

Lesson-1 Physical Quantities and Measurement

Define and write the S.I unit of the following:

1. **Volume :** Volume is defined as the amount of space that an object occupies. SI unit: m^3
2. **Area :** Area is defined as the space occupied by a plane object or a two-dimensional figure. SI unit: m^2
3. **Density:** Density of an object is defined as mass per unit volume of the substance. S I unit: kg / m^3
4. **Speed:** Speed is defined as the rate of change of motion or the distance travelled by an object in a given unit of time. S I unit is m/s
5. **Unit volume**

Short Answer Questions:

A. Numerical

1. A car covers a distance of 250 km in 5 hours. Express the speed of the car in S.I system
Distance(d) = 250 km = 250000 m
Time (t) = 1 hour = 3600 second
Speed = distance /time = 250 km/1 hour = 250 km/hr.
Speed = distance /time = 250000 m/3600 s = 69.4 m/s
2. A Car moves with a speed of 250 Km/hour. Calculate the distance covered by the car in 3 hours.
Speed = 250 km/hr.
Time = 3 hrs.
Speed = distance/time
 \Rightarrow distance = Speed *time = 250*3 = 750 km
3. An object moves with a speed of 25 m/s, what time will it take to cover 1000 m.
Speed = 25 m/s
Distance = 1000 m
Speed = distance / time
 \Rightarrow Time = distance /speed = 1000/25= 40 seconds.
4. An object of mass 50kg occupies a volume of 150 m^3 . Calculate the density of the object in S.I and C.G.S system.
Mass = 50 kg
Volume = 150 m^3

$$\text{Density} = \text{mass/volume} = 50 \text{ kg}/150 \text{ m}^3 = 0.33 \text{ kg/m}^3.$$

5. Calculate the mass of the object that occupies a volume of 150 m^3 , and has density 3 kg/m^3 .

$$\text{Volume} = 150 \text{ m}^3.$$

$$\text{Density} = 3 \text{ Kg/m}^3$$

$$\text{Density} = \text{mass/volume}$$

$$\Rightarrow \text{Mass} = \text{density} * \text{volume} = 3 * 150 = 450 \text{ Kg/m}^3.$$

6. Calculate the volume of the object with mass 500 g and density 50 g/cm^3 .

$$\text{Mass} = 500 \text{ g}$$

$$\text{Density} = 50 \text{ g/cm}^3.$$

$$\text{Density} = \text{mass/volume}$$

$$\Rightarrow \text{Volume} = \text{mass/ density} = 500/50 = 10 \text{ cm}^3.$$

7. Derive the relation between the following units

(i) m^2 to cm^2

$$\text{m}^2 = \text{m} * \text{m}$$

$$(\text{1 m} = \text{100 cm})$$

$$= 100 \text{ cm} * 100 \text{ cm}$$

$$= 10^4 \text{ cm}^2.$$

(ii) m^3 to cm^3

$$\text{m}^3 = \text{m} * \text{m} * \text{m}$$

$$= 100 \text{ cm} * 100 \text{ cm} * 100 \text{ cm}$$

$$= 10^6 \text{ cm}^3.$$

(iii) m/s to km/hour

$$1 \text{ m}/1 \text{ s} = 10^{-3} \text{ km}/(1/3600 \text{ s}) = 18/5 \text{ km/hr}$$

(iv) kg/m^3 to g/cm^3

$$1 \text{ kg}/1 \text{ m}^3 = 1000 \text{ g} / 10^6 \text{ cm}^3 = 10^{-3} \text{ g/cm}^3$$

C. Answer the following questions:

1. Explain the following with examples

i. Equal volume of different substances having different masses

Take equal volume (5 cm^3) of cotton and salt and measure their mass. The mass of salt will be more than that of cotton. This is because different substances have different densities.

ii. Equal masses having different volumes.

Take 1 kg of cotton and 1 kg of salt though they have equal mass their volume differs. The volume occupied by 1 kg of cotton will be much more than the volume occupied by 1 kg of salt

2. Write the different units of volume.

i. Volume of solid – S.I unit - m^3 , C.G.S unit - cm^3

ii. Volume of liquid – liter (l), milliliter (ml).

3. Write the different units of area.
S.I unit – m^2 , C.G.S unit – cm^2

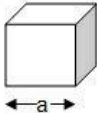

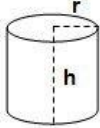
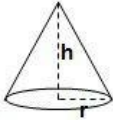

WORKSHEET

CHAPTER 1: PHYSICAL QUANTITIES AND MEASUREMENT

1. Find the volume of the following shapes shown made with the cubes of volume 1 cubic unit.

1. 12 cubic unit
2. 7 cubic unit
3. 13 cubic unit
4. 7 cubic unit
5. 15 cubic unit
6. 12 cubic unit
7. 11 cubic unit
8. 13 cubic unit

2. Write the formula to find the volume of the following shapes

Figure	Formula	Variables
Cube 	a^3	a = length of edge
Rectangular prism 	$l \times w \times h$	l = length w = width h = height
Cylinder 	$\pi \times r^2 \times h$	r = radius of circular face h = height
Cone 	$\frac{1}{3} \times \pi \times r^2 \times h$	r = radius of circular base h = height from tip to base
Sphere 	$\frac{4}{3} \times \pi \times r^3$	r = radius

3. Find the volume of the following solid shapes with the values given

Cube: $V = a^3 = a \cdot a \cdot a = 2\text{cm} \cdot 2\text{cm} \cdot 2\text{cm} = 8 \text{ cm}^3$

Cuboid: $V = l \cdot b \cdot h = 4\text{cm} \cdot 2\text{cm} \cdot 3\text{cm} = 24 \text{ cm}^3$

Cylinder $V = \pi r^2 h = 3.14 \cdot 2^2 \cdot 4 = 50.24 \text{ cm}^3$

Cone $V = \frac{1}{3} \pi r^2 h = 0.33 \cdot 3.14 \cdot 2^2 \cdot 4 = 16.74 \text{ cm}^3$

Sphere: $V = \frac{4}{3} \pi r^3 = \frac{4}{3} \cdot 3.14 \cdot 4^3 = 267.9 \text{ cm}^3$

4. Find the volume of the irregular object shown in the following figures.

1. Initial volume of water = 50 ml

Final volume of water = 60 ml

Volume of the solid = volume of water displaced = $60 - 50 = 10 \text{ ml}$

Volume of solid = 10 cm^3 ($1 \text{ ml} = 1 \text{ cm}^3$)

2. Initial volume of water = 50 ml

Final volume of water = 75 ml

Volume of solid = volume of water displaced = $75 - 50 = 25 \text{ ml}$

Volume of solid = $25 \text{ ml} = 25 \text{ cm}^3$.

3. Initial volume of water = 10 ml

Final volume of water = 30 ml

Volume of solid = volume of water displaced = $30 - 10 = 20 \text{ ml}$

Volume of solid = $20 \text{ ml} = 20 \text{ cm}^3$.

4. Initial volume of water = 82 ml

Final volume of water = 100 ml

Volume of solid = volume of water displaced = $100 - 82 = 18 \text{ ml}$

Volume of solid = $18 \text{ ml} = 18 \text{ cm}^3$.

5. Name the equipment's shown below that is used for measuring the volume of the liquid.

1. Measuring cylinder

2. Measuring cup

3. Conical flask

1. Find the volume of the water in each graduated cylinder

1. 25 ml

2. 9 ml

3. 40 ml

4. 20 ml

5. 12 ml

6. 16 ml

7. 20 ml

8. 48 ml

1. Identify the meniscus and mark the correct position of the eye in the following figure

1. Water in glass – concave meniscus – reading should be taken from the bottom of concave meniscus
2. Mercury in glass – convex meniscus – reading should be taken from the top of convex meniscus.

2. Measure the area of the following objects shown in graph

1. No of fully covered squares = 8
No of more than half covered squares = 8
No of exactly half covered squares = 7
Area = No of fully covered squares + No of more than half covered squares + No of exactly half covered squares/2
= $8+8+7/2=19.5 \text{ cm}^2$

2. No of fully covered squares = 29
No of more than half covered squares = 7
No of exactly half covered squares = 2
Area = No of fully covered squares + No of more than half covered squares + No of exactly half covered squares/2
= $29+7+2/2=37 \text{ cm}^2$

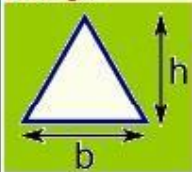
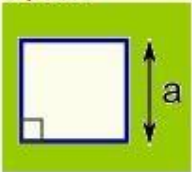
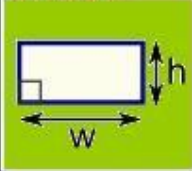
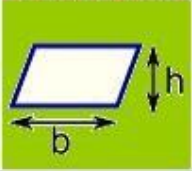
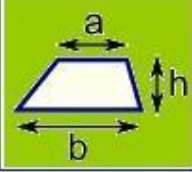

3. No of fully covered squares = 36
No of more than half covered squares = 6
No of exactly half covered squares = 6
Area = No of fully covered squares + No of more than half covered squares + No of exactly half covered squares/2
= $36+6+6/2=45 \text{ cm}^2$

4. No of fully covered squares = 33
No of more than half covered squares = 4
No of exactly half covered squares = 3
Area = No of fully covered squares + No of more than half covered squares + No of exactly half covered squares/2
= $33+4+3/2=38.5 \text{ cm}^2$

5. $25+5+5/2= 32.5 \text{ cm}^2$

6. $20+6+3/2=27.5 \text{ cm}^2$

6. Write the formula to find the area of the following shapes.

Shape	Formula	Shape	Formula
Triangle 	Area = $\frac{1}{2}b \times h$ b = base h = height	Square 	Area = a^2 a = length of side
Rectangle 	Area = $w \times h$ w = width h = height	Parallelogram 	Area = $b \times h$ b = base h = vertical height
Trapezoid 	Area = $\frac{1}{2}(a+b) \times h$ h = vertical height a, b are the parallel sides	Circle 	Area = πr^2 r = radius

7. Find the areas of the following shapes with the values in the figure shown

Triangle: Area = $\frac{1}{2} * 3 * 2 = 3 \text{ m}^2$

Square: Area = $3 * 3 = 9 \text{ m}^2$

Rectangle: Area = $3 * 5 = 15 \text{ m}^2$

Parallelogram: Area = $3 * 4 = 12 \text{ m}^2$

Trapezoid: Area = $(2+4)/2 * 3 = 6 \text{ m}^2$

Circle: Area = $3.14 * 3^2 = 28.26 \text{ m}^2$

8. Convert the following units:

Refer Pg 5:

a. $1 \text{ m}^3 = 1\text{m} * 1\text{m} * 1\text{m} = 100\text{cm} * 100\text{cm} * 100\text{cm} = 10^6 \text{ cm}^3$

b. $1\text{cm}^3 = 1\text{cm} * 1\text{cm} * 1\text{cm} = 10^{-2} \text{ m} * 10^{-2} \text{ m} * 10^{-2} \text{ m} = 10^{-6} \text{ m}^3$

c. $1 \text{ m}^2 = 1\text{m} * 1\text{m} = 100 \text{ cm} * 100\text{cm} = 10^4 \text{ cm}^2$

d. $1\text{cm}^2 = 1\text{cm} * 1\text{cm} = 10^2 \text{ mm} * 10^2 \text{ mm} = 10^4 \text{ mm}^2$

e. $1 \text{ km}^2 = 1 \text{ km} * 1\text{km} = 10^3 \text{ m} * 10^3 \text{ m} = 10^6 \text{ m}^2$

9. Observe the formula triangle and write the formula for the following

Mass = Density * Volume

Volume = Mass/Density

Density = Mass/Volume

10. The cookie shown here has mass 10 g and volume 10 cm³. Find the density of this cookie?

Mass = 10 g

Volume = 10 cm³

Density = mass/ volume = 10 g/10 cm³ = 1 g/cm³

11. The egg shown below has density 6 g/cm³, find the mass of the egg if its volume is 10 cm³.

Density = 6 g/cm³

Volume = 10 cm³

Density = mass/volume

⇒ Mass = density * volume = 6 * 10 = 60 g

12. This rock has density 3 g/cm³ and mass 12 g. Find the volume of the rock

Density = 3 g/cm³

Mass = 12 g

Density = mass/volume

⇒ Volume = mass/ density = 12/3 = 4 cm³

13. Calculate the speed of the car between the points A & B, A & C

i. Speed of the car between points A and B:

Distance = 10 m – 1 m = 9 m

Time = 2 sec

Speed = distance / time = 9/2 = 4.5 m/s.

ii. Speed of the car between points A and C:

Total Distance = 24 m

Total time = 4 sec

Speed = total distance/ total time = 24 m/4 sec = 6 m/sec.

14. Observe the given figure and compare the mass and volume of the iron and cotton shown in the figure.

Equal mass of different substances has different volume.

Equal mass(1kg) of iron and cotton are taken, though they have equal mass, their volume differs, the volume of iron is very less compared to volume of equal mass of cotton.

15. Observe the given figure and compare the mass and volume of the iron and cotton

Shown in the figure

Equal Volume of different substances has different mass.

Equal volume of iron and cotton are taken, though they have equal volume, their mass differs, the mass of iron is more compared to mass of equal volume of cotton.

16. Find the density of regular object shown

Mass of the cuboid = 240 g

Volume of the cuboid = length * breadth * height

$$4 \text{ cm} * 3 \text{ cm} * 2 \text{ cm}$$

$$24 \text{ cm}^3$$

1. Density = $250 \text{ g}/100 \text{ cm}^3 = 2.5 \text{ g/cm}^3$

2. Density = $325 \text{ g}/96 \text{ cm}^3 = 3.38 \text{ g/cm}^3$

3. Density = $520 \text{ g}/112 \text{ cm}^3 = 4.64 \text{ g/cm}^3$

4. Density = $125 \text{ g}/18 \text{ cm}^3 = 6.94 \text{ g/cm}^3$

17. Find the density of the irregular object shown

Mass of the object = 300 gf

Volume of water displaced = 100 cm^3

Density = mass/volume = $300/100 = 3 \text{ gf/cm}^3$

Lesson-2 Force and Pressure: Motion

Define the following with an example:

1. **Rest:** If the position of a body does not change with time, with respect to its surrounding, then the body is said to be in a state of rest. E.g., a book kept on a table
2. **Motion:** A body is said to be in a state of motion, if that body, with respect to its surroundings, keeps on changing its position with respect to time. E.g., a moving car
3. **Translatory motion:** It is a type of motion in which every particle of an object moves through the same distance in the same time interval.
4. **Rectilinear motion:** Motion where an object moves along a straight-line path is called rectilinear motion. E.g., Car moving on a straight road.
5. **Curvilinear motion:** Motion where an object moves in a curved path is called curvilinear motion. E.g., Car moving on curved road.
6. **Circular motion:** Motion in which an object moves in a circular orbit around a fixed point is called circular motion. E.g., A child sitting on a merry go round.
7. **Rotatory or Rotational motion:** Motion in which each point of the object moves in circular motion about the fixed axis that lies within its body. E.g., Motion of a ceiling fan.
8. **Oscillatory motion:** Motion in which an object moves back and forth or to and fro about its mean position is called oscillatory motion. E.g., Motion of swing in park.
9. **Vibratory motion:** Motion in which an object as a whole does not move back and forth or to and fro but its atoms oscillate about their mean position is called vibratory motion. E.g., Motion of cell phone kept on vibrating mode.
10. **Periodic motion:** Motion in which an object repeats its motion in a regular interval of time is called periodic motion. E.g., Heartbeats of a normal person.
11. **Non periodic motion:** Motion in which an object repeats its motion but not at regular intervals of time is called non periodic motion. E.g., the ball rolling down the ground slows down and stops.

12. **Combined motion:** Motion in which two or more motion occurs simultaneously is called combined motion. E.g., A rolling ball undergoes both translatory and rotational motion.
13. **Rolling motion:** the type of motion in which objects undergo both rotational and translatory motion along a surface is called rolling motion. e.g., Movement of a wheel of a car.
14. **Random motion:** an object showing random motion moves with no specific path, rather the object suddenly changes its direction. E.g., Waves in water bodies undergo random motion.
15. **Uniform motion:** A body is said to be in uniform motion if it covers equal distance in equal intervals of time along the same path.
16. **Non uniform motion:** A body is said to be in non-uniform motion if it covers unequal distances in equal intervals of time along the same path.
17. Differentiate between scalar and vector quantities.

Scalar quantities	Vector quantities
The physical quantities which can be described only by their magnitude but not by the direction are called Scalars.	The physical quantities which can be described both by their magnitude and the direction are called Vectors
E.g.: Mass, Density, Area, Volume	E.g.: Weight, Displacement, Force, Velocity

18. Differentiate between Mass and Weight.

Ans: Refer Pg. 27

19. An object moves 6 kms from point A to point B and then 6 Kms from Point B to Point C. find the distance covered by the object and displacement.

Distance AB = 6 km

Distance AC = 6 km

Total distance covered = AB + AC = 6 + 6 = 12 km

Displacement = AC (the shortest distance)

According to Pythagoras theorem

$$AC^2 = AB^2 + BC^2 = 6^2 + 6^2 = 36 + 36 = 72$$

$$AC = \sqrt{72}$$

20. Soman moves along the perimeter of a rectangular field of length 5 m and breadth 3 m. He takes 5 rounds and returns to his starting point. Find the distance covered by him and displacement.

Length of the rectangular field (l) = 5 m

Breadth of the rectangular field (b) = 3 m

Perimeter of the field = $2(l+b) = 2(5+3) = 2*8 = 16$ m

Distance covered by Soman in one round = 16 m

Distance covered by Soman in 5 rounds = $16 * 5 = 80$ m

Displacement = 0. (Since he is in the same starting point)

21. A car covers 400 km in 10 hrs. find the speed of the car in m/s and km/hr.

Distance = 400 km

Time = 10 hrs.

Speed = distance / time = $400 / 10 = 40$ km/hr.

1 km/hr. = $5/18$ m/sec

40 km/hr. = $40 * 5/18 = 11.1$ m/sec

22. A train moves at a uniform speed of 200 km/hr. how long will it take to cover 50 km.

Ans: Speed = 200 km/hr

Distance = 50 km

Speed = distance / time

Time = distance/speed = $50/200 = 0.25$ hr.

23. A bus moving at a constant speed of 50 m/s. how much distance will it cover in 100 seconds.

Ans: Speed = 50 m/s

Time = 100 sec

Speed = distance/time

Distance = speed * time = $50 * 100 = 5000$ m

24. A truck covers 200 km in first hour and 180 km in second hour and 160 km in the third hour. What is the average speed of the truck during the whole journey?

Ans: Total Distance = $200+180+160 = 540$ kms

Total Time = 3 hrs.

Average speed = total distance / total time = $540/3 = 180$ kms/hr.

25. Which speed is more 80 km/hr. or 40 m/s.?

Ans: 80 km/hr. = $80 * 5/18 = 22.2$ m/s

40 m/s is more than 80 km/hr.

26. A bus starts from location P and moves 200 km to reach location Q in 3 hours. From Q, the bus takes another 3 hours to reach location R, which is

250 km away. What type of motion what type of motion did the bus take to travel from location P to location R.?

Ans: P to Q \rightarrow 200 km in 3 hrs.

Q to R \rightarrow 250 km in 3 hrs.

The bus took Non uniform motion to travel from P to R because it travels unequal distance in equal intervals of time

27. You travelled a distance of 210 km by car and the trip lasted 3 hours and 12 minutes. What is the average speed of your car?

Ans: Distance = 210 km

Time = 3 hours 12 minutes = 3.2 hours

Average speed = total distance / total time = $210 / 3.2 = 65.62$ km/hr.

28. A car travels up the hill at a constant speed of 30 km/hr and returns down the hill at a constant speed of 60 km/hr. Calculate the average speed of the car for the whole trip.

Ans: Average speed = $(\text{speed 1} + \text{speed 2}) / 2 = (30 + 60) / 2 = 90 / 2 = 45$ km/hr.

29. The reading on the odometer of a car at 8.40 am is 55891 km. After travelling a certain distance, the odometer shows 55,912 km at 8.50 am. Calculate the average speed of the car in km/hr.

Ans: Distance Travelled = $55912 - 55891 = 21$ km

Time taken = 10 min = $10 / 60$ hr. = 126 km/hr.

WORKSHEET

1. Observe the following figure and answer the following questions with reason.

- i. The boy standing in the moving train is in motion with respect to the person standing outside the train.
- ii. The boy standing in the moving train is in rest with respect to the person standing in the moving train.
- iii. Rest and motion are relative.

2. Identify the types of motion from the following figures.

1. Vibrational motion
2. Linear motion
3. Curvilinear motion
4. Oscillatory motion
5. Circular motion

6. Rotatory motion
7. Circular motion
8. Oscillatory motion
9. Oscillatory motion

3. From the following figure, identify which motion is uniform and non-uniform with reason

Uniform motion: the car moves equal distance in equal intervals of time

Non-Uniform Motion: The car moves unequal distance in equal intervals of time

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