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2019-20 EDITION

SURA'S

SCIENCE

As per the Updated New Textbook for 2019 - 20

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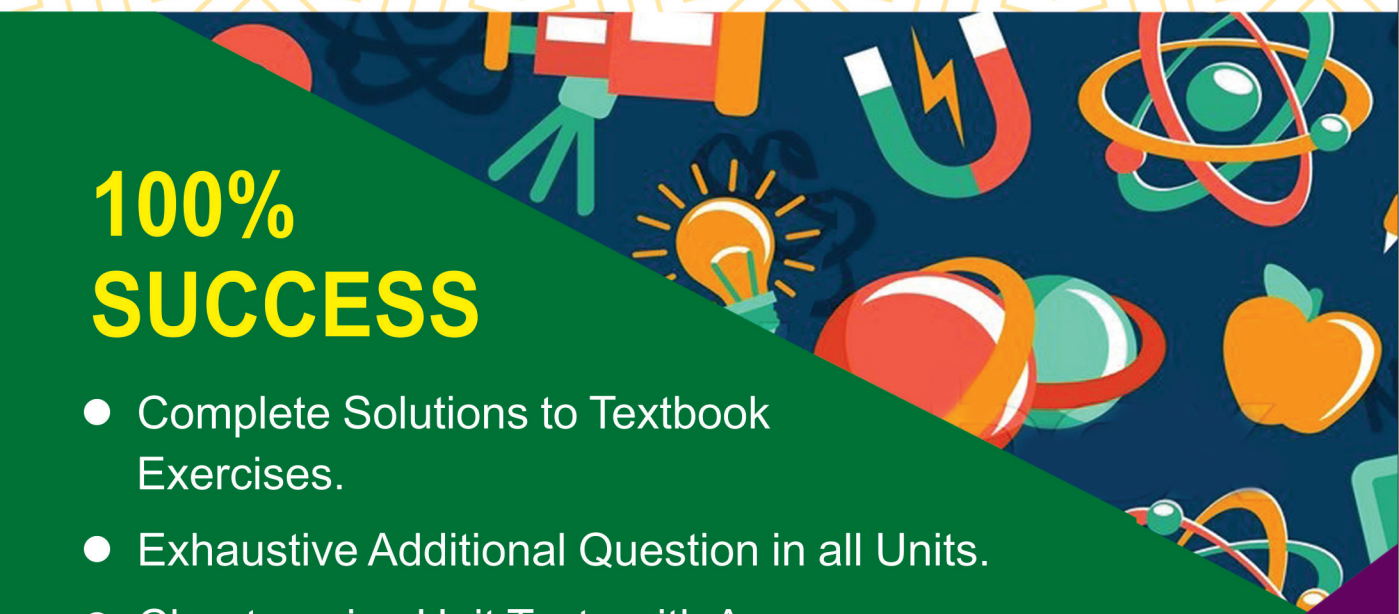

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9th Std.

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Science

IX - Standard

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

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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Science Guide** for **9th Standard**. 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.
- Publisher
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UNIT
01

PHYSICS

MEASUREMENT

LEARNING OBJECTIVES

At the end of this lesson, students will be able to

- Understand the fundamental and derived quantities and their units.
- Know the rules to be followed while expressing physical quantities in SI units.
- Get familiar with the usage of scientific notations.
- Know the characteristics of measuring instruments.
- Use vernier caliper and screw gauge for small measurements.
- Find the weight of an object using a spring balance.
- Know the importance of accurate measurements.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. Choose the correct one.

(a) mm < cm < m < km (b) mm > cm > m > km

(c) km < m < cm < mm (d) mm > m > cm > km

[Ans : (a) mm < cm < m < km]

2. Rulers, measuring tapes and metre scales are used to measure

(a) mass (b) weight (c) time (d) length

[Ans : (d) length]

3. 1 metric ton is equal to

(a) 100 quintals (b) 10 quintals

(c) 1/10 quintals (d) 1/100 quintals **[Ans : (b) 10 quintals]**

4. Which among the following is not a device to measure mass?

(a) Spring balance (b) Beam balance

(c) Physical balance (d) Digital balance **[Ans : (a) Spring balance]**

II. Fill in the blanks :

1. Metre is the unit of _____. **[Ans : length]**

2. 1 kg of rice is weighed by _____. **[Ans : beam balance]**

3. Thickness of a cricket ball is measured by _____. [Ans : vernier caliper]
4. Radius of a thin wire is measured by _____. [Ans : screw gauge]
5. A physical balance measures small differences in mass up to _____. [Ans : 1mg or less]

III. State whether true or false. If false, correct the statement :

1. The SI unit of electric current is kilogram.

Ans. False.

Correct statement : The SI unit of electric current is ampere.

2. Kilometre is one of the SI units of measurement.

Ans. True.

3. In everyday life, we use the term weight instead of mass.

Ans. True.

4. A physical balance is more sensitive than a beam balance.

Ans. True.

5. One Celsius degree is an interval of 1K and zero degree Celsius is 273.15 K.

Ans. True.

6. With the help of vernier caliper we can have an accuracy of 0.1 mm and with screw gauge we can have an accuracy of 0.01 mm.

Ans. True.

IV. Match the following :

1.

Column I	Column II
Length	kelvin
Mass	metre
Time	kilogram
Temperature	second

Ans.

Column I	Column II
Length	metre
Mass	kilogram
Time	second
Temperature	kelvin

2.

Column I	Column II
Screw gauge	Vegetables
Vernier caliper	Coins
Beam balance	Gold ornaments
Digital balance	Cricket ball

Ans.

Column I	Column II
Screw gauge	Coins
Vernier caliper	Cricket ball
Beam balance	Vegetables
Digital balance	Gold ornaments

V. Assertion and reason type :

Mark the correct answer 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 scientifically correct expression is "The mass of the bag is 10 kg"
Reason (R) : In everyday life, we use the term weight instead of mass.

[Ans : (a) Both A and R are true but R is not the correct reason]

2. **Assertion (A) :** 0° C = 273.16 K. For our convenience we take it as 273 K after rounding off the decimal.

Reason (R) : To convert a temperature on the Celsius scale we have to add 273 to the given temperature.

[Ans : (b) Both A and R are true and R is the correct reason]

3. **Assertion (A) :** Distance between two celestial bodies is measured in terms of light year.

Reason (R) : The distance travelled by the light in one year is one light year.

[Ans : (d) A is false but R is true]

Assertion : Distance between two celestial bodies is measured in terms of **astronomical unit.**

VI. Answer very briefly :

1. Define measurement.

Ans. Measurement is the processes of comparison of the given physical quantity with the known standard quantity of the same nature.

2. Define standard unit.

Ans. Unit is the quantity of a constant magnitude which is used to measure the magnitudes of other quantities of the same nature.

3. What is the full form of SI system?

Ans. International System of Units.

4. Define least count of any device.

Ans. Least count is the least measurement possible in a given device.

It is the distance moved by the tip of the screw for a rotation of one division on the head scale.

Least count = [Pitch / No. of head scale divisions]

5. What do you know about pitch of screw gauge?

Ans. Pitch of the screw gauge is the distance between two successive screw threads. It is measured by the ratio of distance travelled on the pitch scale to the number of rotations of the head scale.

Pitch = [Distance travelled on the pitch scale / Number of rotations of the head scale]

6. Can you find the diameter of a thin wire of length 2 m using the ruler from your instrument box?

Ans. No, I can not find the diameter of a thin wire of length 2 m using the ruler.

VII. Answer briefly :

1. Write the rules that are followed in writing the symbols of units in SI system.

Ans. (i) Units named after scientists are written in lower case.
eg. joule, kelvin and newton.

(ii) Symbols for the units are always written in lower case.
eg. m, kg and s.

(iii) However, the symbols for the units derived from the names of scientists are written in capital letters.
eg. C (Celsius), N (newton) and J (joule).

(iv) Symbols are not followed by a full stop.
eg. 75 cm and not 75 cm.

(v) Symbols are never written in plural.
eg. 100 kg, not as 100 kgs.

2. Write the need of a standard unit.

Ans. A Standard Unit is needed to maintain uniformity in measurements like length, weight, size and distance. Eg: Standard Unit of length is metre.

3. Differentiate mass and weight.

Ans.

Sl. No.	Mass	Weight
1.	Fundamental quantity	Derived quantity
2.	Has magnitude alone – scalar quantity	Has magnitude and direction – vector quantity
3.	It is the amount of matter contained in a body	It is the normal force exerted by the surface on the object against gravitational pull
4.	Remains the same	Varies from place to place
5.	It is measured using physical balance	It is measured using spring balance
6.	Its unit is kilogram	Its unit is newton

4. How will you measure the least count of vernier caliper?

Ans. Least Count or L.C. is the minimum reading or value that can be measured with a measuring tool or device.

VIII. Answer in detail :

1. Explain a method to find the thickness of a hollow tea cup.

Ans.

Step 1 : The Pitch, Least count and the type of zero error of the screw gauge are determined.

Step 2 : The given cup is placed in between two studs.

Step 3 : The head screw using the ratchat arrangement is freely rotated until the given cup is held firmly, but not tightly.

Step 4 : Pitch scale reading (PSR) by the head scale and head scale coincidence (HSC) with the axis of the pitch scale, are found.

Step 5 : The readings are recorded and the experiment for different positions of the given cup is repeated.

Step 6 : The thickness of the cup is calculated using the formula P.S.R + (HSC × L.C)

Step 7 : Then the average of the last column of the table. is found.
Hence the thickness of a hollow tea cup = _____ mm.

2. How will you find the thickness of a one rupee coin?

Ans. Step 1 : The Pitch, Least count and the type of zero error of the screw gauge are determined.

Step 2 : The given coin is placed in between two studs.

Step 3 : The head screw using the ratchat arrangement is freely rotated until given one rupee coin is held firmly, but not tightly.

Step 4 : Pitch scale reading (PSR) by the head scale and head scale coincidence (HSC) with are axis of the pitch scale are found.

Step 5 : The reading are recorded and the experiment for different positions of the given coin is repeated.

Step 6 : The thickness of the coin is computed using the formula P.S.R + (HSC × L.C)

Step 7 : Then the average of the last column of the table is found.

S. No.	P.S.R. (mm)	HSC (division)	CHSC = HSC ± ZC (Division)	CHSR = CHSC × LC (mm)	Total reading =PSR + CHSR (mm)
1.					
2.					
3.					

mean = _____ mm

Hence the thickness of a one rupee coin = _____ mm

IX. Numerical Problems :

1. Inian and Ezhilan argue about the light year. Inian tells that it is 9.46×10^{15} m and Ezhilan argues that it is 9.46×10^{12} km. Who is right? Justify your answer.

Solution : (Inian is correct)

Light travels 3×10^8 m in one second or 3 Lakhs kilometre in one second.

In one year we have 365 days.

The total number of second in one year is equal to $365 \times 24 \times 60 \times 60$

Distance travelled by light in 1 year $= (3.153 \times 10^{7)} \times (3 \times 10^{8)}$

$= \mathbf{9.46 \times 10^{15}\ m.}$

2. The main scale reading while measuring the thickness of a rubber ball using Vernier caliper is 7 cm and the Vernier scale coincidence is 6. Find the radius of the ball.

Solution :

MSR = 7 cm

VC = 6 cm

LC = 0.1 mm = 0.1 cm

Diameter = DR = MSR + (VC × LC)

= 7 + 0.06 cm

Diameter D = 7.06 cm

Radius $R = \frac{D}{2} = \frac{7.06}{2} = 0.035$ m

The radius of the ball = **0.0353 m.**

3. Find the thickness of a five rupee coin with the screw gauge, if the pitch scale reading is 1 mm and its head scale coincidence is 68.

Solution :

PSR = 1 mm = 1×10^{-3} m

HSC = 68

LC = 0.01 mm = 0.01×10^{-3} m

Total reading = PSR + (HSC × LC)

∴ Thickness of the five rupee coin = $1 \times 10^{-3} + (68 \times 0.01 \times 10^{-3})$ m

∴ Thickness of the five rupee coin = 1.68×10^{-3} m = **1.68 mm**

4. Find the mass of an object weighing 98 N.

Solution : W = mg

W = 98 N

g = 9.8 m/s^2

$m = \frac{W}{g} = \frac{98}{9.8}$ = **10 kg**.

Intext Activities

ACTIVITY - 1

Using Vernier caliper find the outer diameter of your pen cap.

Aim : To find the outer diameter of the pen cap.

Materials required : Vernier caliper, pen cap.

Solution :

S. No.	MSR (cm)	VSR (division)	VSR = (VSC × LC)	Diameter = MSR + VSR
1.	9	34	34 × 0.01 = 0.34	9 + 0.34 = 9.34
2.	9	36	36 × 0.01 = 0.36	9 + 0.36 = 9.36
3.	9	35	35 × 0.01 = 0.35	9 + 0.35 = 9.35
				Mean D = **9.35 cm**

Result : The outer diameter of the pen cap = **9.35 cm**

[End of the activity]

ACTIVITY - 2

Determine the thickness of a single sheet of your science textbook with the help of a Screw gauge.

S. No.	P.S.R. (mm)	HSC (division)	HSR (mm) HSR = HSC × LC	TR (mm) t = PSR + HSR mm
1.	0	29	0.29	0.29
2.	0	30	0.30	0.30
3.	0	31	0.31	0.31
		Mean thickness 't' of the sheet = **0.30**		

LC = Least Count
PSR = Pitch Scale Reading
HSC = Head Scale Coincidence
HSR = Head Scale Reading
TR = Total Reading

Result : The thickness of the single sheet is = **0.30mm.**

[End of the activity]

Additional Questions

I. Choose the correct answer :

1. Length is _____
(a) The amount of matter in an object
(b) The amount of space an object takes up.
(c) The distance between two points.
(d) The amount of stuff in an object **[Ans : (c) The distance between two points]**

2. Mass is _____.
(a) The distance between two points
(b) The distance between three points
(c) The amount of matter contained in an object
(d) The amount of space an object occupies.
[Ans : (c) The amount of matter contained in an object]

3. Unit used to measure length
(a) metre (b) litre
(c) gram (d) cubic metre (m^3) **[Ans : (a) metre]**

4. Unit which is used to measure mass
(a) ml (b) l (c) cm (d) gram
[Ans : (d) gram]

5. How many metres are there in 1 nanometer?
(a) 10^{-10}m (b) 10^{-9}m (c) 10^{9}m (d) 10^{10}m
[Ans : (b) 10^{-9}m]

6. What unit will you use to measure the length of our classroom?
(a) km (b) m (c) cm (d) mm
[Ans : (b) m]

7. The Kelvin is the basic unit of _____
(a) temperature (b) mass (c) length (d) volume
[Ans : (a) temperature]

8. _____ consists of 'U' shape metal frame
(a) Screw gauge (b) Vernier caliper (c) Beam balance (d) Spring balance
[Ans : (a) screw gauge]

9. Least count of a vernier caliper is _____ cm.
(a) 1 (b) 0.1 (c) 0.01 (d) 0.001
[Ans : (c) 0.01]

10. If no object is placed on the hook, then the pointer of the spring balance reads _____
(a) 3 (b) 2 (c) 1 (d) 0 **[Ans : (d) 0]**

11. SI unit of mass and weights are _____.
(a) kg, N (b) N, kg (c) K, N (d) N, K
[Ans : (a) kg, N]

12. Units named after scientists _____.
(a) lower case (b) upper case
(c) both (a) and (b) (d) neither (a) or (b) **[Ans : (a) lower case]**

13. An instrument that is used to measure the diameter of a cricket ball is _____.
(a) Screw guage (b) Meter scale
(c) Vernier caliper (d) Spring balance **[Ans : (a) Vernier caliper]**

14. Distance between Chennai and Kanyakumari can be found in
(a) Kilometres (b) Metres (c) Centimetres (d) Millimetres.
[Ans : (a) Kilometres]

II. Fill in the blanks :

1. The precision of vernier calipers is _____ mm. **[Ans : (a) 0.1mm]**

2. The gravity accelerates any object, the distance fallen is proportional to _____.
[Ans : time squared]

3. SI unit of electric current is _____. **[Ans : ampere]**

4. Larger unit for measuring time is _____. **[Ans : millennium]**

5. The value of an astronomical unit is _____. **[Ans : 1.496×10^{11}m]**

6. Mass is a _____ quantity. **[Ans : scalar]**

III. State whether true or false. If false, correct the statement :

1. The precision of screw guage is 0.001cm.
Ans. True.

2. The unit of amount of substance is candela
Ans. False.
Correct statement : The unit of amount of substance is **mole**.

3. The symbol for the units derived from the names of scientists are written in capital letter
Ans. True.

4. Yard was used as the unit of length.
Ans. True.

5. Micron is also known as micro-metre
Ans. True.

6. A vernier caliper using the scale invented by Galileo.
Ans. False.
Correct statement : A vernier caliper using the scale invented **Pierre Vernier**.

7. The SI unit of mass is kg.
Ans. True.

8. Weight has both magnitude and direction.
Ans. True.

IV. Match the following :

1.

Column - I	Column - II
FPS	Metre, kilogram and second
CGS	Foot, pound and second
MKS or SI	centimetre, gram and second

Ans.

Column - I	Column - II
FPS	Foot, pound and second
CGS	centimetre, gram and second
MKS or SI	Metre, kilogram and second

2.

Column I	Column II
10 years	1 year
10 centuries	1 century (100 years)
10 decades	1 millennium
365.24 days	1 decade

Ans.

Column I	Column II
10 years	1 decade
10 centuries	1 millennium
10 decade	1 century (100 years)
365.24 days	1 year

3.

Column I	Column II
Electric Current	radian
Luminous intensity	ampere
Angle	steradian
Solid angle	candela

Ans.

Column I	Column II
Electric Current	ampere
Luminous intensity	candela
Angle	radian
Solid angle	steradian

4.

Column I	Column II
Length	s
Mass	m
Time	K
Temperature	kg

Ans.

Column I	Column II
Length	m
Mass	kg
Time	s
Temperature	K

5.

Column I	Column II
Millimeter	10^{-15}m
Nanometer	10^{-3}m
Angstrom	10^{-9}m
Fermi	10^{-10}m

Ans.

Column I	Column II
Millimeter	10^{-3}m
Nanometer	10^{-9}m
Angstrom	10^{-10}m
Fermi	10^{-15}m

6.

Column I	Column II
Temperature	Beam balance
Mass	Ruler
Length	Digital clock
Time	Thermometer

Ans.

Column I	Column II
Temperature	Thermometer
Mass	Beam balance
Length	Ruler
Time	Digital clock

V. Assertion and reason type :

1. **Assertion (A) :** Light year and wave length both measure distance
Reason (R) : Both have dimensions of time.
(a) Both A and R are true but R is not the correct explanation of A.
(b) Both A and R are true and R is the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true. **[Ans : (c) A is true but R is false]**

2. **Assertion (A) :** Density is a derived physical quantity
Reason (R) : Density cannot be derived from the fundamental physical quantities.
(a) Both A and R are true but R is not the correct explanation of A.
(b) Both A and R are true and R is the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true. **[Ans : (c) A is true but R is false]**
Correct statement : Density can be derived from **mass and volume**.

3. **Assertion (A) :** Mass, Length and Time are fundamental physical quantities.
Reason (R) : They are independent of each other.
(a) Both A and R are true but R is not the correct explanation of A.
(b) Both A and R are true and R is the correct explanation of A.
(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 explanation of A]

4. **Assertion (A) :** The SI system of units is the improved system of units for measurement.
Reason (R) : The SI unit of mass is kilogram.
(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]

5. **Assertion (A) :** The skill of estimation is important for all of us in our daily life.
Reason (R) : The skill of estimation reduces our consumption of time.
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]

VI. Comprehensive type :

(a) The speed of a body gives us an idea of how slow or fast that a body is moving. Speed of a body is the distance travelled by it per unit time. The SI unit of speed is metre per second. It is a scalar quantity. The speed of a running cab at any instant of time is shown by an instrument called, 'speedometer' and the distance travelled by a car is measured by another instrument called, 'odometer'.

1. Which of the following is not correct unit of speed?

(a) cm/s (b) m/s (c) km/h (d) km/s.

[Ans : (d) km/s]

2. If the distance travelled by the cab in 3 hours is 120 km, then its speed will be

(a) 40 m/s (b) 40 km/s (c) 40 km/h (d) 40 km/min

[Ans : (c) 40 km/h]

3. The formula for finding the speed of the cab is

(a) Distance = speed × time
(b) velocity = distance × time
(c) time = distance × velocity
(d) None of these.

[Ans : (a) Distance = speed × time]

(b) Read the passage and answer the questions given below.

Mass is the amount of matter contained in an object. Measurement of mass helps us to distinguish between lighter and a heavier body. Beam balance, spring balance and electronic balance are used to measure mass of different objects. The SI unit of mass is kilogram (kg). But different units are used to measure the mass of different objects depending upon their weight. e.g. weight (mass) of a tablet is measured in milligrams (mg), weight of a student is measured in kilogram (kg), and weight of a truck with goods is measured in metric tons. 1 metric ton is equal to 10 quintals and 1 quintal is equal to 100 kg. 1 gram is equal to 1000 mg.

1. The value of 1 metric ton is equal to

(a) 1000 kg (b) 10 quintals (c) 1000,000 g (d) 100 kg

[Ans : (a) 1000 kg (or) (b) 10 quintals]

2. How will you measure weight of a tablet?

(a) kg (b) g (c) mg (d) none of these.

[Ans : (c) mg]

VII. Answer very briefly :

1. Write the units which are used to measure long distances.

Ans. km, AU, light year, parsec.

2. Define Astronomical unit.

Ans. AU is defined as the average distance between the earth and the sun.

$1\ AU = 1.496 \times 10^{11} m$.

3. Define light year.

Ans. The distance travelled by light in one year in vacuum.

1 light year = $9.46 \times 10^{15} m$.

4. Convert the temperature from Fahrenheit into Celsius & Kelvin.

Ans.

°F to °C	°F to K
$\frac{(F-32)}{1.8}$	$\left[\frac{(F-32)}{1.8}+273\right]$

5. Convert 100°C into Kelvin.

Ans. 100 + 273 = 373 K. ie. °C + 273

6. Convert 112°F into K.

Ans. $\frac{(F-32)}{1.8}+273 = \frac{(112-32)}{1.8}+273 = \frac{80}{1.8}+273 = 44.44 + 273 = 317.44$ K

7. Write the principle of screw gauge.

Ans. (i) When a screw is rotated in a nut, the distance moved by the tip of the screw is directly proportional to the number of rotations given.

(ii) Hence principle of the screw is considered as the principle of screw gauge.

8. What are the kinds of units?

Ans. 1. Fundamental or basic units
2. Derived units

9. Give some examples of fundamental units.

Ans. The examples of fundamental units are kg for mass, m for length, s for time.

10. Give some examples of derived units.

Ans. The units of area, volume, density.

11. What is the standard unit of weight?

Ans. Newton is the standard unit of weight.

12. What is the standard unit of mass?

Ans. Kilogram is the standard unit of mass.

13. Define Mass.

Ans. Mass is the amount of matter contained in a body.

14. Define Weight.

Ans. The force with which the earth attracts a body towards its center is called weight.

15. What is the SI unit of temperature?

Ans. Kelvin is the SI unit of temperature.

16. What is the measuring unit of the thickness of a plastic carry bag?

Ans. 1 micron = 10^{-6}m (or) µm.

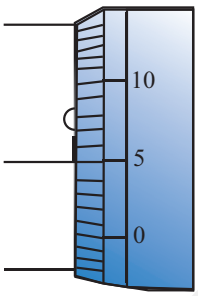
VIII. Answer briefly :

1. Write temperature conversion.

Ans. Temperature Conversion (Exact)

From	To Fahrenheit	To Celsius	To Kelvin
Fahrenheit (°F)	°F	$\left(\frac{F-32}{1.8}\right)$	$\left[\frac{F-32}{1.8}+273\right]$
Celsius (°C)	(C × 1.8) + 32	°C	°C + 273
Kelvin (K)	[(K – 273) × 1.8] + 32	K – 273	K

2. Write about the positive zero error in screw gauge instrument.



Positive Zero error

Ans. When the plane surface of the screw and the opposite plane stud on the frame are brought into contact, if the zero of the head scale lies below the pitch scale axis, the zero error is positive. For example, the 5th division of the head scale coincides with the pitch scale axis, then the zero error is positive and is given by

Z.E = + (n × LC) where 'n' is the head scale coincidence. In this case, Zero error = + (5 × 0.01) = 0.05 mm. So the zero correction is – 0.05 mm.

3. Write SI units for the fundamental quantity.

Ans.

Basic Quantity	Unit
Length	metre
Mass	kilogram
Time	second
Electric current	ampere
Temperature	kelvin
Amount of substance	mole
Luminous intensity	candela

4. Convert the following units in metre.

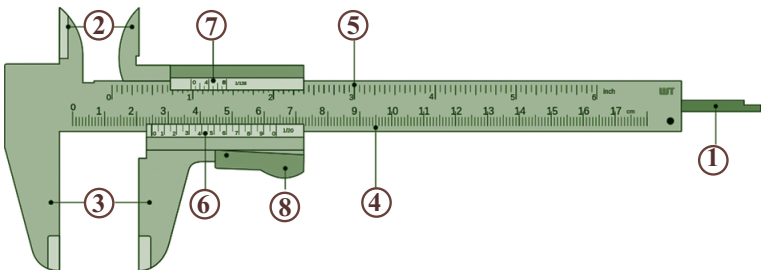
Ans.

Smaller units	Value in metre
centimetre (cm)	10^{-2} m
millimetre (mm)	10^{-3} m
micron or μm	10^{-6} m
nanometre (nm)	10^{-9} m
angstrom (Å)	10^{-10} m
fermi (f)	10^{-15} m

5. Draw and mark the parts of vernier caliper

Ans. PARTS Marked in the Vernier caliper

1. Lower fixed jaw
2. Upper fixed jaw
3. Lower movable jaw
4. Vernier scale
5. Retainer
6. Main scale
7. Depth probe.



IX. Numerical Problems :

1. A piece of iron of volume 40cm³ whose density is 6.8g/cm³. Find the mass of iron.

Solution :

Given, density of iron, D = 6.8g/cm³

volume of iron, V = 40 cm³

mass of iron, M = V × D [∴ mass = volume × density]

$= 40\ \cancel{cm^3} \times \frac{6.8g}{\cancel{cm^3}}$

m = **272.0g.**

2. Solve : The mass of 40 apples in a box is 5 kg.

(i) Find the mass of a dozen of them.

(ii) Express the mass of one apple in gram.

Solution :

(i) 40 apple = 5 kg = 5000 g

$1 \text{ apple} = \frac{500\cancel{0}}{4\cancel{0}}$

1 apple = 125 g

∴ 1 dozen = 12 apples

12 apples = 125 × 12 g

12 apples = 1500 g.

(ii) 40 apples = 5000 g

$1 \text{ apple} = \frac{5000}{40}\text{ g}$

1 apple = 125 g

The mass of 1 apple = 125 g.

X. Answer in detail :

1. How will you find Zero Error of the screw gauge?

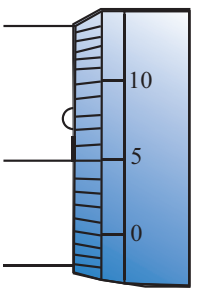
Ans. Zero Error of a screw gauge :

When the plane surface of the screw and the opposite plane stud on the frame area brought into contact, if the zero of the head scale coincides with the pitch scale axis there is no zero error.

Positive zero error :

When the plane surface of the screw and the opposite plane stud on the frame are brought into contact, if the zero of the head scale lies below the pitch scale axis, the zero error is positive. For example, the 5th division of the head scale coincides with the pitch scale axis, then the zero error is positive and is given by

Z.E = + (n × LC) where 'n' is the head scale coincidence. In this case, Zero error = + (5 × 0.01) = 0.05mm. So the zero correction is – 0.05 mm.

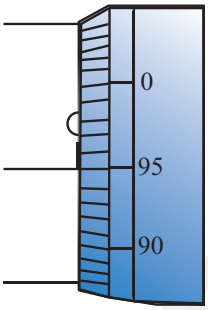


Positive Zero error

Negative zero error :

When the plane surface of the screw and the opposite plane stud on the frame are brought into contact, if the zero of the head scale lies above the pitch scale axis, the zero error is negative.

For example, the 95th division coincides with the pitch scale axis, then the zero error is negative and is given by



Negative Zero Error

$$ZE = -(100 - n) \times LC$$
$$ZE = -(100 - 95) \times LC$$
$$= -(5 \times 0.01)$$
$$= -0.05 \text{ mm}$$

The zero correction is **+ 0.05 mm**.

2. How will you find Zero Error of Vernier Caliper? Explain.

Ans. Zero error :

(i) Unscrew the slider and move it to the left, such that both the jaws touch each other. Check whether the zero marking of the main scale coincides with that of the Vernier scale.

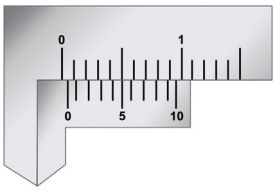
(ii) If they are not coinciding with each other, the instrument is said to posses zero error. Zero error may be positive or negative.

(iii) If the zero mark of the Vernier is shifted to the right, it is called positive error.

(iv) On the other hand, if the Vernier zero is shifted to the left of the main scale zero marking, then the error is negative.

Positive zero error :

(i) From the figure you can see that zero of the vernier scale is shifted to the right of zero of the main scale.



Positive zero error

(ii) In this case the reading will be more than the actual reading.

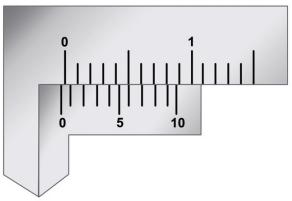
(iii) Hence, this error should be corrected. In order to correct this error, find out which vernier division is coinciding with any of the main scale divisions.

(iv) Here, fifth vernier division is coinciding with a main scale division.

(v) So, positive zero error = +5 × LC = +5 x 0.01 = 0.05 cm.

Negative zero error :

(i) You can see that zero of the vernier scale is shifted to the left of the zero of the main scale.



Negative zero error

(ii) So, the obtained reading will be less than the actual reading.

(iii) To correct this error we should first find which vernier division is coinciding with any of the main scale divisions, as we found in the previous case.

(iv) In this case, you can see that sixth line is coinciding. But, to find the negative error, we can count backward (from 10).

(v) So, the 4th line is coinciding. Therefore, negative zero error
= –4 × LC = –4 × 0.01 = –0.04 cm.

3. Write short note on the following :

(i) Common balance

(ii) Physical balance

(iii) Digital balance

(iv) Spring balance

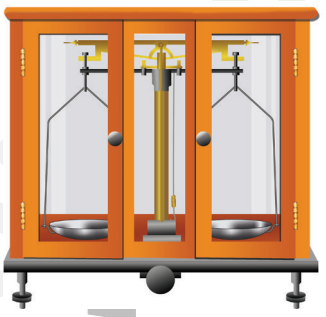
Ans. Common (beam) balance :

A beam balance compares the sample mass with a standard reference mass (Standard reference masses are 5g, 10g, 20g, 50g, 100g, 200g, 500g, 1kg, 2kg, 5kg). This balance can measure mass accurately up to 5g

Common beam balance

Physical balance :

This balance is used in labs and is similar to the beam balance but it is a lot more sensitive and can measure mass of an object correct to a milligram. The standard reference masses used in this physical balance are 10 mg, 20 mg, 50 mg, 100 mg, 200 mg, 500 mg, 1 g, 2g, 5 g, 10 g, 20 g, 50 g, 100g, and 200 g.



Physical balance

Digital balance :

Nowadays, for accurate measurements digital balances are used, which measure mass accurately even up to a few milligrams, the least value being 10 mg (Figure 1.11). This electrical device is easy to handle and commonly used in jewellery shops and labs.

Digital balance

Spring balance :

This balance helps us to find the weight of an object. It consists of a spring fixed at one end and a hook attached to a rod at the other end. It works by 'Hooke's law' which states that the addition of weight produces a proportional increase in the length of the spring. A pointer is attached to the rod which slides over a graduated scale on the right. The spring extends according to the weight attached to the hook and the pointer reads the weight of the object on the scale.

Spring balance

UNIT
02

MOTION

LEARNING OBJECTIVES

Students will be able to

- List the objects which are at rest and which are in motion around them.
- Understand distance and displacement.
- Determine the displacement and distance covered by an object describing a circular path .
- Classify the motion of vehicles as uniform motion and non-uniform motion. distinguish between speed and velocity.
- Relate accelerated and unaccelerated motion.
- Deduce the equations of motion of an object from velocity – time graph.
- Write the equations of motion for a freely falling body.
- Understand the nature of circular motion.
- Identify centripetal force and centrifugal force in day to day life.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. The area under velocity – time graph represents the

(a) velocity of the moving object. (b) displacement covered by the moving object.
(c) speed of the moving object. (d) acceleration of the moving object.

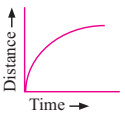
[Ans : (b) displacement covered by the moving object]

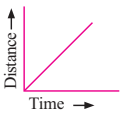
2. Which one of the following is most likely not a case of uniform circular motion?

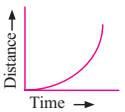
(a) Motion of the Earth around the Sun.
(b) Motion of a toy train on a circular track.
(c) Motion of a racing car on a circular track.
(d) Motion of hours' hand on the dial of the clock.

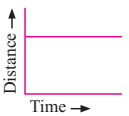
[Ans : (c) Motion of a racing car on a circular track]

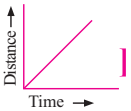
3. Which of the following graph represents uniform motion of a moving particle?

(a) 

(b) 

(c) 

(d) 

[Ans : (b) 

]

4. The centrifugal force is

(a) a real force.
(b) the force of reaction of centripetal force.
(c) a virtual force.
(d) directed towards the centre of the circular path. **[Ans : (c) a virtual force]**

II. Fill in the blanks :

1. Speed is a _____ quantity whereas velocity is a _____ quantity.
[Ans : Scalar, Vector]

2. The slope of the distance – time graph at any point gives _____. **[Ans : Speed]**

3. Negative acceleration is called _____. **[Ans : retardation (or) deceleration]**

4. Area under velocity – time graph shows _____. **[Ans : displacement]**

III. State whether true or false. If false, correct the statement :

1. The motion of a city bus in a heavy traffic road is an example for uniform motion.

Ans. False.

Correct statement : The motion of a city bus in a heavy traffic road is an example for **non-uniform motion**.

2. Acceleration can get negative value also.

Ans. True.

3. Distance covered by a particle never becomes zero but displacement becomes zero.

Ans. True.

4. The velocity – time graph of a particle falling freely under gravity would be a straight line parallel to the *x* axis.

Ans. False.

Correct statement : The velocity - time graph of a particle **moving at uniform velocity,** would be straight line parallel to the *x* axis.

5. If the velocity – time graph of a particle is a straight line inclined to X-axis then its displacement – time graph will be a straight line.

Ans. True.

IV. 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) If assertion is true but reason is false.
(d) If assertion is false but reason is true.

1. Assertion : The accelerated motion of an object may be due to change in magnitude of velocity or direction or both of them..

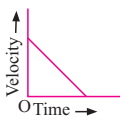
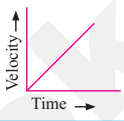
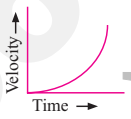
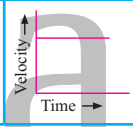
Reason : Acceleration can be produced only by change in magnitude of the velocity. It does not depend the direction.

[Ans : (c) If assertion is true but reason is false.]

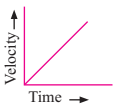
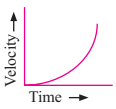
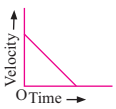
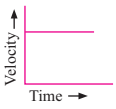
2. **Assertion** : The Speedometer of a car or a motor-cycle measures its average speed.
Reason : Average velocity is equal to total displacement divided by total time taken. **[Ans : (d) Assertion is false but reason is true]**

3. **Assertion** : Displacement of a body may be zero when distance travelled by it is not zero.
Reason : The displacement is the shortest distance between initial and final position. **[Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion]**

V. Match the Following :

	List I		List II
1.	Motion of a body covering equal distances in equal intervals of time	A	
2.	Motion with non uniform acceleration	B	
3.	Constant retardation	C	
4.	Uniform acceleration	D	

Ans.

	List I		List II
1.	Motion of a body covering equal distances in equal intervals of time	A	
2.	Motion with non uniform acceleration	B	
3.	Constant retardation	C	
4.	Uniform acceleration	D	

VI. Answer briefly :

1. Define velocity.

Ans. (i) Velocity is the rate of change of displacement. It is the displacement with unit time. It is a vector quantity. The SI unit of velocity is ms^{-1}.

(ii) Thus, Velocity = Displacement / time taken.

2. Distinguish distance and displacement.

Ans.

Sl. No.	Distance	Displacement
1	The actual length of the path travelled by a moving body irrespective of the direction	The change in position of a moving body in a particular direction
2	It is a Scalar quantity	It is a Vector quantity

3. What do you mean by uniform motion?

Ans. An object is said to be in uniform motion if it covers equal distances in equal intervals of time howsoever big or small these time intervals may be.

4. Compare speed and velocity.

Ans.

Sl. No.	Speed	Velocity
1.	It is the rate of change of distance with respect to time	It is the rate of change of displacement with respect to time
2.	It is a scalar quantity having magnitude only	It is a vector quantity having both magnitude and direction
3.	Speed is velocity without a particular direction	Velocity is speed in a particular direction
4.	It is measured in ms^{-1} in SI system	It is also measured in ms^{-1} in a particular direction in SI system
5.	Speed in any direction would be a positive quantity, since the distance in any direction is a positive quantity.	Velocity can get both positive and negative values. If velocity in one direction is assumed to be positive then the velocity in the opposite direction would be a negative quantity. Velocity can get zero value also.

5. What do you understand about negative acceleration?

Ans. If velocity decreases with time the value of acceleration is negative.

Note : Negative acceleration is called retardation or deceleration.

6. Is the uniform circular motion accelerated? Give reasons for your answer.

Ans. When an object is moving with a constant speed along a circular path, the change in velocity is only due to the change in direction. Hence it is accelerated motion.

7. What is meant by uniform circular motion? Give two examples of uniform circular motion.

Ans. When an object moves with constant speed along a circular path, the motion is called uniform circular motion.

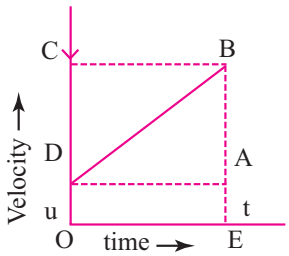
Example :

1. The earth moves around the sun in the uniform circular motion.
2. The moon moves in uniform circular motion around the earth.

VII. Answer in detail :

1. Derive the equations of motion by graphical method.

Ans. Equations of motion from velocity – time graph:



Graph shows the change in velocity with time of a uniformly accelerated object. The object starts from the point D in the graph with velocity u. Its velocity keeps increasing and after time t it reaches the point B on the graph.

The initial velocity of the object = u = OD = EA

The final velocity of the object = v = OC = EB

Time = t = OE = DA

Also from the graph we know that, AB = DC

1. First equation of motion :

By definition, acceleration = change in velocity / time

= (final velocity – initial velocity)/time

= (OC – OD) / OE

= DC / OE

a = DC / t

DC = AB = at

From the graph EB = EA + AB

$$v = u + at \longrightarrow (1)$$

This is first equation of motion.

2. Second equation on of motion :

From the graph the distance covered by the object during time t is given by the area of quadrangle DOEB

s = area of the quadrangle DOEB

= area of the rectangle DOEA + area of the triangle DAB

= (AE × OE) + (1/2 × AB × DA)

$$s = ut + \tfrac{1}{2}(at^2) \longrightarrow (2)$$

This is the second equation of motion.

3. Third equation of motion :

From the graph the distance covered by the object during time, t is given by the area of the quadrangle DOEB. Here DOEB is a trapezium. Then,

s = area of trapezium DOEB

= ½ × sum of length of parallel side × distance between parallel sides

= ½ × (OD + BE) × OE

s = ½ × (u + v) × t

since $a = (v - u) / t$ or $t = (v - u) / a$

$$\text{Therefore } s = \tfrac{1}{2} \times (v + u) \times (v - u) / a$$
$$2as = v^2 - u^2$$
$$v^2 = u^2 + 2as \longrightarrow (3)$$

This is the third equation of motion.

2. Explain different types of motion.

Ans. Different types of motion :

(i) **Linear motion :** The motion of an object along a straight line is known as linear motion. **Ex :** Car moving on a straight road.

(ii) **Circular motion :** The motion of an object is a circular path is known as circular motion. **Ex :** Earth revolving around the sun.

(iii) **Oscillatory motion :** Repetitive to and fro motion of an object at regular interval of time is called as oscillatory motion. **Ex :** Motion of pendulum of a clock.

(iv) **Random motion :** The disordered or irregular motion of a body is called random motion. **Ex :** Movement of fish under water.

VIII. Exercise Problems :

1. A ball is gently dropped from a height of 20 m. If its velocity increases uniformly at the rate of 10ms^{-2}, with what velocity will it strike the ground? After what time will it strike the ground?

Ans. Here we have

Initial velocity, $u = 0$
Distance, $s = 20$ m
Acceleration, $a = 10 \text{m/s}^2$
Final velocity, $v = ?$
Time, $t = ?$

a) Calculation of final velocity, v

We know that, $v^2 = u^2 + 2as$
$v^2 = 0 + 2 \times 10 \text{ m/s}^2 \times 20 \text{ m}$
$v^2 = 400 \text{ m}^2/\text{s}^2$
$= \sqrt{400 m^2 / s^2}$
$v = 20$ m/s

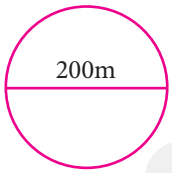
b) Calculation of time, t

We know that, $v = u + at$
$20 \text{ m/s} = 0 + 10 \text{ m/s}^2 \times t$
$t = \dfrac{20 m / s^2}{20 m / s} = 2s$

$\therefore$ Ball will strike the ground at a velocity of 20 ms^{-1}
Time taken to reach the ground = **2s.**

2. An athlete completes one round of a circular track of diameter 200 m in 40 s. What will be the distance covered and the displacement at the end of 2 m and 20 s?

Ans. Here we have



Diameter = 200 m

$\therefore$ Radius = 200 m/2 = 100 m

Time of one rotation = 40 s

Time after 2m 20 s = 2 × 60 s + 20 s = 140 s

Distance after 140 s = ?

Displacement after 140 s = ?

Circular track with diameter of 200m

We know that, velocity along a circular path = $\frac{\text{circumference}}{\text{time}}$

$$v = \frac{2\pi r}{40s}$$

$$v = \frac{2 \times 3.14 \times 100\text{m}}{40s}$$

$$v = \frac{628\text{ m}}{40s}$$

$$v = 15.7\text{ m/s}$$

a) Distance after 140 s

We know that, distance = velocity × time

$\Rightarrow$ Distance = 15.7 m/s × 140 s

= 2198 m

b) Displacement after 2 min 20 s i.e, in 140 s

We know that, distance = velocity × time

Since, rotation in 40 s = 1

$\therefore$ Rotation in 1 s = $\frac{1}{40}$

$\therefore$ Rotation in 140 s = $\frac{1}{40} \times 140 = 3.5$

$\therefore$ In 3.5 rotation athlete will be just at the opposite side of the circular track.

i.e. at a distance equal to the diameter of the circular track which is equal to 200m

$\therefore$ Distance covered in 2min 20 s = **2198 m**

Displacement after 2min 20 s = **200 m**.

3. A racing car has a uniform acceleration of 4ms^{-2}. What distance it covers in 10s after the start?

Ans. Here we have

Acceleration, a = 4 m/s^2
Initial velocity u = 0
Time t = 10 s
Distance (s) covered = ?
We know that, s = $ut + \frac{1}{2} at^2$
s = $(0 \times 10s) + [\frac{1}{2} \times 4\ m/s^2 \times (10\ s)^2]$
= $\frac{1}{2} \times 4\ m/s^2 \times 100\ s^2$
= 2×100 m = **200 m**

Thus, racing car will cover a distance of 200 m after start in 10s with given acceleration.

Intext Activities

ACTIVITY - 1

Look around you. You can see many things: a row of houses, large trees, small plants, flying birds, running cars and many more. List the objects which remain fixed at their position and the objects which keep on changing their position.

Solution :

1. Row of houses, large trees, small plants are the examples, of immovable objects.
2. Flying birds, running cars and buses are the examples of movable objects.

Activity to be done by the students themselves

ACTIVITY - 2

Tabulate the distance covered by a bus in a heavy traffic road in equal intervals of time and do the same for a train which is not in an accelerated motion. From your table what do you understand?

The bus covers unequal distance in equal intervals of time but the train covers equal distances in equal intervals of time.

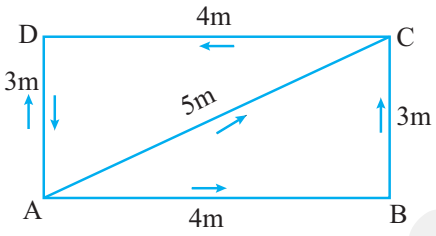
Solution :

Distance covered by a BUS in a heavy traffic	Distance covered by a TRAIN which is NOT in an accelerated motion
In first 10 minutes = 1 km. Next 10 minutes = 2 km. Next 10 minutes = 1.5 km	In first 5 minutes = 2 km. Next 5 minutes = 2 km. Next 5 minutes = 2 km
Covers unequal distance in equal intervals of time.	Covers equal distances in equal intervals of time
Such motion is called Non Uniform Motion.	Such motion is called Uniform Motion.

ACTIVITY - 3

Observe the motion of a car as shown in the figure and answer the following questions:

Compare the distance covered by the car through the path ABC and AC. What do you observe? Which path gives the shortest distance to reach D from A? Is it the path ABCD or the path ACD or the path AD?



Solution :

1. Distance covered by the car through the path ABC = 4m + 3m = 7 m. and AC = 5 m. The distance covered by the car through the path ABC is large compared to AC.
2. The shortest distance to reach D from A is path AD = 3m.
3. The total distance covered by the car ABCDA = 14 m. It finally reaches to A.

ACTIVITY - 4

Take a large stone and a small eraser. Stand on the top of a table and drop them simultaneously from the same height? What do you observe? Now, take a small eraser and a sheet of paper. Drop them simultaneously from the same height. What do you observe? This time, take two sheets of paper having same mass and crumple one of the sheets into a ball. Now, drop the sheet and the ball from the same height. What do you observe?

Solution :

Both the stone and the eraser have reached the surface of the earth almost at the same time.

The eraser reaches first and the sheet of paper reaches later.

The paper crumpled into a ball reaches ground first and plain sheet of paper reaches later, although they have equal mass. It is because of air resistance. The magnitude of air resistance despends on the area of object exposed to air. So the sheet of paper reaches later.

Additional Questions

I. Choose the correct answer :

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

(a) zero (b) πr (c) $2r$ (d) $2\pi r$ **[Ans : (c) $2r$]**

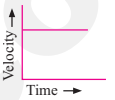
2. In which of the following cases of motions, the distance moved and the magnitude of displacement are equal?

(a) If the car is moving in the straight road.
(b) If the car is moving in a circular road.
(c) The earth is revolving around the sun.
(d) The pendulum is moving to and fro

[Ans : (a) If the car is moving in the straight road]

3. **A body is thrown vertically upward with velocity *u*, the greatest height h to which it will rise is**
(a) $u^2/2g$ (b) u^2/g (c) u/g (d) $u/2g$
[Ans : (a) $u^2/2g$]

4. **If the displacement of an object is proportional to square of time, then the object moves with**
(a) uniform velocity (b) uniform acceleration
(c) increasing acceleration (d) decreasing acceleration
[Ans : (b) uniform acceleration]

5. **From the given *v–t* graph, u 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 : (a) in uniform motion]

6. **Area under *v–t* graph represents a physical quantity which has the unit.**
(a) m^2 (b) m (c) m^3 (d) ms^{-1} **[Ans : (b) m]**

7. **m/s^2 is the unit of**
(a) distance (b) displacement (c) velocity (d) acceleration
[Ans : (d) acceleration]

8. **The rate of change of displacement**
(a) speed (b) velocity (c) acceleration (d) retardation
[Ans : (b) velocity]

9. **A scalar quantity has**
(a) magnitude only (b) direction only
(c) both (d) none **[Ans : (a) magnitude only]**

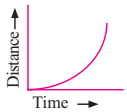
10. **When an object undergoes acceleration**
(a) there is always an increase in its velocity
(b) there is always an increase in its speed
(c) a force always acting on it.
(d) all of the above **[Ans : (c) a force always acting on it]**

11. **A body is projected up with an initial velocity *u* m/s. It goes up to a height, '*h*' metres in '*t*' seconds time. Then it comes back at the point of projection. Considering negligible air resistance, which of the following statement is true?**
(a) the acceleration is zero
(b) the displacement is zero
(c) the average velocity is $2h/t$
(d) the final velocity is $2u$ when body reaches projection point
[Ans : (b) the displacement is zero]

12. **A car accelerates at $1.5 m/s^2$ in a straight road. How much is the increase in velocity in 4s.**
(a) 6 m/s (b) 4 m/s (c) 3 m/s (d) 2.66 m/s
[Ans : (a) 6 m/s]

13. **The slope of the distance time curve is steeper / greater is the _____**
(a) velocity (b) acceleration (c) displacement (d) speed
[Ans : (d) speed]

14. The given graph represents motion with _____ speed.



(a) uniform (b) non uniform
(c) constant (d) none

[Ans : (b) non uniform]

15. The relation between displacement and time is given by the equation of
(a) $v^2 = ut + at$ (b) $s = ut + \frac{1}{2}at^2$ (c) $v = s/t$ (d) $v^2 = u^2 + 2as$

[Ans : (b) $s = ut + \frac{1}{2} at^2$]

16. A body moves in a uniform circular motion
(a) It is moving with constant velocity
(b) its acceleration is zero
(c) the body has an acceleration
(d) none of the above **[Ans : (a) It is moving with constant velocity]**

17. Speed of the body in particular direction can be called
(a) acceleration (b) displacement
(c) velocity (d) distance **[Ans : (c) velocity]**

18. **Statement A :** Uniform circular motion is a case of accelerated motion
Statement B : In third equation of motion we do not have the term time
(a) Statement B is true, A is false (b) Statement A is true, B is false
(c) neither statement A nor B is true (d) both are true **[Ans : (d) both are true]**

19. Which of the following is correct about uniform circular motion
(i) direction of motion is continuously changed
(ii) direction of motion is not changed
(iii) speed and direction both remain constant
(iv) speed is constant but direction is changing
(a) ii & iii are correct (b) i, ii & iii are correct
(c) i & iv are correct (d) all of these **[Ans : (c) i & iv are correct]**

20. Which of the quantities have the same SI unit?
(a) speed, velocity (b) acceleration, time
(c) velocity, time (d) velocity, acceleration

[Ans : (a) speed, velocity]

21. Rest and motion of body are
(a) non relative (b) not related (c) relative (d) none

[Ans : (c) relative]

22. An ant moves from one corner of a room diagonally to the opposite corner. If the dimensions of the hall are 8m × 6m, the displacement of the ant is
(a) 10m (b) 14m (c) 28m (d) 2m

[Ans : (a) 10m]

23. The displacement covered by a second hand of radius 'r' in a clock after one revolution is
(a) 360° (b) 0 (c) 3*r* (d) 2*r* **[Ans : (b) 0]**

24. **A man leaves his house at 6.30 a.m. for a morning walk and returns back at 7.30 a.m. after covering 4 km. Displacement covered by him is _____.**
(a) 2 km (b) zero (c) 8 km (d) 4 km
[Ans : (b) zero]

25. **A body is said to be in non uniform motion if it travels**
(a) equal distance in unequal interval of time
(b) equal distance in equal interval of time
(c) unequal distance in unequal interval of time
(d) unequal distance in equal interval of time.
[Ans : (d) unequal distance in equal interval of time]

26. **A quantity which has both magnitude and direction is**
(a) scalar (b) distance (c) vector (d) moving body
[Ans : (c) vector]

27. **A bus accelerating with $4ms^{-2}$ changes its speed from $60ms^{-1}$ to a certain value in 5s. The final speed is**
(a) 40 m/s (b) 25 ms^{-1} (c) 60 ms^{-1} (d) 30 ms^{-1}
[Ans : (a)] 40 m/s

28. **A quantity has a value of $-16ms^{-2}$. It is the**
(a) acceleration of an object (b) velocity of an object
(c) retardation of an object (d) speed of an object
[Ans : (c) retardation of an object]

29. **A boy throws a ball up and catches it when the ball falls back. In which part of the motion the ball is accelerating?**
(a) during downward motion (b) when the ball comes to rest
(c) during upward motion (d) when the boy catches the ball.
[Ans : (a) during downward motion]

30. **Choose the correct option.**
(a) distance is a scalar, velocity is a vector, acceleration is a vector
(b) distance is a vector, velocity is a scalar, acceleration is a vector
(c) distance is a vector, velocity is a vector, acceleration is a vector
(d) distance is a scalar, velocity is a vector, acceleration is scalar
[Ans : (a) distance is a scalar, velocity is a vector, acceleration is a vector]

31. **If a moving body comes to rest, then its acceleration is**
(a) positive (b) negative
(c) zero
(d) all of these depending upon initial velocity. **[Ans : (b) negative]**

32. **If the velocity of a body changes uniformly from u to v in time t, the sum of average velocity and acceleration is**
(a) $\frac{(u+v)}{t}$ (b) $\frac{(v-u)}{t}$ (c) $\frac{2u}{t}$ (d) $\frac{2v}{t}$
[Ans : (d) $\frac{2v}{t}$]

33. **Acceleration is defined as the rate of change of**
(a) distance (b) velocity (c) speed (d) displacement
[Ans : (b) velocity]

34. When an object undergoes acceleration
(a) there is always an increase in its velocity
(b) there is always an increase in its speed
(c) a force always acting on it.
(d) all the above
[Ans : (c) a force always acting on it]

35. The equation v = u + at gives information as
(a) velocity is a function of time
(b) velocity is a function of position
(c) position is a function of time
(d) position is a function of time and velocity **[Ans : (a) velocity is a function of time]**

36. Which of the following can determine the acceleration of a moving object.
(a) area of velocity time graph (b) slope of velocity time graph
(c) area of distance time graph (d) slope of distance time graph
[Ans : (b) slope of velocity time graph]

37. What is the slope of the body when it moves with uniform velocity?
(a) positive (b) negative
(c) zero (d) may be positive or negative **[Ans : (c) zero]**

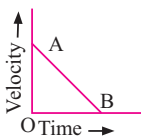
38. If a body starts from rest, what can be said about the acceleration of body?
(a) positively accelerated (b) negative accelerated
(c) uniform accelerated (d) none of the above
[Ans : (a) positively accelerated]

39. When a body moves uniformly along the circle then
(a) its velocity changes but speed remains the same
(b) its speed changes but velocity remains the same
(c) both speed and velocity changes
(d) both speed and velocity remains same
[Ans : (a) its velocity changes but speed remains the same]

40. Distance travelled by a freely falling body is proportional to
(a) mass of the body
(b) square of the acceleration due to gravity
(c) square of the time of fall
(d) time of fall **[Ans : (c) square of the time of fall]**

41. If the displacement - time graph of a particle is parallel to the time axis, then velocity of the particle is.
(a) infinity (b) unity
(c) equal to acceleration (d) zero **[Ans : (d) zero]**

42. In the velocity time graph, AB shows that the body has
(a) uniform acceleration
(b) non-uniform retardation
(c) uniform speed
(d) initial velocity OA & is moving with uniform retardation.



[Ans : (d) initial velocity OA & is moving with uniform retardation]

43. The magnitude of the centripetal force is given by (F = _____)
(a) $\frac{mv^2}{r}$ (b) $\frac{v^2}{r}$ (c) $\frac{2\pi}{T}$ (d) ma
[Ans : (a) $\frac{mv^2}{r}$]

44. **A body moving with an initial velocity $5ms^{-1}$ and accelerates at $2ms^{-2}$. Its velocity after 10s is**

(a) $20ms^{-1}$ (b) $25ms^{-1}$ (c) $5ms^{-1}$ (d) $22.55ms^{-1}$

[Ans : (b) $25ms^{-1}$]

45. **In a 100m race, the winner takes 10s to reach the finishing point. The average speed of the winner is**

(a) $5ms^{-1}$ b) $20ms^{-1}$ c) $40ms^{-1}$ d) $10ms^{-1}$

[Ans : (d) $10ms^{-1}$]

46. **The area under velocity – time graph represents**

(a) velocity of the moving object
(b) displacement covered by the moving object
(c) speed of the moving object
(d) acceleration of the moving object

[Ans : (b) displacement covered by the moving object]

47. **A car is being driven at a speed of $20ms^{-1}$ when brakes are applied to bring it to rest in 5 s. The deceleration produced in this case will be**

(a) $+4ms^{-2}$ (b) $-4ms^{-2}$ (c) $-0.25ms^{-2}$ (d) $+0.25ms^{-2}$

[Ans : (b) $-4ms^{-2}$]

48. **Unit of acceleration is**

(a) ms^{-1} (b) ms^{-2} (c) ms (d) ms^2

[Ans : (b) ms^{-2}]

49. **The force responsible for drying of clothes in a washing machine is _____.**

(a) Centripetal force (b) Centrifugal force
(c) Gravitational force (d) Electro static force

[Ans : (b) Centrifugal force]

II. Fill in the blanks :

1. If a body does not change its position, then it is said to be at _____. **[Ans. rest]**

2. The back and forth motion of a swing is an _____ motion. **[Ans. Oscillatory]**

3. In uniform motion an object travels equal _____ in _____ interval of time. **[Ans. distances, equal]**

4. The actual path covered by a body is called _____. **[Ans. distance]**

5. Displacement is the _____ distance covered by a body. **[Ans. shortest]**

6. The motion of the bus is _____ motion. **[Ans. non-uniform]**

7. Rate of change of displacement is _____. **[Ans. velocity]**

8. Speed is a _____ quantity whereas velocity is a _____. **[Ans. scalar, vector]**

9. If final velocity is less than initial velocity the acceleration is _____. **[Ans. negative]**

10. If final velocity is equal to initial velocity the value of acceleration is _____. **[Ans. zero]**

11. The slope of distance time graph becomes steeper & steeper the speed _____. **[Ans. increases]**

12. A straight line parallel to x-axis in velocity time graph, it represents the object moves in _____. **[Ans. uniform velocity]**

13. From v–t graph _____ can be calculated. **[Ans. displacement]**

14. _____ measures the instantaneous speed of the automobile. **[Ans. Speedometer]**

15. Slope of velocity time graph gives _____. **[Ans. acceleration]**

16. The value of acceleration for a body at rest is _____. **[Ans. zero]**

17. At the highest pount, when a body is thrown vertically upwards, the velocity is _____. **[Ans. zero]**

18. A body moves in a circular pattern the _____ of velocity does not change but _____ changes. **[Ans. magnitude, direction]**

19. When a body moves in a circular pattern _____ acceleration is directed radially towards the centre of the circle. **[Ans. centripetal]**

20. The separation of cream from milk an example for the application of _____. **[Ans. centrifugal]**

21. Consider an object is rest at position x = 20m. Then its displacement – time graph will be straight line _____ to the time axis. **[Ans : Parallel]**

III. State whether true or false. If false, correct the statement :

1. Displacement can be zero but distance never.

Ans. True.

2. Time is a vector quantity.

Ans. False.

Correct statement : Time is a **scalar** quantity.

3. Displacement magnitude can be grater than distance travelled by the object.

Ans. True.

4. If the velocity of the body decreases with time the acceleration is negative and the motion is called decelerated motion.

Ans. True.

5. Acceleration is a scalar.

Ans. False.

Correct statement : Acceleration is a **vector**.

6. The area of the velocity time graph gives displacement of the body.

Ans. True.

7. Motion & rest are relative terms.

Ans. True.

8. An object can be moving with uniform speed but variable acceleration.

Ans. True.

9. Slope of distance-time graph indicates the speed.

Ans. True.

10. It is possible to have object moving with uniform velocity but non-uniform acceleration.

Ans. True.

11. It is possible to have object moving with uniform speed but variable acceleration.

Ans. False.

Correct statement : It is possible to have object moving with uniform speed but **constant** acceleration.

12. The force experienced by a boy in the merry-go-round is a centripetal force.

Ans. **False.**

Correct statement : The force experienced by a boy in the merry-go-round is a **centrifugal** force.

13. The initial velocity of a freely falling object is zero as it is released from rest.

Ans. **True.**

IV. Assertion and Reason Type Questions :

(a) If both assertion & reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion & reason are true but the reason is not correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If assertion & reason both are false.
(e) If assertion is false but reason is true.

1. **Assertion** : A body can have acceleration even if its velocity is zero at a given instant of time.

Reason : A body is momentality at rest when it reverses its direction of motion.

[Ans. (a) Both assertion & reason are true and the reason is the correct explanation of the assertion]

2. **Assertion** : If the displacement of the body is zero, the distance covered by it may not be zero.

Reason : Displacement is a vector & distance is a scalar quantity.

[Ans. (a) Both assertion & reason are true and the reason is the correct explanation of the assertion]

3. **Assertion** : An object can have constant speed but variable velocity.

Reason : Speed is a scalar but velocity is vector.

[Ans. (a) Both assertion & reason are true and the reason is the correct explanation of the assertion]

4. **Assertion** : The speed of a body can be Negative.

Reason : If the body is moving in the opposite direction of positive motion, then its speed is Negative. **[Ans. (d) Assertion & reason both are false]**

5. **Assertion** : The position - time graph of a uniform motion in one dimension of a body can have Negative slope

Reason : When the speed of body decreases with time then, position-time graph of the moving body has Negative slope.

[Ans. (c) Assertion is true but reason is false]

6. **Assertion** : A positive acceleration of a body can be associated with slowing down of the body.

Reason : Acceleration is a vector.

[Ans. (b) Both assertion & reason are true but the reason is not correct explanation of the assertion]

7. **Assertion** : A negative acceleration of a body can be associated with speeding up of the body.

Reason : Increase in speed of a moving body is independent of its direction of motion.

[Ans. (b) Both assertion & reason are true but the reason is not correct explanation of the assertion]

8. **Assertion** : When a body is subjected to an uniform acceleration, it is always move in a straight line.

Reason : Motion may be straight line motion or circular motion.

[Ans. (e) Assertion is false but reason is true]

9. **Assertion** : Position-time graph of a stationary object is a straight line parallel to time axis.

Reason : For a stationary object, position does not change with time.

[Ans. (a) Both assertion & reason are true and the reason is the correct explanation of the assertion]

10. **Assertion** : The slope of distance-time graph of a body moving with high speed is steeper than slope of distance -time graph of a body with low velocity.

Reason : Slope of distance-time graph = speed of the body.

[Ans. (a) Both assertion & reason are true and the reason is the correct explanation of the assertion]

V. Answer briefly :

1. What is centripetal acceleration and centripetal force?

Ans. When a body moves in a circular pattern the acceleration is directed radially towards the centre of the circle.
The force causing this acceleration is also directed towards the centre of the circle and it is called centripetal force.

2. Find the magnitude of centripetal force.

Ans. Consider an object of mass m, moving along a circular path of radius r, with a velocity v, its centripetal acceleration is given by

$$a = v^2 / r$$

Hence, the magnitude of centripetal force is given by,

$$F = \text{mass} \times \text{centripetal acceleration}$$

$$F = mv^2 / r$$

3. What is centrifugal force? Give examples.

Ans. Force acting on a body away from the centre of circular path is called centrifugal force. Thus centrifugal force is in a direction opposite to the direction of centripetal force. Its magnitude is same as that of centripetal force.

Example : Spin dryer of a washing machine, ride on a merry-go-round.

4. When an object is thrown upwards, what is true of velocity and acceleration at the highest point of motion of the object?

Ans. (i) Velocity becomes zero

(ii) Acceleration remains same as g.

5. Name the two quantities, the slope of whose graph gives (i) speed (ii) acceleration.

Ans. (i) Distance – Time

(ii) Speed – Time

6. Define Average speed.

Ans. It is the total distance travelled divided by the total time taken to cover this distance.

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{total time taken}}$$

7. What do you infer if

(i) Distance - time graph is straight line.

(ii) Velocity time graph is curved.

(iii) Displacement time is zig zag.

Ans. (i) Speed is constant.

(ii) Acceleration is not uniform.

(iii) Non uniform velocity.

8. Give the formula for each.

(i) Relation between initial, final velocity, acceleration and displacement in a uniformly accelerated straight line motion.

(ii) Relation between initial, final velocity, acceleration & time in a uniformly accelerated straight line motion.

(iii) Relation between initial velocity, acceleration, displacement and time.

Ans. (i) Relation between initial, final velocity, acceleration & displacement in a uniformly accelerated straight line motion. $v^2 = u^2 + 2as$

(ii) Relation between initial, final velocity, acceleration & time in a uniformly accelerated straight line motion. $v = u + at$

(iii) Relation between initial velocity, acceleration, displacement and time. $s = ut + \frac{1}{2}at^2$

9. What is the difference between uniform acceleration and non - uniform acceleration?

Ans.

Sl. No.	Uniform Acceleration	Non - Uniform Acceleration
1.	It is the acceleration in which the object changes its velocity with equal intervals of time.	It is the acceleration in which the object changes its velocity with unequal intervals of time.
2.	eg. The motion of a ball rolling down.	A car travels 2 km in 1st hour, 3 km in 2nd hour and 3.5 km in 3rd hour.

11. Define Acceleration.

Ans. Acceleration is the rate of change of velocity with respect to time or it is the rate of change of velocity in unit time. It is a vector quantity. The SI unit of acceleration is ms^{-2}.

VI. Paragraph Questions :

1. Define acceleration and state its SI unit for motion along a straight line, when do we consider the acceleration to be (i) positive (ii) negative? Give an example of a body in uniform acceleration.

Ans. Acceleration is the rate of change of velocity with respect to time or it is the rate of change of velocity in unit time. It is a vector quantity. The SI unit of acceleration is ms^{-2}.

$$\text{Acceleration} = \text{Change in velocity/time}$$
$$= \text{(Final velocity – initial velocity)/time}$$
$$a = \frac{v-u}{t}$$

If $v > u$, then 'a' is positive. If final velocity is greater than initial velocity, the velocity increase with time, the value of acceleration is positive.
If $v < u$, then a is negative. If final velocity is less than initial velocity
Example : The motion of a freely falling body and vertically thrown up body are the examples of uniform acceleration.
The motion of ball rolling down on an inclined plane is another example.

2. Distinguish between uniform motion and non uniform motion.

Ans.

Sl. No.	Uniform Motion	Non - Uniform Motion
1	An object is said to be in uniform motion if it covers equal distances in equal intervals of time.	If a body covers unequal distances in equal interval of time (or) equal distances in different interval of time
2	example of uniform motion 'train'	example of non - uniform motion 'bus'

3. Define uniform circular motion and give example of it. Why is it called accelerated motion?

Ans. When an object moves with constant speed along a circular path, the motion is called uniform circular motion.
When an object is moving with a constant speed along a circular path, the change in velocity is only due to the change in direction. Hence it is accelerated motion.
Example:

1. The earth moves around the sun in the uniform circular motion.
2. The moon moves in uniform circular motion around the earth.

4. When a body is said to be in (i) uniform acceleration (ii) non - uniform acceleration?

Ans. (i) A body is said to be in uniform acceleration if it travels in a straight line and its velocity increases or decreases by equal amounts in equal time intervals.

(ii) A body is said to be in non-uniform acceleration if the rate of change of its velocity is not constant i.e. differs in different time intervals.

6. What remains constant in uniform circular motion? And what changes continuously in uniform circular motion?

Ans. (i) Speed remains constant in uniform circular motion.

(ii) Velocity changes continuously in uniform circular motion.

Problems

1. A bus speed decreases from 50 km/h to 40 km/h in 3s, find the acceleration of the bus.

Ans.

$$\text{Initial speed } (u) = 50 \text{ km/h} = \frac{50 \times 1000\text{m}}{3600 \text{ sec.}} = \frac{250}{18} \text{ m/s}$$

$$\text{Final speed } (v) = 40 \text{ km/h} = \frac{40 \times 1000\text{m}}{3600 \text{ sec}} = \frac{200}{18} \text{ m/s}$$

$$\text{Time taken } (t) = 3\text{s}$$

$$v = u + at$$

$$\therefore a = \frac{v-u}{t} = \frac{-50}{18 \times 3} = -0.925 \text{ ms}^{-2}$$

(Negative) acceleration $= -0.925 \text{ms}^{-2}$

2. A car starting from rest moves with uniform acceleration of 0.2 ms^{-2} for 3 min. Fine the (a) speed acquired (b) the distance travelled.

Ans.

Initial speed $(u) = 0$ m/s

Acceleration $(a) = 0.2 \text{ ms}^{-2}$

Time taken $(t) = 3 \text{ min} = 3 \times 60 = 180$ s

Final velocity $(v) = ?$

Distance covered$(s) = ?$

$v = u + at = 0 + 0.2 \times 180 = 36$ m/s

$\boxed{v = 36 \text{ m/s}}$

$s = ut + \frac{1}{2} at^2 = 0 + \frac{1}{2} \times 0.2 \times (180)^2$

$= 0.1 \times 32400 = 3240$ m

$\boxed{s = 3240 \text{ m}}$

3. A train is travelling at a speed of 90 kmh^{-1}. Brakes are applied so as to produce a uniform acceleration of –0.5 ms^{-2}, find how far the train will go before it is brought to rest.

Ans.

$$\text{Initial velocity of train } (u) = 90 \text{ km/h} = \frac{90,000\text{m}}{3,600 \text{ sec}} = 25 \text{ ms}^{-1}$$

Final velocity $(v) = 0 \text{ ms}^{-1}$

Acceleration $(a) = -0.5 \text{ ms}^{-2}$

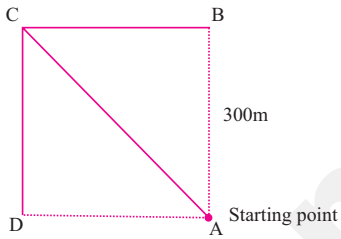
$v^2 = u^2 + 2as$

$\Rightarrow s = (v^2 - u^2) / 2a = (0^2 - 25^2) / -(2 \times 0.5)$

$$s = \frac{-625}{-1} = 625 \text{ m}$$

$\boxed{s = 625 \text{ m}}$

4. In a long distance race the athletes were expected to take four rounds of the track such that the line of finish was same as the line of start. Suppose the length of the track was 300m,



(i) What is the total distance to be covered by the athletes?

(ii) What is the total displacement of the athletes when they touch the finish line?

(iii) Is the motion of the athletes uniform or non-uniform?

(iv) Is the displacement & distance moved by athlete at the end of the race equal?

Ans.

(i) Total distance covered = $4 \times 300 = 1200$ m

(ii) Displacement = 0 [final position – initial position]

(iii) Non - uniform.

∵ the direction of motion is changing while running on the track.

(iv) Both are not equal.

5. Ram swims in a 80m long swimming pool. He covers 160m in 1 min by swimming from one end to the other and back along the same straight pattern. Find the average speed and average velocity.

Ans.

Total distance = 160m

Total displacement = 0

Time taken (t) = 1 min = 60s

$$\text{Average speed } (s_{average}) = \frac{\text{total distance}}{\text{total time taken}}$$

$$s_{average} = \frac{160}{60} = 2.66 \text{ m/s}$$

$$\text{Average velocity } (v_{average}) = \frac{\text{total displacement}}{\text{total time taken}} = \frac{0}{60} = \mathbf{0 \text{ m/s.}}$$

6. A bus from Chennai travels to Trichy passes 100 km, 160 km at 10.15 am, 11.15 am respectively. Find the average speed of the bus during 10.15 - 11.15 am.

Ans. The distance covered between 10.15am & 11.15 am = 160 – 100

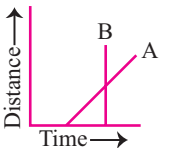
= 60 km

The time interval = 1 h

$$\text{Average speed} = \frac{60}{1}$$

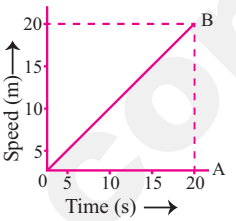
= **60 km/h**

7. In a distance - time graph of two objects A & B, which object is moving with greater speed when both are moving?



Ans. Object B makes a longer angle with the time - axis. Its slope is greater than the slope of the object A. Thus the speed of B is greater than that of A.

8. Find the distance covered by a particle during the time interval t = 0 to t = 20s for which the speed - time graph is shown in figure.



Ans. Distance covered in the time interval 0 to 20s is equal to the area of the triangle OAB.

Area of Δ OAB. ½ × base × height

½ × 20 × 20 = **200 ms^{-1}**

9. A car moves 30 km in 30 min and the next 30 km in 40 min. Calculate the average speed for the entire journey.

Ans. Total time taken = 30 + 40 = 70 min. = $\frac{70}{60}$ hour

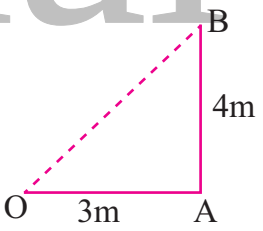
Total distance = 30 + 30 = 60 km

Average speed, $v_{average}$ = $\frac{\text{Total distance}}{\text{Time taken}} = \frac{60}{\frac{70}{60}} = \frac{3600}{70}$ = **51.4 km/h**

10. A boy travels a distance of 3m due east and then 4m due north.

(a) How much is the total distance covered?

(b) What is the magnitude of the displacement?



Ans. (a) Total distance covered = 3 + 4 = 7m

(b) Net displacement : OB^2 = $OA^2 + AB^2$

= $3^2 + 4^2$

OB^2 = $25m^2$

∴ OB = 5m

Net displacement = **5m**

11. During an experiment, a signal from a spaceship reached the ground station in five seconds. What was the distance of the spaceship from the ground station? The signal travels at the speed of light that is 3 × 10^8 ms^{-1}.

Ans. Time taken = 5 seconds.

Speed of signal u = 3 × 10^8 m/s

Distance = ?

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

∴ Distance = Speed × Time

Distance = 3 × 10^8 × 5 = **15 × 10^8 m.**

12. A train travelling at a speed of 90kmph. Brakes are applied so as to produce a uniform acceleration of –0.5 ms^{-2}. Find how far the train will go before it is brought to rest?

Ans. Here we have

$$\text{Initial velocity, } u = 90 \text{ km/h}$$
$$= \frac{90\times1000\text{m}}{60\times60\text{s}} = 25\text{m/s}$$
$$\text{Final velocity, } v = 0$$
$$\text{Acceleration, } a = -0.5 \text{ m/s}^2$$
$$\text{Thus, distance travelled} = ?$$
$$\text{We know that, } v^2 = u^2 + 2as$$
$$\Rightarrow 0 = 25 \text{ m/s}^2 + 2 \times -0.5 \text{ m/s}^2 \times s$$
$$= 625 \text{ m}^2/\text{s}^2 - 1\text{m/s}^2 \times s$$
$$\Rightarrow 1 \text{ ms}^{-2}s = 625 \text{ m}^2s^{-2}$$
$$s = \frac{625\text{m}^2\text{s}^{-2}}{1\text{ms}^{-2}} = \mathbf{625\ m}$$

$\therefore$ Train will go 625m before it is brought to rest

13. The adjacent diagram shows the velocity time graph of a body.

a) During what time interval is the motion of the body accelerated?

Ans. At 0 to 4 second

b) Find the acceleration in the time interval mentioned in part 'a'.

Ans. $a = \frac{v-u}{t} = \frac{30-0}{4} = \mathbf{7.5\ m/s^2}$

c) What is the distance travelled by the body in the time interval mentioned in part 'a'?

Ans. Distance travelled = Area under the graph

= Area of the triangle = ½ bh

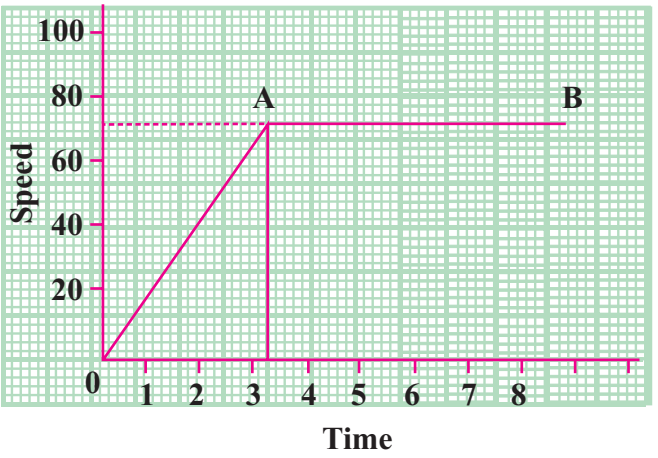
= ½ × 4 × 30 = **60m**

14. The following graph shows the motion of a car. What do you infer from the graph along OA and AB? What is the speed of the car along AB and what time it reached this speed.

a) What do you infer from the graph along OA and AB

Ans. Graph along OA : The car travels with uniform acceleration and uniform motion.

Graph along AB : The car travels with constant speed and unaccelerated motion.



b) What is the speed of the car along AB?

Ans. Along AB : The speed of the car is constant.

From the graph, it seems the speed along AB is 72 km/hr.

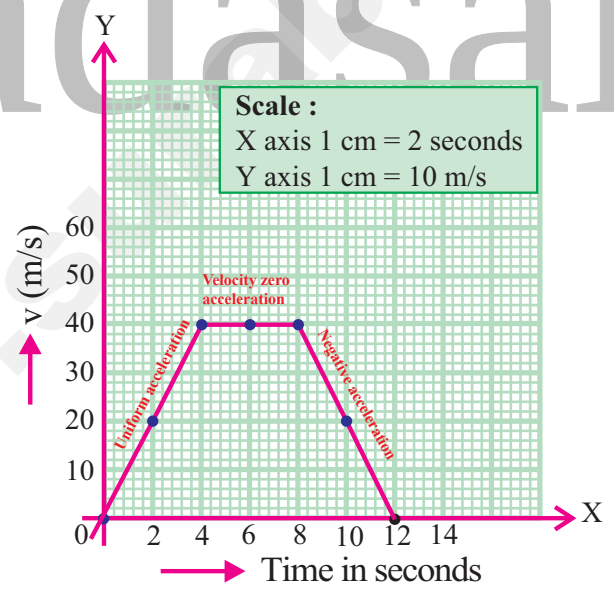
c) What time it reached this speed

Ans. It reaches this speed after 3.2 hours, that is, 3 hours, 12 minutes.

15. From the following table, check the shape of the graph.

Time (s)	0	2	4	6	8	10	12
Velocity (ms^{-1})	0	20	40	40	40	20	0

Ans.



UNIT
03

FLUIDS

LEARNING OBJECTIVES

After completing this lesson, students will be able to :

- Define pressure in terms of weight.
- Explain the variation of pressure with respect to depth in a fluid.
- Learn the fact that water exerts an upward force on objects immersed in it.
- Recall and state the Archimedes' principle.
- Calculate density when pressure and altitude are given.
- Learn the formula for finding the relative density of an object and apply the same.
- Understand the behaviour of floating bodies.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. The size of an air bubble rising up in water

(a) decreases (b) increases
(c) remains same (d) may increase or decrease

[Ans : (b) increases]

2. Clouds float in atmosphere because of their low

(a) density (b) pressure
(c) velocity (d) mass **[Ans : (a) density]**

3. In a pressure cooker, the food is cooked faster because

(a) increased pressure lowers the boiling point.
(b) increased pressure raises the boiling point.
(c) decreased pressure raises the boiling point.
(d) increased pressure lowers the melting point.

[Ans : (b) increased pressure raises the boiling point]

4. An empty plastic bottle closed with an airtight stopper is pushed down into a bucket filled with water. As the bottle is pushed down, there is an increasing force on the bottom. This is because,

(a) more volume of liquid is displaced.
(b) more weight of liquid is displaced.
(c) pressure increases with depth.
(d) All the above. **[Ans : (c) pressure increases with depth]**

II. Fill in the blanks :

1. The weight of the body immersed in a liquid appears to be _____ than its actual weight **[Ans : less]**

2. The instrument used to measure atmospheric pressure is_____. **[Ans : Barometer]**

3. The magnitude of buoyant force acting on an object immersed in a liquid depends on _____ of the liquid. **[Ans : density]**

4. A drinking straw works on the existence of _____. **[Ans : atmospheric pressure]**

III. State whether true or false. If false, correct the statement :

1. The weight of fluid displaced determines the buoyant force on an object.

Ans. True.

2. The shape of an object helps to determine whether the object will float or not.

Ans. False.

Correct statement : The **density** of an object helps to determine whether the object will floater sink.

3. The foundations of high-rise buildings are kept wide so that they may exert more pressure on the ground.

Ans. False.

Correct statement : They may exert **less** pressure on the ground.

4. Archimedes' principle can also be applied to gases.

Ans. True.

5. Hydraulic press is used in the extraction of oil from oil seeds.

Ans. True.

IV. Match the following :

			Ans.			
Density	-	hρg		Density	-	$\frac{\text{Mass}}{\text{Volume}}$
1 gwt	-	Milk		1 gwt	-	980 dyne
Pascal's law	-	$\frac{\text{Mass}}{\text{Volume}}$		Pascal's law	-	Pressure
Pressure exerted by a fluid	-	Pressure		Pressure exerted by a fluid	-	hρg
Lactometer	-	980 dyne		Lactometer	-	Milk

V. Answer in brief :

1. On what factors the pressure exerted by the liquid depends on?

Ans. The pressure exerted by the liquid depends on the

(i) Depth (ii) Density of the liquid

(iii) Acceleration due to gravity.

2. Why does a helium balloon float in air?

Ans. Helium balloon floats in air because helium gas is less dense than air.

3. Why it is easy to swim in river water than in sea water?

Ans. The question itself is wrong. It is easier to swim in **sea water** than in the river water. It is because sea water has (i) greater density and (ii) larger buoyant force than river water.

4. What is meant by atmospheric pressure?

Ans. The pressure exerted by the weight of the atmosphere is called atmospheric pressure.

5. State Pascal's law.

Ans. Pascal's law : The external pressure applied on an incompressible liquid is transmitted uniformly throughout the liquid.

VI. Answer in detail :

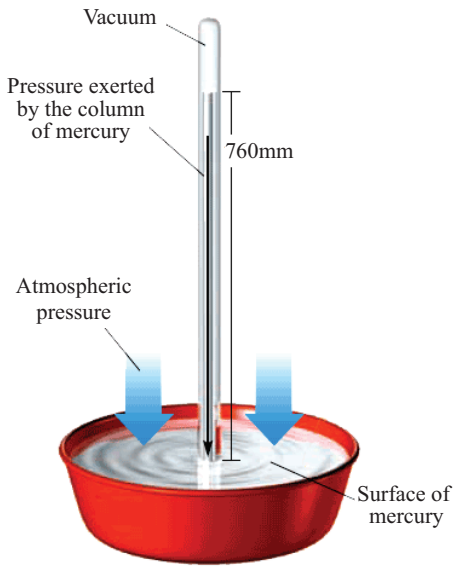
1. With an appropriate illustration prove that the force acting on a smaller area exerts a greater pressure.

Ans.

1. Take a nail. It has two ends. One end is sharp and other end is a bulged head.
2. We usually keep the pointed end on the wall or wood and hammer on the bulged head.
3. So very small area creates a large pressure.
4. Thus the nail penetrates into the wall or wood.

2. Describe the construction and working of mercury barometer.

Ans.



Mercury Barometer

1. It is designed by Torricelli.

Construction :

2. Mercury Barometer consists of long glass tube closed at one end and opened at other.
3. Mercury filled through open end and close that end by thumb and open it after immersing it into a trough of mercury.

Working :

4. The Barometer works by balancing the mercury in the glass tube against the outside air pressure.
5. If air pressure increases, it pushes more of the mercury up into the tub.
6. If air pressure decreases, more mercury drains from the tub.
7. As vaccum cannot exert pressure, Mercury in the tube provides a precise measure of air pressure which is called atomospheric pressure.
8. It is used in a laboratory or weather station.

3. How does an object's density determine whether the object will sink or float in water?

Ans. 1. Whether an object sinks or floats is determined by density of the object compared with density of liquid.

2. If density of object is less than the density of the liquid, the object will float.
(e.g) less density object, **wood** will float on water.
3. If density of object is more than the density of liquid, the object will sink.
(e.g) more dense object, **stone** sinks into water.

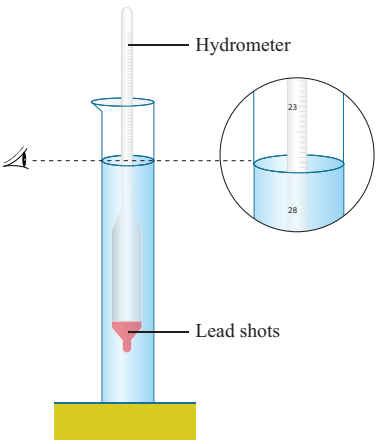
4. Explain the construction and working of a hydrometer with diagram.

Ans. Purpose :

To measure density (or) relative density of liquid.

Principle :

The weight of the liquid displaced by the immersed portion of the hydrometer is equal to the weight of the hydrometer. [Flotation principle].



Construction

Lower end of hydrometer :

A cylindrical stem having a spherical bulb which partially filled with lead shots or mercury which helps to float or stand vertical in liquids.

Upper end of hydrometer :

A narrow tube has markings so that relative density of liquids can be read off directly.

Working :

1. Liquid to be tested is poured into the glass jar.
2. The hydrometer is gently lowered into the liquid until it floats freely.
3. The reading against the level touching the tube gives the relative density of the liquid.

5. State the laws of flotation.

Ans. Laws of flotation

1. The weight of a floating body in a fluid is equal to the weight of the fluid displaced by the body.
2. The centre of gravity of the floating body and the centre of buoyancy are in the same vertical line.

VII. Assertion and Reason :

Mark the correct answer 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) If assertion is true but reason is false.
(d) If assertion is false but reason is true.

1. Assertion (A) : To float, body must displace liquid whose weight is equal to the actual weight.

Reason (R) : The body will experience no net downward force in that case.

[Ans : (a) Both assertion and reason are true and reason is the correct explanation of assertion]

2. Assertion (A) : Pascal's law is the working principle of a hydraulic lift.

Reason (R) : Pressure is thrust per unit area.

[Ans : (b) Both assertion and reason are true but reason is not the correct explanation of assertion.]

Reason : Pascal's law is the working principle of Hydraulic lift. In Hydraulic lift, applied pressure is transmitted **uniformly and multiplied** through out the system.

VIII. Numerical Problems :

1. A block of wood of weight 200 g floats on the surface of water. If the volume of block is 300 cm^3, calculate the upthrust due to water.

Ans. Weight of wood block, m = 200 g
Volume of the wood block, V = 300 cm^3.
Upthrust = Weight of the fluid displaced
= Volume of the wood block
Upthrust = **300 cm^3**

2. Density of mercury is 13600 kg m^{-3}. Calculate the relative density.

Ans. Density of Mercury = 13600 kg m^{-3}
Density of water at 4°C = 1000 kg m^{-3}

$$\text{Relative density} = \frac{\text{Density of mercury}}{\text{Density of water at } 4^{\circ}\text{C}}$$

$$= \frac{13600\,\text{kg m}^{-3}}{1000\,\text{kg m}^{-3}}$$

Relative Density = **13.6**

3. The density of water is 1 g cm^{-3}. What is its density in S.I. units?

Ans. Density of water in SI units = **1000 kg / m^3.**

4. Calculate the apparent weight of wood floating on water if it weighs 100g in air.

Ans. Mass of wood = 100 g.

As the wood floats on the water, water will not be displaced.

So, actual weight of wood is equal to Apparent weight of wood.

IX. Higher Order Thinking Skills :

1. How high does the mercury barometer stand on a day when atmospheric pressure is 98.6 kPa?

Ans. Pressure of Atmosphere Patm = 98.6 kPa.

Density of Mercury, ρ_{Hg} = 13.6×10^3 kg/cm^3

Acceleration due to gravity, g = 9.8 m/s^2

Pressure, P_{atm} = $h \times \rho_{Hg} \times g$

$$h = \frac{P_{atm}}{\rho_{Hg} \times g} = \frac{98.6 \text{ kPa}}{(13.6\times10^3)\times(9.8 \text{ ms}^{-2})}$$

$$= \frac{98.6 \times 10^3 \text{Pa}}{(13.6\times10^3)\times(9.8 \text{ ms}^{-2})}$$

Height of Barometer, h = **0.7397 m = 739.7 mm**

2. How does a fish manage to rise up and move down in water?

Ans. (i) Fish manages to rise up in water by reducing its density by filling oxygen in bladder via the gills. Thus volume will be increased to support its ascending motion.

(ii) Fish moves down by decreasing its volume by releasing oxygen from bladder. Thus volume will be decreased so it will sink in the water.

3. If you put one ice cube in a glass of water and another in a glass of alcohol, what would you observe? Explain your observations.

Ans. Ice cube in water : As the density of ice cube is less than water, the ice cube floats in water.

Ice cube in alcohol : As the density of ice cube is greater than alcohol, the ice cube will sink in alcohol.

[Note : Density : Water = 1.00, Ice cube = 0.917, Alcohol = 0.78].

4. Why does a boat with a hole in the bottom would eventually sink?

Ans. A boat with a hole in the bottom eventually sinks due to :

(1) The water entered through a hole will increase the weight of boat.

(2) The boat becomes heavier so it cannot displace more water. So the boat sinks.

Intext Activities

ACTIVITY - 1

Stand on loose stand. Your feet go deep into the sand. Now, lie down on the sand. What happens? You will find that your body will not go that deep into the sand. Why?

Aim :

To demonstrate the effect of thrust

Materials Required :

Sand

Procedure :

1. First, you stand on the sand on your feet.
2. Lie down on the sand with your whole body.

Observation :

1. While standing on your feet on sand, your feet go deep into the sand.
2. While lying down with your body on sand, your body will not go deep into the sand.

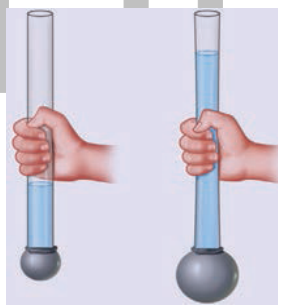
Conclusion :

1. Pressure depends upon the area on which it acts.
2. The effect of thrust on sand is larger while standing than lying.

[End of the activity]

ACTIVITY - 2

Take a transparent plastic pipe. Also take a balloon and tie it tightly over one end of the plastic pipe. Pour some water in the pipe from the top. What happens? The balloon tied at the bottom stretches and bulges out. It shows that the water poured in the pipe exerts a pressure on the bottom of its container.



Aim : To demonstrate that water exerts pressure on the bottom of the container.

Materials Required : Plastic pipe, Balloon, Water.

Procedure :

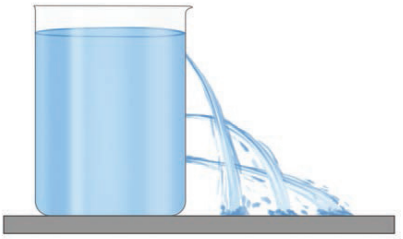
1. Take a transparent plastic pipe and a balloon.
2. Tie the balloon tightly over one end of plastic pipe.
3. Keep the pipe with the closed end at the bottom.
4. Pour some water in the pipe from the top.

Observation : The balloon tied at the bottom stretches and bulges out.

Conclusion : Water poured in the pipe exerts pressure on the bottom of its container.

[End of the activity]

ACTIVITY - 3



Take a large plastic can. Punch holes with a nail in a vertical line on the side of the can as shown in figure. Then fill the can with water. The water may just dribble out from the top hole, but with increased speed at the bottom holes as depth causes the water to squirt out with more pressure.

Aim :

To demonstrate that pressure increases as depth increases.

Materials Required :

1. Large plastic can.
2. A sharp nail.

Procedure :

1. Take a large plastic can.
2. Punch holes with a nail in a vertical line up on the side of can every inch or several centimetres.

Observation :

1. Water dribbes out from top hole.
2. Water from bottom hole flows with increased speed.

Conclusion :

Depth causes water to squirt out with more pressure.

[End of the activity]

ACTIVITY - 4

Take two liquids of different densities say water and oil to a same level in two plastic containers. Make holes in the two containers at the same level. What do you see? It can be seen that water is squirting out with more pressure than oil. This indicates that pressure depends on density of the liquid.

Aim :

To demonstrate pressure depends on density of the liquid.

Materials Required :

1. Two plastic containers, 2. Water, 3. Oil (Both same volume), 4. Sharp nail

Procedure :

1. Take a water and oil to a same level in two plastic containers.
2. Make a hole at same level in two containers.

Observation :

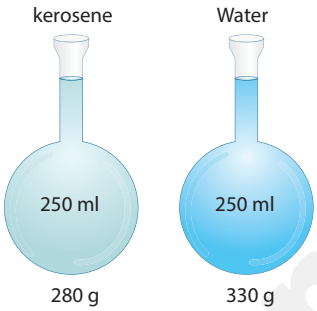
Water squirts out with more pressure than that of oil.

Conclusion :

Pressure depends on density of the liquid.

[End of the activity]

ACTIVITY - 5



Take two identical flasks and fill one flask with water to 250 cm^3 mark and the other with kerosene to the same 250 cm^3 mark. Measure them in a balance. The flask filled with water will be heavier than the one filled with kerosene. Why? The answer is in finding the mass per unit volume of kerosene and water in respective flasks.

Aim :

To prove that density of a substance is the mass per unit volume of given substance.

Materials Required :

1. Two identical flasks.
2. Water
3. Kerosene (same volume as water)

Procedure :

1. Take two identical flasks.
2. Fill one flask with water to 250 cm^3 mark.
3. Fill the other flask with kerosene to same 250 cm^3 mark.
4. Measure both flasks in balance separately.

Observation :

The flask filled with water will be heavier than that of the flask filled with kerosene.

Conclusion :

In the above activity, we know that

1. Both water and kerosene have same volume (i.e.) 250 cm^3.
2. The density of the water 1g / cm^3 and density of kerosene is 0.8g / cm^3
3. Density = $\frac{\text{mass}}{\text{volume}}$, therefore mass = Density × volume.
   Hence mass of water = 1g / cm^3 × 250 cm^3 = 250g
   mass of kerosene = 0.8 g / cm^3 × 250 cm^3 = 200g
4. Even though, water and kerosene have same volume, they have different densities. So water and kerosene have different masses.
5. Water has more mass than kerosene.
   Hence, we proved that density of the substance is the mass per unit volume of the substance.

[End of the activity]

Additional Questions

I. Choose the correct answer :

1. Intermolecular forces are stronger in _____

(a) gases (b) liquids
(c) solids (d) all the above **[Ans : (c) solids]**

2. Water (or) liquids exert pressure on

(a) Upward direction (b) Downward direction
(c) Lateral direction (d) All the above **[Ans : (d) All the above]**

3. **The pressure does not depend upon**

(a) Depth (b) Area
(c) Density (d) Acceleration due to gravity

[Ans : (b) Area]

4. **Fluids in general are**

(a) Gases (b) Liquids
(c) Gases or Liquids (d) None of these **[Ans : (c) Gases or Liquids]**

5. **Scuba divers wear special suits to withstand**

(a) Low pressure (b) High pressure
(c) Low temperature (d) High temperature **[Ans : (b) High pressure]**

6. **To find out relative density of the substance, with respect to density of water at _____ C is taken.**

(a) 4° (b) 0° (c) 100° (d) 60°

[Ans : (a) 4°]

7. **Density Bottle is also called as**

(a) Saccharometer (b) Lactometer
(c) Pycnometer (d) Barometer **[Ans : (c) Pycnometer]**

8. **An object completely immersed in fluid displaces its own volume of fluid.**

(a) Floatation principle (b) Principle of buoyancy
(c) Pascal's law (d) Archimedes principle

[Ans : (d) Archimedes principle]

9. **A solid floats in liquid with a portion of it being submerged. Then**

(a) The liquid exerts an upthrust equal to weight of the solid
(b) The weight of the dispersed liquid is equal to the weight of solid
(c) Solid exerts a force equal to its weight on liquid

Choose correct statements

(A) a & b (B) a & c (C) b & c (D) All of these

[Ans : (A) a & b]

10. **The principle of "Hydrostatic balance" was devised by**

(a) Torricelli (b) Pascal (c) Archimedes (d) Newton

[Ans : (c) Archimedes]

11. **Saccharometer is used to measure the density of _____ in a liquid.**

(a) Milk (b) Sugar (c) Alcohol (d) Ether

[Ans : (b) Sugar]

12. **Most buoyant objects are those with relatively**

(a) high volume (b) higher mass
(c) low density (d) less viscosity

(A) a & b (B) a & c (C) b & c (D) b & d

[Ans : (B) a & c]

13. **If there were no gravity, which of the following will not be there for fluid? (HOTS)**

(a) Viscosity (b) Density
(c) Pressure (d) upthrust **[Ans : (d) upthrust]**

14. **Human lung is well adopted to breath at a pressure of _____ kPa.**

(a) 106.7 (b) 101.3 (c) 98.4 (d) 33.7
[Ans : (b) 101.3]

15. **Petroleum based products float on the surface of water. This is due to their low _____.**

(a) volume (b) density (c) specific gravity (d) viscosity
(A) a & b (B) a & c (C) a & d (D) b & c
[Ans : (D) b & c]

II. Fill in the blanks :

1. It is easy to compress a gas whereas liquids are_____ **[Ans : Incompressible]**

2. The net force in particular direction is called _____ **[Ans : Thrust]**

3. All flowing substances, both liquids and gases are called_____. **[Ans : Fluids]**

4. The air pressure at sea level is referred as _____ **[Ans : Atmospheric pressure]**

5. The pressure in mines is _____ than sea level. **[Ans : Greater]**

6. _____ is the instrument used to measure the atmospheric pressure. **[Ans : Barometer]**

7. On each 1m^2 of surface, the force acting is _____ **[Ans : 1.013 kN]**

8. _____ is a device for measuring atmospheric pressure without the use of liquids.
[Ans : Aneroid Barometer]

9. Absolute Pressure is zero-referenced against a _____. **[Ans : Perfect vaccum]**

10. Psi stands for _____. **[Ans : Pascal per inch]**

11. A tyre pressure of 30psi is almost _____ the atmospheric pressure. **[Ans : Twice]**

12. The density of the substance is the _____ of a given substance.
[Ans : mass per unit volume]

13. Hydrometer is based on the principle of _____. **[Ans : Flotation]**

14. The upward force that is caused due to the pressure difference in liquid (or fluid) is called _____ .
[Ans : Buoyant force]

15. Hot air is _____ dense than ordinary air. **[Ans : less]**

16. The Lactometer works on the principle of _____ of milk. **[Ans : gravity]**

17. Icebergs and ships stay afloat due to _____. **[Ans : Buoyancy]**

18. Archimedes principle is the consequence of _____. **[Ans : Pascal's law]**

19. The point in which the force of buoyancy is supposed to act is known as _____.
[Ans : Centre of buoyancy]

20. The centre of gravity of the floating body and the centre of buoyance are in the same _____ line. **[Ans : Vertical]**

21. In a fluid, buoyant force exists because pressure at the _____ of an object is greater than the pressure at the top. **[Ans : bottom]**

III. Match the following :

(I)

1.	Lactometer	a)	Relative density
2.	Saccharometer	b)	Alcohol
3.	Alcoholometer	c)	Sugar
4.	Pyncometer	d)	Milk

Ans. 1 - d, 2 - c, 3 - b, 4 - a

(II)

1.	Hydraulic press	a)	Archimedes
2.	Cartesian Diver	b)	Floatation
3.	Hydrostatic Balance	c)	Pascal's law
4.	Hydrometer	d)	Buoyancy

Ans. 1 - c, 2 - d, 3 - a, 4 - b

IV. State whether true or false. If false, correct the statement :

1. The shape and size of the solids do not easily change.

Ans. True.

2. Liquid exerts pressure in the upward direction.

Ans. False.

Correct statement : Liquid exerts pressure in **all directions**.

3. The barometer works by balancing the Mercury in the glass tube along the outside air pressure.

Ans. False.

Correct statement : The barometer works by balancing the Mercury in the glass tube **against** the outside air pressure.

4. The absolute pressure is zero-referenced against atmospheric pressure.

Ans. False.

Correct statement : The absolute pressure is zero-referrenced against **perfect** vacuum.

5. The external pressure applied on an incompressible liquid is transmitted uniformly throughout the liquid.

Ans. True.

6. The correct lactometer reading is only obtained at the temperature of 60º C.

Ans. True.

7. If the buoyant force is less, the object will float.

Ans. False.

Correct statement : If the buoyant force is less, the object will **sink**.

8. If the volume of object is above the water surface, then the object is less densed.

Ans. True.

9. Upthrust = weight of the fluid displaced – apparent weight of the object.

Ans. False.

Correct statement : Upthrust = Weight of the fluid displaced – apparent **loss of weight of the object.**

10. Salt water provides less buoyant force than fresh water.

Ans. **False.**

Correct statement : Salt water provides **more buoyant force** than fresh water.

V. Very Short Answer Questions :

1. Differentiate Liquid from Gas.

Ans. It is easy to compress a Gas. Liquid is Incompressible.

2. What is the SI unit of pressure?

Ans. Newton per squaremeter (Nm^{-2}).

3. What are factors determining liquid pressure?

Ans. (i) Depth (b) (ii) Density of Liquid (□) (iii) Acceleration due to gravity (g).

4. Write the equation for pressure due to liquid column.

Ans. P = h□g ; P - Pressure, h- depth, ρ- density, g - Acceleration due to gravity.

5. What is referred as atmospheric pressure?

Ans. Air pressure at sea level is referred as atmospheric pressure.

6. Expand the abbreviation 'psi'.

Ans. Psi = Pascal per inch.

7. What are Force multipliers?

Ans. Hydraulic systems are known as force multipliers.

8. Write SI unit & symbol for density?

Ans. SI unit = kilogram per meter cube (kg / m^3).

Symbol = *rho* (ρ).

9. Where do we use lactometers?

Ans. In milk processing units and Dairies.

VI. Answer in brief :

1. What happen when pressure is increased in solids?

Ans. If pressure is increased in solids

(i) it experiences tension, (ii) it ultimately deforms (or) breaks.

2. How will you calculate fluid pressure?

Ans. Fluid pressure = $\frac{\text{Total Force exerted by the fluid}}{\text{Area over which the force is exerted}} = \frac{F}{A}$

3. How will you find the absolute pressure?

Ans. (1) For pressures higher than atmospheric pressure:

Absolute pressure = Atmospheric pressure + Gauge pressure.

(2) For pressures lower than atmospheric pressure:

Absolute pressure = Atmospheric pressure – Gauge pressure.

4. Why do Scuba divers wear special suits and equipment?

Ans. (1) Deap sea has pressure twice that of atmospheric pressure.

(2) At high pressure, parts of our body including blood vessels & soft tissues cannot withstand.

Hence they use special suits & equipments for protection.

5. Define : Relative Density.

Ans. Relative density of a substance is defined as ratio of density of substance to density of water at 4°C.

$$\text{Relative density} = \frac{\text{Density of substance}}{\text{Density of water at } 4^{\circ}\text{C}}.$$

6. Name different types of Hydrometers with their applications.

Ans.

S.No	Name of Hydrometer	Application (measuring)
1.	Lactometer	Density of milk
2.	Saccharometer	Density of sugar in a liquid
3.	Alcoholometer	Higher levels of alcohols in Spirits

7. What do you understand by the term "Buoyancy".

Ans. When a body partially or completely immersed in a liquid (fluid), pressure is more at the bottom and less at the surface in the liquid.

This Pressure difference causes an upward force called "Buoyant force". The phenonmenon is called 'Buoyancy'.

8. How do submarines sink and float in water?

Ans. Submarins change the level of floating by pumping in and pumping out water into its compartments.

9. Differentiate positive & negative buoyant.

Ans.

S.No	Positive Buoyant	Negative Buoyant
1.	Weight of the object is less than the amount of water displaced.	Weight of the object is more than the amount of water displaced.
2.	More buoyant force	Less Buoyant force.
3.	Object will float	Object will sink.

10. You have a bag of cotton and an iron bar, each indicating a mass of 100 kg when measured on a weighing machine. In reality, one is heavier than other. Can you say which one is heavier and why?

Ans. The bag containing iron bar is heavier than cotton.

Reason : Although both of them have same weight, the bag of iron bar has less volume so more dense compared to the bag of cotton which has more volume and less dense.

VII. Answer in detail :

1. Derive expression for Pressure due to Liquid column.

Ans. A tall beaker filled with water to form a liquid column

Area of cross section at bottom = A
Height of liquid column = h
Density of the liquid = ρ
Thrust at bottom of liquid column (F) = Weight of liquid.
$F = mg$ ...(1) ($\because$ m – mass of liquid)
Mass, $m = \rho \times V$ .....(2)
Volume of liquid column, V = Area of cross section (A) × height (h)
$V = A\,h$ ..... (3)
Substitute (3) in (2) $m = \rho\, Ah$ .....(4)
Substitute (4) in (1) $F = \rho\, Ahg$ .....(5)

$$\text{Pressure (P)} = \frac{\text{Thrust (F)}}{\text{Area (A)}} = \frac{\rho A\, h\, g}{A}$$

$\therefore$ **P = hρg** – This is the expression for pressure due to liquid column.

2. Describe the construction and working of Pycnometer.

Ans. Pycnometer (Density Bottle)

Purpose : To measure relative density.

Construction :

(1) Pycnometer consists of a ground glass stopper with a fine hole through it.
(2) When the bottle is filled and the stopper is inserted, the excess liquid rises through the hole and runs down outside the bottle.

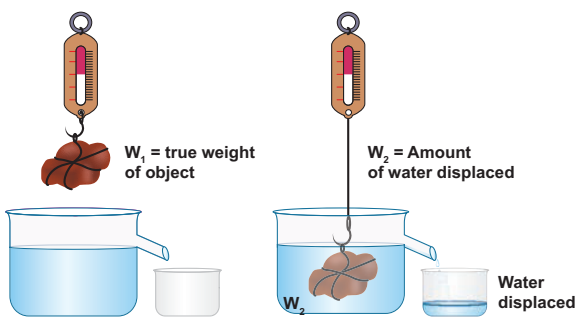
Working :

(1) The bottle will always contain the same volume of liquid at constant temperature.
(2) The density of the given volume of substance to the density of equal volume of referred substance is called relative density or specific gravity of the substance.

3. Explain Archimedes principle with example.

Ans. Principle :

A body immersed in a fluid experience a vertical upward buoyant force equal to the fluid it displaces.



Explanation :

(1) When a body is partially or completely immersed in a fluid at rest, it experiences an upthrust which is equal to the weight of the fluid displaced by it.

(2) Due to the upthrust, the body loses a part of its weight equal to upthrust.

Upthrust = Weight of the fluid displaced.
= Apparent loss of weight of the body.
Apparent weight of an object = True weight of object in air – upthrust.

4. Describe the purpose, principle and working of Lactometer.

Ans. Purpose : Lactometer is an instrument to check the purity of milk.

Principle : Gravity of milk.

Construction :

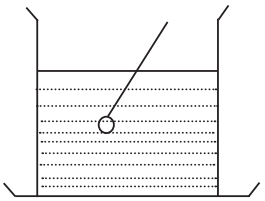
(1) Lactometer consists of a long graduated test tube with a cylindrical bulb.
(2) Cylindrical bulb has graduation from 15 at top and 45 at bottom, which filled with mercury.
(3) The test tube is filled with water.
(4) The air chamber causes the instrument to float.
(5) Mercury causes lactometer to sink up proper level and to float in upright position in the milk.
(6) There is a thermometer inside the lactometer that extends to upper part of test tube.

Working :

(1) The correct lactometer reading is only obtained at 60°C.
(2) Lactometer measures the cream (density) content of milk.
(3) Lactometer floats in milk, if milk has more cream content.
(4) The average reading of normal milk is 32.

VIII. Numerical Problems :

1. A vessel with water is placed on a weighing pan and it reads 600 g. Now a ball of mass 40 g and density is 0.80g / cm^3 is sunk into the water with a pin of neglible volume as shown in figure. The weighing pan will show the reading of .....?



Solution : Weight of vessel with water = 600 g
Mass of ball = 40 g
Density of bal = 0.80 g / cm^3
Volume of the ball = $\frac{\text{mass}}{\text{density}} = \frac{40}{0.80} = 50$ g
So, weight of vessel + volume of ball = 600 + 50 g
The weighing pan will show = 650 g
The weighing pan will show = **650 g**

2. The reading of a spring balance when a block is suspended from it in air is 60 newton. This reading is changed to 40 newton when the block is submerged in water. Calculate the specific gravity of block.

Solution : Weight of block in air = 60 newton

Loss of weight of block in water = 60 – 40 = 20 newton

$$\text{Relative density (or) specific gravity} = \frac{\text{Weight of block in air}}{\text{Loss of weight in water}}$$

$$= \frac{60 \text{ newton}}{20 \text{ newton}}$$

Specific gravity of block = **3**

3. The mass of a body is 4 kg and its volume is 500 cm^3. Find its relative density.

Solution : Mass of the body m = 4 kg = 4000 g

Volume of the body v = 500 cm^3

$$\therefore \text{ Density of the body} = \frac{\text{Mass (m)}}{\text{Volume (v)}}$$

$$= \frac{4000}{500}$$

$\therefore$ The relative density of the body = 8 g cm^{-3}

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

$$= \frac{8 \, g/cm^3}{1 \, g/cm^3}$$

$$= 8$$

Relative density of the body = **8**

4. Calculate the pressure produced by a force of 800 N acting on an area of 2.0 m^2.

Solution : Force = 800 N

Area = 2.0 m^2

$$\text{Pressure, P} = \frac{\text{Force}}{\text{Area}} = \frac{800}{2.0} = 400 \text{ Nm}^{-2}$$

Pressure P = **400 Nm^{-2}** (or) **400 Pa**

5. A swimming pool of width 9.0 m and length 24.0 m is filled with water of depth 3.0 m. Calculate the pressure on the bottom of the pool due to the water.

Solution : Width of the pool, b = 9.0 m

Length of the pool, l = 24.0 m

Depth of the pool, h = 3.0 m

Density of water, ρ = 1000 kg/m^3

Pressure due to column of Fluid, P = ρhg

Acceleration due to gravity, g = 9.8 m/s^2

Substituting the values, P = ρhg

P = (1000 kgm^{-3}) ×(3.0m) × (9.8 ms^{-2})

Pressure, P = 29400 kgm^{-1}s^{-2} ∵ 1Pa = 1 kgm^{-1}s^{-2}

∴ P = 29400 Nm^{-2}(or) 29400 Pa

6. A body of volume 100 cc is immersed completely in water contained in a jar. The weight of water and the jar before immersion of the body was 700 g. Calculate the weight of water and jar after immersion.

Ans. Volume of body completely immersed in water, V = 100 cc.

Weight of water and jar before Immersion = 700 g.

Volume of jar immersed in water = Volume of water displaced

= 100 cc.

Density of water = 1g/cm^3

Mass of water displaced = Apparent weight loss

Mass of water displaced = Volume × Density.

= 100 cc ×1g/cm^3.

Apparent weight loss of body = 100 g

Weight of jar and water after immersion = Weight of water and jar before immersion – Apparent weight loss

= 700 g – 100 g

= **600 g.**

IX. Assertion and Reason :

(a) 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) If assertion is true but reason is false.

(d) If assertion is false but reason is true.

1. Assertion (A) : The buoyant force on submerged rigid object can be considered to be acting at the centre of mass of object.

Reason (R) : In rigid body, force distributed uniformly through its volume can be considered to be acting at the centre of mass of the body.

[Ans : (c) Assertion is true but reason is false]

Reason : Centre of the mass of the body is fixed according to the distribution of density.

2. Assertion (A) : Weight of the truck exerts less pressure on road.

Reason (R) : Truck has six to eight wheels. As area increases pressure decreases.

[Ans : (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion]

3. **Assertion (A) :** Air gets thinner with increasing altitude.
Reason (R) : The atmospheric pressure increases as we go up in mountains.
[Ans : (c) Assertion is true but reason is false]
Reason : The atmospheric pressure **decreases** as we go up in mountains.

4. **Assertion (A) :** Lactometer is used to check the purity of milk.
Reason (R) : Lactometer measures the cream content of milk.
[Ans : (b) Both assertion and reason are true but reason is not the correct explanation of assertion]

(b) Directions : In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as :

5. **Assertion (A) :** The force acting on the surface of a liquid at rest, under gravity, in a container is always horizontal.
Reason (R) : The forces acting on a fluid at rest have to be normal to the surface.
[Ans : (d) Assertion is false but reason is true]
Reason : The force acting on the surface of liquid at rest, under gravity, in a container is always **perpendicular** due to the fact that molecules at the surface is attracted by the molecules below the surface (i.e) an inward attraction.

6. **Assertion (A) :** A sleeping mattress is so designed that when you lie on it, a large area of your body comes in its contact.
Reason (R) : This reduces the pressure on the body and sleeping becomes comfortable.
[Ans : (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion]

7. **Assertion (A) :** Wide wooden sleepers are kept below railway lines to reduce pressure on the railway tracks and prevent them from sinking in the ground.
Reason (R) : Pressure is directly proportional to the area in which it is acting.
[Ans : (c) Assertion is true but reason is false]
Reason : Pressure is **inversely** proportional to the area in which it is acting.

X. Define the following :

1. **Define thrust :** The force which produces compression is called thrust. Its S.I. unit is newton.

2. **Define pressure :** Thrust acting normally to a unit area of a surface is called pressure. Its S.I. unit is pascal.

3. **Define atmospheric pressure :** The pressure exerted by the atmospheric gases on its surroundings and on the surface of the earth is called atmospheric pressure. 1 atm is the pressure exerted by a vertical column of mercury of 76 cm height.

4. **Buoyant force :** The upward force experienced by a body when partly or fully immersed in a fluid is called upthrust or buoyant force.

5. **Pascal's law :** Pascal's law states that an increase in pressure at any point inside a liquid at rest is transmitted equally and without any change, in all directions to every other point in the liquid.

6. **Archimedes principle :** Archimedes' principle states that when a body is partially or wholly immersed in a fluid, it experiences an up thrust or apparent lose of weight, which is equal to the weight of the fluid displaced by the immersed part of the body.

7. **Density :** Density is known as mass per unit volume of a body. Its S.I. unit is kg m^{-3}.

8. **Relative density :** Relative density is the ratio between the density of a substance and density of water. Relative density of a body is a pure number and has no unit.

9. **Hydrometer :** Hydrometer is a device used to measure the relative density of liquids based on the Archimedes' principle.

10. **Lactometer :** Lactometer is a device used to check the purity of milk by measuring its density using Archimedes' principle.

UNIT
04

ELECTRIC CHARGE AND ELECTRIC CURRENT

LEARNING OBJECTIVES

After completing this lesson, students will be able to:

- Understand the electric charge, electric field and Coulomb's law.
- Explain concepts of electric current, voltage, resistance and Ohm's law.
- Draw electrical circuit diagrams, series and parallel circuits .
- Explain effects of electric current like heating or thermal effect, chemical effect, magnetic effect.
- Understand direct and alternating currents.
- Know safety aspects related to electricity.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. In current electricity, a positive charge refers to,

(a) presence of electron (b) presence of proton
(c) absence of electron (d) absence of proton

[Ans : (c) absence of electron]

2. Rubbing of comb with hair

(a) creates electric charge (b) transfers electric charge
(c) either (a) or (b) (d) neither (a) nor (b)

[Ans : (b) transfers electric charge]

3. Electric field lines _____ from positive charge and _____ in negative charge.

(a) start; start (b) start; end
(c) start: end (d) end; end **[Ans : (b) or (c) start, end]**

4. Potential near a charge is the measure of its _____ to bring a positive charge at that point.

(a) force (b) ability (c) tendency (d) work

[Ans : (d) work]

5. Heating effect of current is called,

(a) Joule heating (b) Coulomb heating
(c) Voltage heating (d) Ampere heating **[Ans : (a) Joule heating]**

6. In an electrolyte the current is due to the flow of

(a) electrons (b) positive ions
(c) both (a) and (b) (d) neither (a) nor (b)
[Ans : (c) both (a) and (b)]

7. Electroplating is an example for

(a) heating effect (b) chemical effect
(c) flowing effect (d) magnetic effect
[Ans : (b) chemical effect]

8. Resistance of a wire depends on,

(a) temperature (b) geometry
(c) nature of material (d) all the above **[Ans : (d) all the above]**

II. Match the following :

1.	Electric Charge	(a)	ohm
2.	Potential difference	(b)	ampere
3.	Electric field	(c)	coulomb
4.	Resistance	(d)	newton per coulomb
5.	Electric current	(e)	volt

Ans. 1 - c, 2 - e, 3 - d, 4 - a, 5 - b

III. State whether true or false. If false, correct the statement :

1. Electrically neutral means it is either zero or equal positive and negative charges.
Ans. True.

2. Ammeter is connected in parallel in any electric circuit.
Ans. False.
Correct statement : Ammeter is connected in **series** in any electric circuit.

3. The anode in electrolyte is negative.
Ans. False.
Correct statement : The anode in electrolyte is **positive**.

4. Current can produce magnetic field.
Ans. True.

IV. Fill in the blanks :

1. Electrons move from _____ potential to _____ potential. **[Ans : lower, higher]**
2. The direction opposite to the movement of electron is called _____ current. **[Ans : conventional]**
3. The e.m.f of a cell is analogues to _____ of a pipe line. **[Ans : water pump]**
4. The domestic electricity in India is an ac with a frequency of _____ Hz. **[Ans : 50]**

V. Conceptual questions :

1. A bird sitting on a high power electric line is still safe. How?

Ans. Birds can sit on power lines and not get electric shocks because the electricity is always looking for a way to get to the ground (i.e.) the current is not flowing out of its body to any other material.

Current flows in a loop (which means the circuit is closed). A bird sitting on a transmission line does not complete the circuit. If the same bird keeps one leg on one line and another leg or any part of its body on another line or the neutral points, then it will get burnt.

2. Does a solar cell always maintain the potential across its terminals constant? Discuss.

Ans. Solar cell delivers a constant current for any given illumination level, while the voltage is determined by the load resistance. Potential in a solar cell depends on the intensity of the solar radiation. Since the intensity of solar radiation is not always constant, the potential across its terminal is also not constant.

3. Can electroplating be possible with alternating current?

Ans. The heating effect and the chemical effect experiments have to be performed only with a dc cell of around 9V. The 9V dc cell will not give any electrical shock.

At any cost we **should not use** the main domestic electric supply which is 220V ac voltage. If it is used it will give a heavy electric shock leading to a severe damage to our body.

VI. Answer the following :

1. On what factors does the electrostatic force between two charges depend?

Ans. The numerical value (magnitude) of electric force between two charges depend on the,

(i) value of charges on them,

(ii) distance between them and

(iii) nature of medium between them.

2. What are electric lines of force?

Ans. The lines representing the electric field are called electric lines of force.

3. Define electric field.

Ans. Electric field is the region around a charged body within which its influence can be experienced (i.e) within which it can attract or repel another charged body.

4. Define electric current and give its unit.

Ans. The electric current is defined as the rate of flow of electric charge through any section of a conductor.

Electric current $I = \frac{Q}{t}$

Its unit is Cs^{-1}

Its SI unit : ampere (A).

5. State Ohm's law.

Ans. Ohm's law states that, the current passing through a conductor is directly proportional to the potential difference across its ends, provided the physical conditions like temperature, density, etc. remain unchanged. $V \alpha I$ or $V = IR$.

6. Name any two appliances which work under the principle of heating effect of current.

Ans. Electric heating appliances like iron box, water heater, toaster, etc.

7. How are the home appliances connected in general, in series or parallel. Give reasons.

Ans. In a household electric circuit, different home appliances are connected in parallel to one another due to the following reasons:

(i) The appliances can be operated independently. If one appliance is switched off, others remain unaffected.

(ii) Each appliance gets the same constant voltage.

(iii) In parallel connection of electrical appliances, the overall resistance of the circuit it reduced due to which the current form the power supply is high.

8. List the safety features while handling electricity.

Ans. (i) Ground connection:

The metal bodies of all the electrical appliances are to be connected to the ground by means of a third wire apart from the two wires used for electrical connection.

(ii) Trip switch:

It is an electromechanical device which does not allow a current beyond a particular value by automatically switching off the connection.

(iii) Fuse:

A fuse is another safety mechanism which works on joule heating principle.

VII. Exercises :

1. Rubbing a comb on hair makes the comb get – 0.4C.
(a) Find which material has lost electron and which one gained it.
(b) Find how many electrons are transferred in this process.

Ans : a. Comb gained electrons. Dry hair lost electron.

b. No. of electrons transferred = – 0.4 C

1 coulomb = 6.25×10^{18} electron

– 0.4 C = $0.4 \times 6.25 \times 10^{18}$ electrons

= -2.5×10^{18} electrons

2. Calculate the amount of charge that would flow in 2 hours through an element of an electric bulb drawing a current of 2.5A.

Ans : Current I = 2.5 A

time t = 2 hours = 2×3600 seconds

t = 7200 s

Amount of charge Q = $I \times t$

= 2.5×7200

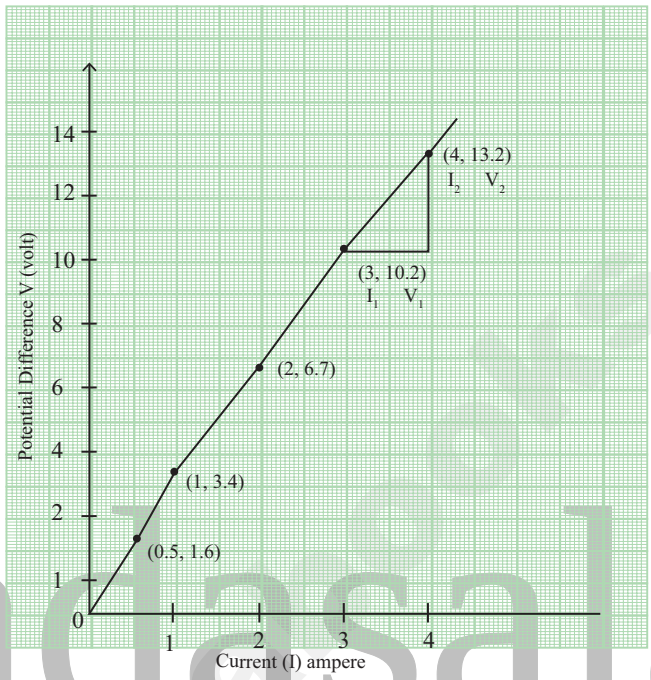
Q = 18,000 C

3. **The values of current (I) flowing through a resistor for various potential differences V across the resistor are given below. What is the value of resistor?**

I (ampere)	0.5	1.0	2.0	3.0	4.0
V (volt)	1.6	3.4	6.7	10.2	13.2

[Hint : plot V-I graph and take slope]

Ans.



Resistance of the resistor $R = \frac{V_2 - V_1}{I_2 - I_1}$

$= \frac{13.2 - 10.2}{4 - 3}$

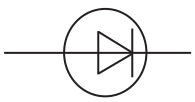
$= \frac{3}{1} = 3\Omega$

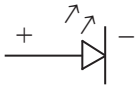
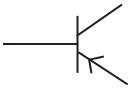
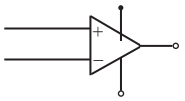
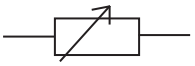
R = 3Ω

Intext Activities

ACTIVITY - 1

Take a condemned electronic circuit board in a TV remote or old mobile phone. Look at the electrical symbols used in the circuit. Find out the meaning of the symbols known to you.

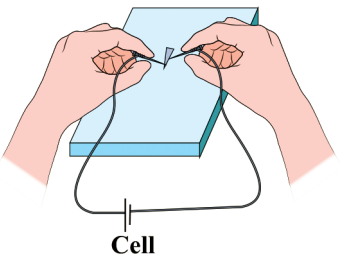
Electrical symbols	Meaning
	Semi -conductor diode
	Capacitor

Electrical symbols	Meaning
	Light Emitting Diode
	PNP Transistor
	Battery
	Amplifier
	Variable resistor
	Coil of wire
	Wires joined
	DC power supply
	AC power supply

[End of the activity]

ACTIVITY - 2

Cut an arrow shaped strip from aluminium foil. Ensure that the head is a fine point. Keep the arrow shaped foil on a wooden board. Connect a thin pin to two lengths of wire. Connect the wires to the terminals of electric cell, may be of 9V. Press one pin onto the pointed tip and other pin at a point about one or two mm away. Can you see that the tip of aluminium foil starts melting?



Aim :

To understand the heating effect of electric current.

Materials Required :

Aluminium strip, wooden board, bell pins, cell of 9 V.

Procedure :

Cut an arrow shaped strip from aluminium foil. Keep the arrow shaped foil on a wooden board. Connect a pin to two lengths of wire. Connect the wires to the terminals of electric cell of 9 V. Press one pin onto the pointed tip and another pin at a point about one or two mm away.

Observation :

The tip of aluminium foil starts melting.

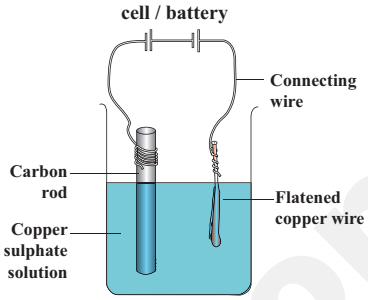
Conclusion :

It starts melting because the electrons while moving in the wire suffer resistance. Work is done to overcome the resistance which is converted into heat energy. This conversion of electrical energy into heating energy is called heating effect of electric current.

[End of the activity]

ACTIVITY - 3

Take a beaker half filled with copper sulphate solution. Take a carbon rod from a used dry cell. Wind a wire on its upper end. Take a thick copper wire, clean it well and flatten it with a hammer. Immerse both the copper wire and carbon rod in the copper sulphate solution. Connect the carbon rod to the negative terminal of an electric cell and copper wire to the positive terminal of the cell. Also ensure that the copper and the carbon rod do not touch each other, but are close enough. Wait and watch. After some time you would find fine copper deposited over the carbon rod. This is called as electroplating. This is due to the chemical effect of current.



Aim :

Electroplating carbon rod with copper.

Materials Required :

Beaker, copper sulphate solution, carbon rod, thick copper wire and hammer.

Procedure :

- Take a beaker half filled with copper sulphate solution.
- Take a carbon rod and wind a wire on its upper end.
- Take a thick copper wire, clean it well and flatten it with a hammer.
- Immerse both the copper wire and carbon rod in the copper sulphate solution.
- Connect the carbon rod to the negative terminal of the cell and copper wire to the positive terminal of the cell.
- Ensure both the rods do not touch each other, but are close enough.
- Observe for some time.

Observation :

After some time, we would find fine copper deposited over the carbon rod.

Conclusion :

When the current passes through the copper sulphate solution, the copper ions migrate from the copper sulphate solution towards the cathode (–ve terminal). These copper ions get deposited on the carbon rod and form a coating of a fine layer on it.
This process of coating a metal over another metal by electrolysis is called electroplating. This is due to chemical effect of electric current.

Additional Questions

I. Choose the correct answer :

1. A current of 2A passing through conductor produces 80 J of heat in 10 seconds. The resistance of the conductor is _____.

(a) 0.5Ω (b) 2Ω (c) 4Ω (d) 20Ω

[Ans : (b) 2Ω]

2. The resistance of a straight conductor is independent of _____.

(a) temperature (b) material
(c) cross sectional area (d) shape of cross section

[Ans : (d) shape of cross section]

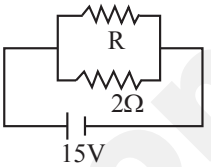
3. Two resistances R_1 and R_2 are connected is parallel. Their equivalent resistance is _____.

(a) $R_1 + R_2$ (b) $\frac{R_1R_2}{R_1 + R_2}$ (c) $\frac{R_1 + R_2}{R_1R_2}$ (d) $\sqrt{R_1R_2}$

[Ans : (b) $\frac{R_1R_2}{R_1 + R_2}$]

4. If in the circuit, power dissipation is 150 W, then R - is _____.

(a) 2Ω (b) 6Ω
(c) 5Ω (d) 4Ω



[Ans : (b) 6Ω]

5. The force between two parallel wires carrying currents has been used to define _____.

(a) ampere (b) coulomb
(c) volt (d) watt [Ans : (a) ampere]

6. Electric current passes through a metallic conductor due to the movement of ____.

(a) ions (b) ampere
(c) electrons (d) protons [Ans : (c) electrons]

7. What is the maximum resistance one can make with ten 1Ω resistors?

(a) 1Ω (b) 2Ω (c) 5Ω (d) 10Ω

[Ans : (d) 10Ω]

8. Two conductors of resistance 2 R and R are connected in series in a battery circuit. The ratio of heat developed in them is _____.

(a) 2 : 1 (b) 1 : 2 (c) 1 : 3 (d) 1 : 4

[Ans : (a) 2 : 1]

9. 1 volt = _____

(a) $\frac{\text{1 Joule}}{\text{Coulomb}}$ (b) $\frac{\text{1 Coulomb}}{\text{Joule}}$ (c) $\frac{\text{1 Joule}}{\text{Coulomb}^2}$ (d) 1 Joule coulomb

[Ans : (a) $\frac{\text{1 Joule}}{\text{Coulomb}}$]

10. The resistance of a conductor is R. If its length is doubled, then its new resistance will be _____.

(a) R (b) 2R (c) 4R (d) 8R

[Ans : (c) 4R]

11. The following is not a safety device.

(a) Fuse (b) Trip switch
(c) Ground connection (d) Wire [Ans : (d) wire]

12. In India the frequency of alternating current is,

(a) 220 Hz (b) 50 Hz
(c) 5 Hz (d) 100 Hz [Ans : (b) 50 Hz]

II. Fill in the blanks :

1. The number of electrons constituting 1 coulomb charge is_____

[Ans : 6.25×10^{18}]

2. Resistors are connected in series, if the resistance of electric circuit is to be _____ **[Ans : increased]**

3. Electric fuse is a wire made up of a material having _____ melting point. **[Ans : low]**

4. _____ is the only non-metal that is a good conductor of electricity. **[Ans : Graphite]**

5. If the area of cross section of the conductor is doubled its resistance gets _____ **[Ans : halved]**

6. A negative charge will move from _____ to _____ potential. **[Ans : lower, higher]**

7. _____ is work done per unit charge. **[Ans : Potential difference]**

8. An electrochemical cell converts _____ energy into _____ energy. **[Ans : chemical, electrical]**

9. Three resistors are connected in series with a cell. If the current in each resistor is 1.5A, then the current through the cell will be_____ . **[Ans : 1.5A]**

10. Three resistors are connected in parallel with a battery. If the current in each resistor is 2A, then the current through the battery will be _____ . **[Ans : 6A]**

11. As electrons are revolving in the_____ of an atom they can be easily removed from an atom and also added to it. **[Ans : orbits]**

12. If an electron is added in excess to an atom then the atom is _____ charged. **[Ans : negatively]**

13. The excess of electrons make an object negative and _____ of electrons make it positive. **[Ans : deficit]**

14. Electric charge is _____ in nature. **[Ans : additive]**

15. Electric lines of force are _____lines. **[Ans : imaginary]**

16. For an isolated positive charge the electric lines of force are radially _____and for an isolated negative charge they are radially _____. **[Ans : outwards, inwards]**

17. _____at a point is a measure of force acting on a unit positive charge placed at that point. **[Ans : Electric field]**

18. Electric potential is a measure of the _____on unit positive charge to bring it to that point against all electrical forces. **[Ans : work done]**

19. The movement of positive charge is called as _____. **[Ans : conventional current]**

20. The _____is the measure of opposition offered by the component to the flow of electric current through it. **[Ans : resistance]**

21. The process of conduction of electric current through solution is called _____. **[Ans : electrolysis]**

22. The device used to convert AC to DC is called _____. **[Ans : rectifier]**

23. Trip switch is a _____ safety device. **[Ans : electro mechanical]**

III. True or False :

1. A fuse is used in electric circuit to stop high current flowing through the circuit.

Ans. True.

2. Rheostat is also known as fixed resistance.

Ans. False.

Correct statement : Rheostat is also known as **variable resistance**.

3. An ammeter is always placed in parallel with the circuit.

Ans. False.

Correct statement : An ammeter is always placed **series** with the circuit.

4. The resistance of a dry human body is high.

Ans. True.

5. For current to flow, one needs an open circuit.

Ans.

Correct statement : For current to flow, one needs **closed** circuit.

6. A comb rubbed with hair and brought near pieces of paper attracts them, because both comb and paper get similarly charged.

Ans. False.

Correct statement : A comb rubbed with hair and brought near pieces of paper attracts them, because both comb and paper **get oppositely** charged.

7. Overloading of electric circuits can lead to short circuiting.

Ans. True.

8. Electrons in outer orbits are called free electrons.

Ans. True.

9. Electric fuse works on Joule heating principle.

Ans. True.

IV. Match the following :

I.

Column I	Column II	
1. Resistor	a)	Galvanometer
2. Connecting wire	b)	Voltmeter
3. Current in an electric circuit	c)	Copper
4. Potential difference	d)	Constantan

Ans. 1 - d, 2 - c, 3 - a, 4 - b

II.

Column I	Column II	
1. Electric power	a)	Volt
2. Electrical energy	b)	Coulomb
3. Electric charge	c)	Watt
4. Potential difference	d)	Joule

Ans. 1 - c, 2 - d, 3 - c, 4 - a

V. 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) If assertion is true but reason is false.
(d) If assertion is false but reason is true.

1. **Assertion (A) :** Electric current will not flow between two charged bodies when connected if their charges are same.
Reason (R) : Current is the rate of flow of charge.

[Ans : (d) Assertion is false but reason is true]

Reason : Current will not flow when two bodies are at the same potential. When their charges are same, their potential may be different. Hence current may flow in this case.

2. **Assertion (A) :** A bird perches on a high power line and nothing happens to the bird.
Reason (R) : The level of bird is very high from the ground.

[Ans : (c) Assertion is true but reason is false]

Reason : Electric shock is due to the electric current flowing through a living body. When the bird perches on a single high power line, no current passes through its body. Because its body is at equipotent surface (i.e.) there is no potential difference. While when man touches the same line, standing bare foot on ground the electrical circuit is completed through the ground. The hands of man are at high potential and his feets are at low potential. Hence large amount of current flows through the body of the man and person therefore gets a fatal shock.

VI. Answer in one word :

1. Name the force which acts between two point charges obey Newton's third law.

Ans. Electrostatic force.

2. What is the SI unit for current?

Ans. ampere (A).

3. Name the device which is used to measure the strength of the electric current in an electric circuit.

Ans. Ammeter.

4. What is the rate at which charges flow past a point on a circuit?

Ans. Current.

5. Name a device that helps to maintain a potential difference a cross a conductors.

Ans. Cell or battery.

6. What do the circuit symbol  represent?

Ans. Wire crossing without touching each other.

7. How many electrons accumulate to make 1C of electric charge?

Ans. $1C = 6.25 \times 10^{18}$ electrons.

8. What is the charge of one electron?

Ans. $e = 1.6 \times 10^{-19}C$.

9. What is the measure of the work done on unit positive charge to bring it to that point against all electrical forces.

Ans. Electric potential

Mouth: The mouth leads into the buccal cavity. The buccal cavity is a large space bound above by the palate (which separates the wind pipe and food tube), below by the throat and on the sides by the jaws. The jaws bear teeth.

Teeth: Teeth are hard structures meant for holding, cutting, grinding and crushing the food. In human beings two sets of teeth (Diphyodont) are developed in their life time.

Dental formula represents the number of different type of teeth present in each half of a jaw (upper and lower jaw).

For Permanent teeth in each half of upper and lower jaw:

$$\frac{2, 1, 2, 3}{2, 1, 2, 3} = 16 \times 2 = 32$$

Salivary glands: Three pairs of salivary glands are present in the mouth cavity. They are: parotid glands, sublingual glands and submaxillary or submandibular glands

i. **Parotid glands** are the largest salivary glands, which lie in the cheeks
ii. **Sublingual** glands are the smallest glands and lie beneath the tongue.
iii. **Submaxillary** or Submandibular glands lie at the angles of the lower jaw.

Tongue: The tongue is a muscular, sensory organ which helps in mixing the food with the saliva.

Pharynx: The pharynx is a membrane lined cavity behind the nose and mouth, connecting them to the oesophagus. It serves as a pathway for the movement of food from mouth to oesophagus.

Oesophagus: Oesophagus or the food pipe is a muscular-membranous canal about 22 cm in length. It conducts food from pharynx to the stomach by peristalsis (wave-like movement) produced by the rhythmic contraction and relaxation of the muscular walls of alimentary canal.

Stomach: The stomach is a wide J-shaped muscular organ located between oesophagus and the small intestine.

Small intestine: The small intestine is the longest part of the alimentary canal, which is a long coiled tube measuring about 5 – 7 m. It comprises three parts- duodenum, jejunum and ileum.

1. **Duodenum** is C-shaped and receives the bile duct (from liver) and pancreatic duct (from pancreas).
2. **Jejunum** is the middle part of the small intestine. It is a short region of the small intestine.

Liver: It is the largest digestive gland of the body which is reddish brown in colour. Bile salts help in the digestion of fats by bringing about their emulsification (conversion of large fat droplets into small ones).

Pancreas: It is a lobed, leaf shaped gland situated between the stomach and duodenum. Pancreas acts both as an exocrine gland and as an endocrine gland.

Large intestine: The unabsorbed and undigested food is passed into the large intestine. It extends from the ileum to the anus. It is about 1.5 meters in length. It has three parts- caecum, colon and rectum.

The caecum is a small blind pouch like structure situated at the junction of the small and large intestine. From its blind end a finger – like structure called vermiform appendix arises. It is a vestigeal (functionless) organ in human beings.

The colon is much broader than ileum. It passes up the abdomen on the right (ascending colon), crosses to the left just below the stomach (transverse colon) and down on the left side (descending colon).

The rectum is the last part which opens into the anus. It is kept closed by a ring of muscles called anal sphincter which opens when passing stools.

37.
1. Kidney
2. Ureter
3. Urine
4. Urinary bladder
5. Urethra

Though the Trimester Pattern is changed from this year, we have given this Question Paper for Practice Purpose only.

9TH STD	III TERM SUMMATIVE ASSESSMENT MODEL QUESTION PAPER 2018-19	Reg No
Time : 2.00 Hrs.	SCIENCE	Marks : 60

SECTION - I

I. Choose the correct answer: **10 × 1 = 10**

1. Water (or) liquids exert pressure on
   (a) Upward direction (b) Downward direction
   (c) Lateral direction (d) All the above
2. The frequency greater than 20,000 Hz is _____ sound.
   (a) infrasonic (b) ultrasonic (c) audible (d) sonic
3. Who proposed the heliocentric model of the universe?
   (a) Tycho Brahe (b) Nicolaus Copernicus
   (c) Ptolemy (d) Archimedes
4. The main component of water gas is _____.
   (a) Carbon dioxide (b) Carbon monoxide (c) Calcium carbide (d) Methane
5. 1% solution of Iodoform is used as
   (a) antipyretic (b) antimalarial (c) antiseptic (d) antacid
6. Root caps is a characteristic adaptation of _____
   (a) Xerophytes (b) Hydrophytes (c) Mesophytes (d) All the above
7. India is the _____ largest producer of vegetables next to China.
   (a) First (b) Second (c) Third (d) Fourth
8. Clouds float in atmosphere because of their low
   (a) density (b) pressure (c) velocity (d) mass
9. AIDS is a _____ disease.
   (a) Endemic (b) Epidermic (c) Pandemic (d) Sporadic
10. Measles vaccine can be administered to the child at the age of _____
    (a) 18 –24 months (b) 15 –18 months (c) 9 –12 months (d) 14th week

SECTION - II

II. Answer the following question (any 15 only) **15 × 2 = 30**

11. On what factors the pressure exerted by the liquid depends on?
12. Density of mercury is 13600 kg m^{-3}. Calculate the relative density.
13. Does a solar cell always maintain the potential across its terminals constant? Discuss.
14. Can sound travel through vacuum?
15. You and your friend are on the moon. Will you be able to hear any sound produced by your friend?
16. How does a planet differ from a star?
17. Define : time period of a satellite.
18. What is solar system?
19. **Match the following:**

1.	Jupiter	a)	87.97 days
2.	Mercury	b)	10.7 hours
3.	Venus	c)	9 hours 55 min
4.	Saturn	d)	243 days

20. **Fill in the blanks:**
    A large family of fullerene exists, starting at _____ and reaching upto _____.
21. What are Polymer resins?
22. Mention the advantages of Green Manure.
23. List out the instruments used to analyse nanoparticles.
24. Draw the cell diagram of Daniel cell.

25. Match the following

1.	Antipyretics	a)	Large surface area
2.	Corrosion prevention	b)	Iodine–131
3.	Hyperthyroidism	c)	Fever
4.	Nanoparticle	d)	Electroplating

26. How do human activities affect nitrogen cycle?
27. Name the main classes of Horticulture.
28. Differentiate: Exotic breed and Indigenous breed.
29. Define the following : Pathogen, Prions.
30. Name the vector of malarial parasite. Mention the species of malarial parasite which cause malignant and fatal malaria.

SECTION - III

III. Note : (i) Answer any four questions by choosing one question from each part.
(ii) Draw diagrams wherever necessary. $4 \times 5 = 20$

PART - A

31. Write the conditions in the use of Paid and Proprietary Software.
32. Give an account of different types of fish ponds used for rearing fishes.

PART - A

33. Explain the construction and working of a Hydrometer with diagram.
34. What is catenation? How does carbon form catenated compounds?

PART - A

35. Describe the processes involved in the water cycle.
36. How will you differentiate the different types of transpiration?

PART - A

37. List out any five advantages of Farm ponds.
38. Suggest precautionary measures you can take in your school to reduce the incidence of infectious disease.

Answers

SECTION - I

I.

1.	(d) All the above	**2.**	(b) ultrasonic	**5.**	(c) antiseptic
3.	(b) Nicolaus Copernicus	**4.**	(b) Carbon Monoxide	**8.**	(a) density
6.	(c) Mesophytes	**7.**	(b) Second		
9.	(c) Pandemic	**10.**	(c) 9 – 12 months		

SECTION - II

II. 11. The pressure exerted by the liquid depends on the
(i) Depth **(ii)** Density of the liquid
(iii) Acceleration due to gravity.

12. Density of Mercury = $13600\ kg\ m^{-3}$
Density of water at 4°C = $1000\ kg\ m^{-3}$

$$\text{Relative density} = \frac{\text{Density of mercury}}{\text{Density of water at } 4^{\circ}C}$$

$$= \frac{13600\ kg\ m^{-3}}{1000\ kg\ m^{-3}} = \mathbf{13.6}$$

13. Solar cell delivers a constant current for any given illumination level, while the voltage is determined by the load resistance. Potential in a solar cell depends on the intensity of the solar radiation. Since the intensity of solar radiation is not always constant, the potential across its terminal is also not constant.

14. (i) Sound cannot travel through vacuum.
(ii) Sound needs a material medium to travel like air, water, steel, etc.

15. We cannot hear any sound on the moon.
Reason : Absence of atmosphere (medium) in the moon.

16.

S.No	Star	Planet
1.	Star is luminous body (emit their own light).	Planet is a non-luminous body. (does not emit light).
2.	It revolves in the galaxy without any centre.	Planet revolves around the star.

17. Time taken by the satellite to complete one revolution round the Earth is called time period of a satellite.
Time Period, $T = \frac{\text{Distance covered}}{\text{Orbital velocity}}$.

18. **(i)** The Sun and celestial bodies which revolve around it form the solar system.
(ii) It consists of larger number of bodies such as planets, comets, asteroids and meteors.

19.

1.	Jupiter	c)	9 hours 55 min
2.	Mercury	a)	87.97 days
3.	Venus	d)	243 days
4.	Saturn	b)	10.7 hours

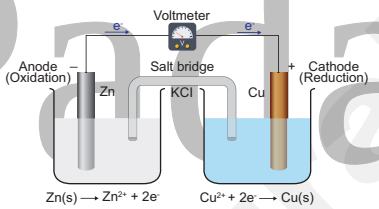
20. C_{20}, C_{540}

21. Plastics, made from long chain organic compounds, are called as "Polymer resins".

22. **(i)** Green Manure improves soil structure.
(ii) It increases water holding capacity and decreases soil loss by erosion.
(iii) It also helps in reclamation of alkaline soils and reduces weed proliferation.

23. **(i)** Scanning Electron Microscope (SEM)
(ii) Tunneling Electron Microscope (TEM).
(iii) Atomic Force Microscope (AFM).

24.



25.

1.	Antipyretics	c)	Fever
2.	Corrosion prevention	d)	Electroplating
3.	Hyperthyroidism	b)	Iodine–131
4.	Nanoparticle	a)	Large surface area

26. Human activities,
(i) alters the biodiversity
(ii) changes the food web structure
(iii) destroys the general habitat.

27. There are four main classes of horticulture
(i) Pomology (fruit farming),
(ii) Olericulture (vegetable farming),
(iii) Floriculture (flowers farming),
(iv) Landscape gardening.

28.

S.No	Exotic Breed	Indigenous Breed
1.	The exotic breeds are imported from foreign countries.	Indigenous Breeds are native of India.
2.	They include Jersey, Brown Swiss, Holstein – Friesian.	They include Sahiwal, Red Sindhi, Deoni and Gir.

29. **Pathogen** - A pathogen is a biological agent that causes disease due to its host E.g. Bacteria, Virus, etc.,
Prions - Prions are viral particles which contain only proteins. They do not contain nucleic acid.

30. **Vector** : Female *Anopheles* mosquito .
Fatal parasite : *Plasmodium falciparum*.

SECTION - III

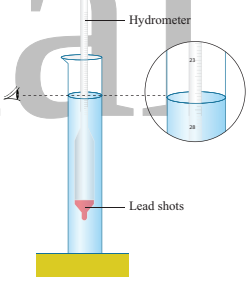
PART - A

31. **Conditions of Paid and Proprietary Software :**
1. The software needs a licence to use it.
2. We have to pay to use the software permanently (or) temporarily.
3. The end user are legally prohibited to steal the software program.
4. The end user are also prohibited to use the pirated versions of the software.

32. **Different types of Ponds**
(1) **Breeding ponds :** Healthy and sexually mature male and female fishes are collected and introduced in the pond for breeding.
(2) **Hatchling ponds :** The fertilized eggs are transferred from breeding ponds to hatchling pits for hatching.
Two types of pits : (1) Hatcheries (2) Hatching hapas.
(3) **Nursery ponds :**
(a) Hatchings are transferred from hatching pits after 2 to 7days.
(b) The hatchings grow into fry and are cultured for about 60 days with proper feeding till they reach 2 - 2.5cm in length.
(4) **Rearing ponds :** The fish fry are transferred from nursery pond to rearing ponds and are maintained for about three months till they reach 10 to 15 cm in length.
(5) **Stocking pond (or Culture pond or Production pond) :**
These ponds are used to rear fingerlings upto marketable size. Pond is manured with organic manure and inorganic fertilizers.

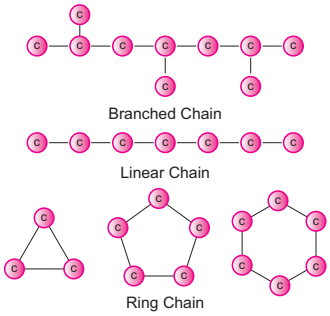
PART - B

33. **Purpose :** To measure density (or) relative density of liquid.
Principle : The weight of the liquid displaced by the immersed portion of the hydrometer is equal to the weight of the hydrometer. [Flotation principle].



Construction
Lower end of hydrometer : A cylindrical stem having a spherical bulb which partially filled with lead shots or mercury which helps to float or stand vertical in liquids.
Upper end of hydrometer : A narrow tube has markings so that relative density of liquids can be read off directly.
Working :
1. Liquid to be tested is poured into the glass jar.
2. The hydrometer is gently lowered into the liquid until it floats freely.
3. The reading against the level touching the tube gives the relative density of the liquid.

34. Catenation is binding of an element to itself or with other elements through covalent bonds to form open chain or closed chain compounds.
(i) Carbon is the most common element which undergoes catenation and forms long chain compounds.
(ii) Carbon atom links repeatedly to itself through covalent bond to form linear chain, branched chain (or) ring structure.
(iii) This property of carbon itself is the reason for the presence of large number of organic carbon compounds.
(iv) So organic chemistry essentially deals with catenated carbon compounds.
(v) Example : Starch and cellulose contain chains of hundreds of carbon atoms.



PART - C

35. Process of water cycle

1. **Evaporation :**
   - **(i)** Conversion of liquid into gas (vapour) before reaching its boiling point.
   - **(ii)** Water evaporates from the surface of the earth and water bodies such as the oceans, seas, lakes, ponds and rivers turn into water vapour.
2. **Sublimation :** Direct conversion from solid to gas.
   (e.g)
   - **(i)** Ice sheets and Ice caps from north and south pole,
   - **(ii)** Ice caps on mountains converted into water vapour.
3. **Transpiration :** The process in which plants release water vapour to atmosphere through small pores in leaves and stems.
4. **Condensation :** Change from gas phase into liquid phase.
   (e.g) Formation of clouds and fog.
5. **Precipitation :**
   - **(i)** Clouds combine to make bigger droplets and pour down as precipitation (rain) due to change in wind or temperature.
   - **(ii)** Precipitation includes drizzle, rain, snow and hail.
6. **Run off :** Rain water runs over the earth to form rivers, lakes and ends up into seas and Oceans.
7. **Infiltration :** Water moves down the soil to increase ground water level.
8. **Percolation :** Water moves through porous or fractured rock.

36. Transpiration in the plant can be differentiated by the loss of water in the form of water vapour from the aerial parts of the plant body is called as transpiration. The leaves have tiny, microscopic pores called stomata. Water evaporates through these stomata. Each stomata is surrounded by guard cells. These guard cells help in regulating the rate of transpiration by opening and closing of stomata.

There are three types of transpiration :

- **(i) Stomatal transpiration :** Loss of water from plants through stomata. It accounts for 90-95% of the water transpired from leaves.
- **(ii) Cuticular transpiration :** Loss of water in plants through the cuticle.
- **(iii) Lenticular transpiration :** Loss of water from plants as vapour through the lenticels. The lenticels are tiny openings that protrude from the barks in woody stems and twigs as well as in other plant organs.

PART - D

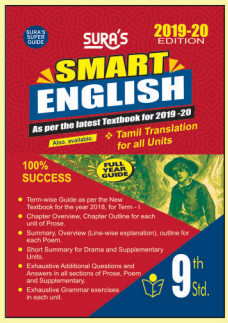
37. The advantages of farm ponds are-

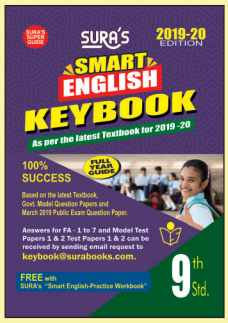
1. They provide water to growing crops, without waiting for rainfall.
2. They reduce soil erosion.
3. They recharge ground water.
4. They improve drainage.
5. The excavated soil can be used to enrich soil in fields and levelling lands.
6. They promote fish rearing.
7. They provide water for domestic purposes and livestock.

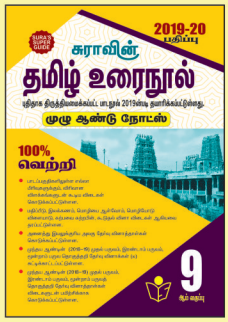
38.

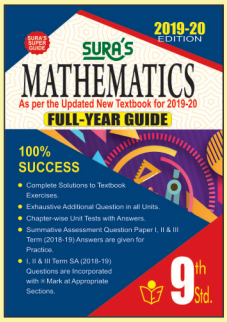
1. Clean and hygienic environment should be maintained inside and outside the school.
2. Enough first aid medicines should be kept in the school.
3. Proper awareness about healthy diet and health instructions should be instructed to the students.
4. If a student is identified with disease, it must be properly communicated to the students and nearby health authorities.
5. The infected student / person must be kept away from other students in order to avoid the spread of infection.

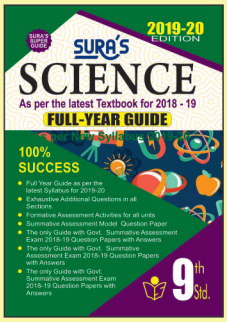
Our other Guides for 9th Std.

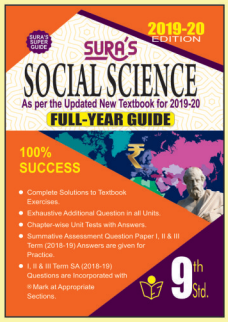


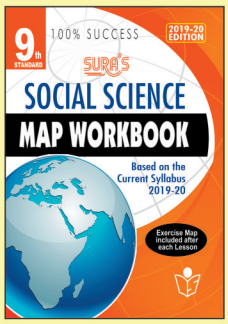












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