A measuring beaker is used to measure a fixed volume of liquid from a large volume.

Suppose it is required to measure 200 ml of milk from the milk contained in a bucket. For this, take the measuring beaker

of capacity 200 ml. Wash it and dry it. Then, immerse the measuring beaker well inside the milk contained in the bucket

so that the beaker gets completely filled with the milk.

Take out the measuring beaker from the bucket gently so that no milk splashes out and then pour the milk from the

measuring beaker into the another empty vessel.

Question 7.
Describe the method in steps to find the area of an irregular lamina using a graph paper.
Answer:
Method to find the area of an irregular lamina using a graph paper : First, place the lamina over a graph paper and draw
its boundary line on the graph paper with a pencil. Then remove the lamina and count and note the number of complete
squares as well as the number of squares more than half within the boundary line (only the squares less than half, are
left while counting). The area of lamina is equal to the sum of the area of complete squares and the area of squares
more than half. Let n be the total number of complete and more than half or half squares within the boundary of lamina.
Since area of one big square is 1 cm × 1cm = 1 cm^2 , so the area of lamina will be n x
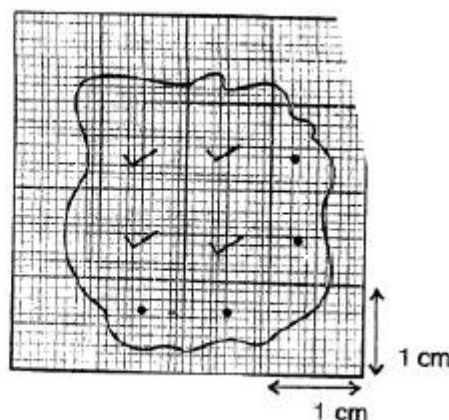
Question 8.
Define the term density of a substance.
Answer:
The density of a substance is defined as the mass of a unit volume of that substance.

Question 9.
State the S.I. and C.G.S. units of density. How are they inte related ?

Answer:

The S.I. unit of mass is kilogram (symbol kg) and of volume is cubic metre (symbol m^3). Therefore S.I. unit of density is kg/m^3 or $kg\ m^{-3}$.

The C.G.S. unit of mass is gram (symbol g) and of volume is cubic centimetre (symbol cm^3). Therefore the C.G.S. unit of density is g/cm^3 or $g\ cm^{-3}$.

Relationship between kg m⁻³ and g cm⁻³

$$1\ kg = 1000\ g$$

$$\text{or}\ 1\ g = \frac{1}{1000}\ kg$$

$$\text{and}\ 1\ m^3 = (100\ cm)^3$$
$$= 100 \times 100 \times 100\ cm^3$$
$$= 10,00,000\ cm^3$$

$$\text{or}\ 1\ cm^3 = \frac{1}{1000000}\ m^3$$

$$\text{Now}\ 1\ g\ cm^{-3} = \frac{1\ g}{1\ cm^3}$$

$$= \frac{\dfrac{1}{1000}\ kg}{\dfrac{1}{1000000}\ m^3} = \frac{1000000}{1000}\ kg\ m^{-3}$$

$$= 1,000\ kg\ m^{-3}$$

Thus, $1\ g\ cm^{-3} = 1,000\ kg\ m^{-3}$

Question 10.
How does the density of water changes when :
(a) it is heated from 0°C to 4°C,
(b) it is heated from 4°C to 10°C ?
Answer:
(a) Water contracts on heating from 0°C to 4°C and expands on heating above 4°C.
(b) The density of water is maximum at 4°C. It decreases when it is cooled from 4°C to 0°C or it is heated above 4°C.

Question 11.
Write the density of water at 4°C.
Answer:
The density of water at 4°C is $1.0\ g\ cm^{-3}$, or $1,000\ kg\ m^{-3}$

Question 12.
Explain the meaning of the term speed.
Answer:
The distance covered or travelled by a body in one second is called the speed of the body, i.e.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

Speed is usually denoted by the symbol v.
If a body travels a distance d in time t, then its speed is given as

$$\text{Speed } (v) = \frac{d}{t}$$

Question 13.
Write the S.I. unit of speed.
Answer:
The S.I. unit of speed is metre/second or metre per second. Its symbol is m s^{-1}.

Question 14.
A car travels with a speed 12 m s^{-1}, while a scooter travels with a speed 36 km h^{-1}. Which of the two travels faster ?
Answer:
Speed of car = 12 m s^{-1}
Speed of scooter = 36 km h^{-1}
here, 1 km = 1000 m
1 hr = 3600 sec

$$\therefore \text{ Speed of scooter} = \frac{36 \times 1000}{3600} = 10 \text{ m s}^{-1}$$

∴ Speed of car is more. Car travels faster than scooter.

C. Numericals

Question 1.
A solid silver piece is immersed in water contained in a measuring cylinder. The level of water rises from 50 ml to 62 ml.
Find the volume of silver piece.
Answer:
Given, initial level of water $.v_1$ = 50 ml

Final level of water v_2 = 62 ml

Volume of silver piece V = $v_2 - v_1$

= 62 ml – 50 ml

= 12 ml or 12 cm^3

Question 2.

A rectangular field is of length 60 m and breadth 35 m. Find the area of the field.

Answer:

Length of a rectangular field = 60 m

Breadth of rectangular field = 35 m

∴ Area = 60 m × 35 m

= 2100 m^2

Question 3.

The mass of an iron ball is 312 g. The density of iron is 7.8 g cm^{-3} . Find the volume of the ball.

Answer:

Given, Mass M = 312 g
Density d = 7.8 g cm^{-3}

Since, $d = \dfrac{M}{V}$ $\Rightarrow$ $V = \dfrac{M}{d}$

Hence, volume of an iron ball $V = \dfrac{312}{7.8} = 40$ cm^3

Question 4.

A cork has a volume 25 cm^3 . The density of cork is 0.25 g cm^{-3}. Find the mass of cork.

Answer:

Given, density d = 0.25 g cm^{-3}
V = 25 cm^3

From relation $d = \dfrac{M}{V}$ $\Rightarrow M = d \times V$

= 0.25 × 25

= 6.25 g

Question 5.

A block of iron has dimensions 2 m × 0.5 m × 0.25 m. The density of iron is 7.8 g cm $^{-3}$. Find the mass of block.

Answer:

Given, l = 2m

b = 0.5 m

$h = 0.25$ m

Density of iron $= 7.8$ g cm$^{-3} = 7.8 \times 1000$ kg m$^{-3} = 7800$ kg m^{-3}

Volume of block $= l \times b \times h$

$\qquad = 2 \times 0.5 \times 0.25 = 0.25$ m^3

From relation $d = \dfrac{M}{V}$

∴ Mass of iron block $M = V \times d$

$\qquad\qquad = 0.25 \times 7800$ kg m^{-3}

$\qquad\qquad = 1950$ kg

Question 6.

The density of copper is 8.9 g cm $^{-3}$. What will be its density in kg m $^{-3}$?

Answer:

Density of copper $d = 8.9$ g cm^{-3}

$\qquad\qquad = 8.9 \times 1000$ kg m^{-3}

$\qquad\qquad\qquad [\because\ 1$ g cm$^{-3} = 1000$ kg m$^{-3}]$

$\qquad = 8900$ kg m^{-3}

Question 7.

A car travels a distance of 15 km in 20 minute. Find the speed of the car in (i) km /h , (ii) m /s .

Answer:

Distance travelled by car =15 km

Time taken = 20 minutes

(i) Speed of car in km h

Convert 20 minutes to hour

$$1 \text{ minute} = \frac{1}{60} \text{ hour}$$

$$\therefore \quad 20 \text{ minutes} = \frac{1 \times 20}{60} = \frac{1}{3} \text{ hour}$$

$$\text{Speed of car} = \frac{\text{Distance}}{\text{Time taken}}$$

$$= \frac{15 \text{ km}}{\frac{1}{3} \text{ h}}$$

$$= 15 \text{ km} \times 3 \text{ h}^{-1} = 45 \text{ km h}^{-1} = 45 \text{ km h}^{-1}$$

(ii) Speed of car in m s^{-1}

Convert 15 km into metres

1 km = 1000 m

15 km = 1000 × 15 = 15000 m   ...(i)

Convert minutes into seconds

1 minutes = 60 sec.

20 minutes = 60 × 20 = 1200 sec   ...(ii)

$$\text{Speed of car} = \frac{15000 \text{ m}}{1200 \text{ sec}}$$

$$= 12.5 \text{ m s}^{-1}$$

. . . . .

Question 8.

How long a train will take to travel a distance of 200 km with a speed of 60 km h ?

Answer:

Distance covered by train = 200 km

Speed of train = 60 km h

$$\text{We know speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\Rightarrow \qquad 60 = \frac{200}{\text{Time}}$$

$$\text{Time} = \frac{200}{60} = \frac{20}{6} = \frac{10}{3} \text{ hours}$$

$$= 3\frac{1}{3} \text{ hours} = 3 \text{ h} + \frac{1}{3} \text{ hours}$$

$$= 3 \text{ h} + \frac{1}{3} \times 60 \text{ min}$$

$$= 3 \text{ h} + 20 \text{ min}$$

$$= 3 \text{h } 20 \text{ min}$$

Question 9.

A boy travels with a speed of 10 m/s for 30 minute. How much distance does he travel ?

Answer:

Speed of boy = 10 m/s

Time taken = 30 minutes

speed = distance travelled / time taken

Distance travelled = Speed × Time taken

Convert 30 minutes to seconds

1 minute = 60 sec

30 minute 60 × 30 = 1800 seconds

Putting the value of speed and time we get

Distance travelled = 10 m/s × (1800 sec) = 18000 m

= 18000 metre or 18 km Ans.

Question 10.

Express 36 km h^{-1} in m s^{-1}

Answer:

$$36 \text{ km h}^{-1} = \frac{36 \times 1000 \text{ m}}{60 \times 60}$$

$$= 10 \text{ m s}^{-1}$$

1st unit syllabus -CHAPTER-1   -PHYSICAL QUANTITIES AND MEARUREMENT