SURA'S SUPER GUIDE

2019-20 EDITION

SURA'S SCIENCE TERM-I

New Syllabus 2019-20

- Term-wise Guide for the year 2019-20, for Term-I.
- Answers for all Textbook Questions.
- Exhaustive Additional Questions in all Units.
- Unit Test Question paper for each unit, with answer key.

7th Std.

SURA'S

Science

Term - 1

VII - Standard

Based on the New Syllabus and New Textbook for 2019-20

Salient Features :

- Term-wise Guide for the year 2019-20, for Term-I.
- Complete Solutions to Textbook Exercises.
- Exhaustive Additional Question in all Units.
- Unit Test Question paper for each unit, with answer key.

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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Science Guide** for **7th Standard Term - 1**. It is prepared as per the New Syllabus and New Textbook for for the year 2019 - 20.

This guide encompasses all the requirements of the students to comprehend the text and the evaluation of the textbook.

Additional questions have been provided exhaustively for clear understanding of the units under study.

In order to learn effectively, I advise students to learn the subject section-wise and practice the exercises given. It will be a teaching companion to teachers and a learning companion to students.

Though these salient features are available in this Guide, I cannot negate the indispensable role of the teachers in assisting the student to understand the subject thoroughly.

I sincerely believe this guide satisfies the needs of the students and bolsters the teaching methodologies of the teachers.

I pray the almighty to bless the students for consummate success in their examinations.

Subash Raj, B.E., M.S.
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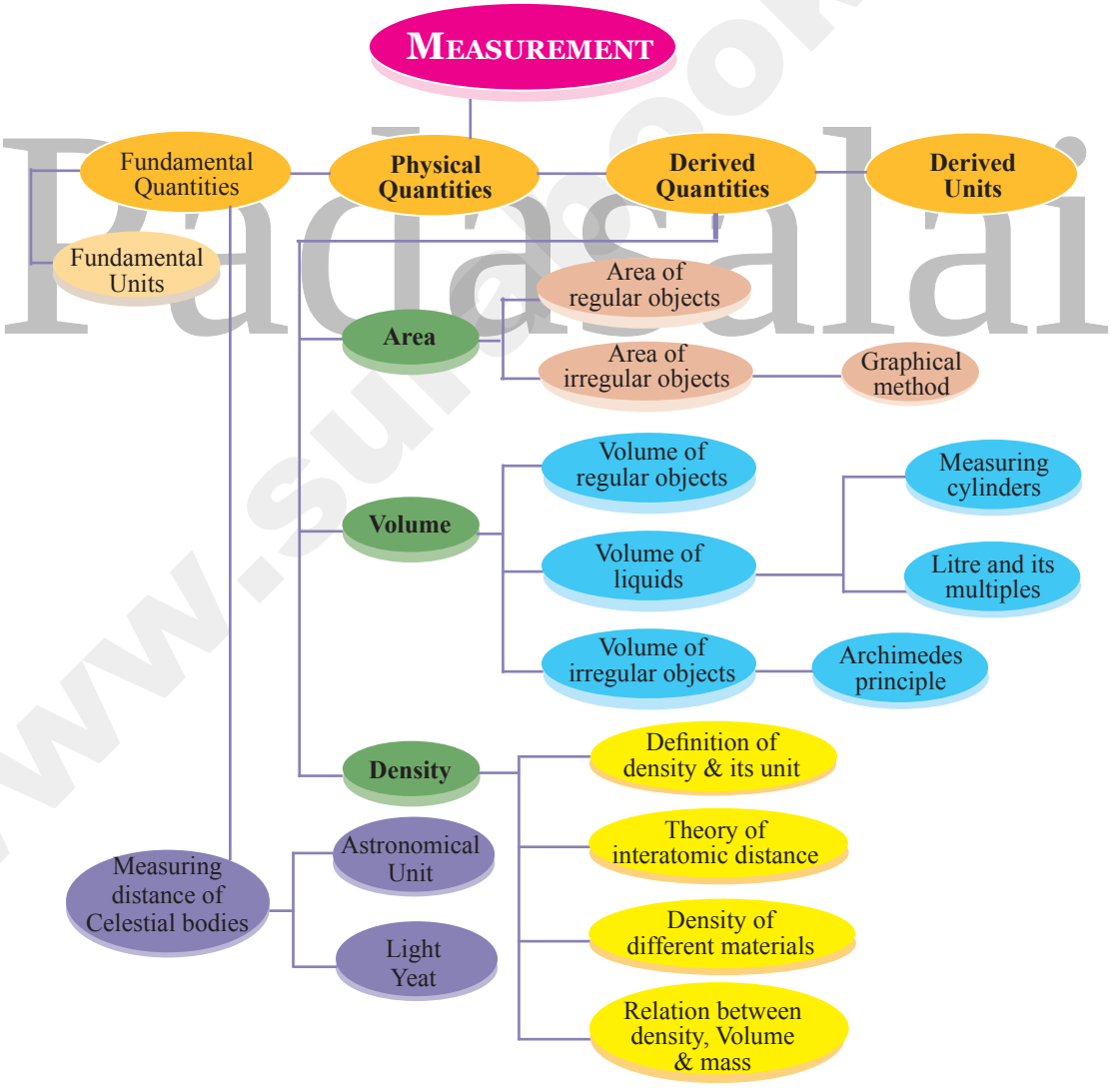
CONTENTS

Unit

01 MEASUREMENT

LEARNING OBJECTIVES

- To identify fundamental and derived physical quantities
- To identify fundamental and derived units.
- To obtain units for certain derived quantities.
- To measure the area and volume of some regular shaped and irregular shaped objects.
- To convert the volume of objects from cubic metre to litre and vice versa.
- To calculate the density of solids and liquids.
- To define Astronomical unit and light year.



Definitions

Physical quantity	:	A quantity that can be measured is called a physical quantity.
Measurement	:	Measurement is a process of comparing an unknown physical quantity with a known physical quantity called unit.
Unit	:	A unit is a known measure of a physical quantity with which physical quantities of the same kind are measured.
Area	:	Area is the measure of the region inside a closed line.
Volume	:	The amount of space occupied by a three dimensional object is known as its volume.
Capacity of a container	:	The maximum volume of liquid that a container can hold is called as capacity of the container.
Density	:	Density of a substance is defined as the mass of the substance contained in unit volume (1 m^3)
Astronomical Unit	:	One astronomical unit is defined as the average distance between the earth and the sun.
Light year	:	One light year is defined as the distance traveled by light in vacuum during the period of one year.
Fundamental quantities	:	A set of physical quantities which cannot be expressed in terms of any other quantities are known as "Fundamental quantities". Their corresponding units are called "Fundamental units".
Derived quantities	:	The physical quantities which can be obtained by mathematically combining (i.e., multiplying and dividing) the fundamental quantities are known as "Derived quantities". Their corresponding units are called "Derived units".
Perihelion	:	It is the position of the shortest distance between the earth and the sun.
Aphelion	:	It is the position of the largest distance between the earth and the sun.

Formulae to Remember

S. No	Dimension		Formula	Unit
1.	Area of rectangle	=	$l \times b$	m^2
2.	Area of square	=	$s \times s$	m^2
3.	Area of circle	=	$\pi \times r^2$	m^2
4.	Triangle	=	$\frac{1}{2} \times b \times h$	m^2

5.	Volume	=	$l \times b \times h$	m^3
6.	Speed	=	distance/time	m/s
7.	Electric charge	=	electric current × time	Coulomb (C)
8.	Density	=	Mass/Volume	Kg/m^3
9.	Mass	=	Density × Volume	kg
10.	Volume	=	mass/density	m^3
11.	Volume of cube	=	$a \times a \times a$	m^3
12.	Volume of cuboid	=	$l \times b \times h$	m^3
13.	Volume of sphere	=	$\frac{4}{3} \times \pi \times r^3$	m^3
14.	Cylinder	=	$\pi \times r^2 \times h$	m^3
15.	Light year	= Speed of light in vacuum × time = 3×10^8 m/s × 365 × 24 × 60 × 60 = 9.46×10^{15}m		
16.	Astronomical unit	= Average distance between the earth and the sun = 1.496×10^{11} m		

Evaluation

I. Choose the appropriate answer:

1. Which of the following is a derived unit?

(a) mass (b) time
(c) area (d) length **[Ans. (c) area]**

2. Which of the following is correct?

(a) 1L = 1cc (b) 1L = 10cc
(c) 1L = 100cc (d) 1L = 1000cc **[Ans. (d) 1L = 1000 cc]**

3. SI unit of density is

(a) kg/m^2 (b) kg/m^3
(c) kg/m (d) g/m^3 **[Ans. (b) kg/m^3]**

4. Two spheres have equal mass and volume in the ratio 2:1. The ratio of their density is

(a) 1:2 (b) 2:1
(c) 4:1 (d) 1:4 **[Ans. (b) 2:1]**

5. Light year is the unit of

(a) Distance (b) time
(c) density (d) both length and time **[Ans. (a) Distance]**

II. Fill in the blanks:

1. Volume of irregularly shaped objects are measured using the law of _____.
[Ans. Archimedes]

2. One cubic metre is equal to_____ cubic centimetre. [Ans. 10,00,000 or 10^6]

3. Density of mercury is _____. [Ans. 13,600 kg/m^3]

4. One astronomical unit is equal to _____. [Ans. 1.496×10^{11} m]

5. The area of a leaf can be measured using a _____ [Ans. graph sheet]

III. State whether the following statements are true or false.

1. The region covered by the boundary of the plane figure is called its volume.

Ans. False. Correct statement : The region covered by the boundary of plane figure is called its area.

2. Volume of liquids can be found using measuring containers.

Ans. True

3. Water is denser than kerosene.

Ans. True

4. A ball of iron floats in mercury.

Ans. True

5. A substance which contains less number of molecules per unit volume is said to be denser.

Ans. False. Correct statement : A substance which contains more number of molecules per unit volume is said to be denser.

IV. Match the items in column – I to the items in column - II :

1.

Column - I		Column - II	
i.	Area	(a)	light year
ii.	Distance	(b)	m^3
iii.	Density	(c)	m^2
iv.	Volume	(d)	kg
v.	Mass	(e)	kg / m^3

[Ans : i-c, ii-a, iii-e, iv- b, v - d]

2.

Column - I		Column - II	
i.	Area	(a)	g / cm^3
ii.	Length	(b)	measuring jar
iii.	Density	(c)	amount of a substance
iv.	Volume	(d)	rope
v.	Mass	(e)	plane figures

[Ans : i-e, ii-d, iii-a, iv- b, v - c]

V. Arrange the following in correct sequence :

1. 1L, 100 cc, 10 L, 10 cc

Ans. 10 cc, 100 cc, 1L, 10L

2. Copper, Aluminium, Gold, Iron

Ans. Aluminium, Iron, Copper, Gold

VI. Use the analogy to fill in the blank:

3. Area: M^2 :: Volume : _____

Ans. M^3

4. Liquid : Litre :: Solid : _____

Ans. cm^3

5. Water : Kerosene :: _____ :Aluminium

Ans. Iron

VII. Assertion and reason type questions:

Mark the correct choice as

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(b) If both assertion and reason are true, but reason is not the correct explanation of assertion

(c) Assertion is true but reason is false

(d) Assertion is false but reason is true.

1. **Assertion (A) : Volume of a stone is found using a measuring cylinder.**
Reason (R) : Stone is an irregularly shaped object.
[Ans. (a) If both assertion and reason are true and reason is the correct explanation of assertion]

2. **Assertion (A) : Wood floats in water.**
Reason (R) : Water is a transparent liquid.
[Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion]
Correct explanation: Density of water is more than the density of wood.

3. **Assertion (A) : Iron ball sinks in water.**
Reason (R) : Water is denser than iron.
[Ans. (b) If both assertion and reason are true, but reason is not the correct explanation of assertion]
Correct explanation : Density of iron is more than that of water.

VIII. Give very short answer:

1. **Name some of the derived quantities.**

Ans. Area, volume, density.

2. Give the value of one light year.

Ans. One light year = 9.46×10^{15}m

3. Write down the formula used to find the volume of a cylinder.

Ans. Volume of a cylinder = $\pi r^2 h$

4. Give the formula to find the density of objects.

Ans. Density (D) = $\frac{\text{mass}(m)}{\text{volume}(v)}$

$$D = \frac{(m)}{(v)}$$

5. Name the liquid in which an iron ball sinks.

Ans. Iron ball sinks in water. The density of an iron ball is more than that of water so it sinks in water.

6. Name the unit used to measure the distance between celestial objects.

Ans. Astronomical unit and light year are the units used to measure the distance between celestial objects.

7. What is the density of gold?

Ans. Density of gold is 19,300 kg/m^3.

IX. Give Short Answer.

1. What are derived quantities?

Ans. The physical quantities which can be obtained by multiplying, dividing or by mathematically combining the fundamental quantities are known as derived quantities.

(or)

The physical quantities which are expressed is terms of fundamental quantities are called derived quantities.

2. Distinguish between the volume of liquid and capacity of a container.

Ans.

S.No	Volume of liquid	Capacity of a container
1.	Volume is the amount of space taken up by a liquid	Capacity is the measure of an objects ability to hold a substance like solid, liquid or gas
2.	It is measured in cubic units.	It is measured in litres, gallons, pounds, etc.
3.	It is calculated by multiplying the length, width and height of an object.	It's measurement is cc or ml.

3. Define the density of objects.

Ans. Density of a substance is defined as the mass of the substance contained in unit volume.

Density (D) = $\frac{\text{mass}(m)}{\text{volume}(v)}$

4. What is one light year?

Ans. One light year is the distance travelled by light in vacuum during the period of one year.

1 Light year = 9.46×10^{15}m.

5. Define one astronomical unit?

Ans. One astronomical unit is defined as the average distance between the earth and the sun.

1AU = 1.496 5 10^{6}km = 1.496×10^{11}m.

X. Answer in detail.

1. Describe the graphical method to find the area of an irregularly shaped plane figure.

Ans. To find the area of an irregularly shaped plane figure, we have to use graph paper.

(i) Place a piece of paper with an irregular shape on a graph paper and draw its outline.

(ii) To find the area enclosed by the outline, count the number of squares inside it (M).

(iii) You will find that some squares lie partially inside the outline.

(iv) Count a square only if half (p) or more of it (N) lies inside the outline.

(v) Finally count the number of squares, that are less than half. Let it be Q.

For the shape in figure we have the following:

M = 50 N = 7

P = 4 Q = 4

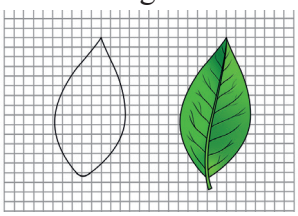
Now, the approximate area of the can be calculated using the following formula.

$$\text{Area of the leaf} = M + \left(\frac{3}{4}\right)N + \left(\frac{1}{2}\right)P + \left(\frac{1}{4}\right)Q \text{ sq. cm}$$

$$= 50 + \frac{3}{4} \times 7 + \frac{1}{\cancel{2}} \times \cancel{4}^{2} + \frac{1}{\cancel{4}} \times \cancel{4}$$

$$= 50 + \frac{21}{4} + 2$$

$$= 52 + 5.25 = 58.25 \text{ sq.mm} = 0.5825 \text{ sq.cm}$$



Area of an irregularly shaped plane figure

2. How will you determine the density of a stone using a measuring jar?

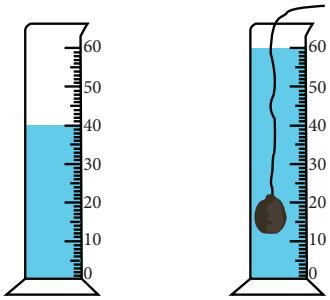
Ans. Determination of density of a stone using a measuring cylinder.

(i) In order to determine the density of a solid, we must know the mass and volume of the stone.

(ii) The mass of the stone is determined by a physical balance very accurately. Let it be 'm' grams.

(iii) In order to find the volume, take a measuring cylinder and pour in it some water.

(iv) Record the volume of water from the graduations marked on measuring cylinder. Let it be 40 cm3.



Density of a stone using measuring cylinder.

(v) Now tie the given stone to a fine thread and lower it gently in the measuring cylinder, such that it is completely immersed in water.

(vi) Record the new level of water. Let it be 60 cm^3.

$\therefore$ Volume of the solid = $(60 - 40)\ cm^3$

= $20\ cm^3 = V\ cm^3$ (assume)

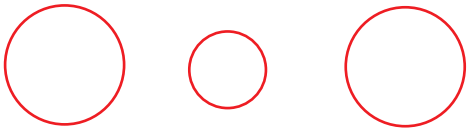
Knowing the mass and the volume of the stone, the density can be calculate by the formula :

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{m}{v}\ g/cm^3$$

XI. Questions based on Higher Order Thinking skills:

1. There are three spheres A, B, C as shown below :

Sphere A Sphere B Sphere C



Sphere A and B are made of the same material. Sphere C is made of a different material. Spheres A and C have equal radii. The radius of sphere B is half that of A. Density of A is double that of C.

Now answer the following questions:

i. Find the ratio of masses of spheres A and B.

ii. Find the ratio of volumes of spheres A and B.

iii. Find the ratio of masses of spheres A and C.

Ans. i. Ratio of masses of spheres A and B

$M_A : M_B$

$D \times V_A : D \times V_B$ (Radius of sphere B is half that of A)

Let the mass of sphere A = M_A

Let the mass of sphere B = M_B

Mass = Density × Volume

$M_A = D_A \times V_A$

$M_B = D_B \times V_B$ (Density is same)

Volume of Sphere A = $\frac{4}{3}\pi r^3$

Volume of Sphere B = $\frac{4}{3}\pi \times \left(\frac{r_A}{2}\right)^3$

$$D \times \frac{4}{3}\pi r^3 : D \times \frac{4}{3}\pi\left(\frac{r}{2}\right)^3 = 1 : \frac{1}{8} = 8:1$$

ii. Ratio of volumes of spheres A and B

$V_A : V_B$

$\boxed{8 : 1}$ (As mass is directly proportional to volume)

iii. Ratio of masses of spheres A and C.

$M_A : M_C$

$2\cancel{D} \times \cancel{V} : \cancel{D} \times \cancel{V}$ [∴Density of A is double that of C]

$\boxed{2 : 1}$

XII. Numerical problems:

1. A circular disc has a radius 10 cm. Find the area of the disc in m^2. (Use $\pi = 3.14$)

Ans. Given radius = 10 cm = 0.1m

$\pi = 3.14$

Area of a circular disc A = ? (in m2)

Formula : Area of a circle A = πr^2

$= 3.14 \times 0.1 \times 0.1$

Solution : $A = 0.0314 m^2$

2. The dimension of a school playground is 800 m × 500 m. Find the area of the ground.

Ans. Given : The dimension of a school

Playground = $l \times b = 800\ m \times 500\ m$

Formula : Area of the ground A = $l \times b$

$= 800 \times 500$

$= 4,00,000$

Solution : $A = 4,00,000\ m^2$

3. Two spheres of same size are made from copper and iron respectively. Find the ratio between their masses. Density of copper 8,900 kg/m^3 and iron 7,800 kg/m^3.

Ans. Given : Density Copper $D_C = 8900\ kg/m^3$

Density of Iron $D_I = 7800\ kg/m^3$

Volume of Copper sphere = Volume of Iron sphere

To find : Ratio of Masses of Copper (M_C) and Iron (M_I)

Solution: Mass = Density × Volume

$M_C = D_C \times V,\ M_I = D_I \times V$

$M_C = 8900\ V, \quad M_I = 7,800\ V$

$M_C = M_I$

$8900\ V : 7800\ V$

$= 1.14 : 1$

4. A liquid having a mass of 250 g fills a space of 1000cc. Find the density of the liquid.

Ans. Given : Mass of a liquid M = 250g

Volume V = 1000cc

Density of the liquid D = ?

Formula: Density $D = \frac{\text{mass}(m)}{\text{volume}(v)}$

$= \frac{25\cancel{0}}{100\cancel{0}} = 0.25$ g/cc

Solution: Density of the liquid = 0.25g/cc

5. A sphere of radius 1cm is made from silver. If the mass of the sphere is 33g, find the density of silver (Take $\pi = 3.14$)

Ans. Given : radius of a sphere r = 1cm

Volume of the sphere V = ?

Mass of the sphere M = 33g

Density of silver D = ?

Formula: Density $D = \frac{\text{mass of the sphere(M)}}{\text{volume of the sphere(V)}}$

Volume (V) $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times 3.14 \times 1 \times 1 \times 1$

$V = 4.187\ (cm^3)$

$D = \frac{M}{V} = \frac{33}{4.187} = 7.889$ g/cc

Solution: Density of silver sphere = 7.889 g/cc.

XIII. Cross word puzzle:

Clues – Across

1. SI unit of temperature
2. A derived quantity
3. Mass per unit volume
4. Maximum volume of liquid a container can hold

Clues – Down

a. A derived quantity
b. SI unit of volume
c. A liquid denser than iron
d. A unit of length used to measure very long distances

Ans.

	K (1)	E	L	V (a)	I	N					
				E							
	L (d)			L		C (b)					M (c)
	I		V (2)	O	L	U	M	E			E
	G			C		B					R
	H			I		I					C
	T			T		C					U
	Y			Y		M					R
	E				D (3)	E	N	S	I	T	Y
C (4)	A	P	A	C	I	T	Y				
	R					R					
						E					

Clues – Across

1. KELVIN
2. VOLUME
3. DENSITY
4. CAPACITY

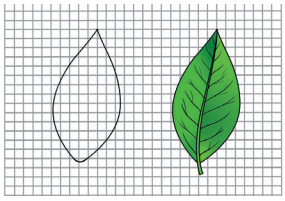
Clues – Down

a. VELOCITY
b. CUBIC METRE
c. MERCURY
d. LIGHT YEAR

Intext Activities

→ ACTIVITY - 1

Take a leaf from any one of trees in your neighborhood. Place the leaf on a graph sheet and draw the outline of the leaf with a pencil. Remove the leaf. You can see the outline of the leaf on the graph sheet.



i. Now, count the number of whole squares enclosed within the outline of the leaf. Take it to be M.

ii. Then, count the number of squares that are more than half. Take it as N.

iii. Next, count the number of squares which are half of a whole square. Note it to be P.

iv. Finally, count the number of squares that are less than half. Let it be Q.

v. M = _____; N = _____;

P = _____; Q = _____

Now, the approximate area of the leaf can be calculated using the following formula:

Approximate area of the leaf = $M + \left(\frac{3}{4}\right)N + \left(\frac{1}{2}\right)P + \left(\frac{1}{4}\right)Q$ square cm.

Area of the leaf = _____.

This formula can be used to calculate the area of any irregularly shaped plane figures.

Ans. v. M = 50 N = 7

P = 4 Q = 4

Approximate area o the leaf $= M+\left(\frac{3}{4}\right)N+\left(\frac{1}{2}\right)P+\left(\frac{1}{4}\right)Q$

$= 50+\left(\frac{3}{4}\right)\times 7+\left(\frac{1}{\cancel{2}}\times \overset{2}{\cancel{4}}\right)+\frac{1}{\cancel{4}}\times \cancel{4}$

$= 50+\frac{21}{4}+2+1= 50 + 5.25 + 2 + 1$

$= \boxed{58.25 \text{ sq. mm}}$

$= 0.5825$ sq.cm

➝ ACTIVITY - 2

Draw the following regularly shaped figures on a graph sheet and find their area by the graphical method. Also, find their area using appropriate formula. Compare the results obtained in two methods by tabulating them.

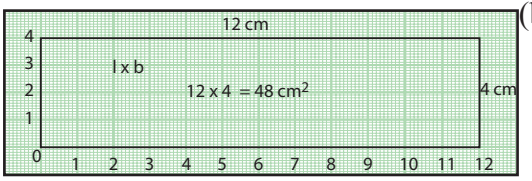
(a) A rectangle whose length is 12 cm and breadth is 4 cm.

(b) A square whose side is 6 cm.

(c) A circle whose radius is 7 cm.

(d) A triangle whose base is 6 cm and height is 8 cm.

Ans. (a)



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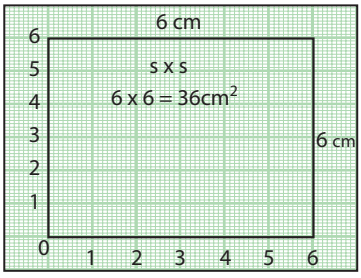

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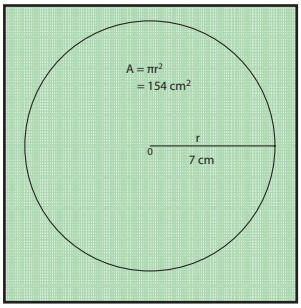
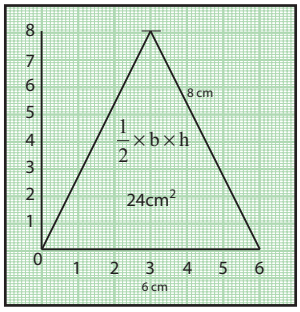


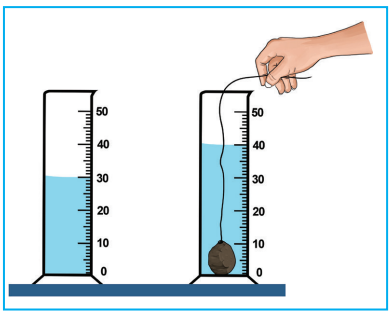
(d)



S. No	Shape	Area using formula	Area using graphical method
1.	Rectangle	$A = l \times b = 12 \times 4 = 48$sq.cm	48 sq. cm
2.	Square	$A = s \times s = 6 \times 6 = 36$ sq. cm	36 sq. cm
3.	Circle	$A = \pi r^2 = \frac{22}{\cancel{7}} \times \cancel{7} \times 7 = 154$ sq.cm	154 sq.cm
4.	Triangle	$\frac{1}{2} \times b \times h = \frac{1}{\cancel{2}} \times \cancel{6}^{3} \times 8 = 24$ sq. cm	24 sq. cm

➙ ACTIVITY - 3

Take a measuring cylinder and pour some water into it (Do not fill the cylinder completely). Note down the volume of water from the readings of the measuring cylinder. Take it as V_1. Now take a small stone and tie it with a thread. Immerse the stone inside the water by holding the thread. This has to be done such that the stone does not touch the walls of the measuring cylinder. Now, the level of water has raised. Note down the volume of water and take it to be V_2. The volume of the stone is equal to the raise in the volume of water.



V_1 = _____; V_2 = _____;

Volume of stone = $V_2 - V_1$ = _____.

Ans. $V_1 = 30$ cc, $V_2 = 40$ cc; Volume of stone = $V_2 - V_1 = 40\text{cc} - 30\text{cc} =$ 10cc

➙ ACTIVITY - 4

(a) Take an iron block and a wooden block of same mass (say 1kg each). Measure their volume. Which one of them has more volume and occupies more volume?

(b) Take an iron block and a wooden block of same size. Weigh them and measure their mass. Which one of them has more mass?

Ans. (a) Wooden block has more volume and occupies more volume. (As the molecules of wood are loosely packed)

(b) Iron block has more mass. (In iron block, molecules are closely packed).

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Additional Questions

I. Choose the correct answer.

1. The unit of volume is _____
(a) m^3 (b) m^2
(c) cm^3 (d) km
[Ans. (a) m^3]

2. Physical quantities are classified into _____ types
(a) three (b) two
(c) four (d) none of the above
[Ans. (b) two]

3. The SI unit of speed is _____
(a) m/s^2 (b) m/s
(c) km/h (d) m^2/s
[Ans. (a) m/s^2]

4. 1 litre = _____ cc
(a) 100 (b) 1000
(c) 10 (d) 0.1
[Ans. (b) 1000]

5. The formula to calculate area of a rectangle is _____.
(a) length × breadth (b) side × side
(c) π × radius × radius (d) none of the above **[Ans. (a) length × breadth]**

6. _____ is a derived quantity.
(a) length (b) mass
(c) time (d) area
[Ans. (d) area]

7. The amount of space occupied by a three dimensional object is known as its ____
(a) density (b) volume
(c) Area (d) mass
[Ans. (b) volume]

8. The maximum volume of liquid that a continer can hold is ____ .
(a) area (b) volume
(c) capacity (d) density
[Ans. (c) capacity]

9. The shortest distance between the earth and the sun is called as ____ position.
(a) Light year (b) normal
(c) perihelion (d) aphelion
[Ans. (c) Perihelion]

10. The largest distance between the earth and the sun is called as ____ position.
(a) normal (b) perihelion
(c) aphelion (d) none of the above
[Ans. (c) aphelion]

11. ____ is defined as the average distance between the earth and the sun.
(a) Astronomical unit (b) Light year
(c) Kilometre (d) none
[Ans. (a) Astronomical unit]

II. Fill in the Blanks.

1. The materials with higher density are called_____. **[Ans. denser]**
2. The materials with lower density are called _____ **[Ans. rarer]**
3. The area of irregularly shaped figures can be calculated with the help of a _____ **[Ans. graph sheet]**

4. The SI unit of volume is _____. [Ans. cubic metre or m^3]
5. The SI unit of density is _____. [Ans. kg/m^3]
6. The CGS unit of density is _____. [Ans. g/cm^3]
7. If the density of a solid is lower than that of a liquid it _____ in that liquid [Ans. floats]
8. If the density of a solid is higher than that of a liquid, it _____ in that liquid. [Ans. sinks]
9. The total number of seconds in one year = _____ [Ans. 3.15 3×10^7 second]
10. The average distance between the earth and the sun is about _____ million kilometre. [Ans. 149.6]
11. The corresponding units of fundamental quantities are called _____ [Ans. fundamental units]

III. True or False - if false give the correct statement.

1. One square metre is the area enclosed inside a square of side 2 metre.
Ans. False. Correct Statement : One square metre is the area enclosed inside a square of side **1 metre**.

2. Area is a derived quantity as we obtain by multiplying twice of the fundamental physical quantity length.
Ans. True.

3. Density of water is 100 kg/m^3.
Ans. False. Correct statement: Density of water is **1000 kg/m^3.**

4. Density is defined as the mass of the substance contained in unit volume.
Ans. True.

5. The lightness or heaviness of a body is due to volume
Ans. False. Correct statement: The lightness or heaviness of a body is due to **density**.

6. Neptune is 30 AU away from sun.
Ans. True.

7. The nearest star to our solar system is proxima centauri.
Ans. True.

8. The volume of a figure is the region covered by the boundary of the figure.
Ans. False. Correct statement: The **area** of a figure is the region covered by the boundary of the figure.

9. 1 Light year = 9.46×10^5 m.
Ans. True.

10. One light year is defined as the distance travelled by light in vacuum during the period of one year.
Ans. True.

IV. Match the following :

1.

1.	Length	(a)	ampere (A)
2.	time	(b)	kelvin (K)
3.	Mass	(c)	metre (M)
4.	Temperature	(d)	second (S)
5.	Electric current	(e)	kilogram (K)

[Ans. (1-c. 2-d, 3-e, 4- b, 5 -a)]

2.

	Plane figure		**Area**
1.	Rectangle	(a)	$\pi \times r^2$
2.	Square	(b)	$\frac{1}{2} \times b \times h$
3.	Circle	(c)	$l \times b$
4.	Triangle	(d)	$s \times s$

[Ans. (1-c. 2-d, 3-a, 4- b)]

3.

1.	Amount of substance	(a)	Litre
2.	Luminous intensity	(b)	Metre
3.	Vegetables	(c)	Mole
4.	Cloth	(d)	Candela
5.	Milk	(e)	kg

[Ans. (1-c. 2-d, 3-e, 4- b, 5-a)]

V. Assertion and Reason.

Mark the correct choice as

(a) Both A and R are true but R is not the correct reason.
(b) Both A and R are true and R is the correct reason.
(c) A is true but R is false.
(d) A is false but R is true.

1. **Assertion (A) :** The distance between two celestial bodies is measured by the unit of light year.
Reason (R) : The distance travelled by the light in one year in vacuum is called one light year.
[Ans. (a) Both A and R are true but R is not the correct reason.]

2. **Assertion (A) :** It is easier to swim in sea water than in river water.
Reason (R) : Density of sea water is more than that of river water
(a) Both A and R are true but R is not the correct reason.
(b) Both A and R are true and R is the correct reason.
(c) A is true but R is false.
(d) A is false but R is true.
[Ans. (b) Both A and R are true and R is the correct reason.]

3. **Assertion (A) :** Volume is a derived quantity.
Reason (R) : The amount of space occupied by a three dimensional object is known as its volume.
[Ans. (a) Both A and R are true but R is not the correct reason.]

VI. Very short Answers:

1. **Write the SI unit of speed.**
Ans. m/s

2. **What is the fundamental unit of amount of substance?**
Ans. mole (mol)

3. **What are the types of physical quantity?**
Ans. (i) Fundamental quantity (ii) Derived quantity.

4. **What is the SI unit of electric charge?**
Ans. Coulomb (C)

5. **Mention the formula to calculate area of a circle?**
Ans. $\pi \times r^2 = \pi r^2$.

6. **How do you find the area of irregularly shaped figures?**
Ans. Graphical method.

7. **How will you determine the volume of a liquid?**
Ans. By using measuring cylinder.

8. **What are the other units used to measure the volume of liquids?**
Ans. Gallon, ounce and quart.

9. **Which one of the following has more volume. Iron block or a wooden block of same mass.**
Ans. Wooden block.

10. **Which one of the following has more density. Water or cooking oil.**
Ans. Water

11. **What is the special unit used by astronomers for measuring the distance in deep space?**
Ans. Light year.

12. **What is the distance between the earth and proxima centauri star?**
Ans. 4.22 light years.

13. **How many fundamental quantities are there is SI units?**
Ans. Seven.

VII. Short Answer.

1. What is fundamental quantity? Give examples.

Ans. A set of physical quantities which cannot be expressed in terms of any other quantities are known as fundamental quantities. Ex: Length, mass, time.

2. Define mass Mention its unit.

Ans. Mass is the amount of matter contained in a body. It's unit is kilogram (kg).

3. What are the multiples and sub multiples of mass?

Ans. The multiples of mass are quintal and metric tonne.
The sub-multiples of mass are gram and milligrams.

4. What is physical quantity? give example.

Ans. A quantity that can be measured is called a physical quantity.
For example, the length of a piece of cloth, the time at which school begins.

5. What do you mean by 'unit'?

Ans. The known measure of a physical quantity is called the unit of measurement.

6. What is measurement?

Ans. Comparison of an unknown quantity with a standard quantity is called measurement.

7. What is meant by area?

Ans. Area is the measure of the region inside a closed line.

8. What is capacity of a container?

Ans. The volume of liquid which a container can hold is called its capacity.

9. What is the relation between density, volume and mass?

Ans. Density = $\frac{\text{mass}}{\text{volume}}$

10. Define astronomical unit.

Ans. One astronomical unit is defined as the average distance between the earth and the sun. $1AU = 1.496 \times 10^{11}$ m or 149.6×10^{6} m

11. Define one light year.

Ans. One light year is defined as the distance traveled by light in vacuum during the period of one year. 1 light year = 9.46×10^{15} m

VIII. Long Answer

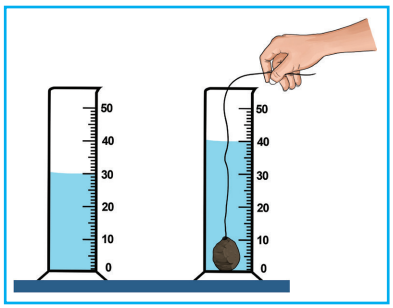
1. How will you find the volume of an irregularly shaped object (stone) by using measuring cylinder?

Ans. (i) Take a measuring cylinder and pour some water into it.

(ii) Note down the volume of water from the readings of the measuring cylinder.

(iii) Take it as V_1

(iv) Now take Q small stone and tie it with a thread.



(v) Immerse the stone inside the water by holding the thread.

(vi) This has to be done such that the stone does not touch the walls of the measuring cylinder.

(vii) Now the level of water has raised.

(viii) Note down the volume of water and take it to be V_2

The volume of the stone is equal to the raise in the volume of water.

$V_1 = 30cc, \quad V_2 = 40cc$

Volume of stone = $V_2 - V_1 = 40 - 30 =$ **10 cc**

2. How will you find the area of irregular objects?

Ans. (i) Place the irregular object on a graph sheet and draw its outline. Then remove the object.

(ii) To find the area enclosed by the outline count the number of small squares.

(iii) If more than half-a-square is inside the boundary, count it as one otherwise neglect it.

(iv) The area of each small square is 1sq. mm.

(v) Area of the irregular object = No. of squares × 1 sq.mm.

IX. Problems for practice:

1. A piece of iron weighs 230 g and has a volume of 20cm^3. Find the density of iron.

Solution: Mass of iron (m) = 230g

Volume of iron (v) = 20 cm^3

$\therefore$ Density of iron D = $\frac{m}{v} \times \frac{23\cancel{0}}{2\cancel{0}} =$ **11.5 g/cm^3**

2. Find the mass of silver of volume 50 cm^3 and density10.5 g / cm^3.

Solution: Mass of silver (M) = ?

Volume of silver (V) = 50 cm^3

Density of silver D = 10.5 g/cm^3

Density (D) = $\frac{\text{mass}(m)}{\text{volume}(v)}$

mass (M) = Density × Volume

= 10.5 × 50

= **525g**

3. The volume of water is a measuring cylinder is 50 ml. When a stone is tied to a string is immersed in the water, the water level rises to 83 ml. Find the volume of the stone.

Solution: Volume of water V_1 = 50 ml

Volume of water V_2 = 83 ml

Volume of the stone (V) = $V_2 - V_1$

$= 83 - 50$

$= \boxed{33 \text{ ml}}$

$1\text{ml} = 1\text{cm}^3$

$33\text{ml} = 33 \times 1\text{cm}^3$

Volume of the stone $= \boxed{33\text{cm}^3}$

4. Find the area of the following regular shaped figures :

a. A circle whose diameter is 70m.

b. A triangle whose height is 11m and base is 7m

c. A square of side 20m

Solution: (a) area of a circle $= \pi r^2$

$r = \frac{d}{2} = \frac{70}{2}$

$= \frac{22}{\cancel{7}} \times \cancel{35}^{5} \times 35$

$\boxed{r = 35\text{m}}$

$= \boxed{3850\text{m}^2}$

Solution: (b) area of a triangle $A = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 7 \times 11 = \frac{77}{2} = \boxed{38.5\ \text{m}^2}$

Solution: (c) area of a square $A =$ side $\times$ side

$= 20 \times 20$

$= \boxed{400\text{m}^2}$

X. Creative questions: HOTS

1. Why does an iron needle sink in water, but not an iron ship?

Ans. Iron needle is compact and its density is 7.6 g/cm^3. Thus, as the density of iron needle is more than 1 g/cm^3 therefore, it sinks in water.

However, the iron ship is constructed in such a way that it is mostly hollow from within, thus, the volume of iron ship becomes very large as compared to its mass and hence its density is less than 1g/cm^3 . As the density of iron ship is less than 1g/cm^3, therefore it floats in water.

2. Wooden block occupies more volume than the iron ball of same mass. Give reason.

Ans. The matter (atoms and molecules) is more densely packed in iron. Whereas is wooden block the matter is loosely packed.

In the language of science, we will say that the density of iron is more than the density of wooden block.

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UNIT TEST

Time : 60 min. **Marks : 25**

I. Choose the correct answer: (3×1 = 3)

1. **The area of a spherical object is _____.**

(a) $l \times b \times h$ (b) $\pi r^2 h$ (c) $\frac{4}{3} \times \pi \times r^2$ (d) a^3

2. **What is the SI unit of density?**

(a) a^2 (b) mm^3 (c) kg/m^3 (d) kg/m^2

3. **The speed of light in vacuum is _____.**

(a) 10×10^6 m/s (b) 3×10^8 m/s
(c) 1.496×10^{11} m/s (d) 2×10^8 m/s

II. Fill in the blanks. (3 × 1 = 3)

4. The unit of amount of substance is _____.

5. There are _____ fundamental physical quantities in SI units.

6. The materials with higher density are called _____.

III. Match the following (4 × 1 = 4)

7.	Cylinder	(a)	litre
8.	Mass	(b)	1000 kg/m^3
9.	Volume of liquids	(c)	$\pi r^2 h$
10.	water	(d)	kg

IV. Answer in one word: (4 × 1 = 4)

11. What is the symbol of unit of temperature?

12. Name the method which is used to find the area of irregularly shaped figures.

13. What is the formula to calculate volume of a cube?

14. Name the unit which is used to measure distance between the two stars.

V. Answer the following in one or two sentences: (3 × 2=6)

15. Define derived quantity.

16. Heavy objects sink in water and lighter objects float in water. give reason.

17. What do you mean by the term 'capacity of the container?

18. What is light year?

19. Calculate the volume of wood of mass 5000 kg, when density of wood is 0.5g cm^{-3}

VI. Answer the following in detail: (5 × 1 = 5)

20. (a) How will you find the area of irregular objects?

(or)

(b) Describe the graphical method to find the area of an irregularly shaped plane figure.

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Answer Key

I. 1. (c) $\frac{4}{3}\times\pi\times r^2$ 2. (c) kg/m^3 3. (b) 3×10^8 m/s

II. 4. mole 5. seven 6. denser

III. 7 - c, 8 - d, 9 - a, 10 - b.

IV. 11. kelvin

12. Graphical method

13. side × side × side

14. Astronomical unit

V. 15. All other physical quantities which can be obtained by multiplying, dividing or by mathematically combining the fundamental quantities are known as"derived quantities".

16. The substances with the density more than (heavier objects) $1g/cm^3$ sink in water.

Conversely, the substances having density less than $1g/cm^3$, float in water (lighter objects)

17. The maximum volume of liquid that a container can hold is known as the "capacity of the container"

18. One light year is defined as the distance travelled by light in vacuum during the period of one year. 1 Light year = 9.46×10^{15} m.

19. Mass of wood M = 5000 kg

Density of wood D = $0.59 gcm^{-3}$

Volume of wood V = ?

Formula : Volume (V) = $\frac{\text{Mass(M)}}{\text{Density(D)}}$

$= \frac{5000}{0.5} = \frac{5000\times10}{0.5\times10}$

V = $10{,}000 m^3$

or

$= 10 \times 10^3 m^3$

VI. 20. a) Refer Sura's Guide Page No.19, Q. No. VIII - 2.

(or)

b) Refer Sura's Guide Page No.7, Q. No. X - 1.

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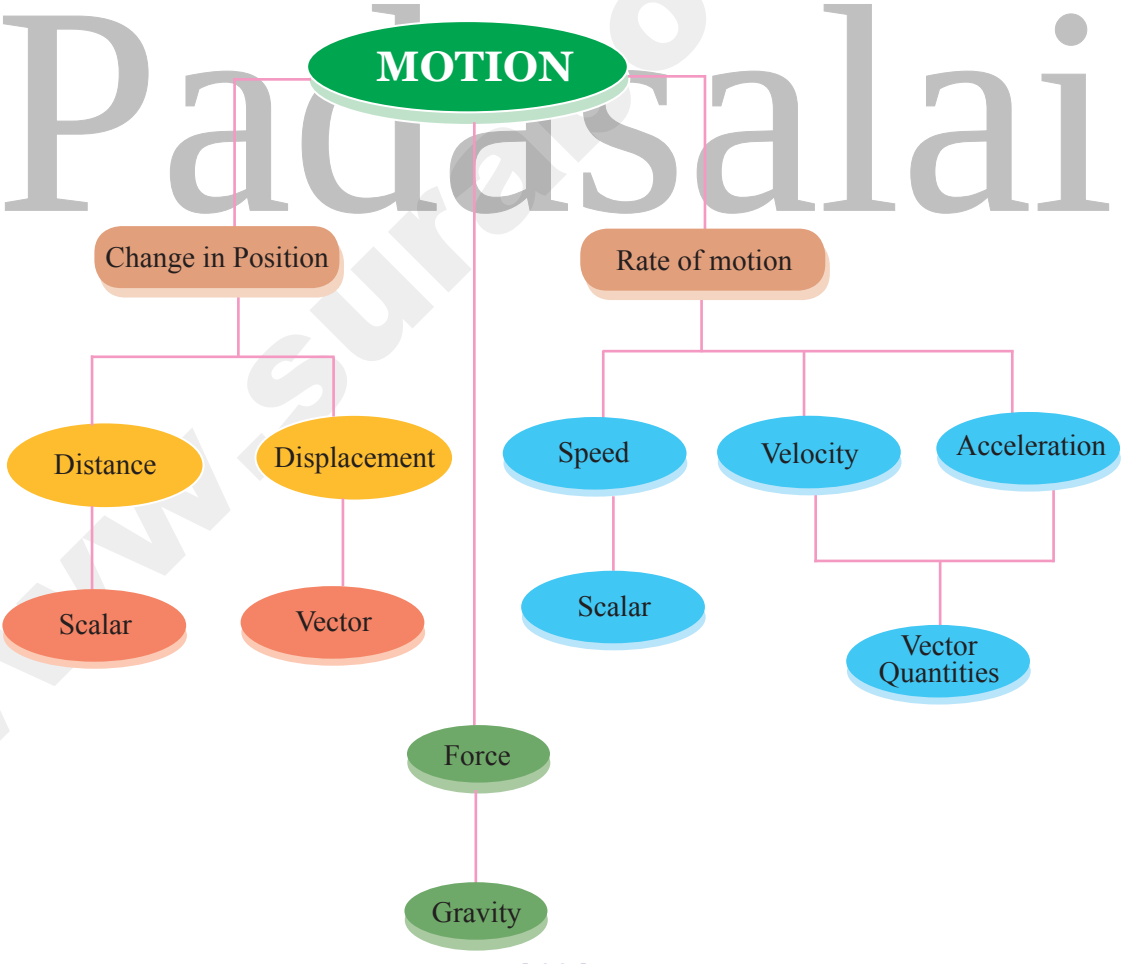
Unit
02 FORCE AND MOTION

LEARNING OBJECTIVES

- To define distance and displacement.
- To differentiate distance and displacement
- To define speed, velocity and acceleration.
- To differentiate speed and velocity
- To draw and explain distance- time and velocity time graphs.
- To measure and calculate the speed of the moving objects.
- To know the day to day uses of centre of gravity and stability.

CONCEPT MAP



Definitions

Distance	:	The total length of a path taken by an object to reach one place from the other is called distance.
Displacement	:	The shortest distance from the initial to the final position of an object.
Nautical mile	:	Nautical mile is the unit for measuring the distance is the field of aviation and sea transportation.
One knot	:	The speed taken to travel one nautical mile in one hour.
Speed	:	It is the rate of change of distance.
Uniform speed	:	If a body in motion covers equal distances in equal intervals of time, then the body is said to be in uniform speed.
Non-uniform speed	:	If a body covers unequal distances in equal intervals of time, the body is said to be in non-uniform speed.
Velocity	:	It is the rate of change in displacement.
Uniform velocity	:	If a body covers equal displacement in the same direction in equal intervals of time.
Non-uniform velocity	:	If either speed or direction changes, the velocity is non uniform.
Average velocity	:	The total displacement of a body divided by the total time taken to cover that displacement.
Acceleration	:	It is the rate of change in velocity.
Positive acceleration	:	If the velocity of an object increases with respect to time, then the object is said to be in positive acceleration.
Negative acceleration or deceleration or retardation	:	If the velocity of an object decreases with respect to time, then the object is said to be in negative acceleration or deceleration or retardation.
Uniform acceleration	:	An object undergoes uniform acceleration when the change (increase or decrease) in its velocity for every unit of five is the same.
Non-uniform acceleration	:	An object undergoes non uniform acceleration if the change in its velocity for every unit of time is not the same.
Centre of gravity	:	The centre of gravity of an object is the point through which the entire weight of the object appears to act.
Stability	:	Stability is a measure of the body's ability to maintain its original position.

Formulae to Remember

				Unit
1.	Speed	=	$\frac{\text{Distance}}{\text{time}}$	m/s
2.	Average speed	=	$\frac{\text{Total distance travelled}}{\text{time taken}}$	
3.	Velocity	=	$\frac{\text{Displacement}}{\text{time}}$	m/s
4.	Average velocity	=	$\frac{\text{Total displacement}}{\text{Time tanken}}$	
5.	Acceleration	=	$\frac{\text{change in velocity}}{\text{time}} = \frac{\text{Final velocity(v)-Initial velocity(u)}}{\text{time(t)}}$ $a = \frac{v-u}{t}$ $1\ \text{km/h} = \frac{5}{18}\ \text{m/s}$ $1\ \text{m/s} = \frac{18}{5}\ \text{km/h}$	m/s^2

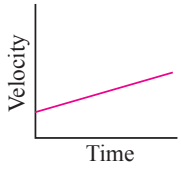
Evaluation

I. Choose the appropriate answer :

1. A particle is moving in a circular path of radius *r*. The displacement after half a circle would be

(a) Zero (b) R
(c) 2*r* (d) *r*/2 **[Ans. (c) 2r]**

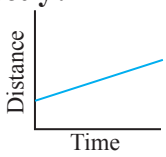
2. From the given v-t graph it can be inferred that the object is

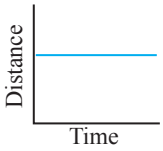


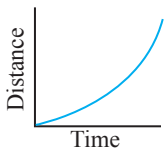
(a) in uniform motion
(b) at rest
(c) in non uniform motion
(d) moving with uniform acceleration

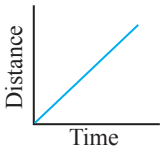
[Ans. (moving with uniform acceleration)]

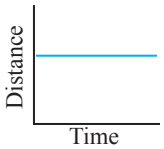
3. **Which of the following figures represent uniform motion of a moving object correctly?**

(a) 

(b) 

(c) 

(d) 

[Ans. (b) 

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4. **Suppose a boy is enjoying a ride on a merry go round which is moving with a constant speed of 10m/s. It implies that the boy is.**

(a) at rest (b) moving with no acceleration
(c) in accelerated motion (d) moving with uniform velocity

[Ans. (c) in accelerated motion]

5. **What is one way you might increase the stability of an object?**

(a) lower the centre of gravity
(b) raise the centre of gravity
(c) increase the height of the object
(d) shorten the base of the object **[Ans. (a) lower the centre of gravity]**

II. Fill in the blanks :

1. The shortest distance between the two places is _____. **[Ans. displacement]**

2. The rate of change of velocity is_____. **[Ans. acceleration]**

3. If the velocity of an object increases with respect to time, then the object is said to be in_____ acceleration. **[Ans. positive]**

4. The slope of the speed–time graph gives _____. **[Ans. velocity]**

5. In _____ equilibrium its centre of gravity remains at the same height when it is displaced. **[Ans. neutral]**

III. Match the following :

1.	Displacement	(a)	Knot
2.	Light travels through vacuum	(b)	Geometric centre
3.	Speed of ship	(c)	Metre
4.	Centre of gravity of the geometrical shaped object	(d)	Larger base area
5.	Stability	(e)	Uniform velocity

[Ans : 1-c, 2-e, 3-a, 4- b, 5 - d]

IV. Analogy :

1. velocity : metre/ second : : acceleration : _____ .

Ans. metre/second^2

2. length of scale : metre : : speed of aeroplane : _____ .

Ans. knot

3. displacement / time : velocity : : speed / time : _____ .

Ans. acceleration

V. Give very short answer :

1. All objects having uniform speed need not have uniform velocity. Describe with the help of examples.

Ans. An object moving in uniform circular motion is moving around the perimeter of the circle with a constant speed. While the speed of object is constant, its velocity is changing, Ex: Merry-go-round, roller coaster, planets orbiting the sun.

2. "She moves at a constant speed in a constant direction". Rephrase the same sentence in fewer words using concepts related to motion.

Ans. She moves in a straight line with constant velocity.

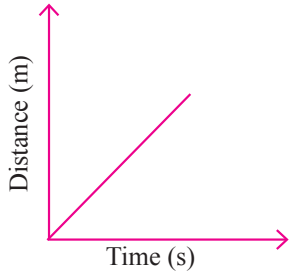
3. Correct your friend who says "The acceleration gives the idea of how fast the position changes".

Ans. There are two possible answers:
Velocity gives an idea of how fast the position changes. or
Acceleration gives an idea of how fast the velocity changes.

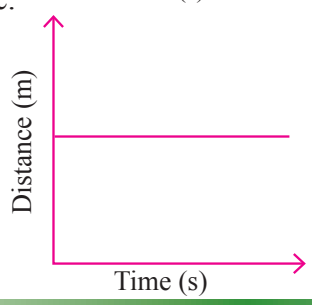
VI. Give Short Answer :

1. Show the shape of the distance – time graph for the motion in the following cases. a. A bus moving with a constant speed. b. A car parked on a road side.

Ans. (a) A bus moving with constant speed.



(b) A car parked on road side.



2. Distinguish between speed and velocity.

Ans.

S.No	Speed	Velocity
1.	Speed is the distance travelled by an object in unit time.	Velocity is the distance travelled by an object in unit time in a given direction.
2.	Speed of a moving body can never be zero.	Velocity of a moving body will be zero, if it returns to its original position. (i.e) when its displacement is zero.
3.	It is a scalar quantity	It is a vector quantity
4.	Speed = $\frac{\text{Distance travelled}}{\text{time taken}}$	Velocity = $\frac{\text{Displacement}}{\text{time taken}}$

3. What do you mean by constant acceleration?

Ans. A body is said to have constant acceleration, if it travels is a straight line and its velocity increases or decreases by equal magnitude in equal intervals of time.

Ex: the motion of a freely falling body.

4. What is centre of gravity ?

Ans. The centre of gravity of an object is the point through which the entire weight of the object appears to act.

VII. Answer in detail.

1. Explain the types of stability with suitable examples.

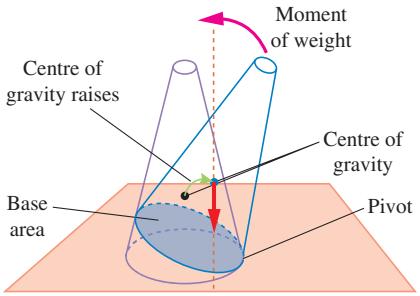
Ans. Stability is a measure of the body's ability to maintain its original position.

The three types of stability are

Ans. (i) Stable equilibrium
(ii) Unstable equilibrium
(iii) Neutral equilibrium

Stable Equilibrium

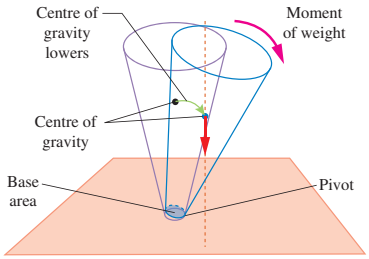
The frustum can be tilted through quite a big angle without toppling.



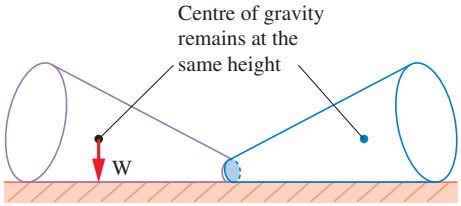
Its centre of gravity is raised when it is displaced. The vertical line through its centre of gravity still falls within its base. So it can return to its original position.

Unstable Equilibrium

The frustum will topple with the slightest tilting. Its centre of gravity is lowered when it is displaced.



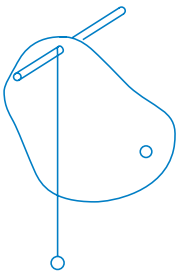
The vertical line through its centre of gravity falls outside its base.



Neutral Equilibrium

(i) It causes frustum to topple.
(ii) The frustum will rolls about but does not topple.
(iii) Its centre of gravity remains at the same height when it is displaced.
(iv) The body will stay in any position to which it has been displaced.

2. Write about the experiment to find the centre of gravity of the irregularly shaped plate.



Ans. (i) Make three holes in the lamina.
(ii) Suspend the lamina from the optical pin through one of the holes as shown.
(iii) Suspend the plumb line from the pin and mark the position of the plumb line on the lamina.
(iv) Draw lines on the lamina representing the positions of the plumb line.
(v) Repeat the above steps for the holes.
(vi) Label the intersection of the three lines as X, the position of the center of gravity of the lamina.

VIII. Numerical problems:

1. Geetha takes 15 minutes from her house to reach her school on a bicycle. If the bicycle has a speed of 2 m/s, calculate the distance between her house and the school.

Ans. Given : time taken = 15 minutes [1 min = 60 sec]
= 15 × 60 = 900 sec
Speed = 2 m/s
Distance = ?
Formula : Distance = Speed × time = 2 × 900
Distance between her house and the school = 1,800 m

2. A car started from rest and travelling with velocity of 20 m /s in 10 s. What is its acceleration?

Ans. Given :

Initial velocity of the car (u) = 0 m/s (since the car starts from rest)

Final velocity of the car(v) = 20 m/s

time taken = 10s

Acceleration = ?

Formula: Acceleration =

$$= \frac{20-0}{10} = \frac{20}{10}$$

Acceleration of the car = $\boxed{2\ m/s^2}$

3. A bus can accelerate with an acceleration 1 m / s^2. Find the minimum time for the bus to reach the speed of 100 km / s from 50 km / s.

Ans. Given :

Acceleration of the bus (a) = 1 m/s^2

Initial velocity (u) = 50 km/s

$= 50 \times 10^3$ m/s

Final velocity (v) = 100 km/s

$= 100 \times 10^3$ m/s

time (t) = ?

$$t = \frac{v-u}{t} = \frac{100\times10^3 - 50\times10^3}{1}$$

$$= \frac{(100-50)\times10^3}{1}$$

$$\boxed{t = 50 \times 10^3\ s}$$

IX. Fill in the boxes:

S.No.	First Move	Second Move	Distance (m)	Displacement
1.	Move 4 meters east	Move 2 meters west	6	2 m east
2.	Move 4 meters north	Move 2 meters south		
3.	Move 2 meters east	Move 4 meters west		
4.	Move 5 meters east	Move 5 meters west		
5.	Move 5 meters south	Move 2 meters north		
6.	Move 10 meters west	Move 3 meters east		

Ans.

S.No..	First Move	Second Move	Distance (m)	Displacement
1.	Move 4 meters east	Move 2 meters west	6 m	2 m east
2.	Move 4 meters north	Move 2 meters south	6 m	2 m north
3.	Move 2 meters east	Move 4 meters west	6 m	2 m west
4.	Move 5 meters east	Move 5 meters west	10 m	0 (same place)
5.	Move 5 meters south	Move 2 meters north	7 m	3 m south
6.	Move 10 meters west	Move 3 meters east	13 m	7 m west

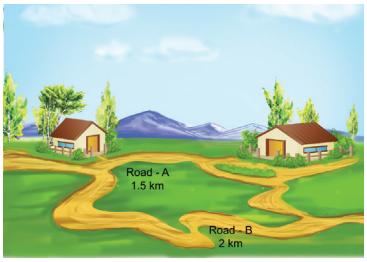
Intext Activities

→ ACTIVITY

1. **As shown in the above picture, Kavitha can reach her school in two ways. Can you tell, by choosing which path she could reach the school early.**

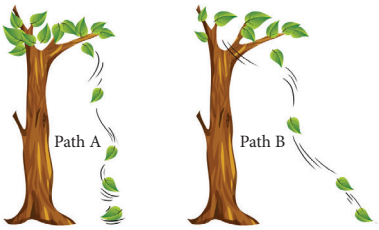
Road A

Road B



Ans. By choosing road A kavitha could reach the school early as the distance is less compared to road B.

2. **Look at the nearby picture**

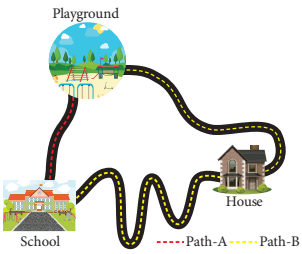


Path of the leaf, when there is no wind. *Path of the leaf when there is wind.*

In which path the leaf will reach the ground first?

Ans. The leaf will reach the ground first by path - A, as it reach as the ground in straight line.

3. **Uma and Priya are friends studying in the same school. After school hours, they go to the nearby playground, play games and return back home. One day Uma told that she would reach the playground after visiting her grandmother's house . The path in which they took reached the playground is shown here.**

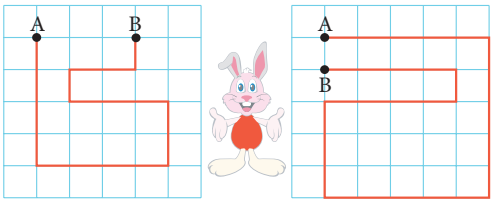


Take a twine and measure the length of the two paths (A & B). Which is the longest path among the two?

_____.

Ans. Path A is the longest among the two. as it is not a straight line.

4. **The path in which a rabbit ran is shown in figure. Find the distance and displacement of it in the two figures. Let us consider that each square is in an unit of one square meter. The rabbit starts from point A and reaches the point B.**



Distance _____ Distance _____
Displacement _____ Displacement _____

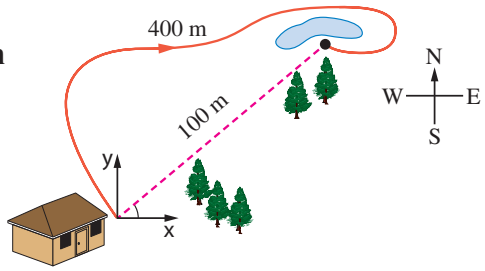
When will the distance and displacement be equal. Explain. But the starting and finishing points should be different. _____

Ans. Distance : 17 Distance: 24
Displacement : 3 Displacement: 1
When the rabbit moves in a straight line from A to B, the distance and displacement will be equal.

5. **Here we can consider the starting point as A and while the object moves from A to B the displacement is considered to be positive and from B to A it is negative.**

Answer the following questions:

Subha goes to the nearby playground from her home.



1. What is the distance she travelled?

Ans. 400 m

2. What is her displacement?

Ans. 100 m

The distance travelled by an object is 15 km and its displacement is 15 km. What do you infer from this?

Ans. The object moves in a straight line in one direction without turning back.

The distance of a person is 30 km and his displacement is 0 km. What do you infer from this?

Ans. The distance of a person = 30 km
Displacement = 0 km.
The person returns to the same position where he has started.
(i.e.) The initial and the final position is same.

6. **Answer the following questions:**

(i) Calculate the velocity of a car travelling with a uniform velocity covering 100 m distance in 4 seconds.

Ans. Velocity = $\frac{\text{Distance}}{\text{time}} = \frac{100}{4} = 25$ m/s

(ii) Usain Bolt covers 100 m distance in 9.58 seconds. Calculate his speed. Who will be the winner if Usain Bolt comepetes with a Cheetah running at a speed of 30 m/s?

Ans. Speed of Usain Bolt $= \frac{\text{Distance}}{\text{time}} = \frac{100}{9.58}$

Speed of Usain Bolt = 10.43 m/s

Speed of cheetah = 30 m/s

$\therefore$ Cheetah will be the winner.

(iii) You are walking along east covering a distance of 4 m, then 2 m towards south, then 4 m towards west and at last 2 m towards north. You cover the total distance in 21 seconds, what is your average speed and average velocity?

Ans. Total distance covered = 12 m

Total time taken = 21 seconds

$$\text{Average speed} = \frac{\text{Total distnace covered}}{\text{total time}}$$

$$= \frac{12\text{m}}{21} = 0.571 \text{ m/s}$$

Average velocity = 0 m/s

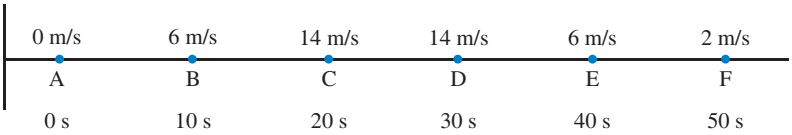
Average velocity is zero because the starting point and the finishing point is same
$\therefore$ Displacement is zero so, average velocity is also

$\therefore$ $$\text{Average velocity} = \frac{\text{Total displacement}}{\text{time}}$$

7. (a) Change in speed (b) Change in direction (c) Change in both speed and direction

The distance travelled by train	Initial velocity (u) m/s	Final velocity (v) m/s	Change in velocity (v – u) m/s	Time taken (t) s	Acceleration = change in velocity / time a = (v – u) / t m / s2
A-B	0	6	6	10	0.6
B-C					
C-D					
D-E					
E-F					

The velocity at different times of a train departing direction is given in the figure. Analyse this and complete the table .



Ans.

The distance travelled by train	Initial velocity (u) m/s	Final velocity (v) m/s	Change in velocity (v – u) m/s	Time taken (t) s	Acceleration = change in velocity / time $a = (v - u) / t$ m / s^2
A-B	0	6	6	10	0.6
B-C	6	14	14 – 6 = 8	10	0.8
C-D	14	14	14 – 14 = 0	10	0
D-E	14	6	6 – 14 = – 8	10	–0.8
E-F	6	2	2 – 6 = – 4	10	–0.4

Analysis:

When the train covers the distance A to B and B to C, it is accelerated motion. When it covers the distance C-D, there is no acceleration (i.e) uniform velocity. When it covers the distance D to E and E to F it has negative acceleration or deceleration or retardation. (i.e.) Its velocity decreases with respect to time.

8. **My name is cheetah. I can run at a great speed. Do you know what my speed is? 25 m/s to 30 m/s. My speed changes from 0 to 20 m/s in 2 second. See how good my acceleration is !**

From the above information, can you calculate the acceleration of the cheetah?

Ans. Acceleration of the cheetah $= \frac{\text{Final velocity(v)-Initial velocity (u)}}{\text{time taken}}$

$$= \frac{v-u}{t} = \frac{20-0}{2} = \frac{\cancel{20}}{\cancel{2}} = \boxed{10\ m/s^2}$$

Acceleration of the cheetah $= \boxed{10\ m/s^2}$

9.

Time (s)	**1**	**2**	**3**	**4**	**5**
Velocity (m/s)	**20 + 20**	**40 + 20**	**60 + 20**	**80 + 20**	**100 + 20**
	(Acceleration)				
	100 – 20	**80 – 20**	**60 – 20**	**40 – 20**	**20 – 20**
	(Deceleration)				

When the velocity of the object is increasing by 20 m/s the acceleration is 20 m/s^2 .
When the velocity of the object is decreasing by 20 m/s the deceleration is 20 m/s^2 .

Ans. When the velocity of the object is decreasing by 20m/s the deceleration is 20 m/s^2.

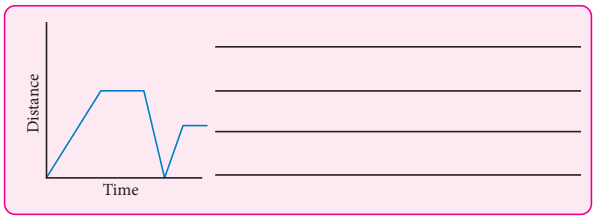
$$\text{Deceleration} = \frac{\text{Decrease in velocity}}{\text{time}}$$

$$t = \frac{\text{Decrease in velocity}}{\text{Deceleration}}$$

$$t = \frac{\cancel{20}}{\cancel{20}} = \boxed{1\text{s}}$$

The velocity of the object is decreasing by 20m/s in one second.

10. Imagine and write a story on your own for the given graph?



Ans. Raghul and his father starting from home to the school by car. At the school gate, he stopped the car to drop Raghul. After 2 minutes he went back to home to pick up his mother. Then they both started to go to their work. On the way, they are waiting for the signal.

★★★★★

Additional Questions

I. Choose the correct answer.

1. Distance travelled by a body in a given time

(a) is always positive (b) can be zero or positive
(c) is always negative (d) either (a) or (c)

[Ans. (b) can be zero or positive]

2. Which of the following is correct

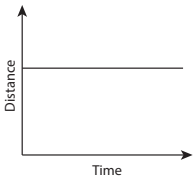
(a) magnitude of displacement may be greater than distance.
(b) Distance is always greater than or equal to the magnitude of displacement.
(c) Distance is always greater than the magnitude of displacement.
(d) Both are scalar quantities.

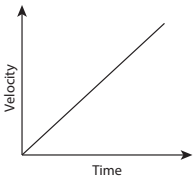
[Ans. (b) Distance is always greater than or equal to the magnitude of displacement.]

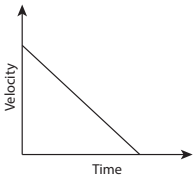
3. Average speed of a moving object is equal to the magnitude of its average velocity when it travels.

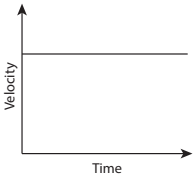
(a) in a straight line without turning back
(b) in a circle
(c) back and forth
(d) in a zig-zag path **[Ans. (a) in a straight line without turning back]**

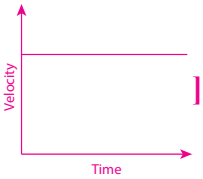
4. **A car is moving along a straight road with uniform velocity which is the correct representation:**

(a) 

(b) 

(c) 

(d) 

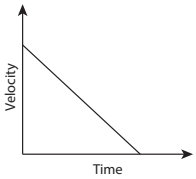
[Ans. (d) 

]

5. **The slope of a velocity-time graph gives _____.**

(a) velocity (b) distance
(c) displacement (d) acceleration **[Ans. (d) acceleration]**

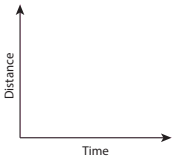
6. **Velocity-time graph of an object is given below the object has**

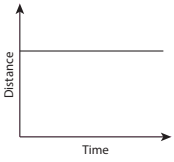


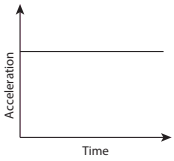
(a) uniform velocity (b) uniform retardation
(c) uniform speed (d) variable retardation

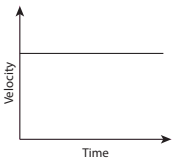
[Ans. (b) uniform retardation]

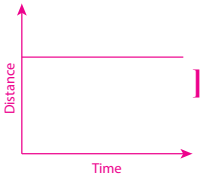
7. **Which one of the following graphs is showing an object is stationary?**

(a) 

(b) 

(c) 

(d) 

[Ans. (b) 

]

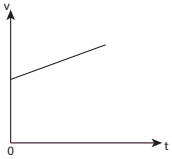
8. **If the velocity of a body does not change, then its acceleration is _____.**

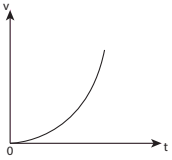
(a) infinity (b) unity
(c) zero (d) between zero and unity **[Ans. (c) zero]**

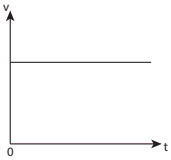
9. **If the distance travelled by a car is direct proportional to the duration of time. The car will travel with _____.**

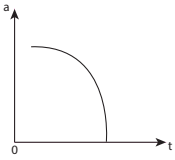
(a) uniform speed (b) non-uniform acceleration
(c) uniform acceleration (d) uniform velocity **[Ans. (a) uniform speed]**

10. **Which of the following graphs represent the object moving with uniform acceleration?**

(a) 

(b) 

(c) 

(d) 

(a) only D (b) only B
(c) both A & C (d) only A **[Ans. (d) only A]**

II. Fill in the Blanks.

1. The SI unit of displacement is_____. **[Ans. metre (m)]**

2. The SI unit of speed is _____. **[Ans. m/s]**

3. _____ is the length of actual path covered by a body. **[Ans. Distance]**

4. _____ is the distance trtavelled by a body per unit time **[Ans. speed]**

5. Distance is a _____ quantity. **[Ans. scalar]**

6. The displacement is zero when the initial and final positions are _____. **[Ans. same]**

7. Speed is always positive or zero but never be _____. **[Ans. negative]**

8. When the velocity of a body increases with time, its acceleration is _____. **[Ans. positive]**

9. The acceleration of a body moving with uniform velocity is _____ **[Ans. zero]**

10. A car increases its speed from 20 km/h to 50km/h in 10 seconds. Its acceleration is _____ **[Ans. 0.83 m/s^2]**

III. Match the following :

	Column I		Column II
a.	Uniform motion.	(i)	Body having uniform acceleration
b.	Non-uniform motion.	(ii)	Body at rest.
c.	The velocity-time graph is a circle.	(iii)	Unequal distance covered in equal interval of time.
d.	Straight line parallel to time axis in position-time graph.	(iv)	Equal distances covered in equal intervals of time.
e.	Straight line inclined to 45° with time axis is velocity-time graph.	(v)	Not possible.

[Ans. a-iv. b-iii, c-v, d- i, e -ii]

Very short Answers:

1. Give one example where the displacement is zero but the distance travelled is not zero.

Ans. When an object travels is a circular path (ie. the initial and positions are same).

2. Is displacement a scalar quantity?

Ans. No, displacement is a vector quantity as it depends on direction.

3. Give some examples for vector quantity.

Ans. Displacement, velocity, force.

4. Give some examples for scalar quantity.

Ans. Mass, distance, speed, temperature.

5. If an object is moving with velocity 54 km/h. What will be its velocity in m/s?

Ans.

$$\text{Velocity} = 54 \text{ km/h}$$

$$1 \text{ km/h} = \frac{5}{18}$$

$$54 \text{ km/h} = \cancel{54} \times \frac{5}{\cancel{18}}$$

$$= 3 \times 5 = 15 \text{ m/s}$$

$$\frac{1\text{km}}{\text{h}} = \frac{1000}{3600} \text{ m/s} = \frac{5}{18}$$

6. Give one example for uniform acceleration.

Ans. The motion of a freely falling object.

7. Give one example for non-uniform acceleration.

Ans. The motion of a car on a crowded road.

8. Give an example for retardation or declaration.

Ans. When a person applies brake on a moving car, its velocity decreases with time.

9. What are three types of stability of an object?

Ans.
1. Stable equilibrium
2. Unstable equilibrium
3. Neutral equilibrium

10. Mention any two conditions for stability of a body?

Ans.
1. Increase the area of its base.
2. Lower its centre of gravity.

V. Give Short Answer.

1. A body moves is a circle of radius '2R' what is the distance covered and displacement of the body after 2 complete rounds?

Ans. Distance covered after 2 complete rounds

$$= 2 \times \text{circumference of a circle}$$

$$\text{Distance} = 2 \times 2\,\pi(2R) = \boxed{8\,\pi(2R)}$$

After 2 complete rounds, the body comes back to its initial position.

$$\text{so, displacement} = \boxed{0}$$

2. What are the uses of graphical study of motion?

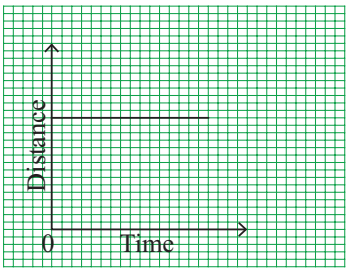
Ans. (i) By simply looking at the graph, one can tell whether motion is uniform or not.

(ii) It is useful for comparing the motions of two moving bodies.

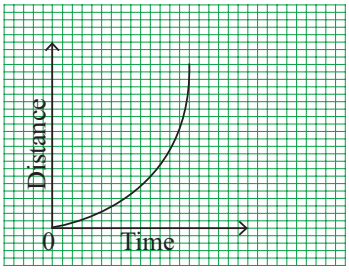
3. Draw distance-time graphs for the following

(i) a stationary body **(ii) a body moving with variable velocity.**

Ans. (i)



(ii)



4. The following table gives the data about motion of a car.

Time (h)	11.00	11.30	12.00	12.30	1.00
Distance (km)	0	30	30	65	100

(i) Find the speed of the car between 12.00 hrs and 12.30 hrs?

(ii) Is the car's motion an example of uniform motion?

Ans. (i) Average speed $= \frac{\text{Final speed-Initial speed}}{\text{time taken}}$

$= \frac{(65-30)\text{km}}{30\,\text{min}} = \frac{35\,km}{30\,\text{min}}$

Speed $= 1\frac{35}{\cancel{30}\,\cancel{60}\,2}$ [1 hr = 60 min]

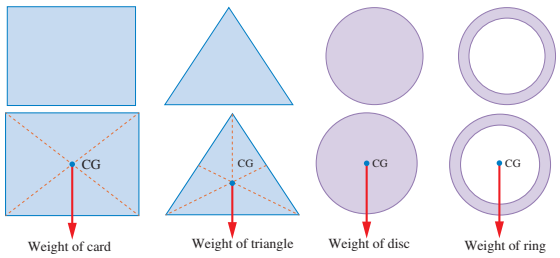
$30\text{ min} = \frac{30}{60}$

$= \frac{35}{\frac{1}{2}} = 35 \times 2 = \boxed{70\text{ km/h}}$

(ii) No, motion is non-uniform.

5. Draw centre of gravity of the following regular shaped objects.

Ans.



6. Mention the real life applications of centre of gravity.

Ans. (i) Luggage compartment of a tour bus is located at the bottom and not on the roof.

(ii) Racing cars are built low and broad for stability.

(iii) Table lamps and fans are designed with large heavy bases to make them stable.

7. Explain the concept which is used in the continuous movement of Thanjavur doll?

Ans. The centre of gravity and the total weight of the doll is concentrated at its bottom most point, generating a dance-like continuous movement with slow oscillations.

8. Write note on the following : (i) Nautical mile (ii) knot.

Ans. (i) Nautical mile is the unit for measuring the distance in the field of aviation and sea transportation. One nautical mile is 1.852 km.

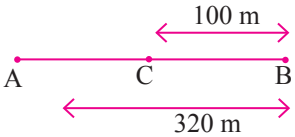
(ii) The unit for measuring the speed of aeroplanes and ships is knot. One knot is the speed taken to travel one nautical mile in hour.

9. Saranya jogs from one end A to the other end B of a straight road of length 320m in 2min 40 seconds. Then she turns back and jogs 100m to point C in 1 min. what is her average velocity in jogging.

Ans.

Total displacement = 320m

From A to C displacement = 320 – 100 = **220 m**



Time taken = 3 min 40 sec

= 180 + 40 = 220 s

$$\text{Average velocity} = \frac{\text{Displacement}}{\text{total time}} = \frac{\cancel{220}}{\cancel{220}} = \boxed{1 \text{ m/s}}$$

Average velocity = 1 m/s

10. A train starting from a railway station and moving with uniform acceleration attains a speed of 40 km/h in 10 minutes. Find its acceleration?

Ans.

Initial velocity (u) = 0 km/h

Final velocity (v) = 40 km/h

Time (t) = 10 min = $\frac{10}{60\text{h}} = \frac{1}{6\text{h}}$

$$\text{Acceleration } (a) = \frac{v-u}{t} = \frac{40-0}{\frac{1}{6}} = 40 \times 6 = \boxed{240 \text{ km/h}}$$

11. Define speed Mention its formula and unit.

Ans. Speed is the rate of change of distance

Formula : Speed = distance /time

Unit is meter/second (m/s)

12. Define velocity Mention its formula and unit.

Ans. Velocity is the rate of change in displacement.

Formula : Velocity (v) = displacement / time

SI unit of velocity is meter / second (m/s).

13. What is uniform velocity? Give one example.

Ans. A body has uniform velocity, if it covers equal displacement in the same direction in equal intervals of time. Eg. light travels through vacuum.

14. What is non-uniform velocity? Give example.

Ans. If either speed or direction changes, then the velocity is non uniform. Eg. a train starting and moving out of the station.

15. Define acceleration. Mention its formula and unit.

Ans. Acceleration is the rate of change in velocity.

Formula : Acceleration = change in velocity / time

SI unit of acceleration is m/s^2

16. Define the following: (i) positive acceleration. (ii) negative acceleration.

Ans. (i) Positive acceleration

If the velocity of an object increases with respect to time, then the object is said to be in positive acceleration or just acceleration.

(ii) Negative acceleration or deceleration or retardation

If the velocity of an object decreases with respect to time, then the object is said to be in negative acceleration or deceleration or retardation.

17. What is stability? Mention its types.

Ans. Stability is a measure of the body's ability to maintain its original position.

The three types of stability are

(a) Stable equilibrium
(b) Unstable equilibrium
(c) Neutral equilibrium

18. Mention the typical speed of the following?

(i) Tortoise (ii) falling raindrop (iii) cycling (iv) cheetah running (v) person walking.

Ans.

(i)	Tortoise	0.1 m/s
(ii)	Falling raindrop	9-10 m / s
(iii)	Cycling	20-25 km/h
(iv)	Cheetah running	31 m/s
(v)	Person walking	1.4 m / s

VI. Long Answer

1. Write the differences between distance and displacement

Ans.

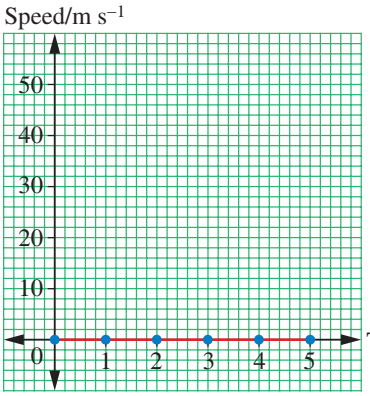
	Distance	Displacement
1.	The total length of a path taken by an object to reach one place from the other is called distance.	The shortest distance from the initial to the final position of an object.
2.	Distance between two gives points may be same or different paths chosen.	Displacement between two given points is always same
3.	It is a scalar quantity	It is a vector quantity
4.	Distance covered is always positive or zero.	Displacement covered may be positive, negative or zero

2. **Draw velocity-time graph for the following data:**

1. Bus at rest

Time / s	0	1	2	3	4	5
Speed /ms^{-1}	0	0	0	0	0	0

Ans.

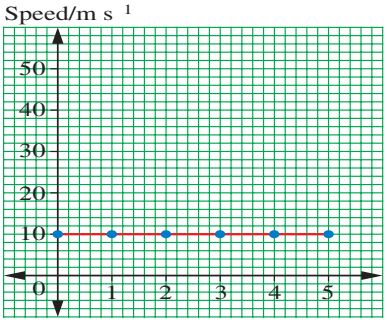


The speed remains at 0 m s^{-1}, so the car has zero acceleration.

2. Bus travelling at uniform speed of m/s

Time / s	0	1	2	3	4	5
Speed /ms^{-1}	10	10	10	10	10	10

Ans.

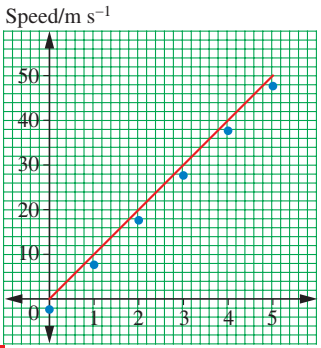


The speed remains at 10 m s ^{1}, so the car has zero acceleration.

3. Bus travelling at uniform acceleration

Time / s	0	1	2	3	4	5
Speed /ms^{-1}	10	10	20	30	40	50

Ans.

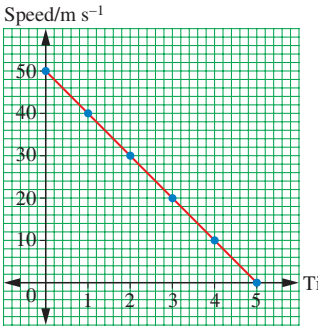


The speed of the car increases by 10 m s^{-1}, every second. Hence, the graph has a positive and constant gradient, and the acceleration is constant.

4. Bus travelling at uniform deceleration

Time / s	0	1	2	3	4	5
Speed /ms^{-1}	50	40	30	20	10	0

Ans.

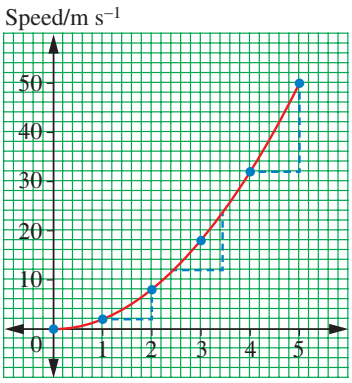


The speed of the car decreases by 10 m s^{-1}, every second. Hence, the graph has a negative and constant gradient, and the acceleration is constant.

5. Bus travelling with increasing acceleration (non - uniform acceleration)

Time / s	0	1	2	3	4	5
Speed /ms^{-1}	0	2	8	18	32	50

Ans.



The increase in speed is **increasing** with time. Hence, the graph has a positive and increasing gradient, and the acceleration increases.

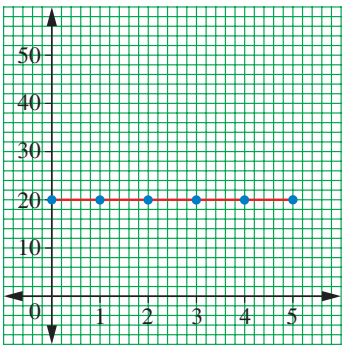
The instantaneous acceleration of the car at $t = 3$ s is given by the gradient of the tangent at the point.

3. The motion of a car is given in the following data draw distance - time graph.

(a) Car at rest

Time / s	0	1	2	3	4	5
Speed /m	0	20	20	20	20	20

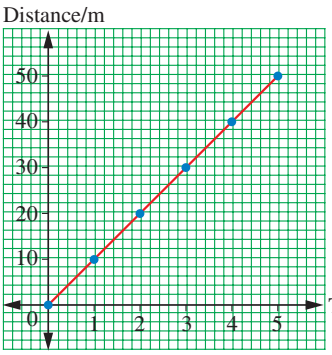
Ans.



The graph has zero gradient. The distance is a constant for every second.

(b) Car travelling at uniform speed of 10 ms^{-1}

Time / s	0	1	2	3	4	5
Speed /m	0	10	20	30	40	50

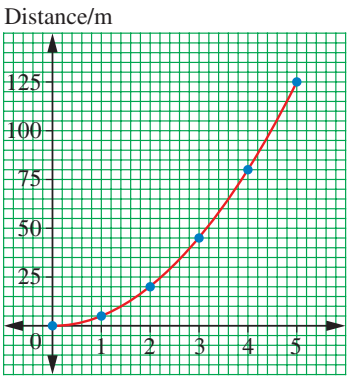


The graph has a zero constant gradient. The distance increases 10 m every second.

(c) Car travelling at increasing speed

Time / s	0	1	2	3	4	5
Speed /m	0	5	20	45	80	125

Ans.



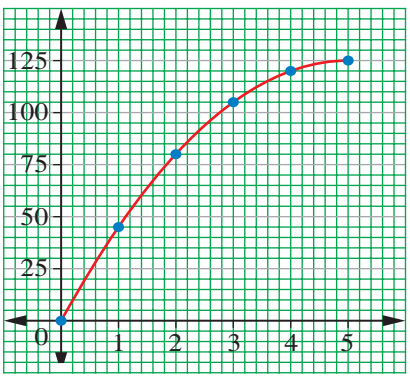
The graph has an increasing gradient. The speed increases

The instantaneous speed of the car at $t = 3$ s is given by the gradient of the tangent at the point.

(d) Car travelling at decreasing speed

Time / s	0	1	2	3	4	5
Speed /m	0	45	80	105	120	125

Ans.



The graph has a decreasing gradient. The speed decreases

★★★★★

UNIT TEST

Time : 60 min. **Marks : 25**

I. Choose the correct answer: (3 × 1 = 3)

1. _____ is a scalar quantity.
(a) Speed (b) Velocity
(c) Displacement (d) Acceleration

2. The SI unit of acceleration is _____.
(a) m (b) m/s
(c) m/s^2 (d) km/h

3. The motion of a car on a crowded road is an example of _____.
(a) uniform speed (b) non-uniform speed
(c) uniform velocity (d) none

II. Fill in the blanks. (3 × 1 = 3)

4. _____ is the rate of change of displacement.

5. If the velocity of an object increases with respect to time, then it is said to be in _____ acceleration.

6. _____ is a measure of the body's ability to maintain its original position.

III. Give very short answer:

7. What is retardation?

8. Write the formula to calculate velocity.

9. Can the displacement be greater than the distance travelled by an object?

10. Mention the formula to calculate average speed.

IV. Give short answer: (3 × 2 = 6)

11. Can a body have constant speed but variable velocity?

12. Differentiate acceleration from velocity?

13. What is centre of gravity?

14. Write about the concept behind the movement of Thanjavur doll.

15. Write about neutral equilibrium.

V. Answer the following in detail:

16. (a) Explain the types of stability with suitable examples.

(or)

(b) Write the differences between distance and displacement.

★★★★★

Answer Key

I 1. (a) Speed

2. (c) m/s^2

3. (a) uniform speed

II 4. velocity 5. positive 6. stability

III 7. Negative acceleration

8. Velocity = $\frac{\text{Displacement}}{\text{time}}$

9. No, the displacement can be either equal to or less than the distance travelled.

10. Average speed = $\frac{\text{Total distance}}{\text{total time}}$

IV 11. Yes. For example, a body in uniform circular motion has constant speed but its velocity changes at every point due to the change in the direction of motion.

12. Velocity is the change in position of a body per unit time in a given direction while acceleration is the change in velocity of a body per unit time.

13. The centre of gravity of an object is the point through which the entire weight of the object appears to act.

14. The centre of gravity and the total weight of the doll is concentrated at its bottom most point, generating a dance-like continuous movement with slow oscillations.

15. Neutral Equilibrium

(i) The frustum will roll about but does not topple.

(ii) Its centre of gravity remains at the same height when it is displaced.

(iii) The body will stay in any position to which it has been displaced.

V 16. Refer Sura's Guide Page No.28, Q. No. VII - 1.

(or)

17. Refer Sura's Guide Page No.41, Q. No. VI - 1.

★★★★★

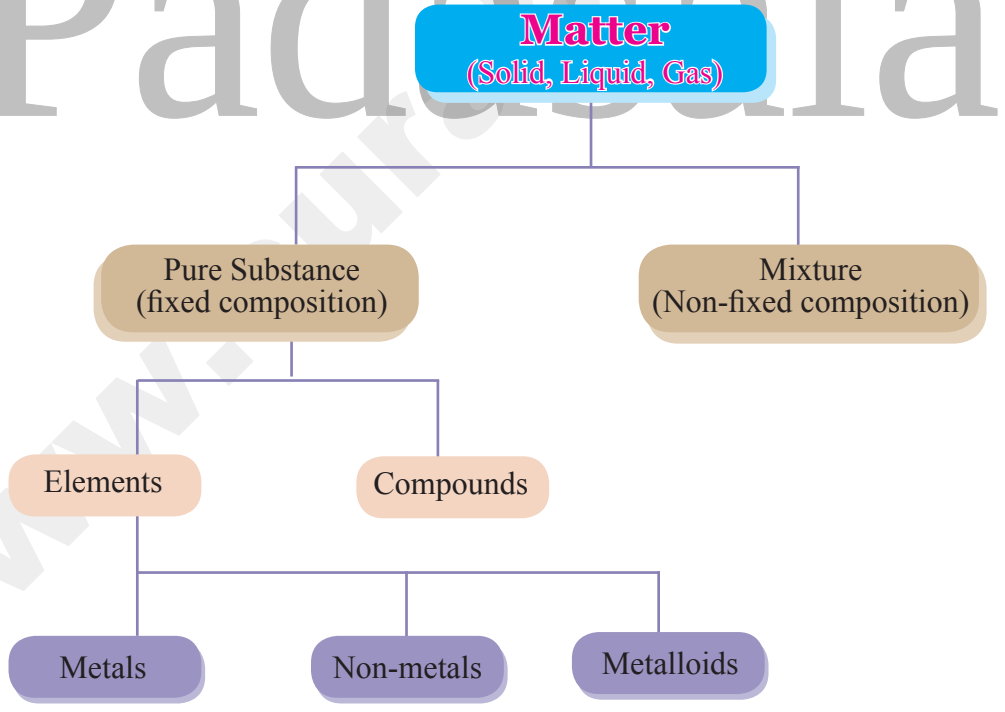
Unit 03

MATTER AROUND US

LEARNING OBJECTIVES

- To understand molecules of elements and compounds
- To recognize the symbols of common elements
- Able to calculate atomicity of commonly used elements
- To recognize the occurrences of elements and compounds in nature and human body / air
- To understand the effects of temperature on solid, liquid and gas

CONCEPT MAP



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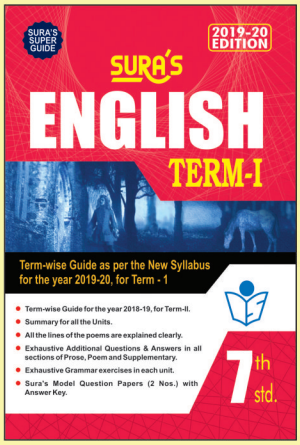

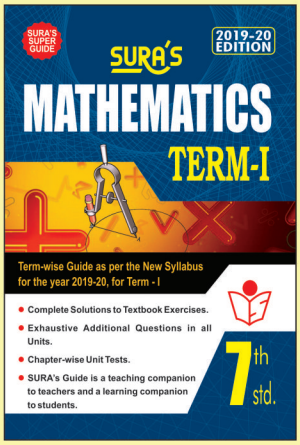

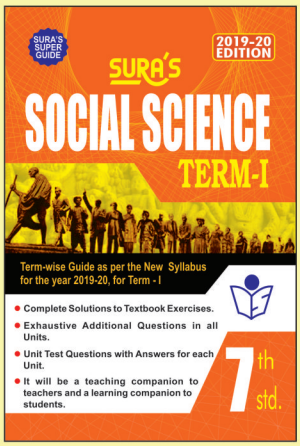

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