MOTION®

PHYSICS

CLASS - VIII

BOOKLET - 1

CONTENTS

MEASUREMENT AND MOTION

FORCE & PRESSURE

FRICTION

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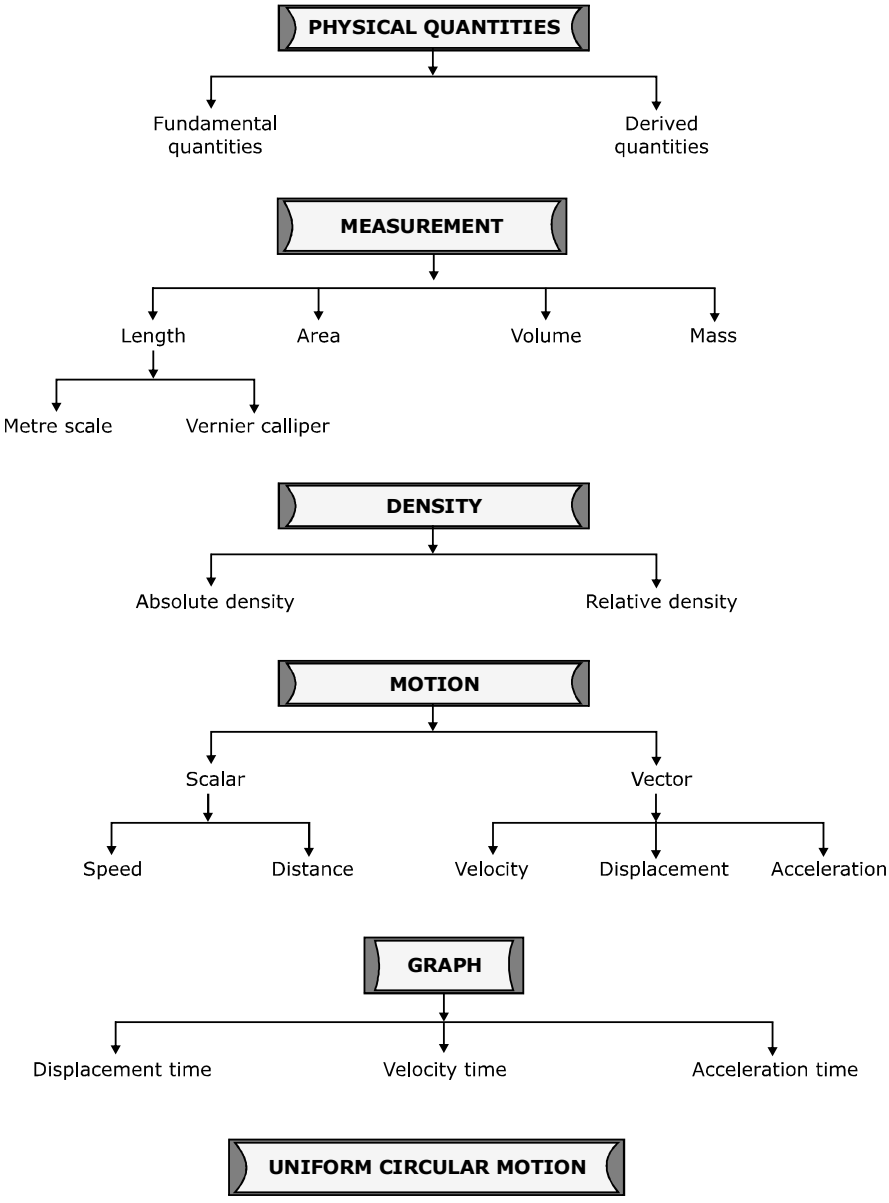
LIGHT

HEAT

ANSWER KEY

CHAPTER 1

MEASUREMENT AND MOTION



INTRODUCTION

Physics deals with nature and its laws. It describes laws of nature quantitatively and qualitatively. This description involves measurement of various physical quantities like height, weight, time etc. To understand the importance of measurements, let us take few examples. To decide who is the winner in a running race, the time taken by runners to cover a certain distance is measured. Similarly, to determine the mileage of a vehicle, the distance travelled by it is measured. Thus, the measurement of quantities play an important role in our everyday life. In this chapter, we make an attempt to identify different physical quantities and associate them with proper units. We will also discuss some important techniques used for measuring physical quantities.

PHYSICAL QUANTITIES

The quantities that can be measured are called **physical quantities**. For example, mass, length, volume, area, etc. In order to measure any physical quantity, the quantity is compared with a known standard quantity. This well defined standard quantity is called unit. The unit **kilogram (kg)** is defined as the mass of a certain platinum-iridium block kept at the international bureau of weights and measures. Now, any body having the same mass as this lump is said to have a mass of 1 kg and a body having double the mass as this lump is said to have a mass of 2 kg and so on.

Characteristics of a Unit

A unit used to measure a physical quantity should have the following characteristics :

1. It should be well-defined.
2. It should be reproducible.
3. It should be unchangeable.
4. It should be of measurable size.

Based on their independency from other quantities, physical quantities can be classified into two categories.

1. FUNDAMENTAL QUANTITY

A quantity which is independent of other quantities is called **fundamental quantity**. Mass, length, time, electric current, temperature, luminous intensity and the amount of substance are the fundamental quantities.

Fundamental Unit

The unit of a fundamental quantity like mass or length is called **fundamental unit**.

Example: kilogram, metre, second, ampere, kelvin, candela and mole.

2. DERIVED QUANTITY

A quantity which is dependent on other physical quantities and can be derived from the fundamental quantities is called **derived quantity**. Area, volume, density, force and velocity are some example of derived quantities.

Derived Unit

The unit of a derive quantity like volume or velocity is called **derived unit**.

Example: m s^{-1}, g cm^{-3}, m s^{-2}, etc.

3. SYSTEM OF UNITS

A system which defines the fundamental units, in comparision with which a fundamental quantity can be expressed is referred to as system of units. Different systems have been developed over a period of time.

The following systems of units are in common use:

1. **F.P.S. system:** In this system, the units of mass, length and time are in pound, foot and second, respectively.
2. **C.G.S system:** In this system, the units of mass, length and time are in gram, centimetre and second, respectively.
3. **M.K.S. system:** In this system, the units of mass, length and time are in kilogram, metre and second, respectively.
4. **S.I. – (Systeme International d'unites):** This system is an extended version of M.K.S. system. This system has seven fundamental and two supplementary quantities. In this system the units of metre, kilogram and second have been redefined for more accuracy. As of today S.I. system is accepted and is used all over the world for scientific work.

Units and their symbols of fundamental quantities in various systems of units

Fundamental Quantity	C.G.S.	F.P.S.	M.K.S.	S.I.
Length	centimetre (cm)	foot (ft)	metre (m)	metre (m)
Mass	gram (g)	pound	kilogram (kg)	kilogram (s)
Time	second (s)	second (s)	second (s)	second (s)
Amount of substance	–	–	–	mole (mol)
Intensity of light	–	–	–	candela (cd)
Strength of light	–	–	–	ampere (A)
Temperature	–	–	–	kelvin (K)

DEFINITIONS OF UNITS

1. **Metre :** Initially metre was defined as one ten-milionth part of the distance on the Earth from the pole to the equator. As per the modern definition, one metre is the length of a certain platinum-iridium rod maintained at 0°C and kept in the International Bureau of Weights and Measures at Sevres near Paris.

OR

One metre is 1,650,763.73 times the wavelength of orange light emitted by a krypton atom at normal pressure.

2. **Kilogram:** One kilogram is the mass of a certain lump made from an alloy of platinum-iridium maintained at 0°C in the International Bureau of weights and measures.

3. **Second:** One second is defined as $(1/86,400)^{th}$ part of the mean solar day. As per the modern definition, one second is the time taken by a cesium atom (Cs^{133}) to complete 9,192,631,770 vibrations.

MEASUREMENT OF LENGTH

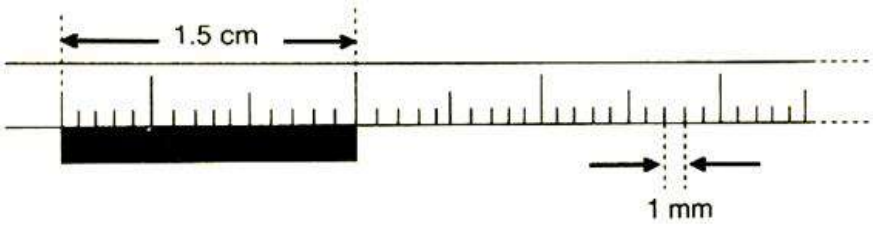
Different instrument are used for measuring length depending upon the length being measured. For measuring the length of a room, width of a road, length of a piece of cloth, etc., which are larger quantities, measuring tapes may be used. But while measuring smaller lengths, like the diameter of a rod or wire, the length of a small rod, the thickness of a lamination sheet etc., more accurate instruments need to be used. Vernier calliper is one such instrument.

The accuracy with which can an instrument can measure a physical quantity is determined by its least count.

Least count of an instrument is the smallest measurement that the instrument can make accurately. The least count of a metre scale is 0.1 m.

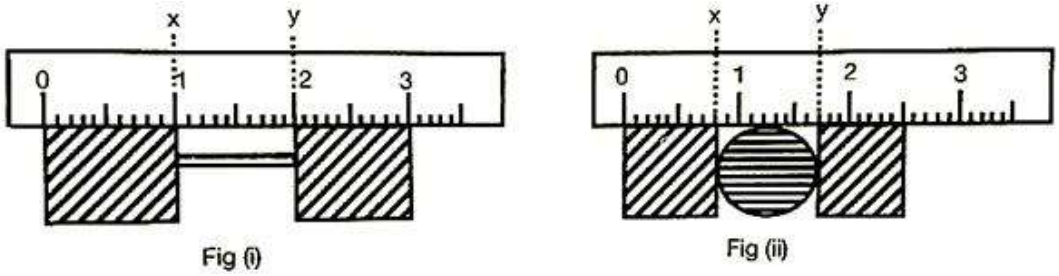
Metre Scale

Metre scale is graduated in millimetres i.e., its least count is 1 mm. While measuring the length of any object using a scale, the observations should be taken by keeping the eye vertically above the ends of the object. This avoids the parallax error.



Measuring length of a rod using a scale

To measure the length of a rod or diameter of a sphere, etc., the objects can be held between two blocks as shown in figure (i) and figure (ii).



Measuring length of (i) a rod and (ii) diameter of a sphere using a scale and blocks

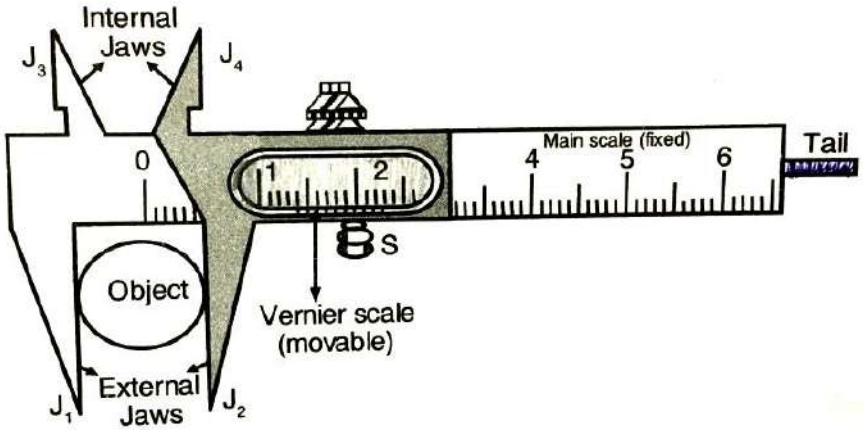
The readings x and y correspond to the positions of the two edges that hold the object.

Length of rod = y – x = 2 cm – 1 cm = 1 cm.

Diameter of sphere = y – x = 1.7 cm – 0.8 cm = 0.9 cm.

Vernier Calliper

Vernier calliper is an instrument which uses a combination of two scales, main scale and vernier scale sliding over each other, such that least count of the instrument is less than the least count of the main scale.



Measuring length of an object using Vernier callipers

The principle of a vernier is to make 'N' vernier scale divisions equal to (N – 1) main scale divisions.

Description of Vernier Callipers

A typical vernier calliper consists of a steel strip which is generally marked in centimetres and millimetres along the lower edge. This scale is known as the main scale. The end of the main scale is provided with the fixed jaws J_1 (external jaw) on the main steel strip; this scale is known as the vernier scale.

Generally, the vernier scale of a standard vernier calliper is provided with 10 graduations to coincide with 9 main scale divisions, i.e., the 10 divisions on vernier scale measure 9 mm.

The vernier frame is also provided with the movable jaws, J_2 (external jaw) on the lower side an J_4 (internal jaw) on the upper side.

For a standard vernier calliper, **Least Count (L.C.) = $\frac{\text{1 M.S.D.}}{\text{Number of V.S.D.s}}$**

(where M.S.D. is the main scale division and V.S.D. is the Vernier Scale. For a standard vernier calliper, 9 M.S.D.)

Least Count (L.C.) = 1 M.S.D. – 1 V.S.D.

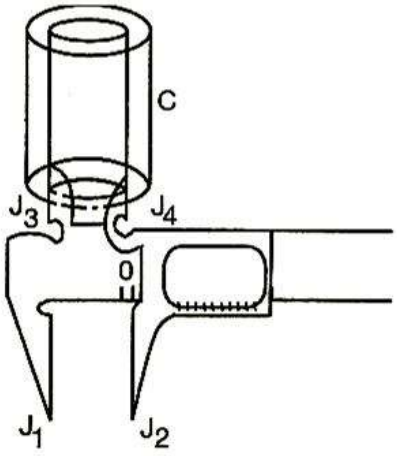
= 1 MM – 0.9.mm = 0.1 mm = 0.01 cm or

$= \frac{1\text{mm}}{10} = 0.1 \text{ mm} = 0.01 \text{ cm}$

Procedure for taking measurements using a vernier calliper:

1. Determine the least count of the given calliper.

2. To measure dimensions of any object, that object should be held tightly and gently between the external jaws (for external dimensions) or with internal jaws (for inner dimensions) as shown in below figure.



Inner diameter of a tube

Observation :

1. **Main Scale Reading (M.S.R.):** Is the smaller of the two values of the main scale between which the zero division of vernier scale lies.

2. **Vernier Coinciding Division (V.C.D.):** It is the vernier scale division which coincides with any one of main scale divisions. It is denoted as 'n'.

3. **Observed reading :** Length of the rod = y – x

= (z – x) + (y – x)

= M.S.R. + (y – z)

The fraction (y – z) can be determined using the Vernier scale.

$$y - z = (w - z) - (w - y)$$

Let 'n' be the V.C.D.

Then, $(w - z) = n \times$ M.S.D.

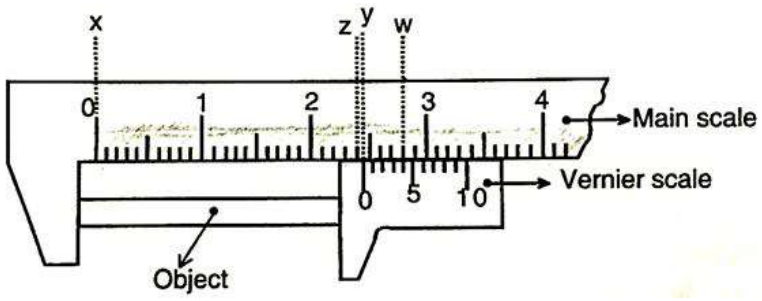
$(w - y) = n \times$ V.S.D

$\therefore y - z = n$(M.S.D. – V.S.D)

$= n \times$ L.C.

$\therefore$ Length of the rod, $y - x =$ M.S.R. $+ n \times$ L.C.

Thus, observed measurement = M.S.R. $+ n \times$ L.C.

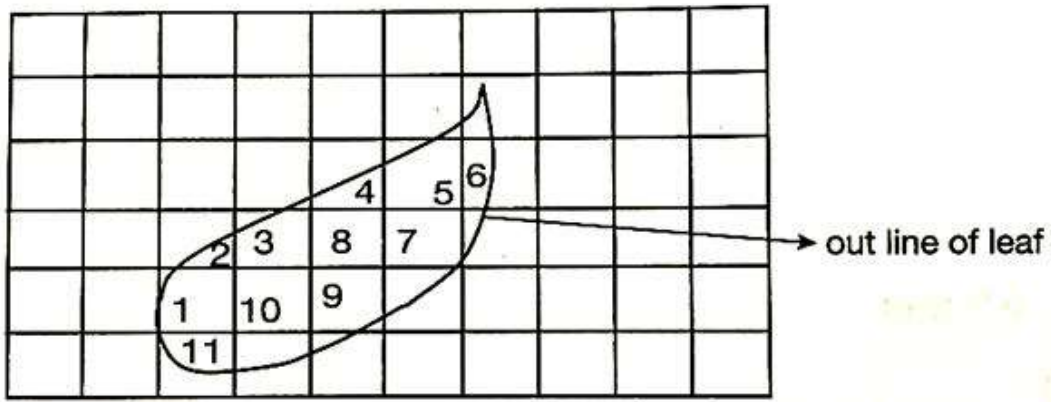


Measuring length of a rod using Vernier callipers

MEASUREMENT OF AREA

Area is the extent or measure of a surface. Area is a derived quantity and its units can be deduced from the units of length. The S.I. unit of area is **1 m² = 10000 cm²**. The area of regular geometrical figures like squares, rectangles, circles, triangles, etc., can be calculated by using appropriate formulae relating the areas of these figures to their length, breadth, radius, etc. For instance, the area of a square is given by $A = (\text{side})^2$; so by knowing the measure of the side of the square, its area can be calculated.

Measurement of the Area of a Leaf



Measuring area of a leaf using graph paper

Procedure

1. Place a leaf on a graph paper and draw its outline.

2. The area of the leaf in mm_2 is the number of squares that fall within this outline.

3. Generally, the squares with half or more than half of its area within the outline are counted and others can be neglected.

Example: In the above figure the squares labeled as 1, 3, 8, 7, 5, 9, 10 will be counted and remaining can be neglected. Thus, the area of leaf taken is = 7 mm^2.

MEASUREMENT OF VOLUME

We can use a Vernier calliper (along with a beaker or a calliper or a calorimeter and a magnifying glass) to measure the internal dimensions and depth of given beaker/calorimeter and hence can also find the volume of an object.

Measuring Jar

Measuring Jar is graduated in millimeters and used to measure the volume of liquid in mililitres.

Measuring Flask and Pilette

Measuring Flask and Pipette are used to take fixed amounts of liquids.

Burette

Burette has a nozzle vent at the bottom with a screw system and graduated in millimetres and is used to take the desired amount of a liquid.

To determine the volume of single drop of water

- Fill a clean burette with water, clamped upright to a stand.
- Remove air bubbles by opening the tap for some time.
- Note the level, V_1, of water in the burette.
- Allow the water to trickle slowly, drop by drop, counting the number of drops (n) at the same time.
- Close the tap after 20 cm^3 of water has been drained.
- The average volume of a drop of water = $\frac{20}{n}$ cm^3.

PRACTICE YOUR CONCEPTS

1. Volume of water in a burette is 35mL. Find the volume of a drop of water if volume of water in the burette is 5mL when 50 drops of water drained out.

Sol. Volume of single drop of water = $\frac{35-5}{50}$ = 0.6 mL.

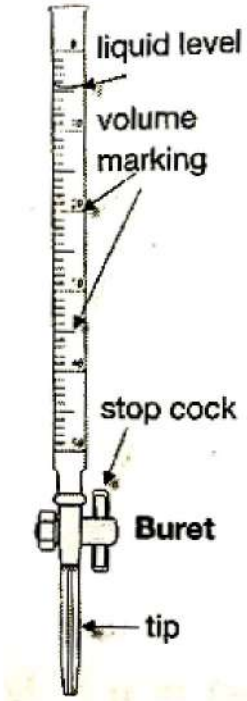


fig. Burette

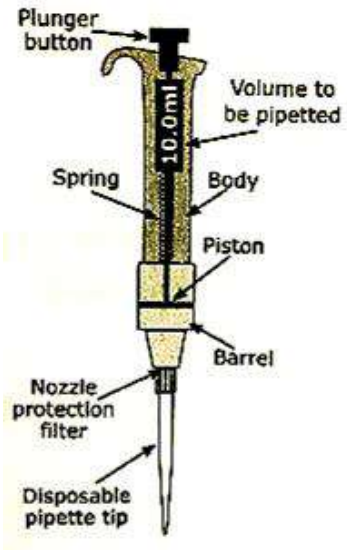


fig. Pipette

MEASUREMENT OF MASS

Mass

Mass is the amount of matter contained in a body. It is a fundamental quantity and its unit in S.I. system is kilogram(kg). Mass is different from weight, as weight is the force with which a body is attracted towards the Earth and changes from place to place. Mass of a body always remains constant and is generally measured using a common balance.

Common balance works on the principle of moments according to which a beam remains horizontal and 'balanced', when equal weights are placed at equal distance from the point suspension, which is at the middle of the beam. Spring balance, table balance, platform balance, roman steel yard, triple beam steel yard are a few of the other type of balance.

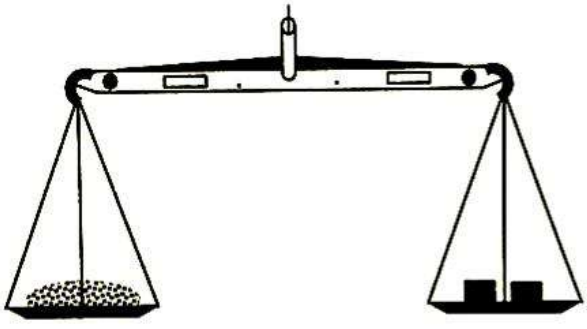


fig. Common Balance

Application of different types of balances.

S. No.	Type	Application
1.	Spring balance	Weight of an object
2.	Compression spring balance	Weight of a person
3.	Postal balances	In post offices
4.	Table balances	In fancy shops and sweet shops
5.	Platform balances	In hardware shops, parcel offices, railway stations
6.	Roman steelyard and Danish steel yard	In hardware shops
7.	Triple beam balance	In hardware shops
8.	Electronic balances	In jewellery shops for accurate measurements of mass
9.	Single pan analytical balance	In laboratories to measre mass upto 0.1 mg
10.	Microbalances	To measure mass upto 1 microgram (1 μg)

DENSITY AND RELATIVE DENSITY

The **density** of a substance is defined as the mass per unit volume. It is a derived quantity. The unit of density in S.I. system is kilogram per cubic metre (kg m^{-3}).

The ratio of the density of the substance to the density of water is called **relative density**. A specific gravity bottle is used to measure relative density.

Specific gravity bottle (density bottle) is a glass bottle with a long narrow neck and a glass stopper with a hole fitted the neck, designed to hold a specific volume of liquid indicated on the bottle. This is used to determine the relative density of liquids.

fig. Density Bottle

Measurement of Relative Density

To find the relative density of a liquid, the density bottle is initially filled with the liquid and then with water and the mass of the bottle in each case is noted.

We then use the following relation to find the relative density of the given liquid:

$$\textbf{Relative density} = \frac{\textbf{mass of V cm}^3\textbf{ of liquid}}{\textbf{mass of V cm}^3\textbf{ of water}}$$

$$\mathbf{1000\ kg/m^3 = 1\ g/cm^3}$$

The density and relative density value for some common substances are listed in the table given below:

Density and relative density of some common substances

S. No.	Substances	Density in kg m^{-3}	Relative density
1.	Water	1×10^3	1
2.	Kerosene	0.8×10^3	0.8
3.	Mercury	1.36×10^3	13.6
4.	Glass	2.5×10^3	2.5
5.	Copper	8.9×10^3	8.9
6.	Gold	19.3×10^3	19.3
7.	Hydrogen at S.T.P.	8.9×10^{-2}	8.9×10^{-5}
8.	Air at S.T.P.	1.29	1.29×10^{-3}

MOTION

Mechanics is classified into statics and dynamics.

Statics: It deals with bodies at rest under the action of forces.

Dynamics: Dynamics deals with bodies under motion and it is further classified into kinematics and kinetics.

Kinematics: It deals with the motion of bodies without considering the cause of motion.

Kinetics: It deals with the motion of bodies considering the cause of their motion.

Rest and Motion: An object is said to be at rest if its position does not change with respect to its surroundings with the passage of time, e.g., a clock hanging on the wall, a suitcase in a train.

An object is said to be in motion as long as its position changes with respect to its surroundings.

Ex. A moving train, rotation of the Earth about its axis.

Motion is Relative: Consider two persons in a lift. Let the lift move upwards. The two persons are not in motion with respect to each other. But for a person outside the lift, the two persons are in motion. Hence, motion is relative.

In our study of mechanics we shall refer to bodies or objects as particles. An object is said to be a particle (point object) if its dimensions are negligible. For example, in planetary motion around the sun, different planets can be approximated to be particles as the distance travelled by them is very large compared to their dimensions.

SCALERS AND VECTORS

All physical quantities can be classified into scalers or vectors. Quantities that can be completely specified by specified by means of numerical value and a unit are called **physical quantities**, and thus quantities which are said to have only magnitude are called **scalers**, e.g., mass, distance, time, speed, density and temperature.

Physical quantities that can be defined only if both magnitude and direction are specified are called **vectors**, e.g., displacement, force, velocity, acceleration, etc.

Ex- Consider a person moving in the eastern direction in a straight path from A to B. At position B he takes left turn and moves along a straight line to another position C which is due north as shown in the below figure.

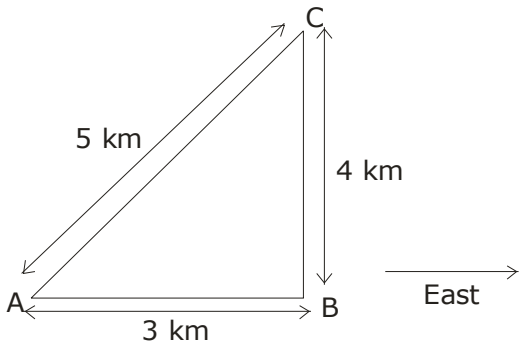


fig. Path covered by a person starting from A and ended at C

If lengths of AB and BC are 3 km and 4 km, respectively, the distance travelled by the body from A to C is given by AB + BC = 3 km = 7 km.

To measure this distance (the actual length of the path travelled) no direction is to be considered as it is not important in which direction it is covered. The magnitude gives the total description of the physical quantity and thus it is a scaler. The initial and final position of the person being A and C, respectively, the net displacement (change in position) of the person is given by AC (the length of the shortest path between the two positions). The magnitude (length) of AC is 5 km which can be obtained by using Pythagorean theorem. This displacement is in the direction from A to C. Thus, to measure displacement, the direction also needs to be specified along with the magnitude. Specifying only one cannot give the complete description of the quantity. Thus, the physical quantities such as displacement are vectors.

Geometrical Representation of a Vector

A vector can be represented by a line segment with an arrow head.

- The length of the line segment (AB) is proportional to the magnitude of the vector.

A ⟶ B

- The arrow head indicates the direction of the vector.

Consider a man walking along a straight path from P to Q, the length of the path between the two position being 100 m. Then, this displacement is represented by a directed line segment PQ as shown in the figure.

P ⟶ Q

The direction of the displacement is shown by the arrow and its magnitude is given by the length of the line segment drawn to scale. For example, if the length of the line segment PQ is chosen as 5 cm, the scale considered for drawing the line segment is 1 cm = 20 m. Instead if the length of the line segment is chosen to be 4 cm, the scale considered for drawing the line segment is 1 cm = 25 m.

An arrow or a short line is drawn above the quantity to represent a vector.

Ex. , $\vec{F}, \vec{a}, \overrightarrow{AB}, \overrightarrow{EF}$ etc.

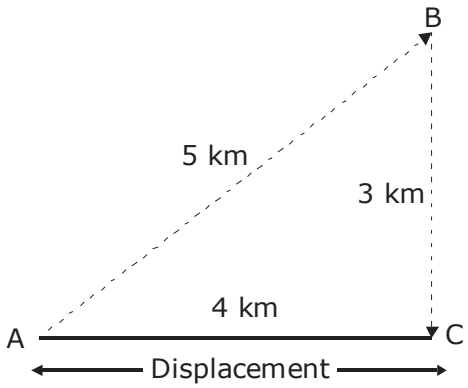
Difference between scalar quantity and vector quantity

Scalar Quantity	Vector Quantity
They have only magnitude	Both magnitude and direction are needed to define vectors.
Addition or subtraction of scalar quantities can be done by simple arithmetical means.	Special vector addition rules are needed for adding or subtracting vectors.

DISTANCE AND DISPLACEMENT

In order to study the motion of objects, we should first know the meaning of two terms distance and displacement. In everyday language, the words distance and displacement are used in the same sense but in physics these two words have different meanings. Let us understand this difference by taking an example.

Suppose a man lives at place A (Figure aside) and he has to reach another place C, but first he has to meet his friend living at place B. Now, the man starts from point A and travels a distance of 5 km to reach B, and then travels another 3 km from B to reach C. Thus, the man goes along the path ABC (shown by dotted lines).



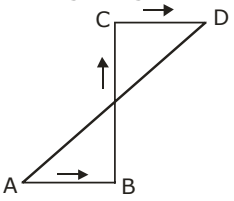
Length of the path ABC gives us the actual distance travelled by the man. Thus, the distance travelled by a body is the actual length of the path covered by a moving body irrespective of the direction in which the body travels. For example, in this case, the actual length of the path covered by the man is 5 km + 3 km = 8 km, so the distance travelled by the man is 8 km.

- We will now discuss this problem in a different way. When the man has reached point C, we want to know how far he is now from the starting point A, that is we want to know the shortest distance between point A and point C. Let us draw a straight line AC between A and C. The length of the straight line path AC (which is 4 km here) is the displacement of the man from point , that is, on reaching C, the man is only 4 km away from the starting point A. This displacement is in the east direction. Thus, when a body moves from one point to another, the distance travelled refers to the actual length of the indirect path whereas displacement refers to the straight line path between the initial and the final positions. So, whatever be the actual length of the path followed by a moving body, displacement of the body is always represented by the shortest distance between the initial and final position of the body. Thus when a body moves from one position to another, the shortest (straight line) distance between the initial position and final position of the body, along with direction, is known as its displacement. In the above example, the shortest distance between the initial position A and final position C of the man is 4 km, so the displacement of man is 4 km in the east direction. It is clear that the distance travelled has only magnitude whereas displacement has magnitude as well as direction.

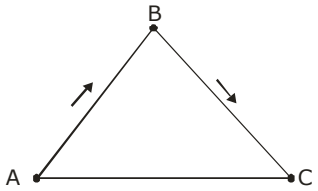
Displacement = Final position – Initial position

1. Graphical Representation of Displacement and Distance Travelled

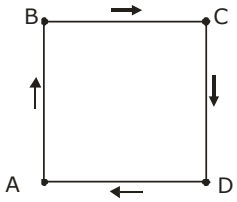
The difference between the distance travelled by a body and its displacement is shown graphically in the figure gien below:



Path : A to B, B to C and C to D
Distance travelled = AB + BC + CD
Displacement = AD
(from A to D)



Path : A to B, B to C
Distance travelled = AB + BC
Displacement = AC
(from A to C)



Path : A to B, B to C, C to D and D to A
Distance travelled = AB + BC + CD + DA
Displacement = 0
(because the body has returned to its initial position)

2. Positive, Negative and Zero Displacement

Depending upon the locations of the initial and the final positions, the displacement may be negative, zero or positive.

Let x_1 be the initial position of an object undergoing motion and x_2 be the final positions of it. Then displacement, d is given by, $d = x_2 - x_1$.

When x_2 is greater than x_1, then

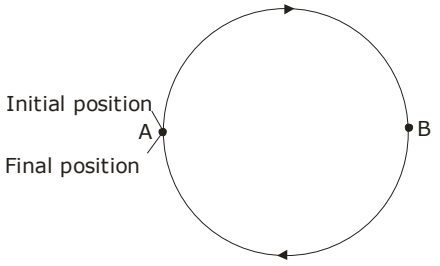
$d = x_2 - x_1$ is positive

When x_2 is less than x_1, then

$d = x_2 - x_1$ is negative

When x_2 is equal to x_1, then

$d = x_2 - x_1 = 0$



If the displacement of a body is zero, it means that the initial and final positions of the body are same, or it means the body returns to its initial position.

PRACTICE YOUR CONCEPTS

2. Show the following vectors graphically:

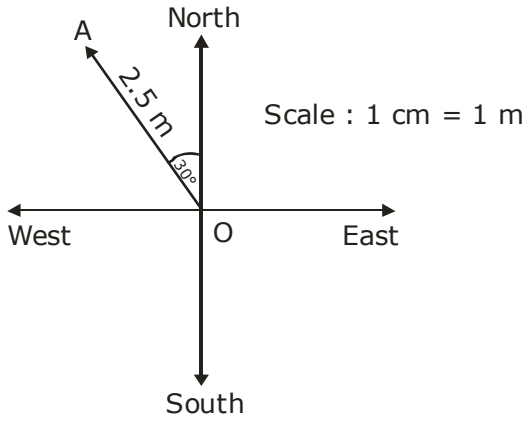
(a) a displacement of 2.5 m towards 30° west of north on a scale, 1 cm = 1 m

(b) a force of 5 N towards north-east on a scale 1 cm = 1 N.

Sol.

(a) We have, 1 m = 1 cm

So, 2.5 m = 2.5 × 1 cm = 2.5 cm

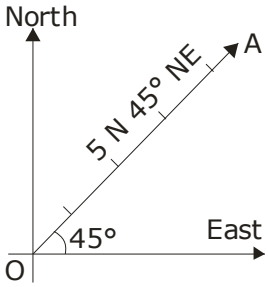


This means the vector can be shown graphically by a line of 2.5 cm in the direction 30° west of north. Thus, the displacement vector is represented by the arrow OA.

(b) We have to represent a force (a vector quantity) of 5 N on the scale,

1 cm = 1 N, 5 N = 5 cm

This means the force vector of 5 N magnitude can be shown graphically by an arrow of length 5 cm in the north-east direction means at an angle of 45° with the north and east directions. Thus vector OA shown in figure, represents a force of 5 N in the north-east direction (or 45° NE).



Speed is a scalar quantity but velocity is a vector quantity. Likewise, distance is a scalar quantity but displacement is a vector quantity.

3. Can displacement of an object in motion be zero or negative ?

Sol. Yes, displacement is zero when final position coincides with the initial position. Displacement is negative when direction of motion is reversed.

4. A body thrown vertically upward rises up to a height h, and comes back to the initial position. Calculate (a) the total distance travelled by the body, (b) the displacement of the body.

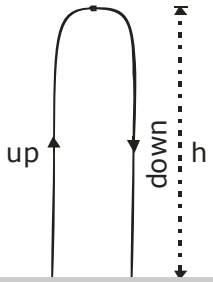
Sol. The body thrown vertically up rises up to a height h, and then returns to its initial position. So, from the figure given.

(a) The total distance travelled = h + h = 2h

(b) The body returns to its initial position.

So, the initial and final positions coincide with each other.

Therefore, displacement fo the body = 0.



SPEED

Speed is defined as the rate at which a particle covers a distance along a given path.

It is given by the ratio of distance travelled to time taken.

$$\text{Speed} = \frac{\text{Distance travelled (s)}}{\text{Time (t)}} = \frac{s}{t}$$

Note:

(i) Since distance travelled is a scalar quantity, the speed of a particle is also a scalar.

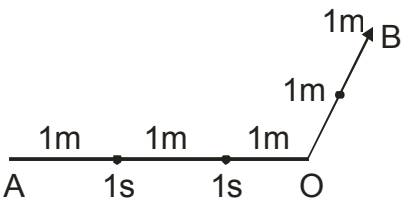
(ii) The unit of speed is cm s^{-1} in CGS system and m s^{-1} in MKS or SI system.

- **Instantaneous Speed**

  It is the speed of particle at a given instant.

  The speedometer of a vehicle indicates the instantaneous speed of the vehicle.

  Consider a person travelling from A to B through O. If he walks at a constant rate of 1 m s^{-1} i.e., for every 1 s if he travels 1 m, then the person is said to posses uniform speed. Uniform speed indicates that the instantaneous speed of particle remains the same through the motion.



- **Uniform Speed:** If an object travels equal distances in equal interval of time then the object is said to be in uniform motion.
- **Variable Speed:** If the distance travelled by the particle changes with time then the body is said to be moving with variable speed.
- **Average Speed:** It is defined as the ratio of the total distance travelled to the total time taken by the particle to cover that distance.

$$\text{Average speed} = \frac{\text{total distance}}{\text{total time}} \quad , \quad v_{avg} = \frac{s}{t}$$

VELOCITY

It is the rate of change of displacement,

$$\textbf{velocity} = \frac{\textbf{displacement}}{\textbf{time}}$$

Velocity is a vector quantity. Its unit is same as that of speed (m s^{-1}).

- **Instantaneous Velocity :** The velocity of a particle at a given instant of time is called its instantaneous velocity.
- **Average Velocity:** It is the ratio of total displacement to total time taken.

$$\text{Average velocity} = \frac{\text{total displacement}}{\text{total time}} \quad , \quad v_{avg} = \frac{s}{t}$$

Uniform and Non-uniform Velocity

- **Uniform Velocity:** A body has a uniform motion if it travels equal distances in equal intervals of time, no matter how small these time intervals may be. For example, a car running at a constant speed of say, 10 metres per second, will cover equal distances of 10 metres, every second, so its motion will be uniform. Note that the distance-time graph for uniform motion is a straight line.
- **Non-uniform Velocity:** A body has a non-uniform motion if it travels unequal distances in equal intervals of time. For example, if we drop a ball from the roof of a tall building, we will find that it covers unequal distances in equal intervals of time.

PRACTICE YOUR CONCEPTS

5. A scooterist covers a distance of 3 kilometers in 5 minutes. Calculate his speed in:

(a) centimetres per second (cm/s)

(b) metres per second (m/s).

Sol.

(a) In order to calculate the speed in centimetres per second we should convert the given distance of 3 kilometres into centimetres and the given time of 5 minutes into seconds. Please note that 1 kilometres has 1000 metres and 1 metres has 100 centimetres.

Now, distance travelled = 3 km = 3 × 1000m = 3 × 1000 × 100 cm = 300,000 cm

Time taken = 5 minutes = 5 × 60 seconds = 300 s

We know that, speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{300{,}000 \text{ cm}}{300 \text{ s}} = 1000$ cm/s

Thus, the speed of scooterist is 1000 centimetres per second.

(b) In order to express the speed in metres per second we should convert the given distance of 3 kilometres into metres and the given time of 5 minutes into seconds, thus in this case:

Distance travelled = 3 km = 3 × 1000 m = 3000 m

Time taken = 5 minutes = 5 × 60 seconds = 300 s

Now, speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{3000 \text{ m}}{300 \text{ s}} = 10$ m/s.

So, the speed of scooterist is 10 metres per second.

6. A bus covers a distance of 250 km from Delhi to Jaipur towards West in 5 hours in the morning and returns to Delhi in the evening covering the same distance of 250 km in the same time of 5 hours. FInd (a) average speed, and (b) average velocity, of the bus for the whole journey.

Sol.

(a) Average speed = $\frac{\text{Total distance travelled}}{\text{Total time taken}} = \frac{250 \text{ km} + 250 \text{ km}}{5\text{h} + 5\text{h}} = \frac{500 \text{ km}}{10 \text{ h}} = 50 \text{ km h}^{-1}$

Thus, the case, the bus travels 250 km from Delhi to Jaipur towards west and then come back to starting point Delhi in the reverse direction. So, the total displacement (or total distance travelled in a specified direction) will be

$$250 \text{ km} - 250 \text{ km} = 0 \text{ km}.$$

Now, Average velocity = $\frac{\text{total displacement}}{\text{total time taken}} = \frac{250\text{km} - 250 \text{ km}}{5\text{ h} + 5\text{h}} = \frac{0 \text{ km}}{10 \text{ h}} = 0 \text{ km h}^{-1}$

Thus, the average velocity of the bus for the whole journey (both ways) is 0 kilometres per hour.

No direction can be stated in this case of zero velocity.

Remember:

- The average speed of an object is greater than or equal to the magnitude of the average velocity over a given time internal.
- Charge is not taken as a fundamental quantity because charge is never at rest.

ACCELERATION

Acceleration of a body is defined as the rate of change of velocity of the body with time.

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time taken}}$$

Suppose the initial velocity of a body is u and it changes to a final velocity v in time t, then

$$a = \frac{v-u}{t}$$ where, a = accleration of the body

$$\text{Unit of acceleration} = \frac{\text{unit of velocity}}{\text{unit of time}} = \frac{\text{metre/second}}{\text{second}} = \text{metre/second}^2 = \text{m s}^{-2}$$

Acceleration is a vector quantity.

Cases :

- When a body is moving along a straight line with a uniform velocity, change in its velocity is zero, so acceleration is also zero.
- When the velocity of a body increases with time v > u. In that case acceleration is positive.
- When the velocity of a body decreases with time v < u. In that case acceleration is negative. Negative acceleration is also called retardation.

Uniform and Non-uniform Acceleration

- **Uniform acceleration:** If the velocity of a body increases by equal amounts in equal intervals of time, then it is said to be moving with uniform acceleration.

- **Non-uniform acceleration:** A body has a non-uniform acceleration of its velocity increases by unequal amounts in equal intervals of time.

PRACTICE YOUR CONCEPTS

7. A train is moving at a speed of 100 m s^{-1} comes to rest in 5 seconds. Find its retardation.

Sol. Initial velocity of the train, u = 100 m s^{-1}

final velocity of the train, v = 0 m s^{-1}

time taken by the train to come to rest, t = 5 s

$\therefore$ acceleration of the train,

$$a = \frac{v-u}{t} = \frac{0-100}{5} = -20 \text{ m s}^{-2}$$

Hence, retardation of the train = 20 m s^{-2}

8. A train starting from rest moves with a uniform acceleration of 0.2 m/s^2 for 5 minutes. Calculate the final velocity and the average velocity in this time.

Sol. Acceleration a = 0.2 m/s^2, initial velocity u = 0

Time t = 5 minutes = 300 s

Final velocity, v = ?

$$a = \frac{v-u}{t} \quad \Rightarrow \quad 0.2 = \frac{v}{300} \quad \Rightarrow \quad v = 60 \text{ m/s}$$

Average velocity,

$$v_{av} = \frac{v+u}{2} = \frac{60+0}{2} = 30 \text{ m/s.}$$

GRAPHICAL REPRESENTATION OF MOTION

Various types of graphs can be used to calculate speed or velocity, acceleration and distance travelled by a body. In case of graph based on motion, time is always taken along the x-axis whereas distance or speed or velocity is taken along the y-axis.

- **Displacement-time graph:** In this graph displacement is plotted along y-axis and time along x-axis.

Ex-

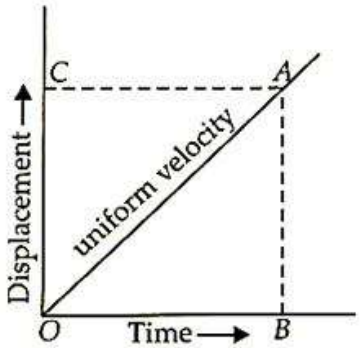
Time in s	0	1	2	3	4	5
Displacement in m	0	5	10	15	20	25

Significance of displacement - time graph

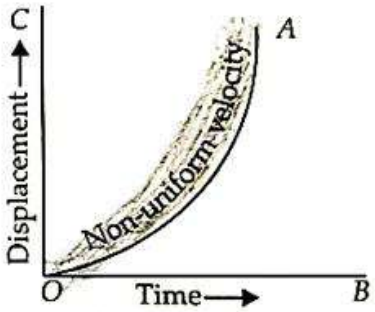
(i) Displacement of a particle at any instant of time can be determined.

(ii) Nature of motion of the particle can be studied.

(iii) Slope of the graph at any point gives the instantaneous velocity of the body.



Displacement-time graph for uniform velocity

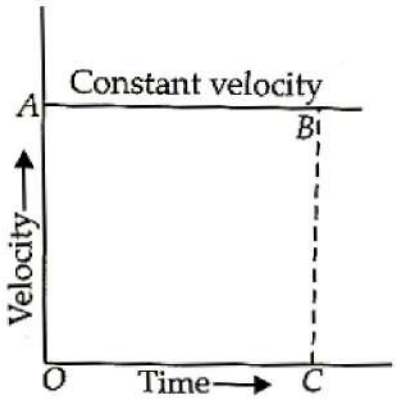


Displacement-time graph for non-uniform velocity

- **Velocity-time graph:** We can have three types of velocity-time graph for a moving body. These three cases are:
  (i) When the velocity of the body remains constant (and there is no acceleration)
  (ii) When the velocity of the body change at a uniform rate (there is uniform acceleration)
  (iii) When the velocity of the body changes in a non-uniform way (there is non-uniform acceleration)

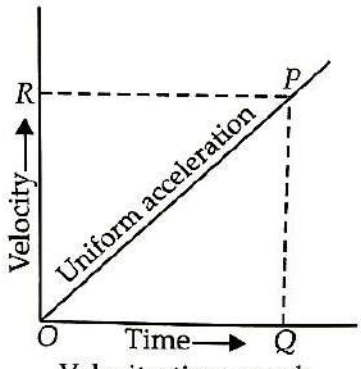
We will now discuss these three types of velocity-time graphs in detail, one by one.

Velocity-time graph when the velocity remains constant: If the velocity-time graph of a body is a straight line parallel to the time axis, then the velocity of the body is constant (or uniform).



Velocity-time graph
when the velocity remains constant
(No acceleration)

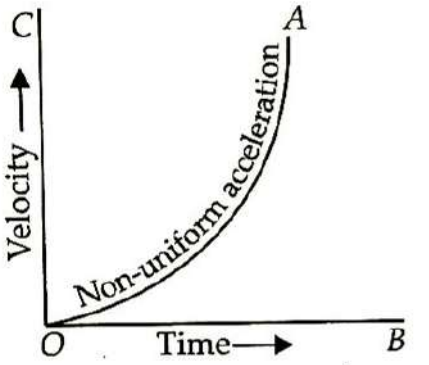
Velocity-time graph when velocity changes at a uniform rate (Uniform acceleration): The velocity-time graph for a uniformly changing velocity (or uniform acceleration will be a straight line).



Velocity-time graph
showing uniform acceleration

Velocity-time graph when velocity changes at a non-uniform rate (Non-uniform acceleration) : When the velocity of a body changes in an irregular manner, then the velocity-time graph of the body is a curved line (as shown y the line OA).

Even now, the distance travelled by the body is given by the area between the velocity-time curve and the time axis.



Velocity-time graph for non-uniform acceleration

Equations of Motion

There are three equations in mechanics which gives the relation betwen initial velocity, final velocity, displacement, time and acceleration.

They are as follows:

(i) $v = u + at$ **(ii)** $v^2 = u^2 + 2as$ **(iii)** $s = ut + \frac{1}{2}at^2$

where v = final velocity, u = initial velocity, a = acceleration, t = time taken, s = displacement.

PRACTICE YOUR CONCEPTS

9. A body is accelerating at a constant rate of 10 ms^{-2}. If the body starts from rest, how much distance will it cover in 2 seconds ?

Sol. Here, acceleration, a = 10 ms^{-2},

initial velocity, u = 0

distance covered, s = ?

time taken, t = 2 s

As $s = ut + \frac{1}{2}at^2$,

$s = 0 \times 2 + \frac{1}{2} \times 10(2)^2 = 20$ m

10. A car acquires a velocity of 72 km/h in 10 seconds starting from rest. Find (a) the acceleration (b) the average velocity (c) the distance travelled in this time.

Sol. Here, initial velocity, u = 0

final velocity, $v = 72\frac{km}{h} = \frac{72\times1000\ m}{60\times60\ s} = 20\ m\ s^{-1}$

time taken, t = 10 s

(a) acceleration,

$$a = \frac{v-u}{t} = \frac{20-0}{10} = 2\ ms^{-2}$$

(b) averge velocity,

$$v_{av} = \frac{u+v}{2} = \frac{0+20}{2} = 10\ ms^{-1}$$

(c) distance travelled, s = ?

From $v^2 - u^2 = 2as$,

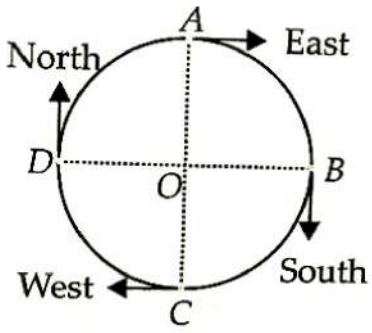
$$s = \frac{v^2-u^2}{2a} = \frac{(20)^2-0}{2\times2} = 100\ m$$

UNIFORM CIRCULAR MOTION

The motion of an object along a circular path is called circular motion. In other words, motion in a circle is circular motion.

During circular motion, the direction of the motion at any point is given by the tangent to the circle at that point.

When a body move along a circular path with a constant (uniform) speed, its motion is called uniform circular motion.



Examples of Circular Motion

- The moon moves around the earth in a circular path.
- Motion of a stone tied at the end of a string when rotated.

ON YOUR TIPS

- The quantities that can be measured are called physical quantities.
- A quantity which is independent of other quantities is called fundamental quantity.
- A quantity which is dependent on other physical quantities and can be derived from the fundamental quantities is called derived quantity.
- The unit of a fundamental quantity like mass or length is called fundamental unit.
- The unit of a derived quantity like volume or velocity is called derived unit.
- A system which defines the fundamental units, in comparison with which a fundamental quantity can be expressed is referred to as system of units.
- One metre is 1,650,763.73 times the wavelength of orange light emitted by a krypton atom at normal pressure.
- One kilogram is the mass of a certain lump made from an alloy of platinum-iridium maintained at 0°C in the International Bureau of weights and measures.
- One second is defined as $(1/86,400)^{th}$ part of the mean solar day.
- Least count of an instrument is the smallest measurement that the instrument can make accurately.
- Vernier calliper is an instrument which uses a combination of two scales, main scale and vernier scale.
- Area is the extent or measure of a surface. The S.I. unit of area is m^2 and 1 m^2 = 10000 cm^2.
- Measure jar is graduated in millilitres and used to measure the volume of liquids in millilitres.
- Burette has a nozzle vent at the bottom with a screw system and graduated in millilitres and is used to take the desired amount of a liquid.
- Mass is the amount of matter contained in a body. It is a fundamental quantity and its unit in S.I. system is kilogram (kg).
- The density of a substance is defined as the mass per unit volume. The unit of density in S.I. system is kilogram per cubic metre (kg m^{-3}).
- The ratio of the density of the substance to the density of water is called relative density or specific gravity. Since this is a ratio of densities, it is a mere number without any units.
- Specific gravity bottle (density bottle) is a glass bottle with a long narrow neck and a glass stopper with a hole fitted into the neck, designed to hold a specific volume of liquid indicated on the bottle.

EXERCISE – I

MULTIPLE CHOICE QUESTIONS

1. Which of the following is a fundamental quantity ?
(A) Length (B) Area
(C) Volume (D) Force

2. Which of the following unit is a derived unit ?
(A) Cubic metre (B) Newton
(C) Metre^2 (D) All of these

3. The unit of electric current is denoted by
(A) I (B) E
(C) A (D) a

4. Prefix used for 10^{-3} is
(A) Milli (B) Micro
(C) Mega (D) Kilo

5. Prefixes used for negative powers of 10 are called
(A) Units (B) Multiples
(C) Submultiples (D) Standards

6. The SI unit of mass is
(A) kg (B) gram
(C) second (D) g cm^{-3}

7. Area is measured in
(A) m^2 (B) cm^2
(C) mm^2 (D) All of these

8. _____ is used to measure the length of a curved line.
(A) A thread (B) A graph paper
(C) Water (D) None of these

9. Relation between length (ℓ), area (A), volume (V) is
(A) $V = A\ell$ (B) $V = \frac{A}{\ell}$
(C) $\ell = VA$ (D) $V = A\ell^2$

10. If the length of a square is 2 cm, then its area in SI system is-
(A) 4 cm^2 (B) 4×10^4 m^2
(C) 4×10^{-4} m^2 (D) 40 cm^2

11. The angle between the minutes hand and hours hand in a clock, at 12:30 p.m. is
(A) > 0° (B) > 30°
(C) > 60° (D) > 90°

12. Temprature is a _____ quantity.
(A) Derived (B) Fundamental
(C) Physical (D) Both (B) and (C)

13. Time is a fundamental quantity
(A) Since it is independent of other quantities
(B) Since it is measured in secondary scale
(C) Since it is dependent on other quantities
(D) Since it depends on the mass of the clock

14. The device used to measure temperature is
(A) Metre scale (B) Barometer
(C) Thermometer (D) Lactometer

15. Which of the following units of temperature is not followed by the word 'degree' ?
(A) Celsius (B) Centigrade
(C) Fahrenheit (D) Kelvin

16. The SI unit of velocity is
(A) cm s^{-1} s (B) m m s^{-1}
(C) m s^{-1} (D) km h^{-1}

17. Which of the following is different from the others ?
(A) Distance covered (B) Displacement
(C) Velocity (D) Acceleration

18. Centimeter per second is the unit of
(A) Distance covere (B) Displacement
(C) Velocity (D) Acceleration

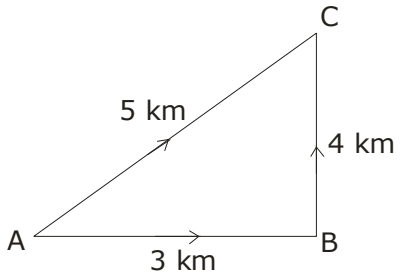
19. If the velocity of a body decreases gradually with time, then it is said to be in

(A) Acceleration (B) Deceleration
(C) Retardation (D) Both (B) and (C)

20. A bus is moving with uniform velocity

(A) Then its acceleration is non-zero
(B) Then its acceleration is negative
(C) Then its acceleration is zero
(D) Then its acceleration is positive

21. Consider a person moving 3 km east of A. He then turns north and moves 4 km in total time 2 hours. (as shown in given figure). Find his average speed.

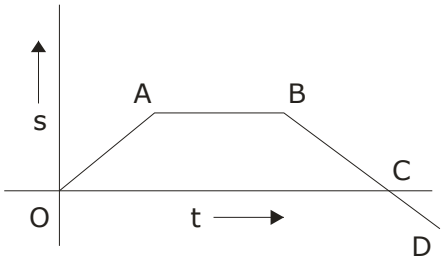


(A) 3.5 km h^{-1} (B) 2.5 km h^{-1}
(C) 1.5 km h^{-1} (D) 0.5 km h^{-1}

22. Two persons X and Y take 10 hours and 12 hours respectively to travel from Bangalore to Hyderabad, then

(A) average velocity of X is equal to the average velocity of Y
(B) average velocity of X is less than that of Y
(C) average velocity of X is more than that of Y
(D) we cannot compare their velocities.

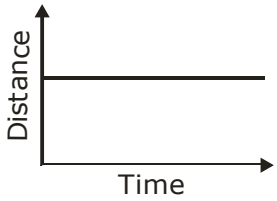
23. The displacement-time graph of a body is shown in the figure below.



The part of the graph that represents the body at rest is

(A) OA (B) AB
(C) BC (D) CD

24. The distance-time graph of an object is shown in the figure. The object is



(A) at rest
(B) is moving with constant speed
(C) is moving with constant velocity
(D) is moving with constant acceleration.

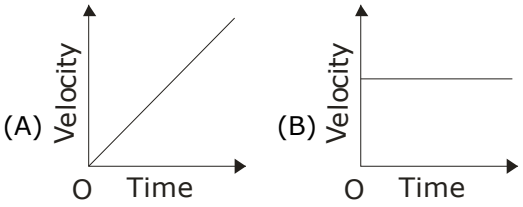
25. Suppose you walk across a room of length 9 m with a velocity of 1.5 km h^{-1}. Express this velocity in m/s and find the time you will take to move across the room.

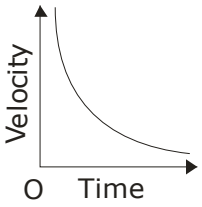
(A) 20.6 s (B) 21.6 s
(C) 22.6 s (D) 23.6 s

26. A body thrown vertically upwards reaches a maximum height h. It then returns to ground. Find the distance travelled and the displacement.

(A) 2h, 0 (B) h, 0
(C) 0, 2h (D) 0, h

27. A body moves with uniform velocity. Which of the graphs shown here is a graph of velocity against time for this motion ?



(C) 

(D) 

28. Physical quantity which we can't obtain from a distance-time graph is
(A) Speed
(B) Time taken
(C) Change in position
(D) Change in weight

29. The speed of a train which covers 200 kilometre in 4 hours is
(A) 30 km h^{-1} (B) 50 km h^{-1}
(C) 80 km h^{-1} (D) 70 km h^{-1}

30. The distance between two stations is 240 km. A train takes 4 hours to cover this distance. Find the speed of the train.
(A) 40 km h^{-1} (B) 50 km h^{-1}
(C) 60 km h^{-1} (D) 70 km h^{-1}

31. The relation between speed and displacement is
(A) displacement = speed / time
(B) displacement = speed × time
(C) displacement = time / speed
(D) none of the above

32. The SI unit of luminous intensity is
(A) ampere (B) candela
(C) mole (D) none of these

33. 1 A.U. is equal to
(A) 1.5×10^{11} m (B) 1.5×10^{10} m
(C) 1.5×10^{9} m (D) 1.5×10^{-11} m

34. Which of the following is different from others ?
(A) Speed (B) Acceleration
(C) Force (D) Time

35. The amount of substance in the SI system of units is represented by
(A) candela (B) mole
(C) weight (D) kilogram

FILL IN THE BLANKS

1. To measure irregular areas _____ paper is used.

2. 2 decades are equal to _____ years.

3. 5 centimeters are equal to _____ metres.

4. _____ grams make 0.2 kilograms.

5. 5 milliseconds is equal to _____ .

6. The ratio of the SI unit of mass to its CGS unit is _____ .

7. A thread of length 20 cm is made into square, then the length of its side is _____ .

8. Ratio of the SI unit of volume to the SI unit of area is _____ .

9. If the volume of a sphere is $\frac{4}{3}\pi r^3$ where $\pi = \frac{22}{7}$ and r is radius of the sphere, then the radius of the sphere of volume $\frac{704}{21}$ m^3 is _____ .

10. _____ grams make 20 miligrams.

11. The least measurement of time in a wall clock is _____ .

12. The thermometer used to measure the minimum and maximum temperature of a day is called ____ thermometer.

13. The short hand of a clock is at 12 and the minutes hand is 3, then the time at that instant is _____ .

14. The relations between kelvin and celsius scales is K = C + 273. The temperature of a body in Kelvin scale is 19 K, if its equivalent temperature in celsius scale is _____ .

15. The shape of six's maximum and minimum thermometer is in the shape of the English alphabet _____ .

TRUE/FALSE

1. Length, mass, time are derived quantities.

2. If impulse = force × time and the S.I. unit of force is newton (N), then the S.I., unit of impulse is newton second.

3. CGS, FPS, SI, MKS are system of fundamental units.

4. 1,650,763.73 is the number of waves of orange light that will be emmitted by krypton in 10 m.

5. 1 kg = 100 g.

6. A standard unit should not change with respect to time bu may change from place to place.

7. The zeroth division of a vernier scale lies between the 40th and 41st main scale divisions. Then, the M.S.R. = 4 cm if 1 M.S.D. = 1 mm.

MATCH THE COLUMN

1.

Column A	Column B
A. Temperature	(a) Definition of metre
B. S.I. unit	(b) Measurement of volume
C. Roman	(c) Fundamental quantity
D. ampere	(d) Derived unit
E. Krypton	(e) pound
F. Area	(f) kilogram
G. newton	(g) Derived quantity
H. Pipette	(h) Fundamental unit
I. Cesium-133	(i) Measurement of mass
J. FPS system	(j) Definition of second

SHORT ANSWER TYPE QUESTIONS

1. What are the characteristics of a standard unit ?

2. List the fundamental quantities along with their units in S.I. system.

3. Define least count. Describe the method to find the least count of a vernier calliper.

4. A vernier calliper has 20 divisions on the vernier scale. One centimetre on the main scale is divided into 20 equal parts. Find the least count of this instrument.

5. While measuring the length of a copper rod using a vernier calliper, the zero of the vernier scale was found to be between 4.6 cm and 4.7 cm on the main scale. The 6^{th} division of the vernier scale is found to coincide with a division on the main scale. Find the length of the rod if the least count is 0.01 cm.

LONG ANSWER TYPE QUESTIONS

1. Explain the need for standards and system of units in measurements.

2. Explain the principle of vernier. Draw a neat diagram of a vernier calliper showing the various parts.

3. Describes a vernier calliper and explain the method by which the inner diameter of a hollow cylinder is determined.

4. Draw neat labelled diagrams of a pipette and a burette.

ACTIVITY BASED QUESTIONS

1. A vernier scale has 10 divisions. It slides over the main scale, whose 1 M.S.D. is 1.0 mm. If the number of divisions to the left side of the zero fo the vernier scale on the main scale is 49 and the 8^{th} vernier scale division coincides with the main scale, calculate the length in centimetres.

2. When a vernier calliper is used to measure external and internal diameters of an aluminium tube, the observations were made as follows:

For external diamter :

Main scale reading = 2.2 cm

Vernier coinciding division = 4

For inner diameter:

Main scale reading = 1.8 cm

Vernier coinciding division = 8

If the least count of vernier calliper is 0.1 mm, find the thickness of the wall of the tube.

3. A vernier calliper has 10 divisions on the vernier scale. If one centimetre of main scale is divided into 5 equal parts, find the best possible least count of the given vernier calliper.

EXERCISE – II

MULTIPLE CHOICE QUESTIONS

1. If the unit of mass is doubled and the units of length are halved, how much is 20 N of force in new units ? (1 N = 1 kg ms^{-2})

(A) 0.5 N

(B) 5 new units of force

(C) 5 N

(D) 0.5 new units of force

2. Which among the following physical quantities does not possess a unit ?

(A) Area (B) Volume

(C) Density (D) Specific gravity

3. Which of the following is not a derived quantity ?

(A) The area of floor of a room

(B) The height of a room

(C) The volume of air in a room

(D) The weight of air in a room

4. While measuring the diameter of a sphere using a vernier callipers the main scale reading was found to be p while the vernier coinciding division was q. If the least count of the instrument is r, then the radius of the sphere is given by the expression _____ .

(A) p + q + r (B) $\frac{qr + p}{2}$

(C) p + qr (D) $\frac{pr + q}{2}$

5. Which of the following equations is true with reference to a vernier caliipers ?

(A) Least count = 1 M.S.D. – 1 V.S.D.

(B) 1 M.S.D. = (L.C.) × number of divisions on the Vernier scale

(C) If the least count is 0.1 mm, then

1 M.S.D. = $\frac{N}{10}$ mm

(D) All of the above

6. The CGS unit of average speed is _____ .

(A) m s^{-1} (B) cm s^{-1}

(C) ft s^{-1} (D) km s^{-1}

7. To determine the diameter of a rod a student wound a thread 5 times a round the rod and measured the length of thread as 156 mm on a metre scale. Using this value he calculated the diameter of the rod. If the actual diameter of the rod is 9.94 mm, what is the error that could result in the method followed by the student ? (take π = 22/7)

(A) + 0.01 mm (B) –0.01 mm

(C) +0.02 mm (D) – 0.02 mm

8. In a vernier calliper 1 M.S.D. = 0.1 cm and the least count is 0.05 mm. If the reading on this vernier callipers while taking a measurement is 2.8 mm, then the vernier coinciding division is _____ .

(A) 20 (B) 4

(C) 8 (D) 16

9. Which of the following is true about the density of a substance ?

(A) It is a derived quantity

(B) The unit of density in S.I. system is kilogram per cubic metre

(C) The density of a substance can be measured if the mass of the substance for a certain volume is known

(D) All of the above

10. The main scale readings of a vernier callipers (1 M.S.D. = 1 mm) having least count 0.01 cm for the internal and external diameters of a hollow tube are 11 mm and 12 mm. The minimum thickness of the tube is _____.

(A) 1 mm (B) 0.1 mm

(C) 0.05 mm (D) 0.5 mm

11. The following information is noted in respect of two vernier callipers A and B.

Vernier calipers	M.S.D.	No. of divisions on vernier scale
A	1 mm	20
B	3 mm	30

If N V.S.D. = (N – 1) M.S.D. in both the vernier callipers, then which of the following statements is true ?

(A) The least count of A is less than that of B

(B) The least count of B is 0.01 cm

(C) The largest measurement that can be made between 10 mm and 11 mm with the vernier callipers A is 10.95 mm

(D) All of the above

12. Three cylindrical flasks. A, B and C of diameter 50 mm, 75 mm and 100 mm, respectively have graduation marked in mm and used for measurement of volume of liquid. Which of the following statements is correct ?

(A) A is more accurate than B and C

(B) C has better least count than B

(C) The least counts of all three are the same

(D) B has better least count than A.

13. R.D. of 'x' and 'y' are 3 and 2, respectively. Then, the density of 'x' with respect to that of 'y' is _____ .

(A) 6 (B) 5

(C) 1.5 (D) 1

14. The initial and final readings of a burette while draining out 50 drops of a liquid are 10 mL and 40 mL, respectively. Then, the volume of each drop is _____ .

(A) 0.6 mL (B) 0.06 cm^3

(C) 6×10^{-2} litres (D) 6×10^{-6} m^3

15. If the ratio of density of ice to that of wood is (9/8) and the relative density of ice is 0.9, then the density of wood is _____ kg m^{-3}.

(Take density of water = 10^3 kg m^{-3})

(A) 0.8 (B) 800

(C) 8×10^3 (D) 80

16. A vernier calipers has positive zero error of 0.05 mm. While finding the diameter a cylinder, the MSR is 9 mm and the VCD is 9. If the least count of the vernier caliper is 0.1 mm, the area of cross section of the cylinder is __ mm^2.

(A) 76.2 (B) 19.1

(C) 23.6 (D) 26.5

17. If there are 'N' number of vernier scale division (V.S.D.) an N V.S.D. = (N – 2) M.S.D., find the value of L.C. in terms of 'N'.

(A) $\frac{1\,\text{M.S.D.}}{N}$ (B) $\frac{2\,\text{M.S.D.}}{N}$

(C) $\frac{(N-2)\,\text{M.S.D.}}{N}$ (D) $\frac{N\,\text{M.S.D.}}{2}$

18. When a body moves with uniform velocity then

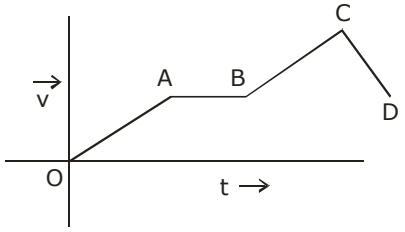
(A) it has zero acceleration

(B) it moves along a straight line path

(C) average velocity = instantaneous velocity

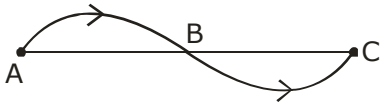
(D) all of the above

19. The velocity-time graph of a certain body is shown in the following graph. The part of the graph that shows deacceleration of the body is



(A) OA (B) AB (C) BC (D) CD

20. A body is moving along the curve ABC as shown in the figure and the initial and final position are A and C respectively. Displacement is the line joining.

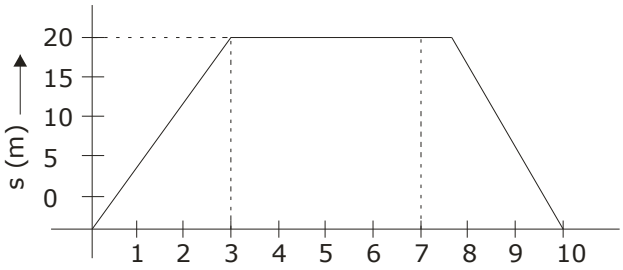


(A) initial and final position of the body
(B) midpoint (B) and final position of the body
(C) midpoint (B) and initial position of the body
(D) Both (B) and (C)

21. The speedometer of a car indicates
(A) its instantaneous speed
(B) average speed
(C) average velocity
(D) Both (A) and (C)

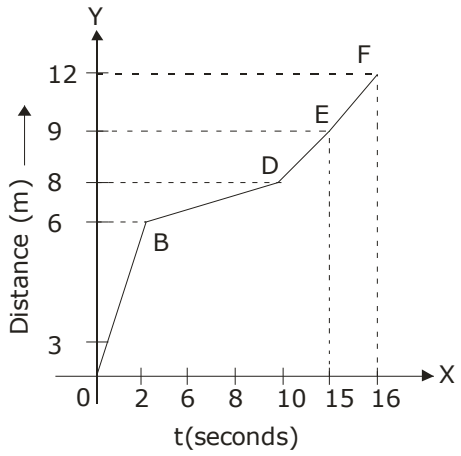
22. A boy throws a ball vertically upwards and catches it after 2 seconds. Which of the following is true regarding the motion of the ball ?
(i) The displacement is zero.
(ii) Magnitude of acceleration is constant
(A) Only (i) is true
(B) Only (ii) is true
(C) Both (i) and (ii) are true
(D) Both (i) and (ii) are false

23. The $\vec{s}-t$ graph a body is as shown in the figure. The time for which the body is in motion is _____ second.



(A) 2 (B) 3
(C) 6 (D) 10

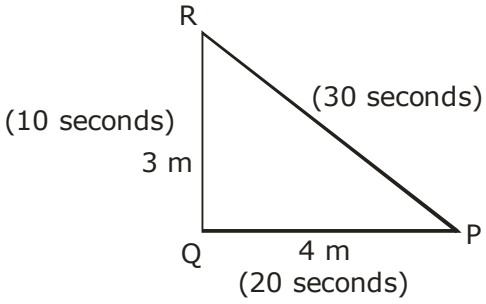
24. The motion of a body is depicted graphically as shown in the figure. The average speed of the body is _____ ms^{-1}.



(A) 3/4 (B) 9/8
(C) 4/3 (D) 8/9

25. An electric fan rotates 100 times in 50s. If the length of its wing from its axis of rotation is 0.5 m, then the speed of particle at the edge of the wing is _____ $m\ s^{-1}$.
(A) 2π (B) 0.5π
(C) π (D) 2

26. A person starts from a point and travels along a path PQRP as shown in the figure. Then, the speed of the person is _____ $m\ s^{-1}$.



(A) 0.2 (B) 20
(C) 12 (D) 0.4

27. The ratio of the unit of acceleration to that of velocity gives the unit of the physical quantity _____ .

(A) Time (B) Frequency

(C) Amplitude (D) Speed

28. A bus moves with uniform velocity along a straight line path. If the average velocity of the bus is 80 km h^{-1}, then its instantaneous velocity at t = 0 is _____ km h^{-1}.

(A) 70 (B) 100

(C) 80 (D) 0

29. A bus travels one-third of the distance with a speed of 12 km h^{-1} and the remaining distance with a speed of 20 km^{-1}. The average speed of the bus is nearly _____ km h^{-1}.

(A) 14 (B) 20

(C) 12 (D) 16

EXERCISE – III

MULTIPLE CHOICE QUETSIONS

1. If the smallest measurement that can be measured by using a scale is 0.1 mm, then the length of 1 m in the scale is divide into _____ equal parts.

(A) 1000 (B) 5000

(C) 10000 (D) 50000

2. An atlas of India is drawn by taking scale 100 cm = 15000 km. If the actual distance between the cities of Bhopal and Goa is 1500 km, the distance between the two places in the atlas will be _____ cm.

(A) 10 (B) 1

(C) 10000 (D) 100

3. For each of the two vernier calipers P and Q, 1 MSD = 1 mm. For P, 10 VSD = 8 MSD and for Q, 20 VSD = 15 MSD. The vernier callipers that gives more accurate reading is _____ .

(A) P

(B) Q

(C) Both P and Q give equal accuracy

(D) Data insufficient.

4. The following information is given in respect of a vernier calipers.

1 main scale division = 0.3 cm

30 V.S.D. = 29 M.S.D.

The least count of this vernier caliper is ___.

(A) 0.01 mm (B) 0.1 cm

(C) 0.03 cm (D) 0.1 mm

5. Taking 1 ly (light year) = 9.3×10^{15} m and one day = 86400 s, express the speed of light ($= 3\times 10^{8}$ ms^{-1}) as ly $(day)^{-1}$

(A) 2.79×10^{-6} (B) 2.79×10^{-3}

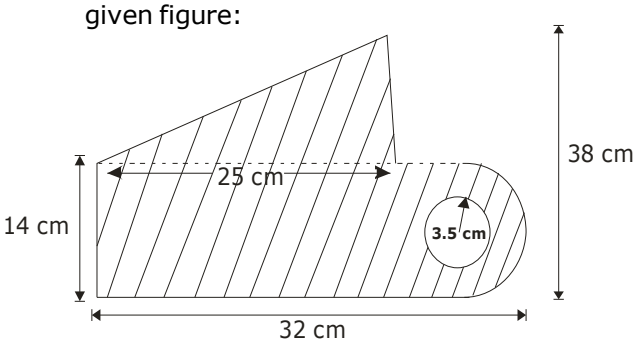
(C) 2.79×10^{-9} (D) 2.79×10^{-12}

6. The internal jaws of a vernier calipers were held tightly inside a hollow tube when the zero of the vernier scale showed a reading of 1.9 cm and the 18^{th} division on the vernier scale is coinciding with a division on the main scale. The thickness of the wall of the tube is 1 mm. If 1 M.S.D. = 1 mm and the number of divisions on the vernier scale is 20, find the outside diameter of the hollow tube.

(A) 23.9 mm (B) 21.9 mm

(C) 22.9 mm (D) 20.9 mm

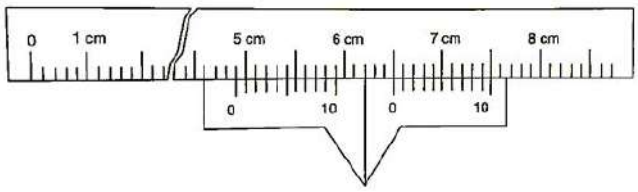
7. Find the area of the shaded region in the given figure:



(A) 765.5 cm^2 (B) 788.5 cm^2

(C) 200.5 cm^2 (D) 188.5 cm^2

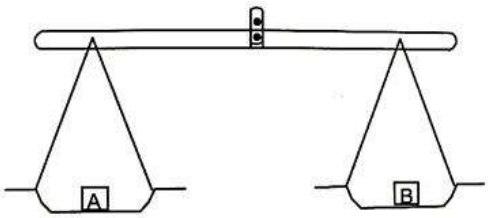
8. A vernier calipers has two sliding jaws with scales marked as shown in the figure. When a brass rod of length 5.23 cm was held between the jaws, the zero of jaw A was found to lie between the 34th and 35th main scale division with the 3rd division on the vernier scale coinciding with a main scale division. Find the M.S.R. for the vernier scale on jaw B.



(A) 10.2 cm (B) 11.0 cm

(C) 10.4 cm (D) 10.3 cm

9. Two metal blocks A and B were placed on the two pans of a common balance and the beam of the balance was horizontal. However, when the blocks were interchanged and block B was placed in the left pan and block A in the right pan, the beam was not balanced and tilted down towards the left.



(A) No, $m_B = m_A$ (B) Yes, $m_B < m_A$

(C) No, $m_B > m_A$ (D) None

10. 100 ml of liquid A (density = 1200 kg m^{-3}) and 100 g of liquid B (density = 0.8 g cm^{-3}) are mixed to form a homogenous mixture.

Assuming that the two liquids do not chemically react with each other, find the density of the resultant mixture.

(A) 44/45 g cm^{-3} (B) 45/44 g cm^{-3}

(C) 44/46 g cm^{-3} (D) 1/2 g cm^{-3}

11. Volume of a body is increased to thrice of its initial volume without changing its mass. Find the percentage change in density.

(A) 200/3 % (B) 100/3 %

(C) 70/3 % (D) 117/3 %

12. A metallic rod of unknown radius was held in between the lower jaws of a vernier callipers. The main scale is divided into millimetres and the vernier scale has 50 divisions. The vernier coinciding division is 39. If the zeroth division of the vernier scales lies between 6.3 cm and 6.4 cm of the main scale, find the radius.

(A) 30.89 mm (B) 31.89 mm

(C) 32.89 mm (D) 30.89 mm

13. In a vernier callipers 15 vernier scale division correspond to 14 main scale divisions and one main scale divisions is equal to 1.5 mm. An object is held between the external jaws of the given vernier callipers. If the zeroth division of the vernier scale is to left of the 20^{th} division of the main scale, find the measurement of the object; if the 14^{th} division of the vernier scale coincides with the main scale division.

(A) 2.89 cm (B) 2.3 cm

(C) 2.99 cm (D) 2.4 cm

14. An object X of volume 200 cm^3 and another object Y of volume 250 cm^3, when placed on the two pans of a common balance they balance each other. Determine the ratio of density of X to the density of Y.

(A) 5/4 (B) 1/4

(C) 4/5 (D) 1/5

15. When 100 drops of a liquid P is added into a liquid Q the volume of the liquid in the container which is initially filled with liquid Q doubled. Determine density of the mixture if density of the liquids P and Q are 1.5 g cm^{-3} and 1.3 cm^{-3} respectively.

(A) 1.6 g cm^{-3} (B) 1.5 g cm^{-3}

(C) 1.7 g cm^{-3} (D) 1.4 g cm^{-3}

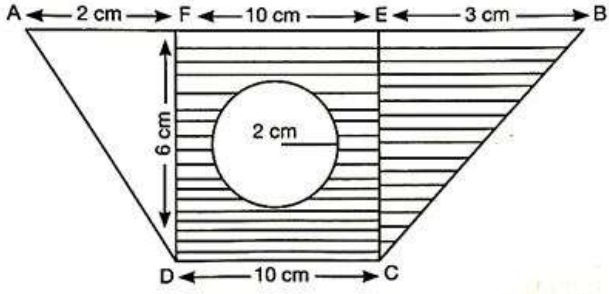
16. A Fortin's barometer has a main scale and a vernier scale to measure the atmospheric pressure. The main scale graduation are in mm. If 49 main scale divisions coincide with 50 vernier divisions, find the least count of the instrument, in Pa.

(Given pressure exerted by 76 cm column of mercury = 10^5 Pa)

(A) 1.63 Pa (B) 2.63 Pa

(C) 3.2 Pa (D) 3 Pa

17. Find the area of the shaded region in the figure given below:



(A) 52.44 cm^2 (B) 54.44 cm^2
(C) 56.44 cm^2 (D) 58.44 cm^2

18. Siri placed two objects A and B of volumes 100 cm^3 and 400 cm^3 in two pans of a common balance and she was surprised because the two pans balanced with each other. Find the density of object A if the density of object B is 20 kg m^{-3} and clear the doubt raised by Siri.

(A) 0.08 g cm^{-2} (B) 0.06 g cm^{-2}
(C) 0.02 g cm^{-2} (D) 0.04 g cm^{-2}

19. Relative density of a sphere of mass 88 kg is 194.481. Find its total surface area.

(A) 0.029 m^2 (B) 0.0030 m^2
(C) 0.039 m^2 (D) 0.04 m^2

20. An ant is moving on a straight line drawn on the paper obtained from velocity-time graph of a car starting from rest and travel with acceleration 5 m s^{-2} for 5 seconds. Find the time taken by the ant to move from one end of the graph to another end if it moves with uniform velocity of 1 mm s^{-1} (Take 1 cm as 1 sec on x-axis and 1 cm as 10 ms^{-1} on y-axis).

(A) 55 sec (B) 58 sec
(C) 56 sec (D) 52 sec

21. A boy kicks a football horizontally from the roof of a building of height 10 m. If the line joining the initial position of the football and the point where it hits the ground make an angle of 45° with the ground, then find the displacement of the football.

(A) $10\sqrt{5}$ m (B) $12\sqrt{5}$ m
(C) $10\sqrt{2}$ m (D) $11\sqrt{5}$ m

22. A person is running perpendicular to the straight railway track from 40 m distance to save a dog sleeping on the railway track at a place exactly opposite to the person. Find the minimum uniform velocity required by the person to save the dog if the distance of the front part of a train is 50 m from the person when he is at a distance of 30 m from dog and velocity of the train is 36 km h^{-1}.

(A) 7.5 m/s (B) 6.5 m/s
(C) 8 m/s (D) 9.5 m/s

23. A car starts from rest moving on the straight road accelerates with 1 ms^{-2}. Find the displacement of the car in 36^{th} second.

(A) 30 m (B) 32.5 m
(C) 34.5 m (D) 35.5 m

MOTION®

CHEMISTRY

CLASS - VIII

BOOKLET - 1

CONTENTS

SYNTHETIC FIBRES AND PLASTICS

METALS AND NON-METALS

ANSWER KEY

Motion Education, 394 - Rajeev Gandhi Nagar, Kota-5 (Raj.)
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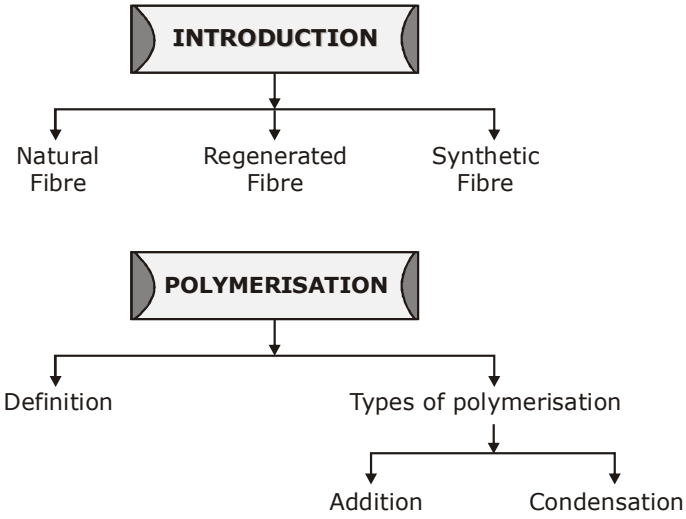
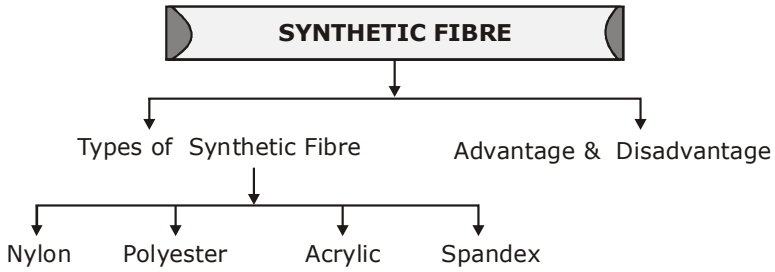
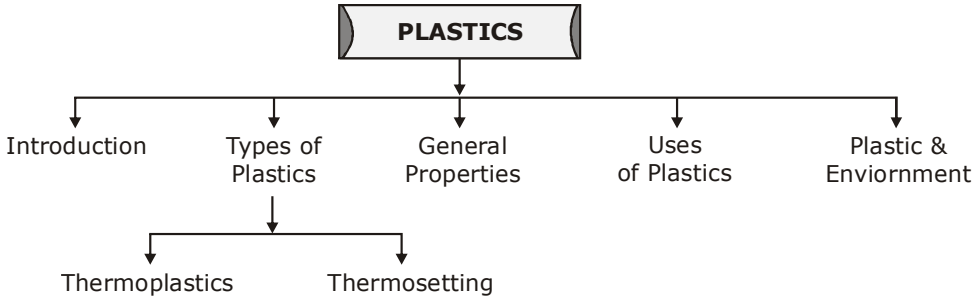
CHAPTER 1

SYNTHETIC FIBRES AND PLASTICS







INTRODUCTION

The clothes which we wear are made up of fabrics. Fabrics are made from fibres. Fabric are made by knitting of threads called yarns which are made of still thinner threads called fibres. Apart from covering our body, clothes are required by us for protection against cold, rain, dust & sunlight.

A fibre is a thread or filament like material which is so strong & flexible that can be converted into clothes, ropes and nets etc.

They are of three kinds :-

(1) Natural fibres (2) Regenerated fibers (Semi-Synthetic fibre) (3) Synthetic fibres

1. NATURAL FIBRES : - These are long thin threads which are obtained from natural polymers obtained from animals or plants eg.

(A) Cotton — From bolls of cotton flower.
(B) Wool – From the fleece of sheeps & goats.
(C) Linen – From stalk of a plant (Flax).
(D) Silk – From cocoons of silk worm.
(E) Jute - From stem of plant.

2. REGENERATED FIBRES :- Fibres that are regenerated from chemically treated natural material such as cellulose (originally derived from wood pulp) are called as regenerated fibers. eg. Bamboo fibre, Rayon.

Info Bubble

There is one more class of fibre i.e. the mineral fibre. Asbestos is the only naturally occurring long mineral fibre.

(A) Rayon: It is prepared by chemical treatment (viscose process) of wood pulp (cellulose). It is also called artificial silk because it resembles in appearance like natural silk.

Clothes

Properties :

(i) Rayon can absorb sweat because of its tendency to absorb moisture. So it is preferred over other synthetic fabrics in summer season.
(ii) It is shiny and lustrous and resembles to silk.
(iii) It can be dyed in a wide variety of colours.

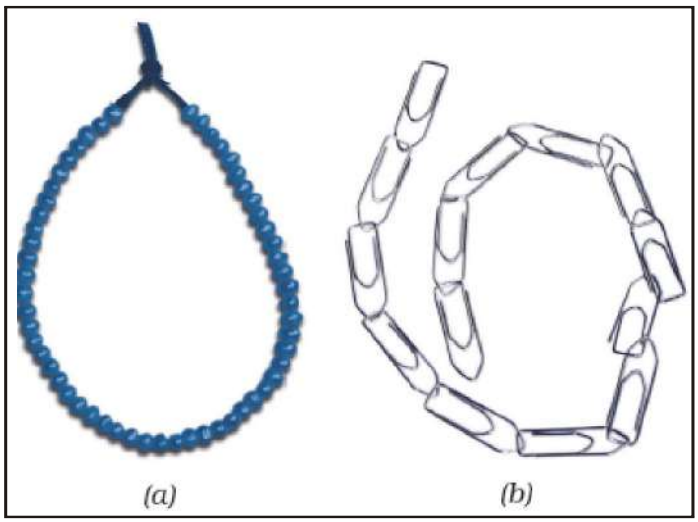
Uses :

(i) Rayon is mixed with cotton to make bed sheets and mixed with wool to make carpets.
(ii) Shirts, ties and linings are made up of rayon fibre.
(iii) It is used to manufacture tyre cords.
(iv) It is used to make bandages and surgical dressings.

3. **SYNTHETIC FIBRES :-** Those fibres which are synthetically man made, and are polymer of small units are called synthetic fibre. All the synthetic fibres are prepared from raw materials of petroleum origin called petrochemical. eg. Nylon, Polyester etc.

POLYMERISATION

Synthetic fibres are polymers. The word polymer is made up of two Greek words **poly** which means many and **mer** means unit. A polymer is a large molecule formed by the combining of many small molecules, each of which is called a **monomer.** The process of combining the monomers to form a polymer is called **polymerisation.**



Polymerisation can be of various kinds, for example : **Addition polymerisation and Condensation polymerisation.**

1. **ADDITION POLYMERISATION :** These are formed by an addition reaction where many monomers bond together via rearrangement of bonds without the loss of any atom or molecule.

Example : Polyvinyl chloride, polyethene etc.

2. **CONDENSATION POLYMERISATION :** Condensation Polymers are any kind of polymers formed through a condensation reaction - where molecules join together - losing small molecules as byproducts such as water.

Example : Polyesters, Polyamides etc.

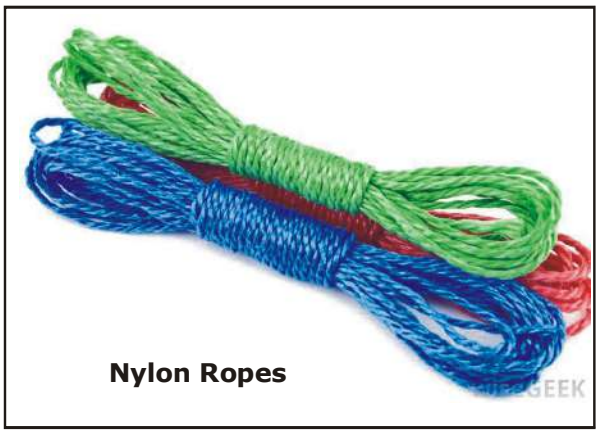
1. TYPES OF SYNTHETIC FIBRES

(A) Nylon (B) Polyester

(C) Acrylic (D) Spandex

(A) Nylon

Nylon was first introduced in 1931. It was developed in Newyork (Ny) & London (Lon) so it was named as **Nylon**. It is the first man made fully synthetic fibre. It is a polymer made from two monomers, a **diacid** and a **diamine,** by the process called **condensation polymerisation.** There are various nylons such as nylon 6, nylon 6-6 and nylon 5-10.



Nylon Ropes

Info Bubble

A nylon thread is stronger than steel wire.

Properties :

(i) Nylon has high strength and high elasticity. It does not lose strength even after repeated use.

(ii) It is lustrous and easy to wash.

(iii) It absorbs very little water hence known to have drip-dry property.

(iv) It is wrinkle resistant and keeps permanent creases.

(v) It is moth and mould resistant.

(vi) It is light, fine and durable.

Uses :

(i) In making socks, sarees, shirts and other garments.

(ii) It is used to blend with wool to increase the strength & used in making carpets.

(iii) Used to make tents, parachutes, umbrella, fishing nets, climbing ropes, tyre cord, strings for sports goods.

Info Bubble

All synthetic fibres are prepared from raw materials of petroleum origin called petrochemicals

(iv) It's fibres are used for making tooth brush, car seat belt, slipping bags and curtains.

(v) It is used to make machine parts.

- **MAKING NYLON 6-6 : Nylon 6-6** is a commerically successful variety of nylon made from **adipic acid and hexamethylene diamine.** First 6 in 'nylon 6-6' refers to the 6 carbons of adipic acid and the second 6 to the 6 carbons of the diamine.

Adipic acid + hexamethylene diamine → nylon 6-6 + water

The reaction is carried out at high temperature and pressure. The **molten nylon 6-6** is then forced through a spinneret, with very fine holes into air where it hardens into filaments. The fibres are then stretched upon cooling.

PRACTICE YOUR CONCEPTS

1. Which of the following are natural fibres?
(a) Polyester (b) PVC (c) Nylon (d) Cotton (e)Rayon (F) Terrylene (G) Jute (h) Orlon

Ans. (d) and (g)

2. why nylon fibres are so strong?

Ans. Nylon or Polyamide is made up of an acid and a molecule of diamine. When they join they form a special kind of bond known as amide bond, which is very strong. This makes nylon so strong.

3. Explain the following terms : Elasticity, Polymerisation, tensile strength.

Ans. **Elasticity :** Property of being able to resume normal shape after being stretched or squeezed.
Polymerisation: A process of linking up of large number of monomers to form a big molecule under specific conditions.
Tensile strength: Property of a material to resist breaking under tension of a weight.

4. What are biodegradable and non-biodegradable materials? Explain with examples.

Ans. **Biodegradable materials :** A material which gets decomposed through natural process, such as action by micro organisms, is called biodegradable. For example : paper, leaves, vegetables, fruits, etc.
Non-biodegradable materials : A material which is not easily decomposed by natural processes, such as action of micro organisms is called non-biodegradable material. For example: Glass, copper, plastics and synthetic fibres, etc.

5. Though rayon has a silky sheen, it is otherwise similar to cotton. Can you say why?

Ans. Rayon is a type of synthetic (man-made) material that resembles silk in appearance. It is obtained from cellulose which is a naturally occuring polymer hence is it closer to cotton.

s

(B) Polyester

It is made of repeating units of a chemical called "ester" which has fruit like smell. Most polyester fabrics have excellent wash and wear characteristics and therefore requires minimum care eg. Terylene and Dacron. It is first prepared in England.

Polyester is a polymer, which is produced from coal, air, water and petroleum products.

Making Polyester : PET (Polyethylene terephthalate), the commonly used polyester, is made from two monomers, **terephthalic acid** and **ethylene glycol,** by the process called **condensation polymerisation**

Terephthalic acid + ethylene glycol → polyethylene terephthalate (PET) + water.

Properties :

(i) It absorbs very little water so dries quickly.

(ii) It is strong, light weight, wrinkle resistant and elastic fibre.

(iii) It is not attacked by moths and ordinary chemicals.

(iv) It can be drawn in to very fine fibres that can be woven like any other yarn.

Info Bubble

Polycot is mixture of Polyester and cotton. Polywool is a mixture of Polyester and wool.

Uses :

(i) Polyester fibres are used in manufacture of textiles.

(ii) Terry wool, a blend of terylene and wool, is used for making suits,

Terrycot is used for making skirts, shirts and other dress materials.

(iii) It is used to make light weight sails, conveyor belts.

(iv) Polyester films, which is known as "mylar" are used for making magnetic recording tapes in audio cassettes, video cassettes and floppy discs.

(C) Acrylic

Synthetic fibre which resemble wool. It is prepared from acrylonitrile (Monomer unit). Acrylic fibre is also known as polyacrylonitrile ("PAN") or "Orlon" or Acrilan"

Gloves

Sweater

Properties :

(i) It is warm, soft, light and flexible fibre.

(ii) It closely resembles to wool in its properties & cheaper than natural wool.

(iii) Acrylic yarn can be easily knitted.

(iv) They are available in variety of colours.

Info Bubble

Polymers which are made up of same type of monomer units are called homopolymers. when two or more different monomers unite together or polymerize, their result is called a copolymer or heteropolymer.

Uses :

(i) Acrylic fibre is used for making sweaters, socks & shawls.

(ii) It is used for making carpets and blankets.

(D) Spandex

Spandex is known for its high elasticity which makes it suitable for use in clothes, that require snug fitting, eg swimming costumes. It is also known as "LYCRA" .

When spandex is blended with cotton fabrics, stretched fabric is obtained which is used for making T-shirts and caps.

Uses : It is used in the making of costumes, caps, T-shirts etc.

Disadvantages of Synthetic Fibres

- They are not comfortable in summers since they do not adsorb sweat.
- They are highly inflammable i.e., they catch fire easily.
- They are not biodegradable i.e., they are not decomposed by natural processes.
- They may cause skin problems like rashes or allergies.

ACTIVITY - 1

AIM- To determine relative water absorbing capacity of different fibres.

MATERIALS REQUIRED: 5g fibre of (a) cotton (b) silk (c) wool (d) rayon (e) nylon , a beaker filled with water,preweighed plastic dishes , physical balance.

METHOD:

(i) Soak 5g of each of the fibres in water for 2 minutes.

(ii) Take out the cotton fibre and hold it in hand till the water stops dropping.

(iii) Place it in a preweighed plastic dish and record the increase in weight on account of absorption of water.

(iv) Repeat the procedure with silk,wool,rayon and nylon.

(v) Record the increase in weight in each case.

OBSERVATION:

You will find that increase in weight is maximum in case of wool followed by cotton,rayon , silk and least in nylon.

CONCLUSION:

This activity clearly proves that different fibres having different water absorbing capacities.

2. ADVANTAGES AND DISADVANTAGES OF SYNTHETIC FIBRES

	Advantages of Synthetic fibre	Disadvantages of Synthetic fibre
1.	Its tensile strength is high and it can bear heavy loads without breaking.	1. Synthetic fibres can absorb very little moisture. It becomes sticky when body sweats.
2.	These fibres are generally elastic in nature. It can regain its original shape after stretching or compressing to some extent.	2. These fibres have low melting points so melts easily, so it is dangerous to worn while working in the kitchen.
3.	These fibres are wrinkle resistant.	3. It requires very careful ironing.

PRACTICE YOUR CONCEPTS

6. Name the artificial silk.

Ans Rayon

7. Name the fibres which make terrycot.

Ans. Terrylene + Cotton

8. Synthetic fibres are more popular than natural fibres. Why?

Ans. Because of superior qualities, more durability and affordable cost, synthetic fibres are more popular than natural fibres.

9. Why is polyester quite suitable for making dress materials?

Ans. Polyester is a synthetic fibre which is quite suitable to make dresses and other clothes due to its properties. It does not wrinkle easily. It remains and is easy to wash. It is light and durable. It takes very less time to dry up.

10. Name five fibres and discuss their sources and uses.

Ans.

	Fibres	Source	Uses
1.	Jute	Plant	In making bags and mats
2.	Silk	Silk worm	In making dress material
3.	Wool	Sheep	In making winter clothing
4.	Cotton	Plant	In making dress material

PLASTICS

Plastics are materials that can be shaped by applying heat and pressure. Plastic means easy to mould. Plastic is a polymeric substance that can be moulded when soft and then hardened to produce a durable article. It is made soft by applying heat and pressure before moulding.

Plastics

1. TYPES OF PLASTICS :- On the basis of their reaction to heat, all types of plastic can be classified into two groups.

(A) Thermoplastics (B) Thermosetting plastics

(A) Thermoplastics:- Those plastics which can be melted by heating and moulded into desired shapes and sizes, repeatedly are called thermoplastics. On heating these softens and on cooling they becomes hard. This cyclic process of heating, moulding & cooling is adopted to get desired shaped article.

e.g Polythene, PVC, Nylon, Terylene and Polystyrene

etc.

Info Bubble

Natural rubber is a soft material having low tensile strength. It is a thermoplastic because when mixed with 1-3% sulphur heated and moulded into a shape, it retains the shape.This process is called vulcanization of rubber

Thermoplastic

Info Bubble

Teflon is a special plastic on which oil and water do not stick. It is used for non-stick coating on cook wares.

Info Bubble

Your mother always buys PET bottles and PET jars for storing rice and sugar. What PET is ?
PET is very familiar form of polyester. It is used for making bottles, jars etc.

(B) Thermosetting Plastics :- These are harder and stronger than thermoplastics and can retain their shape and size even at high temperature. These polymers once set in a given shape on heating, can not be resoftened or remelted on being reheated. eg. Bakelite, Melamine.

Thermosetting

Info Bubble

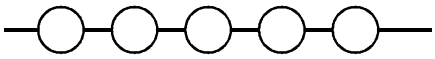
Polystyrene is the cheapest plastic used for making thermocole.

- **On the basis of arrangement of monomers plastic can be of two types :**

(i) Plastic with linear arrangement of monomers

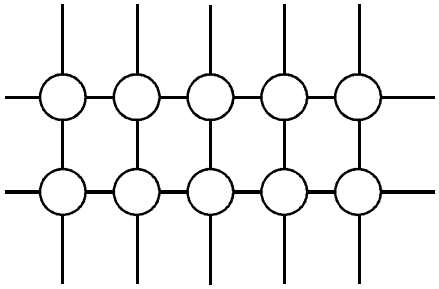
(ii) Cross linked plastics

(i) Plastic with linear arrangement : These are plastics in which monomers are arranged in a straight line chain.Such plastic are said to have linear arrangements of monomers.
These plastics are generally thermoplastics.



Linear arrangement of monomers

(ii) Plastic with cross linked arrangement : In some other plastics monomers are cross linked. Such plastics are said to have cross linked arrangement and are generally known as thermosetting plastics.



Cross-linked arrangement of monomers

2. GENERAL PROPERTIES OF PLASTICS

(A) Plastic can be recycled, reused, coloured, melted, rolled into sheets or made into wires.

(B) Plastic is non-reactive with moisture & air and insoluble in water. It is not corroded easily.

(C) Plastic is light in weight, strong & durable and moulded into different shapes and sizes.

(D) Plastics are poor conductor of heat and electricity, that's why electrical wire coverings, handles of screw drivers and frying pans are made of plastics.

Info Bubble

* Food can be heated in a microwave in special plastic containers, that do not get heated but only the food inside them gets heated.
* Non-stick cookware is made of teflon–a special plastic, on which oil and water do not stick.
* Some plastics are fire-proof. The uniform of fireman are fire-coating of melamine plastic.

3. USES OF PLASTICS

S. No.	Man-made plastic	Type of plastic	Property	Uses
1.	Polythene (or polyethylene)	Thermoplastic	Strong but flexible; can be rolled into sheets or moulded into any shape; water resistant	Sheets of polythene are used to pack liquids such as milk; polythene pipes are used to transport liquids such as oil or water; polythene containers are used to store liquids.
2.	Polyvinyl chloride (PVC)	Thermoplastic	Tougher than polythene; insulator	Used as a covering for electric wires; used to make shoes, handbags, furniture, floor coverings, raincoats and bottles
3.	Polystyrene	Thermoplastic	Easily moulded	Used as a packaging material for delicate objects like electronic items and to make thermocol; used to insulate the hollow walls of refrigerators.
4.	Perspex	Thermoplastic	Transparent like glass, but much stronger	Used as a substitute for glass, for making windows in aeroplanes and windscreens of cars
5.	Teflon or PTFE (Polytetra-fluoroethylene)	Thermoplastic	Slippery, not affected by heat and does not react chemically with other substances.	Used as a non-stick coating on pans and other cooking utensils
6.	Bakelite	Thermosetting	Harder than other plastics and a good electrical insulator	Used for making buttons, plugs, switches and other electrical fittings
7.	Formica and melamine	Thermosetting	Hard and smooth surface	Used as table-tops and for making crockery.
8.	PET (Poly Ethylene Terephthalate)	Thermoplastic	High strength, high rigidity and hardness.	Containers for microwave cooking, carbonated beverage bottles and other food containers.
9.	HDPE (High Density Polyethylene)	Thermoplastic	Tensile Strength, Thermal Coefficient of expansion.	For packaging strong and corrosive household and industrial chemicals like bleaches, acids and liquid detergents.
10.	LDPE (Low Density Polyethylene)	Thermoplastic	Low temperature flexibility, toughness and corrosion resistance.	Polybags, grocery bags and packages of frozenfoods and bread.
11.	PP (Polypropylene)	Thermoplastic	Lower density, The service temperature of Polypropylene is higher	Ketchup bottles, yoghurt containers, medicine bottles, automobile battery casings.

4. PLASTIC AND ENVIRONMENT

Plastic takes several years to decompose so it is not environment friendly. It causes environmental pollution (Air, Water & Land)

(A) When plastic burns, it releases lot of poisonous gases into atmosphere causing air pollution.

(B) When plastic wastes are dumped in water they cause water pollution.

(C) Accumulation of plastic waste on road sides & collection of ugly dumps causes many diseases to humans and animals.

PRACTICE YOUR CONCEPTS

11. How can we reduce use of plastics?

Ans 1. Avoid the use of plastics as far as possible.

2. Recycle plastic waste.

3. Collect biodegradable and non-biodegradable waste separately.

4. Avoid throwing polythene bags and wrappers to prevent clogging of drains.

5. Limit their use by the processes of reduce, reuse, recycle and recover.

12. Give some uses of plastics in healthcare and cookware.

Ans. Healthcare: They are used in packaging of tablets, medicines, threads used for stitching wounds, syringes, gloves, medical instruments.

Cookware : They are used in making microwave oven cookwares, non-stick cookwares, handles of sauce-pans.

13. Teflon, that is used to make non-stick pans, is also used to make the wind screen wipers of cars. Why?

Ans. Teflon is chemically inert and heat resistant polymer. It is scratch proof, corrosion resistant and offers very low friction. Due to low friction, windscreen wipers do not scratch against the glass on repeated movement.

14. Melamine and formica are two commonly used plastics. Find out what items are made from them and why are they useful for these items?

Ans. Melamine and formica are thermosetting polymers. Melamine is used for making unbreakable cups and crockery. Laminated plastics such as formica are made from layers of plastics sandwiched with another material, such as paper or wood and pressed into thin sheets. This form of plastic is resistant to heat.

15. Mention which kind of plastic, thermosetting or thermoplastic is most suitable for making the following: Handle of a cooker, furniture, bucket, plug socket, buttons, combs, pipe for watering plants.

Ans. Handle of a cooker – Thermosetting

Furniture – Thermoplastic

Bucket – Thermoplastic

Plug socket – Thermosetting

Buttons	– Thermosetting
Combs	– Thermosetting
Pipe for watering plants	– Thermoplastic

Info Bubble

To overcome the problem of plastic disposal, scientist have made some photodegradable (decomposed by sunlight) polymers.

Problems and solutions associated with Plastic disposal :

Problems : Environmental and health hazards problems arise with their disposal because they are non-biodegradable. Accumulation of plastics is a serious problem, because most of the method used to dispose them results in some type of pollution to the environment.

(i) Buried plastic materials prevent rain water from seeping into earth, so plant growth is affected in those areas.

(ii) Plastic waste may end up in littering road sides, floating in lakes and streams and collecting in ugly dumps. These provides homes for many diseases.

(iii) When wastes are dumped in water. They causes water pollution through toxic substances present in plastics. This can cause death or reproductive failure in fish and other aquatic animals.

(iv) When cows eats garbage they swallow materials like polythene bags and wrappers of food. It chokes the respiratory system of cows and forms a lining in their stomach and can be the cause of their death.

(v) The polybags thrown carelessly here and there are responsible for clogging the drains.

Solutions :

(i) Avoid the use of plastics as far as possible.

(ii) Use cotton or jute bags instead of plastic bags when we go for shopping.

(iii) Biodegradable and Nonbiodegradable waste should be collected separately and disposed off separately.

(iv) Recycle the plastic waste. Take care in collection, sorting and processing the plastic waste with this aim that it can be used in manufacturing of other products.

(v) Knowledge should be given to people about "green bin" and "blue bin" provided by municipality for separation of biodegradable waste such as food items (Green bin) and Nonbiodegradable waste such as plastics (Blue bin).

(vi) People should also be advised to follow 4R principles. The "4R" principles are –

(a) Reduce (b) Reuse (c) Recycle (d) Recover

It will make environment friendly.

Info Bubble

Plastic is also a polymer like the synthetic fibre.

- **Mineral Fibres :** The most well known mineral fibres are glass and metal fibres. Fibre glass, made from specific glass formula and optical fibre made from purified natural quartz are also man-made fibres that come from natural raw material. Metallic fibres are drawn from ductile metals like copper, silver, gold. Carbon fibres are made up of pure carbon.
- **Plasticizers :** Certain plastics do not soften very much on heating. These can be easily softened by the addition of some organic compounds which are called plasticizers. For example, polyvinyl chloride (PVC) is very stiff and hard but it is made soft by adding di-n-butyl phthalate (a plasticizer). Some other common plasticizers are dialkyl phthalates, cresyl phthhalate.

ON YOUR TIPS

- Fibres are used for making a large variety of household articles Natural fibres like cotton, wool, silk etc., are obtained from plants and synthetic fibres are made by human beings by chemical processing of petrochemicals.
- Like natural fibres synthetic fibres and plastics are made of very large units called polymers, and polymers are made of many smaller units
- Synthetic fibres are used for making many household articles like ropes, buckets, container, furniture, etc., other applications involves in aircrafts, ships, space- crafts, healthcare, etc.
- Different fibres have different strength, nature of burning, water absorbing capacity, cost, durability etc.
- Synthetic fibres are of different types depending upon the types of chemical used in its manufacturing, they are nylon, rayon, polyester and acrylic. Plastics find extensive use in the healthcare industry, like for packaging of tablets; thread used for stitching wounds, syringes, doctor's gloves, etc.
- Plastic takes several years to decompose; it is not environmental friendly and causes environmental pollution so we should avoid the use of plastics as far as possible.

NCERT QUESTIONS WITH SOLUTION

1. Explain why some fibres are called synthetic.

Sol. Explain fibres are called synthetic fibre because they do not occur in the nature.

2. Mark the correct answer.
Rayon is different from synthetic fibres because:
(a) It has a silk like appearance.
(b) It is obtained from wood pulp.
(c) Its fibres can also be woven like those of natural fibres.

Sol. (b) It is obtained from wood pulp.

3. Fill in the blanks with appropriate words.
(a) Synthetic fibres are also called _____ or _____ fibres.
(b) Synthetic fibres are synthesised from raw material called _____
(c) Like synthetic fibres, plastic is also a _____ .

Sol. (a) man-made, artificial fibres.
(b) Petrochemicals. (c) Polymer.

4. Give examples which indicate that nylon fibres are very strong.

Sol. Nylon fibres are strong so they are used for making parachutes and ropes for rock climbing.

5. Explain why plastic containers are favoured for storing food.

Sol. Advantages of plastic containers.
(a) Plastics do not react with food items.
(b) Plastics are strong and light.
(c) They are easy to handle and safe.

6. Explain why the following are made of thermosetting plastics.
(a) Saucepan handles.
(b) Electric plugs /switches /plug boards

Sol. (a) The handles of saucepan are made of thermosetting plastics becausse it is a bad conductor of heat and do not get heated up while cooking.
(b) Electric plugs/switches/plug boards are made up of thermosetting plastics, because it is a bad conductor of electricity. The electric current does not passs through such plastics.

7. Categorise the materials of the following products into can be recycled' and 'cannot be recycled'.
Telephone instruments, plastic toys, cooker handles, carry bags, ball point pens, plastic bowls, plastic covering on electrical wires, plastics chairs, electrical switches.

Sol. Can be recycled : Toy, carry bags, plastics toys, ball point pen, plastic chairs, electric wire covering.
Cannot be recycled : cooker handles, electric switches, telephone instruments.

8. Rana wants to buy shirts for summer, Should he buy cotton shirts or shirts made from synthetic material ? Advise Rana, giving your reason.

Sol. Rana should buy cotton shirts for summer because cotton is a bad conductor of heat. It does not allow the transmission of heat from or to the body, thus protects body from heat. It has more capacity to hold moisture than the synthetic clothes. So, it retains the sweat of the body and keeps it cool. So Rana should buy cotton shirts.

9. Give examples to show that plastics are noncorrosive in nature.

Sol. Plastics are noncorrosive in nature :
(i) They do not react with any substances.
(ii) Plastics do not react with air and water which are essential for corrosion.
(iii) They do not show any chemical reaction.

10. Should the handle and bristles of a tooth brush be made of the same materials ? Explain your answer.

Sol. No, handle and bristles of a tooth brush should not be made of the same materials because handle should be hard while bristles should be made of the soft materials. Bristles should be soft so that it does not harm the gum of teeth. Handle gives the firm grip so it should be made of hard material.

11. 'Avoid plastics as far as possible.' Comment of this advice.

Sol. Avoid the use of plastics as far as possible. Plastics are non -biodegradable materials. So use of plastics is harmful for our environment. The plastics cannot be finally disposed off. Thus, plastics should be avoided as far as possible.

12. 'Manufacturing synthetic fibres is actually helping conservation of forests. Comment.

Sol. The natural fibres required the raw materials from plants and animals. so they lead cutting of trees and killing of animals. synthetic fibres are made up of chemicals and these chemicals are not available in forests. So manufacturing synthetic fibres is actually helping conservation of forests.

13. Describe an activity to show that the thermoplastic is a poor conductor of electricity.

Sol. Observe the electrical wires. These wires have plastic covering which show that plastics are poor conductors. The handles of screw drivers are made of plastics. These observations show that thermoplastic is a poor conductor of electricity.

14. Match the terms of Column A correctly with the phrases given in Column B.

Column A	**Column B**
(i) Polyester	(a) Prepared by using wood pulp
(ii) Teflon	(b) Used for making parachutes and stockings.
(iii) Rayon	(c) Used to make non stick cookwares.
(iv) Nylon	(d) Fabrics do not wrinkle easily

Sol.

Column A	**Column B**
(i) Polyester	(a) Fabrics do not wrinkle easily
(ii) Teflon	(b) Used to make non stick cookwares.
(iii) Rayon	(c) Prepared by using wood pulp
(iv) Nylon	(d) Used for making parachutes and stockings.

15. Explain the difference between thermoplastics and thermosetting plastics.

Sol. Differences :

Thermoplastics	***Thermosetting plastics***
(i) These are the plastics which gets deformed easily on heating and can be bent easily. Examples : Polythene and PVC.	(i) These are the plastics which when moulded once, cannot be softened by heating. Examples : Bakelite and Melamine.
(ii) These are used for manufacturing toys, combs, car grills and various types of containers.	(ii) (a) Bakelites are used for making electrical switches, handles of various utensils etc. (b) Melamines are used for making floor tiles, kitchen wares and fabrics, which resist fire.

EXERCISE – I

MULTIPLE CHOICE QUESTIONS

1. Which of the following have long-chains of protein?

(A) Jute (B) Cotton
(C) Silk and wool (D) All of these

2. The units used in the formation of a polymer are

(A) molecules (B) monomers
(C) cells (D) atoms

3. A high molecular weight molecule built from a large number of simple molecules is called

(A) monomer (B) isomer
(C) polymer (D) ester

4. Which of the following is called artificial silk?

(A) Polyester (B) Rayon
(C) Nylon (D) Acrylic

5. Which of the following is correct about blended fabrics?

(A) They are less expensive.

(B) They have combined properties of each fibres.

(C) They are made by blending synthetic fibres with natural fibres.

(D) All of the above.

6. Cotton is used to make clothes as it is/has

(A) strong, heavy and absorbs perspiration

(B) low tensile strength, transparent and absorbs dyes

(C) light, soft, absorbs dyes and perspiration

(D) good conductor of heat.

7. Which of the following is used as non-stick coating for cooking utensils?

(A) Perspex (B) Nylon
(C) Polystyrene (D) Teflon

8. Advantages of synthetic fibres are

(A) they do not shrink on washing

(B) they are easy to clean

(C) they dry quickly

(D) all of the above

9. Nylon is manufacture by _____ polymerization .

(A) Condensation (B) Addition
(C) Both A and B (D) None of these

10. Why is polyester not suitable for summerwear?

(A) Polyester creases easily.
(B) Polyester does not absorb sweat.
(C) It is very soft and thin.
(D) It does not dry easily.

11. Polyester and wool fibres when mixed, make

(A) polycot (B) terrywool
(C) cots wool (D) polyester

12. The first man-made fully synthetic fibre is

(A) nylon (B) polyester
(C) rayon (D) cotton

13. The ability of a material to bend without breaking and to return to its original shape is

(A) flexibility (B) hardness
(C) tensile strength (D) conductivity

14. The polymer of vinyl chloride is named as

(A) PVC (B) PET
(C) PCC (D) PEC

15. Fibre with highest elasticity;

(A) Nylon (B) Polyester
(C) Spandex (D) Acrylic

16. The strength of a material to withstand a weight without breaking is

(A) flexibility (B) hardness
(C) tensile strength (D) conductivity

17. We should not wear polyester while working in kitchen because _____;

(A) it produces heat and we feel hot

(B) It feels uncomfortable ,as it does not allow air to pass through

(C) Its fabric melt and sticks to the body in case of fire.

(D) It is not hygienic to wear synthetic fibre clothes

18. Which of the following has the same monomer unit;

(A) Nylon and Cellulose

(B) Polyester and Nylon

(C) Rayon and Nylon

(D) Cellulose and Rayon

19. What are most plastics made from?

(A) Natural gas (B) Crude oil

(C) Wood (D) None of these

20. Which of the following is an example of thermosetting plastics?

(A) Nylon (B) Polythene

(C) PVC (D) Bakelite

21. Which of the following substances can be used to make the insulation of wires?

(A) Plastic (B) Rubber

(C) Wood (D) Glass

22. Thermocole is made from

(A) Polythene

(B) Polystyrene

(C) Perspex

(D) Teflon

23. Which of the following is thermoplastics?

(A) Polythene

(B) Bakelite

(C) Both (A) and (B)

(D) None of these

24. Toothpaste tubes are made of plastic. Why?

(A) It can hold more amount of toothpaste.

(B) It can be coloured in different colours.

(C) It is flexible and light.

(D) It is biodegradable.

25. Mark the correct statement.

(A) Metals do not conduct electricity.

(B) Bakelite is good conductor of heat.

(C) A flexible object will never change its shape.

(D) Strength of an object refers to its ability to support a load without breaking.

26. Which of the following have linear polymer?

(A) Nylon (B) Bakelite

(C) Melamine (D) Synthetic rubber

27. Which of the following polymers is chemically least reactive and thermally most stable?

(A) PVC (B) Teflon

(C) Polythene (D) Nylon

28. Identify the correct statements.

(i) Plastics are used to store many chemicals as they are not corroded easily

(ii) Electric wires are covered with plastics as they are good conductors of heat and electricity

(iii) Plastics are used in industries and for making household articles as they are very light strong and durable.

(iv) Metals are cheaper than plastics.

(v) Plastics can be mouled into different shapes and sizes and can be reused.

(A) (i), (ii) and (iv) (B) (iii), (iv) and (v)

(C) (i), (iii) and (v) (D) All of these

29. Which of the following synthetic fibres has a feel similar to wool?

(A) Nylon (B) Polyester

(C) Acrylic (D) Rayon

30. Polyester and cotton fibres when mixed, make
(A) polycot (B) terrycot
(C) cots wool (D) polyester

FILL IN THE BLANKS

1. Synthetic materials are made by _____.
2. Plastics are heat_____.
3. _____plastics do not soften on heating and cannot be reshaped.
4. _____synthetic fibres is commonly used to make strong ropes.
5. _____have taken the place of many traditional materials because they last for a long time.
6. The best way to dispose the discarded plastic is _____.
7. Non-stick cookware is made of_____.
8. Rayon is a fibres regenerated from _____.
9. Thermocole is made from _____ plastic material.
10. Plastic are an example of _____ .

TRUE/FALSE

1. Nylon is a polymer of amide molecules.
2. Thermosetting plastics can be easily remoulded on heating
3. Rayon is a regenerated fibre.
4. Synthetic fibres shrink on washing.
5. Polyester fibres are used for making hand knit sweaters.

MATCH THE COLUMN

1.

Column I	**Column II**
(i) A polymer of acrylonitrile	(a) Koroseal
(ii) A high polymer of vinyl chloride	(b) Acrylon
(iii) A regenerated fibre	(c) Nylon
(iv) A pure synthetic fibre	(d) Rayon
(v) A fibre which burns purely with the smell of burning hair and the residue is the form of a grey ball.	(e) Cotton
(vi) A fibre burns vigorously with the smell of burning paper and forms very little ash	(f) Wool

VERY SHORT ANSWER TYPE QUESTIONS

1. What is meant by the term synthetic fibre and natural fibre?
2. Why is food stored in a plastic container?
3. Name the fibre having properties similar to that of silk.
4. Why is rayon called artificial silk ?
5. Write two uses of plastic in medical.

SHORT ANSWER TYPE QUESTIONS

1. Why synthetic fibres are more popular than natural fibres ?
2. Most plastics are non-biodegradable. What does it mean?
3. Which type of synthetic fibre is used to make sweater and blankets and why ?
4. How would you distinguish between a thermoplastic and a thermosetting plastic?
5. List the properties of plastic.

LONG ANSWER TYPE QUESTIONS

1. List the uses

(a) nylon (b) polyester (c) rayon.

2. What are biodegradable and non-biodegradable materials ? Explain with examples.

3. Why plastics are used as covering material in electrical appliances ?

4. Why should we not wear synthetic clothes while working in kitchen ?

5. List the advantages and disadvantages of synthetic fibres.

EXERCISE – II

1. Which of the following statements is/are correct ? **[NSO]**

(i) Polymers can be natural or synthetic.

(ii) Rayon closely resembles silk.

(iii) Most synthetic fibres have very high moisture absorbing capacity.

(iv) Polyester is resistant to most chemicals.

(A) (i) and (ii) only

(B) (ii) and (iii) only

(C) (iv) only

(D) (i), (ii) and (iv) only

2. Pre-weighed pieces of cloth of nylon, cotton and silk of equal measurements were taken and soaked in a beaker filled with water. After a few minutes, the cloth pieces were taken out of the beaker and weight again. Which of the following options places them in the correct order of their final weights? **[NSO]**

(A) Silk > Nylon > Cotton

(B) Cotton > Nylon > Silk

(C) Silk > Cotton > Nylon

(D) Cotton > Silk > Nylon

3. Why is it not advisable to wear clothes made up of synthetic fibres in laboratory or in kitchen ? **[NSO]**

(A) Synthetic fibres catch fire very easily.

(B) Synthetic fibres melt on heating.

(C) Synthetic fibres stick to the body.

(D) All of these

4. A brief information about three different plastics is given below : **[NSO]**

X : Thermoplastic which can be rolled into sheets.

Y : Thermoplastic which is used as a covering for electric wires.

Z : Thermosetting which is used for making plugs and switches.

Identify X, Y and Z.

	X	**Y**	**Z**
(A)	Melamine	Teflon	Bakelite
(B)	Bakelite	Melamine	Polythene
(C)	Polythene	Polyvinyl chloride	Bakelite
(D)	Polyvinyl chloride	Polythene	Melamine

5. Read the following statements and state (T) for true and (F) for false. **[NSO]**

(i) Synthetic fibres are thin, fine and continuous while natural fibres are usually short.

(ii) Synthetic fibres are hydrophobic.

(iii) Natural fibres are usually stronger than synthetic fibres.

(iv) Natural fibres are resistant to moths.

	(i)	**(ii)**	**(iii)**	**(iv)**
(A)	T	T	T	F
(B)	F	T	F	T
(C)	F	F	F	T
(D)	T	T	F	F

6. Match column-I with column-II and select the correct answer from the given codes. **[NSO]**

	Column-I	**Column-II**
(P)	The most common form of polyester	(i) Spandex
(Q)	A synthetic fibre also known as lycra	(ii) Acrylic
(S)	A synthetic fibre that closely resembles wool	(iii) PET

(T) The first true synthetic (iv) Nylon fibre

	P	Q	S	T
(A)	(iv)	(ii)	(iii)	(i)
(B)	(iii)	(i)	(ii)	(iv)
(C)	(ii)	(iii)	(i)	(iv)
(D)	(iii)	(ii)	(iv)	(i)

7. X is a thermoplastic. It does not allow electricity to pass through it. It is used to make coverings around electrical wires, floor tiles, hose pipes, raincoats, etc. X is– **[NSO]**

(A) Bakelite (B) Polyvinyl chloride

(C) Nylon (D) Melamine

8. Select the correct option for the given statments. **[NSO]**

I. Plastics are generally good conductors of electricity.

II. Ropes made of bakelite are used in cranes and elevators.

III. Teflon is a special plastic on which oil and water do not stick.

IV. Plastic is non-biodegradable, hence not environment friendly.

	I	II	III	IV
(A)	T	T	F	F
(B)	F	F	T	T
(C)	T	F	T	F
(D)	F	T	F	T

9. Read the given statements and mark the appropriate answer. **[NSO]**

Statement 1 : Polyester is synthesised from petrochemicals by linking ester units.

Statement 2 : Terylene is a polyester.

(A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

(B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.

(C) Statement 1 is true and statement 2 is false.

(D) Both statements 1 and 2 are false.

10. A few properties are listed in the box.

(i) Good conductors (ii) Recyclable

(iii) Durable (iv) Biodegradable

(v) Resistant to chemicals

The properties which are not shown by plastics are– **[NSO]**

(A) (i), (ii) and (iii) only

(B) (ii), (iii) and (iv) only

(C) (i) and (iv) only

(D) (iv) and (v) only

11. Which of the following applications of plastics show(s) that plastics are bad conductors of electricity ? **[NSO]**

I. Refrigerators have an insulating wool of plastics.

II. Electric wires have a plastic coating.

III. Chemicals are stored in plastic containers.

IV. Parachutes are made from plastics.

(A) II, III and IV only

(B) III and IV only

(C) I only

(D) II only

12. Read the given passage and fill in the blanks by selecting an appropriate option. Cellulose is a naturally occurring fibre. The walls of (i) are made of cellulose. It is used in making a synthetic fibre (ii) which resembles the most expensive natural fibre (iii) in apearance hence, it is also called (iv). **[NSO]**

	(i)	(ii)	(iii)	(iv)
(A)	Animal cell	Cotton	Nylon	Animal fibre
(B)	Plant cell	Rayon	Silk	Artificial silk
(C)	Plant cell	Acrylic	Wool	Artificial wool
(D)	Animal cell	Silk	Rayon	Synthetic wool

13. Raman took three different bags made up of three different materials P, Q and R. He put 10 kg of onions in each bag. Bag Q bursted immediately, bag P carried the weight for a few minutes and then bursted while bag R remained intact. Materials P, Q and R could be respectively. **[NSO]**

(A) Wool, silk and cotton

(B) Nylon, rayon and silk

(C) Silk, cotton and nylon

(D) Cotton, nylon and silk

14. Read the given statements and select the correct option.

Statement 1 : Bakelite is used for making electrical switches and handles of various utensils.

Statement 2 : Bakelite is a good conductor of heat and electricity.

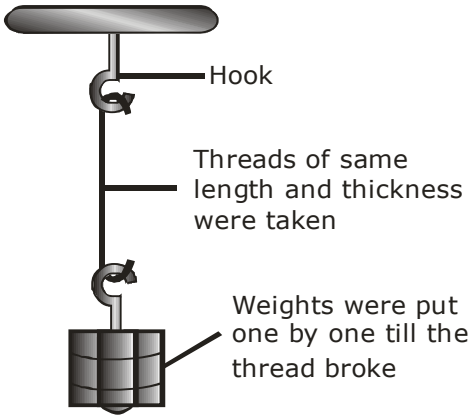
(A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

(B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.

(C) Statement 1 is true and statement 2 is false.

(D) Both statements 1 and 2 are false.

15. Anuj has performed an experiment to compare the strength of different fibres. He arranged the set-up as shown in figure : Arrange the threads in order of their increasing strength.



(A) Nylon < Silk < Cotton

(B) Silk < Cotton < Nylon

(C) Cotton < Nylon < Silk

(D) Cotton < Silk < Nylon

16. Solve the following riddles by identifying X, Y and Z.

X : Your mother loves to cook in the utensils which are coated with me because I make them non-stick

Y : I protect the firemen by coating their uniforms to make them fire resistant.

Z : I am a very familiar form of polyester and used for making bottles, utensils, films, etc.

	X	Y	Z
(A)	Acrylic	Rayon	Bakelite
(B)	PET	Polythene	Teflon
(C)	Rayon	Bakelite	Melamine
(D)	Teflon	Melamine	PET

17. Cotton is used to make clothes as–

(A) It is strong, heavy and absorbs water.

(B) It has low tensile strength, absorbs dyes and is transparent.

(C) It is light, soft, absorbs dyes and sweat.

(D) It is good conductor of heat.

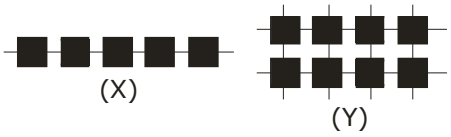
EXERCISE – III

1. Match column-I with column-II and mark the correct option from the given codes. **[NSO]**

	Column-I	Column-II
(a)	Polyester	(i) Prepared by using wood pulp
(b)	Teflon	(ii) Used for making parachute and stockings
(c)	Rayon	(iii) Used for making non-stick cookwares
(d)	Nylon	(iv) Fabrics do not wrinkle easily

	(a)	(b)	(c)	(d)
(A)	(iii)	(iv)	(i)	(ii)
(B)	(iv)	(iii)	(i)	(ii)
(C)	(iv)	(iii)	(ii)	(i)
(D)	(i)	(ii)	(iii)	(iv)

2. Study the given figures and select the correct statements regarding polymers X and Y. **[NSO]**



I. X is a linear polymer while Y is a crosslinked polymer.

II. X could be polyvinyl chloride and Y could be bakelite.

III. X could be melamine resin and Y could be teflon.

IV. X can be recycled easily while Y cannot be recycled.

(A) I, II and IV only

(B) II and IV only

(C) III and IV only

(D) I, II, III and IV

3. Sneha has classified a few materials as shown in the table. **[NSO]**

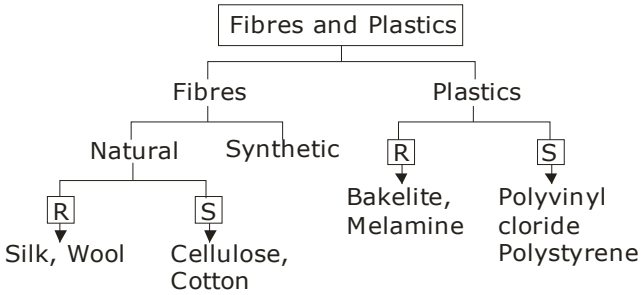
S.No.	Material	Type/Nature
1.	Nylon	Synthetic and non-biodegradable
2.	Jute	Natural and non-biodegradable
3.	Coir	Synthetic and biodegradable
4.	Wool	Natural and biodegradable
5.	Acrylic	Blended and biodegradable
6.	Polyester	Synthetic and non-biodegradable

The materials which are classified incorrectly are–

(A) 1, 3 and 4 only (B) 2, 4 and 5 only

(C) 2, 3 and 5 only (D) 1, 3 and 6 only

4. Anisha prepared a flow chart to show classification of fibres and plastics. She left few columns blank. Fill in the blanks by selecting the option with correct words. **[NSO]**



	P	Q	R	S
(A)	Plant fibres	Animal fibres	Thermo plastics	Thermo setting
(B)	Animal fibres	Plant fibres	Thermo setting	Thermo plastics
(C)	Rayon	Animal fibres	Biode gradable	Non-biode gradable
(D)	Animal fibres	Plant fibres	Non-biode-gradable	Biode gradable

5. A few polymers are randomly grouped together as : **[NSO]**

Group I : Rayon, acrylic, nylon, jute

Group II : PVC, melamine, teflon

Group III : Polycot, terrywool, acrylic

Select the odd one out in group I, II and III on the basis of some common property.

	I	II	III
(A)	Rayon	Teflon	Terrywool
(B)	Nylon	Teflon	Acrylic
(C)	Jute	Melamine	Terrywool
(D)	Jute	Melamine	Acrylic

6. Read the following statements carefully.

P. I am extensively used in the healthcare industry but my one disadvantage is that i am non-biodegradable.

Q. I am very familiar form of polyester and used for making bottles, utensils, films, wires, etc.

R. I am artificial silk and mixed with wool to make carpets.

P, Q and R are respectively. **[NSO]**

(A) PET, Rayon and Plastic

(B) Rayon, Plastic and PET

(C) Plastic, Rayon and PET

(D) Plastic, PET and Rayon

7. Match column-I with column-II and select the correct option from the given codes. **[NSO]**

	Column-I		Column-II
P.	Nylon	(i)	Burns quickly with a smell of burning paper.
Q.	Wool	(ii)	Burns with sooty flame, fabric shrinks and black beads are formed
R.	Acrylic	(iii)	Shrinks after exposure to flame, forms hard beads and gives a smell of plastic or celery like
S.	Rayon	(iv)	Burns slowly with a smell of burning hair

	P	Q	R	S
(A)	(i)	(iv)	(ii)	(iii)
(B)	(iii)	(iv)	(ii)	(i)
(C)	(iv)	(iii)	(i)	(ii)
(D)	(ii)	(iv)	(iii)	(i)

8. The characteristics of different fibres are listed as–

W : I am strong, elastic, light and burn slowly.
I shrink on heating and form hard beads with smell of burning hair.

X : I burn completely leaving no residue.

Y : I can be woven like silk fibres and dyed in a wide variety of colours. I burn quickly with a smell of burning paper.

Z : I do not get wrinkled easily. I burn slowly and produce black smoke.

W, X, y and Z are respectively

(A) Terylene, rayon, cotton and nylon

(B) Bakelite, nylon, rayon and cotton

(C) Melamine, PVC, nylon and rayon

(D) Nylon, cotton, rayon and polyester.

9. Read the given statements about synthetic fibres and plastics carefully.

I. polycot is a mixture of two types of fibres, polyester and cotton.

II. Calendar, woollen clothes and cold drink cans are all non-biodegradable.

III. Uniforms of firemen have coating of nylon to make them flame resistant.

IV. Polythene and PVC are the example of thermosetting plastics.

Which of these statements is/are incorrect?

(A) II and IV (B) I and III

(C) Only II (D) II, III and IV

10. I am a man-made fibre, stronger than a steel wire. Some of my uses are shown in figures–

Who am I ?

(A) Polyester (B) Acrylic

(C) Nylon (D) Rayon

11. Suhani, a class 8 student has listed the important properties and uses of a few plastics in the given table.

Plastics	Properties	Uses
W	Light weight	For making adhesive tapes and as an insulator for electric wires
X	Thermoplastic	For making soles of shoes and sanitary fittings
Y	Thermosetting	For making electrical switches and plugs
Z	Hard, highly polished	For making floor tiles and kitchenware

W, X, Y and Z could be respectively.

(A) Polystyrene, polythene, melamine and teflon

(B) PVC, polythene, bekelite and melamine

(C) Polythene, PVC, bakelite and melamine

(D) Polythene, melamine, bakelite and teflon

12. Match column-I with column-II and choose the correct option using the codes given below.

	Column-I	Column-II
(P)	Terylene	1. Rayon
(Q)	Bakelite	2. Thermoplastic
(R)	PVC	3. Polyester
(S)	Artificial silk	4. Thermosetting

	P	Q	R	S
(A)	3	4	2	1
(B)	4	1	3	2
(C)	3	2	4	1
(D)	2	4	1	3

13. Which of the following statements are incorrect?

I. Rayon is a natural fibre as it is obtained by chemical treatment of wood pulp.

II. Plastics which cannot be softened by heating are called thermoplastics.

III. Nylon is semi-synthetic fibre.

IV. Plastics which get deformed easily on heating are known as thermosetting plastics.

(A) I and III

(B) I, II and III

(C) II, III and IV

(D) All of these

14. Structure of PVC is–

(A) $-\left[\ CH_2 - \underset{Cl}{CH}\ \right]_n-$

(B) $-\left(\ CH_2 - \underset{CH_3}{CH}\ \right)_n-$

(C) $-\left(\ CH_2 - CH_2\ \right)_n-$

(D) $-\left(\ CF_2 - CF_2\ \right)_n-$

15. Chemical formula of Teflon is–

(A) $-\left(\ CF_2 - CF_2\ \right)_n-$

(B) $-\left(\ CH_2 - \underset{Cl}{CH}\ \right)_n-$

(C) $-\left(\ CH_2 - CH_2\ \right)_n-$

(D) none of these

MOTION

BIOLOGY

CLASS - VIII

BOOKLET - 1

CONTENTS

CELL AND TISSUE

MICROORGANISMS IN FOOD

REPRODUCTION IN ANIMALS

Motion Education, 394 - Rajeev Gandhi Nagar, Kota-5 (Raj.)
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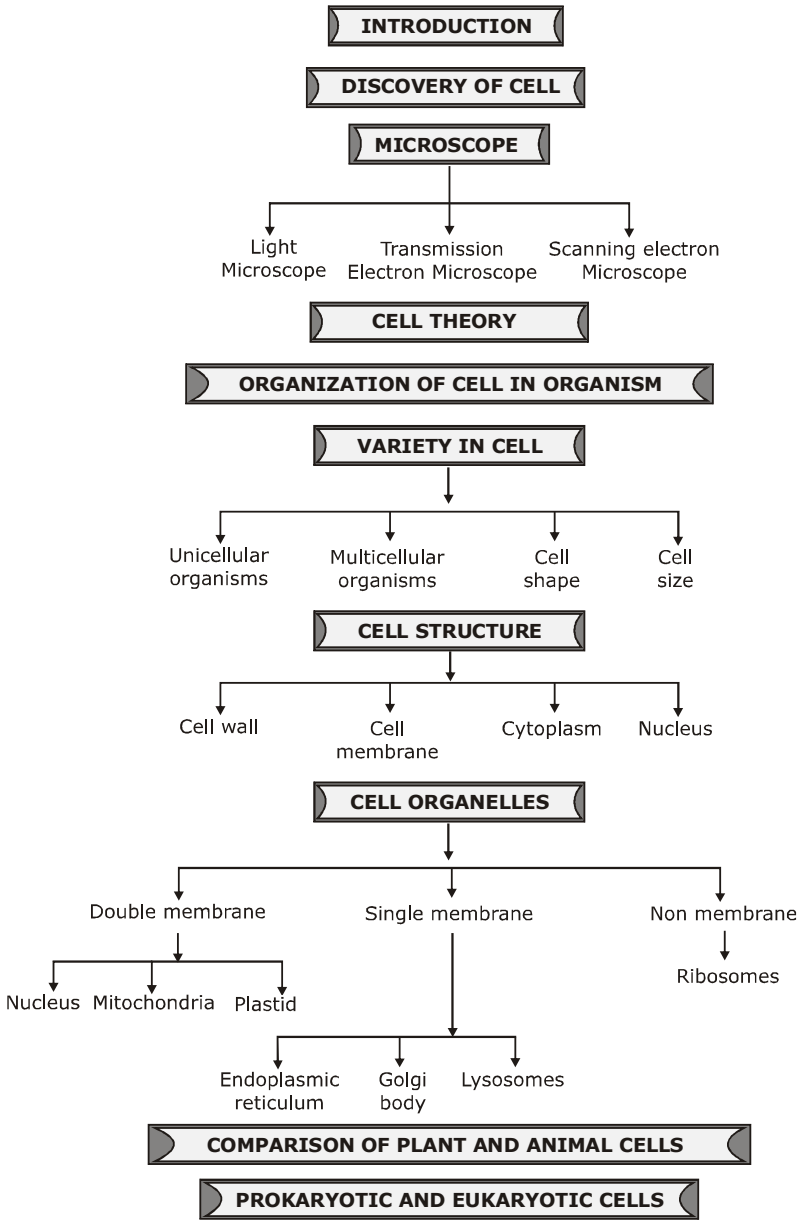
REACHING THE AGE OF ADOLESCENCE

ANSWER KEY

CHAPTER 1

CELL & TISSUE



INTRODUCTION

Inspite of much diversity in the Living organisms with regard to structure, functions, habitat, habits etc. one thing is common in all of them without exception is that they all are made up of cell (single cell or numerous cell). The word cell is derived from latin word "cellula" meaning small room.

A cell may be defined as the smallest unit of structure and function of living organisms.

Smallest 'unit of structure' means, the smallest structures by the union of which the body of an organism is constructed.

'Unit of function' means any function performed by an organism or organ is the activity of its constituent cells. The cell may also be defined as a small speck of nucleated protoplasm bounded by cell membrane or plasma membrane, and is capable of independent existence and perpetuation.

A cell is the structural and functional unit of life. It is the building block of which all living organisms are made, and the smallest unit of life capable of all the living functions. It is defined as a mass of protoplasm bounded by a plasma membrane.

The branch of biology which deals with the study of cell and cell organelles is known as cytology.

DISCOVERY OF CELL

1. Robert Hooke (1665) :– An English man and first curator of Royal society of London.
Observed a thin transverse section of bark of a tree under self designed microscope.
He noticed honey - comb like compartments.
He coined the term cell.
He wrote a book - Micrographia.
He actually observed dead cells.

Cork section shown in Robert Hooke's Microscope

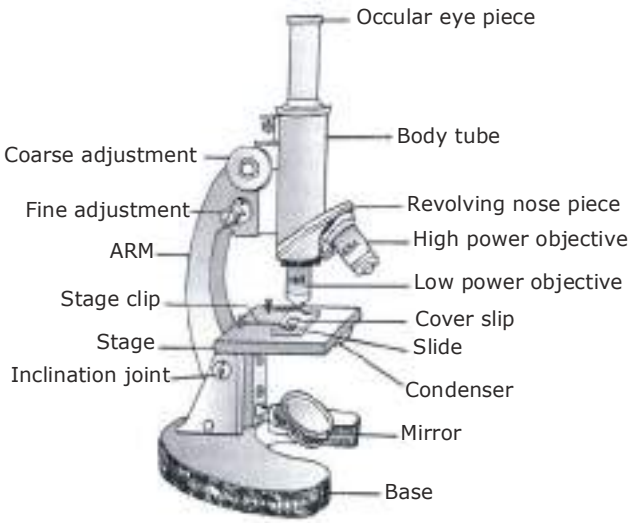
2. Antony Van Leeuwenhoek (1674) was first to observe living cells like bacteria [from pond], erythrocytes [fish], sperms and protozoans [e.g. Vorticella]

3. N. Grew (1682) :– Proposed cell concept which states that cell is basic unit of structure of organisms.

4. Rudolf Virchow (1858) :– Proposed that new cells formed from the pre-existing cells.

MICROSCOPE

A microscope is an instrument to view small objects by magnifying them. It enables us to see the different types of living cells and the structures they contain.



Parts of an ordinary compound microscope

1. TYPES OF MICROSCOPES

There are mainly three types of microscopes. They are :

(A) Light microscope : The light microscope uses light to produce images.

(B) Transmission Electron Microscope (TEM) : The electron microscope was designed by Knoll & Ruska (1932). A TEM makes use of a beam of highly energetic electrons to examine objects. The image produced is of a very fine scale.

(C) Scanning Electron Microscope (SEM) : Like the TEM, the SEM also uses electrons to produce images. In the case of a SEM, electrons are reflected off the surface of the specimen, because of which SEM images usually manage to capture the physical features of a cell in great detail.

CELL THEORY

It was proposed for the first time by the German botanist M.J. Schleiden (1838) and German zoologist T. Schwann (1839).

1. Outcomes of cell theory includes :

(A) A cell is the basic unit of life.

(B) Cells are present in all organisms.

2. Modern cell theory or cell principle or cell doctrine states —

(A) All organisms are made up of cells.

(B) Cell does not arise de novo (Denovo–Spontaneous). Cells arise from pre–existing cells. (Omnis cellula-e-cellula) added by Rudolf Virchow.

(C) Cells contain hereditary material.

(D) A cell is a small mass of protoplasm, usually containing a nucleus or nuclear material along with some organelles.

(E) Cells are physiological unit of life.

(F) Each cell is capable of maintaining its vitality independently.

ORGANIZATION OF CELL IN MULTICELLULAR ORGANISM

Cells usually group together to make tissues, organs, organ systems and finally organisms.

1. **Tissue:** It is a group of cells of the same size, shape and function. Example: Muscle tissue, Nerve tissue etc.
2. **Organ :** It is a structure that contains more than one type of tissues. Example: Heart, Brain (in animals), and leaves, roots and stems in plants.
3. **Organ system:** a group of organ working together is called an organ system. Example : Digestive system.
4. **Organism:** The different organ system working together form the organism.

Cells ⟶ Tissues ⟶ Organs ⟶ Organ Systems ⟶ Organisms

Info Bubble

The study of tissues is known as histology. Cell biology is a branch of biology that studies the different structures and functions of the cells.

VARIETY IN CELL NUMBER, SHAPE AND SIZE

Cells in different organisms show variations in their number, shape and size.

1. **ON THE BASIS OF NUMBER OF CELLS, ORGANISMS CAN BE CATEGORIZED AS:**

(A) **Unicellular Organisms :** In these organisms, all the functions like nutrition, respiration, excretion & reproduction are carried out by the single cell. Example: Amoeba and Paramecium.

(B) **Multicellular Organisms :** Organisms which are made up of a few to billions of cells. Example: Plants & Animals.

Unicellular organisms	Multicellular organisms
(i) Organisms are made up of one cell.	Organisms are made up of many cells.
(ii) One cell carries out all the functions.	Different cells carry out different functions.
(iii) Death of one cell leads to death of the organism.	Death of one cell does not lead to the death of the organism.
(iv) Unicellular organisms do not show levels of organization.	Multicellular organisms show various levels of organisation
(v) Example : *Ameoba, bacteria, Paramecium,* etc.	Example : Man, cow, dog, tree etc.

2. CELL SHAPE :

Cell shows variability with respect to their shape and size in multicellular organisms. Shape of the cell may be variable i.e. constantly changing e.g. Amoeba and leucocytes;or fixed. The shape of the cell is usually related to its function.

Fixed shapes of cells are of following types :-

(A) Flattened e.g. Skin cells (upper layer).
(B) Columnar e.g. cells lining the intestine.
(C) Discoid e.g. R.B.C.
(D) Spherical e.g. eggs of many animals.
(E) Spindle shaped e.g. Smooth muscle fibers.
(F) Elongated e.g. nerve cells.
(G) Branched e.g. pigment cells of the skin.
(H) Bean shaped e.g. Guard cells of stomata

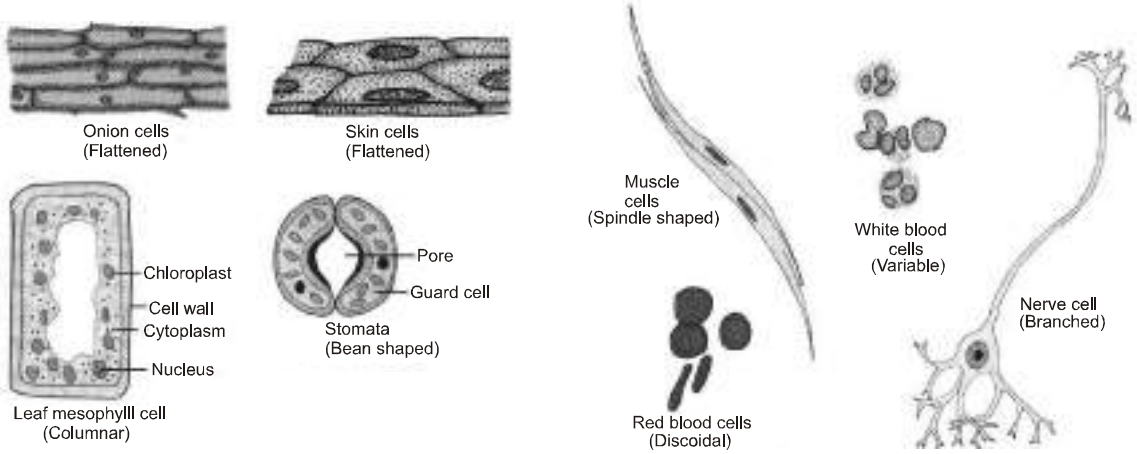


Fig.: Cells of different shape

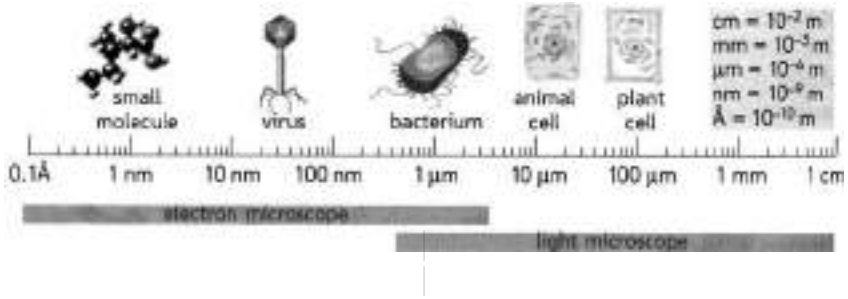
3. CELL SIZE :

(A) Size of cell vary from very small cells of bacteria (0.2 to 0.5 μm) to the very large egg of ostrich.

(B) Smallest cell–PPLO/*Mycoplasma gallisepticum* (Pleuro–pneumonia like organisms) 0.1 – 0.5 µm in size.

(C) Largest cell – Ostrich egg 18 cm in diameter with shell and 15 cm without shell.

(D) Longest cell – nerve cell 90 – 100 cm in length.



ACTIVITY - 1

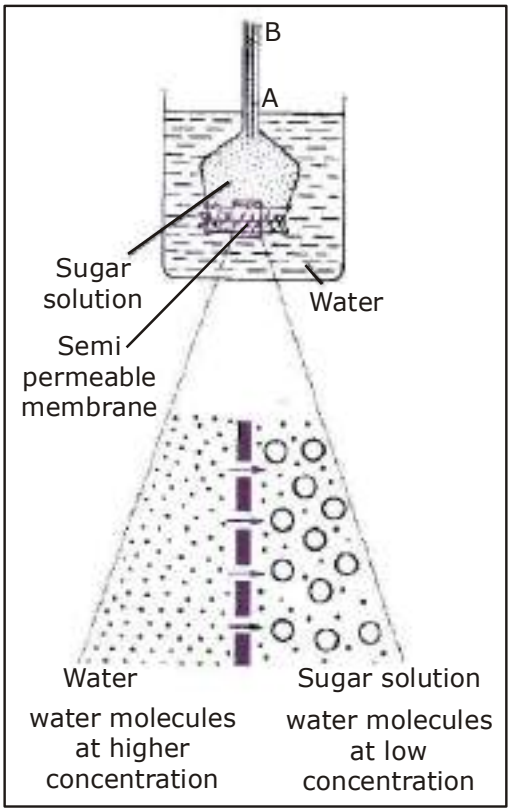
Experiment : Demonstration of osmosis in the laboratory.

Requirements : Funnel fitted with a semipermeable membrane, beaker, sugar solution, water.

Procedure : Take sugar solution in a funnel fitted with a semipermeable membrane (fish bladder or egg membrane) upto mark 'A' and place it in an inverted position in a beaker filled with clean water as shown in figure. After some time,
observe the level of sugar solution in the funnel.

Result :- You would find that the sugar solution has risen from level 'A' to a new level 'B'.

Explanation and conclusion : Sugar solution in the funnel and water in the beaker are separated by a semipermeable membrane. The fitted membrane is permeable to small water molecules but is relatively impermeable to large sugar molecules dissolved in water. Due to difference in the concentration of solute on the two sides of semipermeable membrane, water molecules have moved from the solution having lower concentration of solutes (e.g., water in this experiment) to the solution having higher concentration of solutes [e.g. sugar solution] due to osmosis has risen to new level 'B'.



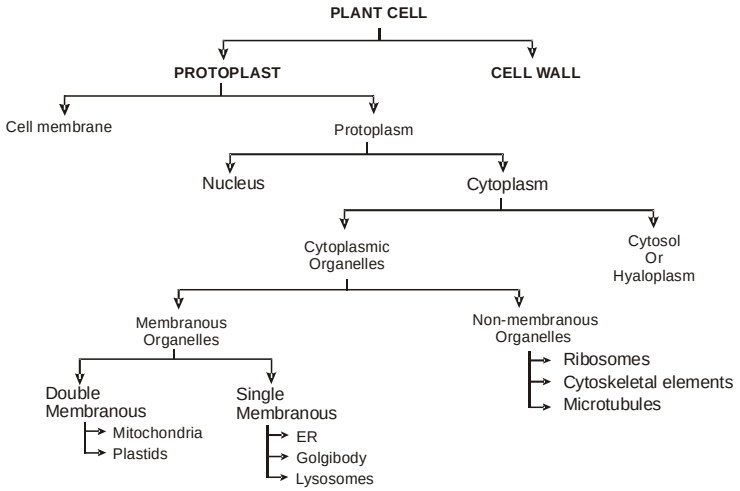
CELL STRUCTURE

All plants and animals cells consist of three basic parts or components

(i) Cell membrane (ii) Cytoplasm (iii) Nucleus

Protoplasm: Protoplasm (proto = first, plasma = liquid): The living substance of the cell is called the protoplasm.It is differentiated in two regions:

(a) Nucleoplasm: Protoplasm of nucleus (b) Cytoplasm : Extra nuclear protoplasm



1. CELL WALL:

(A) It is the outermost covering of the plant cells.

(B) It is absent in animal cells.

(C) Cell wall is rigid, strong, thick, porous and non living structure. It is made up of cellulose and hemicellulose. Cell walls of two adjacent cells are joined by a layer called middle lamellae. It is made up of calcium and magnesium pectate.

(D) **Functions of cell wall :**

(i) It provides definite shape to the cell.

(ii) It provides strength to the cell.

(iii) It is permeable for the entry of molecules of different sizes.

MORE TO KNOW

- The cell wall in plants contains **cellulose.** This cellulose acts as **roughage** in our diet and therefore is very important for us.
- We cannot get roughage from animal foods, as animal cells do not contain a cell wall.

Endosmosis and Exosmosis

- In cells, water molecules may diffuse into the cell or out of the cell, depending on whether the cells are kept in a weaker solution or in a stronger solution respectively.

  The process is called **osmosis**. It is of two types :

  - **Endosmosis** (endo = inward) is the inward diffusion of water when the surrounding solution is less concentrated. This brings about swelling of the cell.
  - **Exosmosis** (exo = outward) is the outward diffusion of water when the surrounding solution is more concentrated. This brings about shrinkage of the cell.

2. CELL MEMBRANE:

(A) Cell membrane is also called as Plasma Membrane or Plasmalemma.

(B) It is the limiting boundary of each cell which separates the cytoplasm from its surroundings.

(C) It is found in both plant as well as animal cells.

(D) It is the outer most covering of a cell in case of animals and lies below the cell wall in case of plants.

(E) It is made up of proteins (58-59%),lipids (40%) and carbohydrate (1–2%).

(F) Plasma membrane name was given by Nageli.

(G) Plasma membrane is selectively permeable in nature. It allows or permits the entry and exit of some materials in and out of the cell.

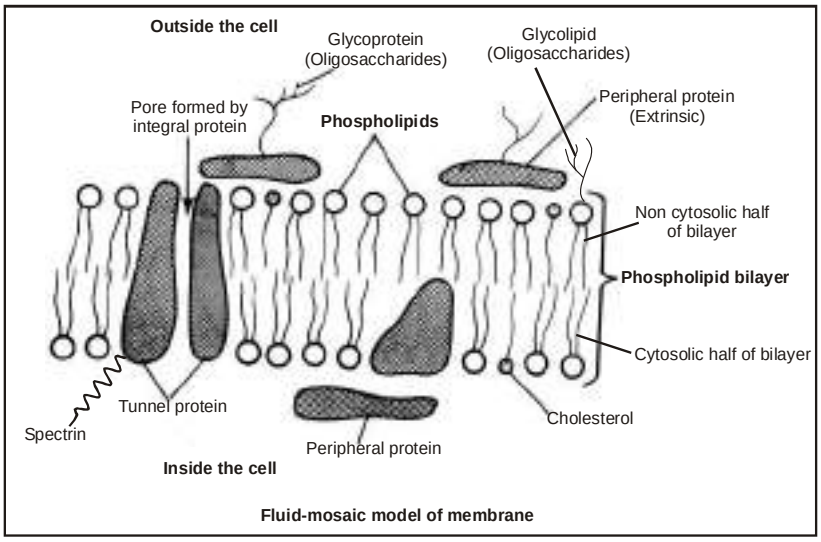
(H) Singer and Nicholson gave the fluid mosaic model of plasma membrane according to them it consists of a protein layer sandwiched between two layers of lipids.

(I) It is 75 Å thick.Due to it's quasifluid state, it is flexible and can be folded, broken and reunited.

(G) **Functions of plasma membrane :**

(i) It regulates the movement of molecules inside and outside the cell.

(ii) It helps in maintaining the distinct composition of the cell.



Plasma membrane

3. CYTOPLASM:

(A) It is the site of both biosynthetic and catabolic pathways.

(B) It can be divided into two parts :

(i) Cytosol or Hyaloplasm : Aqueous soluble part contains various fibrous proteins forming cytoskeleton.

(ii) Cell organelles : Living part of the cells having definite shape, structure and function bounded by plasma membrane.

4. NUCLEUS:

Nucleus is the most important part of a cell. It is usually spherical or oval in shape. It controls all the vital functions of the cell. It is made up of the nuclear membrane, nucleoplasm, nucleolus and chromosomes.

(A) The nuclear membrane surrounds the nucleus and separates it from the cytoplasm. It is permeable and controls the passage of materials through and from the nucleus.

(B) The nucleoplasm or nuclear sap makes up the body of the nucleus. It is denser than the cytoplasm

(C) The nucleolus is a spherical body in the nucleus. It is composed of the nucleoprotein RNA (ribonucleic acid). It is responsible for protein synthesis.

(D) Nucleus also contains thread-like structures called chromosomes, which are composed of nucleoprotein DNA (deoxyribonucleic acid). The hereditary units of chromosomes are the genes. They are responsible for the transmission of characters from the parents to the offspring.

(E) **Functions of the Nucleus :**

(i) It controls all the metabolic activities of the cell and regulates the cell cycle.

(ii) It helps in transmission of hereditary characters from one generation to next generation.

Info Bubble

Muscle cells contain more than one nucleus in each cell. Cells without a nucleus are called enucleated cells.

CELL ORGANELLES

These are living sub-cellular structures of the cytoplasm and are also called protoplasmic bodies or organelle. These includes -

1. Double membrane bound organelles : Mitochondria and Plastids.

2. Single membrane bound organelles : Endoplasmic reticulum, Golgi apparatus, lysosome, Vacuole, Peroxisomes etc.

3. Non- membrane bound organelles : Ribosomes etc.

1. DOUBLE MEMBRANE BOUND ORGANELLES :

(A) Mitochondria:

(i) It was first seen by Kolliker in insect cells and named by Benda.

(ii) It is found in cytoplasm of all eukaryotic cells except mammalian RBC's. These are also absent in prokaryotes.

(iii) Maximum mitochondria are found in metabolically active cells.

(iv) Mitochondria are small, rod-shaped organelles found in large numbers.

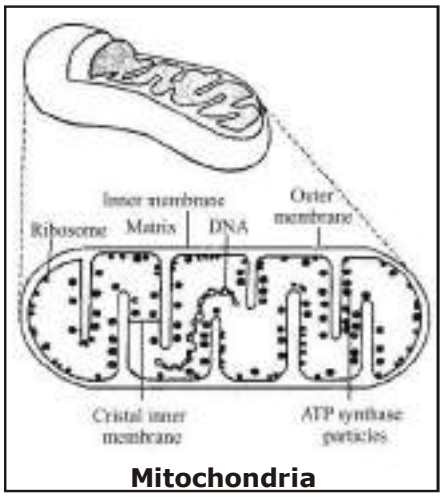
(v) Each mitochondria is bounded by two membranes-outer and inner.

(vi) The outer membrane is smooth and the inner membrane is pushed inwards at intervals forming crests called cristae. The cristae lie in a ground substance called matrix.

(vii) Mitochondria possess enzymes necessary for the oxidation of carbohydrates. This process releases energy in the form of ATP. This is why mitochondria are known as the power house of the cell.

(viii) Mitochondria have their own DNA and ribosomes. They can synthesize their own proteins.

(ix) **Function :** Mitochondria provide energy for the vital activities of living cells.



Mitochondria

(B) Plastid:

Plants and some protists have several types of double membrane bound organelles called plastids, which harvest solar energy, manufacture nutrient molecules and store materials.

Plastid term was coined by E.Haeckel.

Plastids generally contain pigments and synthesize & accumulate various substances.

Plastids are of three types :

(i) Chloroplasts (Chlore – green plastids): Most common plastids with the greatest biological importance.They take part in photosynthesis to produce life supporting gas, oxygen and most of the energy (glucose) used on our planet by living beings and also called **kitchen of the cell**.

Blue green algae lack chloroplasts and have loosely arranged membrane in the cytoplasm in the form of sacs of typical unit membrane structure called lamellae. First seen by A.V. Leeuwenhoek.

Chloroplasts are bag-like, membrane-bound structures filled with a watery substance known as matrix or stroma. These are also lined by a **double membrane,** but no cristae-like structure is seen. A number of organised flattened membranous sacs called the **thylakoids** are present in stroma. Thylakoids are arranged in stacks like the piles of coins called grana (singular : granum).

Many membranous tubules called stroma lamellae interconnect thylakoids of different grana. Each thylakoid have chlorophyll, a green colour pigment, molecules on their surface that trap sunlight and take part in the process of photosynthesis.

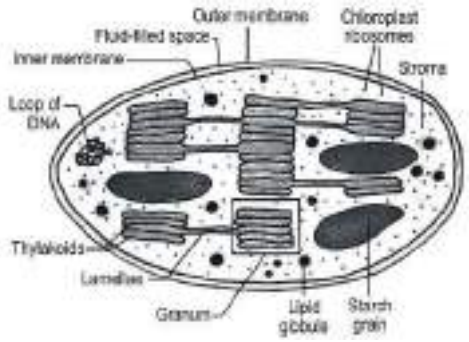


Fig. Chloroplast

(ii) Chromoplast: These are coloured plastids (other than **green**) found in petals, fruits and roots of certain higher plants.

(iii) Leucoplasts : These are colourless plastids, found in underground plant parts which are not exposed to light. They store food materials.

These are also found in embryonic cells, germ cells and meristematic cells.

2. SINGLE MEMBRANE BOUND ORGANELLES :

(A) Endoplasmic reticulum :

(i) The endoplasmic reticulum is a network of tube-like structures running through the cytoplasm. If ribosomes are attached to it, the reticulm is rough and known as **rough** endoplasmic reticulum, if ribosome are absent it is smooth and known as **smooth** endoplasmic reticulum.

(ii) Function : It gives internal support to the colloidal matrix (cytoplasm).

(iii) Rough endoplamic reticulum (RER) is associated with the synthesis of proteins.

(iv) Smooth endoplasmic reticulum is associated with membrane biogenesis.

(B) Golgi body: It was discovered by camilo golgi. It is absent in prokaryotes and mammalian RBC. In plants golgi body is called as **Dictyosome.**

Functions :

(i) It is secretory in nature.

(ii) It helps in formation of middle lamellae

(iii) It helps in formation of lipids

(iv) Lipids and proteins synthesized in endoplasmic reticulum are packed at golgi complex.

(v) They provide the site for assembly of new membrane material.

(C) Lysosome: Lysosomes (Lyso = digestive, soma = body)

(i) Discovered by Christian de Duve.

(ii) They occur in animal cells and a few plant cells.

(iii) Commonly known as **"Suicidal Bags".**

(iv) They do not have a definite shape or size.

(vi) They are bounded by a single membrane.

(vi) These are tiny sac like granules containing hydrolysing enzymes called acid hydrolases for intracellular digestion.

(vii) There main function is phagy = digestion.

(D) Peroxisomes : Peroxisomes are small (0.3 to 1.5 μm in diameter) are spherical organelles contaning powerful oxidative enzymes. They are bounded by a single membrane. Peroxisomes are mostly found in kidney and liver cells.

Functions : Peroxisomes are specialised for carrying out some oxidative reactions; such as detoxification or removal of toxic suubstances from the cell.

3. NON- MEMBRANE BOUND ORGANELLES :

(A) Ribosomes :

(i) First reported by Claude and named by G. Palade.

(ii) They are one of the smallest cell organelles of cell.

(iii) It is of two types that is 70s (Prokaryotic),80s (Eukaryotic).

(iv) Ribosomes are the sites of protein synthesis. All structural and functional (enzymes) proteins coded by the nuclear DNA, are synthesized upon cytoplasmic ribosomes.

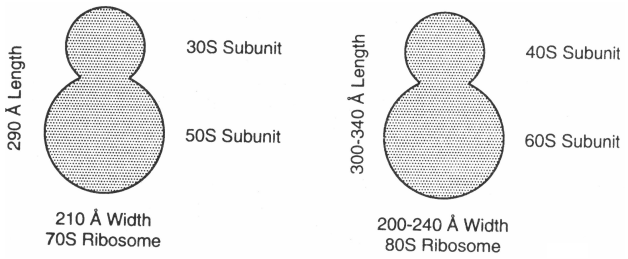


Fig.: Ribosomes

(B) Centrosome: It is a star-like structure found mostly in animal cells. It consists of **centrioles**. It helps in cell division.

Functions : Centrosome helps in cell division in animal cells. During cell division centrioles migrate to the poles of animal cells and are involved in the formation of the spindle.

COMPARISON OF PLANT AND ANIMAL CELLS

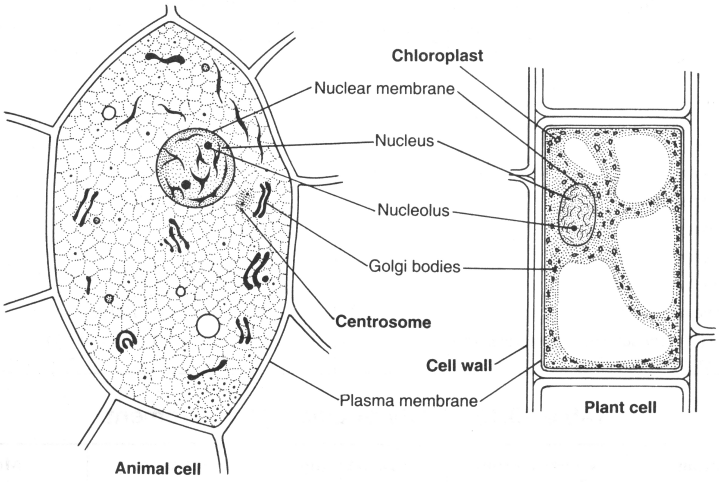


Fig. 13.103 Comparison of Animal and Plant Cells

S.NO.	Component / Organelle	Plant Cell	Animal Cell
1.	Cell wall	Present	Absent
2.	Centrosome	Absent	Present
3.	Plastids	Present	Absent
4.	Vacuoles	Large size	Small size
5.	Nucleus	Present, eccentric	Present, centric
6.	Mitochondria	Present (less in number)	Present (more in number)

PROKARYOTIC AND EUKARYOTIC CELLS

1. ON THE BASIS OF TYPE OF ORGANIZATION, CELLS ARE OF TWO TYPES :

(A) Prokaryotic cells : These are primitive and incomplete cells. They have less developed nucleus without nuclear membrane and nucleolus.**e.g.** Bacteria.

(B) Eukaryotic cells: These are well developed cells. They have advanced nucleus with nuclear membrane and nucleolus. e.g. Plants & animals.

2. DIFFERENCES BETWEEN PROKARYOTIC & EUKARYOTIC CELLS :

Differences between prokaryotic & Eukaryotic cells

Feature	Prokaryotic cell	Eukaryotic cell
Cell size	1 to 10 micrometer	10 to 100 micrometer
Nucleus	Lacks true nucleus; Nucleolus and nuclear membrane are absent and contains circular DNA.	True nucleus bound by nuclear membrane contains linear DNA nucleolus and nuclear membrane present.
Organelles	Membrane-bound organelles like Golgi bodies, plastids, mitrochondria and endoplasmic reticulum (ER) are absent	Membrane bound organelles present.
Ribosomes	Smaller and randomly scattered in the cytoplasm	Bigger, can be free or attached to the ER.
Photosynthesis	No organized choloroplast; photosynthesis takes place on photosynthetic membranes which life freely in the cytoplasm.	Organized chloroplasts (containing stacked membranes called grana) take part in photosynthesis
Examples	Bacteria and cyanobacteria (blue green algae)	All other organisms.

Differences between Animal and Plants cell

ANIMAL PLANT	PLANT CELL
1. Animal cells are generally small in size.	1. Plant cells are generally larger than animal cells.
2. It is enclosed by a thin, flexible, living plasma membrane only. Cell wall is absent.	2. It is enclosed by a thick , rigid, dead cell Wall in addition to plasma membrane.
3. Plastids are absent in animal cells.	3. Plastids are present in the plant cells.
4. Animal cells have s ingle Golgi apparatus generally near the nuclear envelops.	4. Plant cells have many Golgi complexes scattered in the cytoplasm.
5. Animal cells have a centrosome containing centrioles.	5. Centrosome and centrioles are absent in plant cells.
6. Vacuoles are many but small-sized.	6. Vacuoles are fewer but large-sized.

PRACTICE YOUR CONCEPTS

1. Are the cells in an elephant larger than the cells in a rat?

Ans. The size of the cells has no relation with the size of the body of the animal. It is not necessary that the cell in the elephant will be much bigger than those in a rat. The size of the cell is related to its function.

2. What are the functions of centrosome ?

Ans. Centrosome helps in cell division in animal cells. During cell divison, centrioles migrate to the poles of animal cells and are involved in the formation of the spindle.

3. What do you mean by chromatin ?

Ans. Chromatin is a network of thread-like structure consisting mainly of deoxyyribonucleic acid (DNA). During cell division, thhese chromatin becomes more compact and are distinctly visible into a definite number of rod-like bodies called chromosomes.

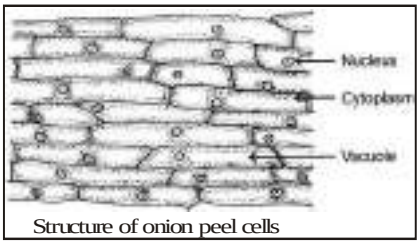
ACTIVITY - 2

Aim: To prepare a temporary slide of onion peel.

Procedure

1. Cut an onion into small pieces. Take a fleshy leaf and break it from concave to convex side.
2. Peel off the thin epithelial membrane with the help of forceps and transfer it into a watch glass containing methylene blue solution for a few seconds.
3. Transfer the stained peel into another watch glass containing clean water to wash off the extra stain.
4. With the help of a brush and needle, place this peel in the centre of the glass slide in such a way that the membrane is not folded.

   Immediately put a drop of glycerine on the peel.
5. Cover the peel gently with the coverslip to avoid the entry of air bubbles.
6. Gently press the coverslip with a needle so as to spread the glycerine evenly.
7. Remove excess glycerine from the edges of the coverslip using a blotting paper.
8. Examine the slide under low power of a microscope.



Structure of onion peel cells

Observations :

- There are a large number of brick-shaped (rectangular) cells lying side by side in membrane.
- Each cell has a distinct **cell wall.**
- A distinct darkly stained nucleus is present in each cell which is spherical or oval shaped dot-like structure.
- A prominent vacuole is seen in the centre, and cytoplasm is present in every cell.

Inference : The cells observed under microscope are plant cells as each has a distinct cell wall and a large vacuole is present in the centre of each cell.

ACTIVITY - 3

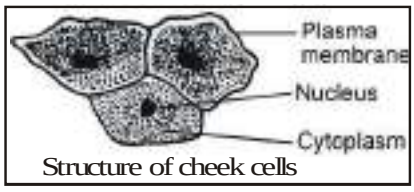
Experiment : Preparation of a temporary stained mount of human cheek cells and observe it under a microscope.

Procedure

1. Rinse your mouth with warm water.
2. With the help of a toothpick/ice-cream spoon, gently scrape the inner surface of the cheek.
3. Put the scraping on a clean glass slide having a drop of water.
4. Spread out the scraping, and separate the cells with the help of a needle.
5. Remove the excess water and put a drop of methylene blue stain or iodine solution on the scraping.
6. Place a clean coverslip gently over it to avoid the entry of air bubbles.
7. Gently press the coverslip with the needle so as to spread the cells uniformly under the coverslip.
8. Examine the slide under the microscope.

Observations :

- A large number of cells are observed. Each cell is bounded by a thin cell membrane. These cells are of squamous epithelium.
- A dark stained distinct **nucleus** is observed in each cell.
- Cytoplasm is granular.
- Cells lack cell wall, large vacuoles and plastids.



Structure of cheek cells

Inference : The cells observed under microscope are animal cell as each cell has a cell membrane only as outer boundary. Cell wall, central prominent vacuole and plastids are absent.

PRACTICE YOUR CONCEPTS

4. Why cell wall is found in plant cell but absent in animal cell?

Ans. Plant cells need protection against variations in temperature, high wind speed, atmospheric moisture etc. They are exposed to these variations because they cannot move. Whereas animals are motile and they can easily escape away from these change.

5. Why is Amoeba irregular in shape?

Ans. Amoeba has projections called pseudopodia protruding out of its body due to which it does not have a fixed shape. They are of varying length and help Amoeba in its movement and in capturing food.

6. Is hen's egg an example of cell? Explain.

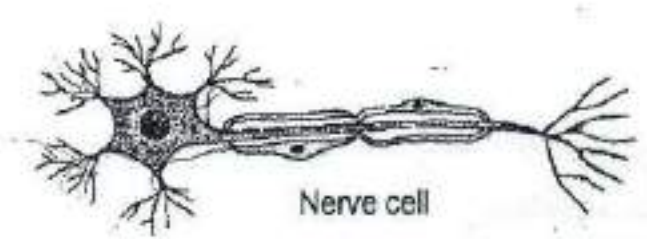
Ans. In the hen's egg there is a central yellow part called yolk which is surrounded by the white albumin (protein). The yellow yolk represents a single cell.

ON YOUR TIPS

- All living organisms from the amoeba to man or algae to big trees are composed of individual units called cells.
- The cell is the basic unit of life and is a physical entity.
- All cells arise from pre-existing cells.The growth of the cells is mainly based on the cell division.
- A multicellular organism has various types of cells.
- Ribosomes are non membranous organelles found in all cells.
- Cell wall is the outermost layer in the plant cell.
- Cell membrane is the outermost layer in the animal cell and present inside the plant cell wall.
- cytoplasm contains and supports the cell organelles.
- Endoplasmic reticulum is of two types:
  (a) rough endoplasmic reticulum
  (b) smooth endoplasmic reticulum
- Mitochondria breakdown sugars and release the energy for use by the cell.
- Chloroplasts use the sun’s energy to make food for plant through photosynthesis.
- Ribosomes help in synthesis of protein.
- Centriole are present only in animal cell. They help in cell division.
- Microtubule, microfilament forms the cytoskeleton of the cell.
- Cilia and flagella helps in locomotion.

NCERT QUESTIONS WITH SOLUTION

1. Make a sketch of the human nerve cell. What function do nerve cells perform?



Sol. Functions of human nerve cell:

(i) Nerve cells receive message from different parts of body.

(ii) They further transfer these messages to brain and accordingly brain send commands for functioning of different organs of body.

2. Write short notes on the following:

(i) Cytoplasm (ii) Nucleus of a cell

Sol. (i) Cytoplasm: Cytoplasm is a jelly like substance which is present between the cell membrane and the nucleus. Various other organelles of cells are present in the cytoplasm. Cytoplasm is made up of chemical substances like carbohydrates, proteins and water. These chemical substances are present in cells of all types and sizes. Cytoplasm contains many important tiny substances called Organelles.

(ii) Nucleus of a cell: Nulceus is the master of the cell. It commands all the functioning of the cell. It is generally located in the center of the cell and is spherical in shape. A membrane called nuclear membrane separates it from cytoplasm. It contains the genetic material DNA and RNA in it. The porous membrane allows the transfer of material in the nucleus and cytoplasm. Nucleus contains a dense body called Nucleolus, chromatin thread nucleo plasm

3. Which part of the cell contains organelles?

Sol. Cytoplasm.

4. State a difference between eukaryotes and prokaryotes.

Sol. Prokaryotes do not have a well designed nuclear membrane while, eukaryotes have a well designed nuclear membrane.

5. Where are the chromosomes found in cell? State their functions?

Sol. Chromosomes are found in the nucleus of a cell. Their function is to carry characteristic features of parent cells to the daughter cell means, from parent to offspring.

6. Cells are the basic structural units of living organism. Explain.

Sol. In Biology, the basic unit of which all living things are composed is knows as cell. The cell is the smallest structural unit of living matter that is capable of functioning independently. A single cell can be a complete organism in itself, as in bacteria and protozoans. A unicellular organism also captures and digests food, respires, excretes, grows, and reproduces. Similar functions in multi-cellular organisms are carried out by groups of specialized cell which are organized into tissues and organs such as, the higher plants and animals. Hence, 'cell' is known as the basic structural and functional unit of life.

7. Explain why chloroplast are found only in plant cells.

Sol. Chloroplasts are found only in plant cells because they are required for photosynthesis.

8. Indicate whether the following statements are True (T) or False (F).

(a) Unicellular organisms have one-celled body. (T/F)

(b) Cardiac Muscle cells are branched. (T/F)

(c) The basic living unit of an organism is an organ. (T/F)

(d) Amoeba has irregular shape. (T/F)

Sol. (a) T (b) T

(c) F (d) T

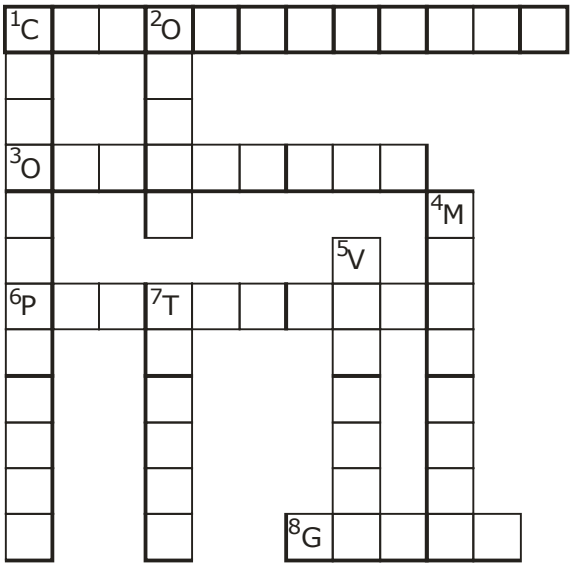
9. Complete the crossword with the help of clues given below:

Across

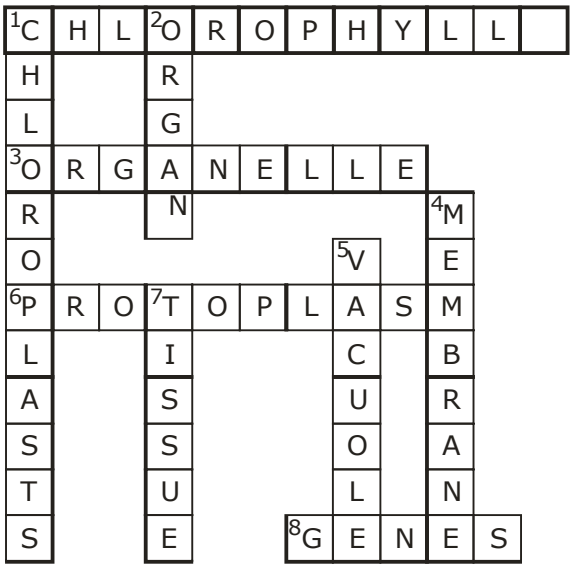
1. This is necessary for photosynthesis.
3. Term for component present in the cytoplasm.
6. The living substance in the cell.
8. Units of inheritance present on the chromosomes.

Down

1. Green plastids.
2. Formed by collection of tissues.
4. It separates the contents of the cell from the surrounding medium.
5. Empty structure in the cytoplasm.
7. A group of cells.



Sol.



EXERCISE – I

MULTIPLE CHOICE QUESTIONS

1. The term cell was given by
(A) Robert Hooke (B) Tatum
(C) Schwann (D) De Bary

2. The cell organelle associated with cell secretion is
(A) Plastids (B) Mitochondria
(C) Golgi apparatus (D) Nucleolus

3. Electron microscope was designed by -
(A) Knoll (B) Ruska
(C) Both a and b (D) F. Zanssen

4. Which of the following would not be considered as part of a cell's cytoplasm?
(A) Ribosome (B) Nucleus
(C) Mitochondria (D) Microtubule

5. Which of the following is called the brain of the cell?
(A) Nucleus (B) Mitochondria
(C) Ribosomes (D) Plasma membrane

6. Which one is not a part of nucleus?
(A) Chromatin (B) Nucleolus
(C) Centrosome (D) Nucleoplasm

7. The common feature amongst nucleus, chloroplast and mitochondria is –
(A) DNA (B) Lamellae
(C) Cristae (D) All of these

8. Nucleus is separated from surrounding cytoplasm by a nuclear envelope which is
(A) Single and porous
(B) Double and porous
(C) Single and nonporous
(D) Double and nonporous

9. Nucleoplasm is continuous with cytoplasm through –
(A) Centriole
(B) Golgi apparatus
(C) Nuclear pores
(D) Endoplasmic reticulum

10. Nucleolus was discovered by
(A) Fontana (B) Schleiden
(C) Altmann (D) Robert Brown

11. The function of the nucleolus in the cell is
(A) Secretory
(B) Synthesis of DNA
(C) Synthesis of RNA and ribosomes
(D) None of these

12. The cell is not applied for
(A) Algae (B) Bacteria
(C) Virus (D) Fungi

13. Name the unicellular organisms -
(A) Algae (B) Bacteria
(C) Mango plant (D) Human

14. Endoplasmic reticulum sometime contains –
(A) Ribosomes (B) Lysosomes
(C) Golgi bodies (D) None of these

15. Ribosomes are composed of –
(A) 1 subunit (B) 5 subunits
(C) 2 subunits (D) 4 subunits

16. Double membrane is absent in –
(A) Mitochondrion (B) Chloroplast
(C) Nucleus (D) Lysosome

17. Animal cell is limited by–
(A) Plasma membrane
(B) Cell membrane
(C) Cell wall
(D) Basement membrane

18. The radiant energy of sunlight is converted to chemical energy and stored as –
(A) AMP (B) ADP
(C) ATP (D) APP

19. Root hair absorbs water from soil through –
(A) Osmosis (B) Active transport
(C) Diffusion (D) Endocytosis

20. The barrier between the protoplasm and outer environment in a plant cell is –

(A) Cell membrane (B) Nuclear membrane
(C) Cell wall (D) Tonoplast

21. An animal cell differs from a plant cell in respect of –
(A) ER (B) Cell wall
(C) Ribosomes (D) Cell membrane.

22. If the nucleus is a cell's "control centre" and chloroplasts are "solar collectors". Which of the following might be called the cell's combination "food processor" and "garbage disposer"?
(A) Lysosome (B) Ribosome
(C) Golgi apparatus (D) Nucleolus

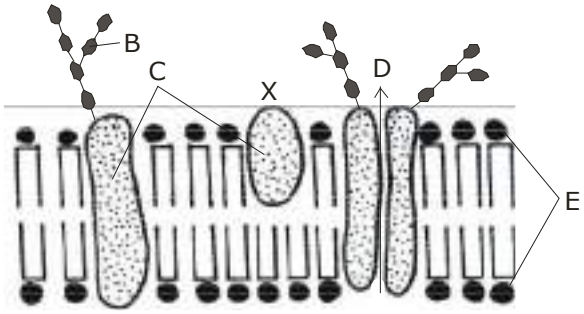
23. The longest cell in human body is –
(A) Neuron (B) Muscle fibre
(C) Epithelial cell (D) Bone cell

24. Identify human cells which lack nucleus–
(A) WBC (B) RBC
(C) Platelets (D) Nerve cells

25. The energy currency of a cell is –
(A) ADP (B) AMP
(C) ATP (D) CTP

Direction (26-27)

Case : Answer the following questions regarding the structure X, an outer living covering of the cel, present in both plants and animals.

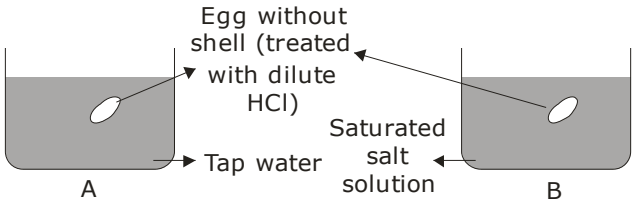


26. Structure E is ..... and is present at .... side of the plasma membrane.
(A) hydrophobic head, inner
(B) hydrophilic head, outer
(C) hydrophobic tail, outer
(D) polar, inner

27. All are the functions of figure X, except–
(A) It regulates the passage of molecules in and out of the cell.
(B) It maintains the composition of the cell.
(C) It protects the content of the cell.
(D) It controls only the exit of salts and water and throws out the waste.

Direction (28-30)

Case : In the gien experimental set up, egg shell is removed from eggby treating with dilute HCl. In bowl A, tap water while in bowl B, saturated salt solution was added. Answer the following questions based on thhe given experiment.



28. After 3 hours, what will you observe in the case A and case B with respect to egg ?

	Case A	**Case B**
(A)	Swelled up	Shrunk
(B)	Shrunk	Swelled up
(C)	Shrunk	Shrunk
(D)	Swelled up	Swelled up

29. Which of the following process occurs in thhe given experimental set-up ?
(A) Diffusion
(B) Osmosis
(C) Reverse osmosis
(D) Plasmolysis

30. When egg is treated with dil. HCl, bubbles are formed due to the evolution of–
(A) CO_2 gas (B) N_2 gas
(C) Water vapour (D) Helium

FILL IN THE BLANKS

1. A _____ is the structural and functional unit of life.

2. The different organ system working together form the _____.

3. Size of cell vary from very small cells of bacteria (0.2 to 0.5 μm) to the very large egg of _____.

4. Cell membrane is also called as _____.

5. _____ is commonly known as "Sucidal Bags".

6. Centrioles help in cell division by forming.....

7. During cell division chromatin condensed into thick cord like structures called.....

8. A compound microscope can magnify an object upto ..... times.

9. The cells having well organised nucleus are called.....

10. The body of *Amoeba* is made up of .....cell.

TRUE/FALSE

1. The branch of biology which deals with the study of cell and cell organelles is known as cytology.

2. Transmission electron mircoscope uses light to produce images.

3. Cytoplasm is the site of both biosynthetic and catabolic pathways.

4. Cell membrane in absent in animal cells.

5. Nucleus also contains thread like structures called chromosomes.

6. The plasma membrane has a rigid structure.

7. Membranes are useful for compart-mentalisation in cells.

8. Solid particles are ingested by pinocytosis.

9. ATP is required for active transport.

10. The ostrich egg is the largest cell known.

MATCH THE COLUMN

1.

Column A	**Column B**
(i) Amoeba	(a) largest cell
(ii) Ostrich egg	(b) plant cell
(iii) Chloroplast	(c) smallest cell
(iv) Mycoplasma	(d) power house of cell
(v) Mitochondria	(e) single celled organism

2.

Column A	**Column B**
(i) Ribsosomes	(a) Star like structure
(ii) Cytology	(b) Well developed cell
(iii) Prokaryotic	(c) Protein synthesis
(iv) Eukaryotic	(d) Branch of biology which deals with study of cell & cell organelles
(v) Centrosome	(e) Primitive and incomplete cell

ASSERTION-REASON

Direction : In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, 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 both Assertion and Reason are false.

1. **Assertion :** Mitochondria and chloroplast are semi-autonomous cell organelles.

Reason : Mitochondria and chloroplast have their own DNA and protein synthesising machinery.

2. **Assertion :** *Amoeba,* a single-celled animal is unable to perform all its functions.

Reason : The nucleus is absent in *Amoeba.*

3. **Assertion :** The plasma membrane is porous and allows the movement of substances outward only.
   Reason : Plasma membrane is made up of lipids and sugars only.
4. **Assertion :** A bigger organism has a large number of cells than a smaller one.
   Reason : The size of cell is related to the size of the organism.
5. **Assertion :** Chromosomes are thread-like structures present in the nucleus.
   Reason : In bacteria, chromosome is not found as there is no nucleus.
6. **Assertion :** Genes are responsible for transfer of characters from the parents to the offspring.
   Reason : Genes are present in the nucleus.

VERY SHORT ANSWER TYPE QUESTIONS

1. Name the four types of animal cells.
2. What is the importance of ribosomes?
3. What is the function of mitochondria?
4. Name the following:
   (a) structural and functional unit of life
   (b) powerhouse of the cell
5. Who discovered the cell and when ?
6. Name two multicellular organisms.
7. What are pseudopodia ?
8. Mention three different shapes of cells in human body.
9. Which part of the cell gives the shape to a cell.
10. What are chromosomes ?
11. Write the name of unit of inheritance in living beings.
12. Name the part of cell which help in control of the activities.
13. Write the name of pigment found in chloroplasts.
14. Name the structural unit of an organism.
15. Where are proteins synthesized inside the cell ?

SHORT ANSWER TYPE QUESTIONS

1. Why is the plasma membrane called selectively permeable.
2. Why lysosomes are called suicidal bags?
3. How many types of organisms are their on the basis of number of cells ?
4. What are tissues ?
5. Why are mitochondria called the power house of the cell?

LONG ANSWER TYPE QUESTIONS

1. What are the basic differences between plant cells and animal cells?
2. Explain the structure of nucleus. What is its function?
3. What is the main function of each of the following organelles:
   (i) Cell wall (ii) Plasma membrane
   (iii) Chromosomes (v) Mitochondria
   (vi) Chloroplasts (vii) Golgi apparatus
   (viii) Lysosomes (ix) Centrioles
   (x) Vacuoles.
4. Distinguish between cell wall and cell membrane.
5. Comment on the following :
   (i) Chloroplast is called "Kitchen of the cell"
   (ii) Chloroplast is semi-autonomous structure cellular organelle.
   (iii) Lysosomes are Garbage disposer.

EXERCISE – II

1. The term "Omnis cellula-e-cellula" was proposed by–
(A) Schwann (B) Virchow
(C) Schleiden (D) Robert Brown

2. In a biology lecture, thhe teacher was dictating the organelles of a cell as endoplasmic reticulum, mitrochondria, nucleus, ribosome, cetriole and centrosome. Which cell was she referring to?
(A) Prokarotic cell
(B) Plant cell
(C) Animal cell
(D) It is not possible to predict from the given data.

3. Wichh of the following statements is/are true regarding cell structure?
(i) The nucleoplasm and the cytoplasm together make up the protoplasm.
(ii) Chloroplasts are type of plastids, which occurs in plant cells.
(iii) In many multicellular organisms, cells have projections calld as cilia and flagella.
(iv) Cell destruction occurs by centrosomes.
(A) (i) and (ii) (B) (i), (ii) and (iii)
(C) (i) only (D) (iii) and (iv)

4. Give the correct order of the procedures listed below to prepare a specimen for microsopic examination.
(A) Embedding, mounting, dehydration, fixation, staining, sectioning.
(B) Embedding, dehydration, mounting, fixation, staining, sectioning.
(C) Fixation, embedding, dehydration, sectioning, staining, mounting, rehydration.
(D) Fixation, dehydration, embedding, sectioning, staining, mounting.

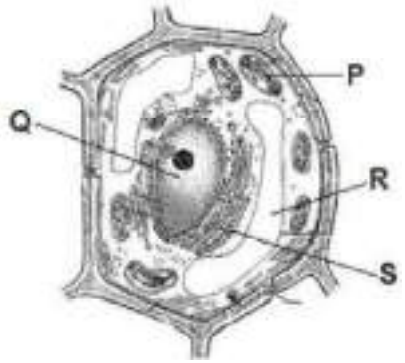
5. Arrange thhe cell organelle useful for intracellular digestion, intracellular respiration, intracellular movement and cell secretion in a sequence.
P. Golgi complex Q. Lysosomes
R. Mitochondria S. Microtubules
(A) Q-R-S-P (B) R-Q-P-S
(C) S-P-Q-R (D) P-S-R-Q

6. Which of the following cells does not have a nucleus ?
(A) Brain cell
(B) Cardiac muscle cell
(C) *Paramecium*
(D) Mature human RBC

7. The infoldings of the inner membrane of mitochondria is referred to as
(A) Grana (B) Stroma
(C) Oxysome (D) Cristae

8. Which of the following is considered an exception to cell theory ?
(A) Protista (B) Mycoplasma
(C) Virus (D) Algae

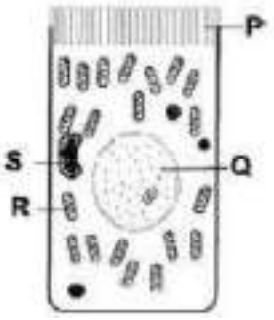
9. Anil wants to see microscopic view of the organelle which takes part in the transmission of hereditary characters from one generation to the next. Which labeled part will his teacher focus to make a microscopic view of the organelle ?
(NSO-2010)



(A) P (B) Q

(C) R (D) S

10. Refer the given figure of a cell. Which organelle is more in number ? Also, identify among P, Q, R and 5, the organelle which is responsible for transmission of hereditary information. **(NSO-2011)**



(A) Endoplasmic reticulum; P

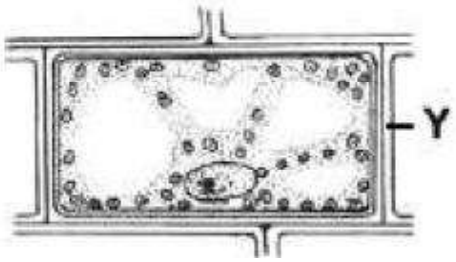
(B) Mitochondria; Q

(C) Ribosome; R

(D) Golgi body; S

11. Look at the given cell carefully. Identify the function of the part labelled 'Y'.

(NSO-2012)



(A) It controls the movement of materials in and out of the cell.

(B) It controls all the activities of the cell.

(C) It contains many cell parts.

(D) It provides protection to the cell.

12. Correct the given statements by replacing the underlined words and select the correct option. **(NSO-2012)**

(i) The viscous fluid present in the nucleus is called cytoplasm.

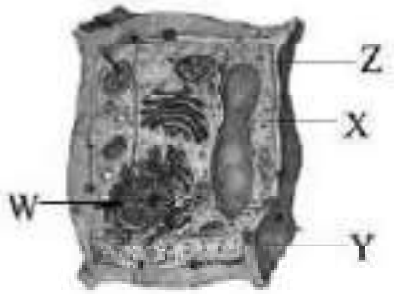
(ii) Vacuoles are rod shaped structures which oxidize food to provide energy.

(iii) Mitochondria contain green pigment chlorophyll and take part in photosynthesis.

(iv) Lysosomes take part in synthesis of protein.

	(i)	(ii)	(iii)	(iv)
(A)	Nucleoplasm	Lysosomes	Plastids	Centrosome
(B)	Protoplasm	Ribosomes	Centrosome	Golgi bodies
(C)	Nucleoplasm	Mitochondria	Chloroplasts	Ribosomes
(D)	Protoplasm	Plastids	Endoplasmic reticulum	Ribosomes

13. Refer the given figure and select the option which correctly describes parts labelled as W. X. Y and Z. **(NSO-2013)**



Codes :

(a) Contains hereditary materials

(b) Most chemical reactions occur here

(c) Made of mainly sugar molecules

(d) Partially permeable

	W	X	Y	Z
(A)	a	c	d	b
(B)	a	b	c	d
(C)	a	b	d	c
(D)	b	a	c	d

14. Read the given statements and select the correct option. **(NSO-2014)**

Statement-1 : Chloroplast and mitochondria are semi-autonomous organelles.

Statement-2 : Chloroplast and mitochondria have their own DNA and protein synthesizing machinery.

(A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

(B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement I.

(C) Statement 1 is true and statement 2 is false.

(D) Both statements 1 and 2 are false.

15. Which of the following statements about the characteristics of organelles are correct? **[NSO-2014]**

(i) Mitochondria contain their own DNA.

(ii) Lysosomes contain many anabolic enzymes.

(iii) Secretory liver cells have abundant number of RER.

(iv) Ribosomes are always found attached to the Golgi apparatus.

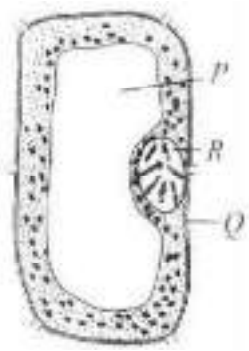
(A) (i) and (iii)

(B) (i) and (ii)

(C) (i) (ii) (iii) and (iv)

(D) (i) (ii) and (iv)

16. Refer to the given figure and select the incorrect statements(s). **(NSO-2015)**



(i) The part labelled P is found in plant cell only.

(ii) The part labelled Q is cell wall, which provides rigidity to a plant cell.

(iii) The part labelled R is the controlling centre.

(iv) The part labelled R gets its shape from part labelled P.

(A) (iv) only

(B) (i) and (iv) only

(C) (ii) and (iii) only

(D) (iii) only

17. Read the given statements each with one or two blanks in it. **(NSO-2015)**

(P) (i) allows water, minerals and some other necessary substances to move across cell.

(Q) The liquid in the nucleus is called (ii) in which are suspended thread - like structures called (iii) .

(R) (iv) are called powerhouse of cell whereas (v) are called kitchens of cell.

(S) (vi) help to destroy old cell structures and (vii) take part in protein synthesis.

Select the option which correctly fills some of the blanks in these statements.

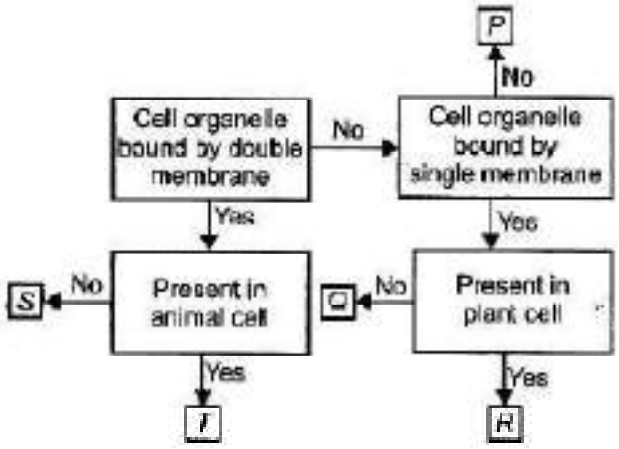
(A) (i)-Cell wall, (ii)-Genes, (v)-Centrosome

(B) (ii)-Nucleoplasm, (iv)-Mitochondria, (vi) Lysosome

(C) (iii)-Plastids, (vi)-Lysosomes,(vii) Ribosome

(D) (v)-Chloroplasts, (vi) - Centrosome, (vii)-Endoplasmic reticulum

18. Study the given flow chart. **(NSO-2016)**



Which of the following holds true for P, Q, R, S and T?

(A) P takes part in cell autophagy and autolysis whereas Q takes part in is more gelatin.

(B) R takes part in protein synthesis and is also present in bacteria.

(C) Inner membrane of T contains stalked particles whereas inner membrane of S is connected to thylakoids at various places.

(D) T takes part in preparation of food whereas S takes part in oxidation of food to release energy.

EXERCISE – III

1. Refer to thhe given dichotomous key and select te correct option regarding cell organnelles L-O.

I. (i) Cell organelle bounded by double membrane-Go to II

(ii) Cell organelle bounded by single membran - Go to III

II. (i) Directs cell growth and controls its activities-L

(ii) Provides colour to flowers and fruits-M

III. (i) Removes dead cells and digests foreign material-N

(ii) Carries out some oxidative reactions in a cell-O

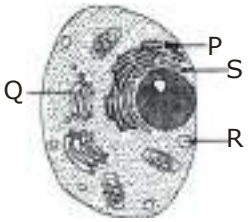
(A) L could be mitochondria whereas M could be chloroplast.

(B) M cold be chromoplast whereas N could be Golgi aparatus.

(C) L could be nucleus whereas O could be peroxisome.

(D) M could be leucoplast whereas N could be vacuole.

2. Refer to the given ultrastructure of an animal cell. Identify te labelled parts (P-S), match them with their functions and select the correct option.



(i) Synthesising proteins from amino acids

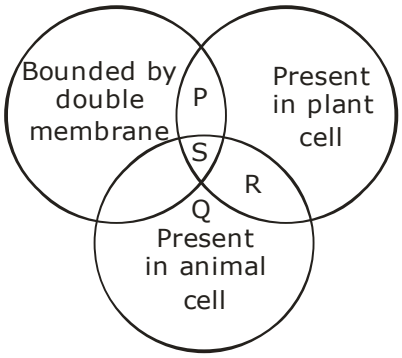
(ii) Syntesising lipids

(iii) Packaging of materials synthesised in cell

(iv) Secreting digestive enzymes

	P	Q	R	S
(A)	(ii)	(iv)	(iii)	(i)
(B)	(ii)	(iii)	(i)	(iv)
(C)	(ii)	(iii)	(iv)	(i)
(D)	(i)	(iii)	(iv)	(ii)

3. Identify P, Q, R and S in the given Venn diagram and select the incorrect option regarding them.



(A) P could be a colourless organelle that helps to store reserve food in the form of lipids, carbohydrates and proteins.

(B) Q could be an organelle that is involved in formation of spindle during cell division.

(C) R could be an organelle that contains genertic material organised as DNA along with proteins to form chromosoms.

(D) S could be an organelle that produces energy currency of the cell, ATP through cellular respiration.

4. The plant cell become turgid due to–

(A) Plasmolysis (B) Exosmosis

(C) Endosmosis (D) Electrolysis

5. If the common salt is sprinkled on lawn grass, it is killed at the spot. This is due to–

(A) Plasmolysis (B) Adhesion

(C) Capillary action (D) Imbibition

6. Chromosome number in the daughter cells after meiosis is–

(A) 1/2 (B) 1/3

(C) 1/4 (D) 1/5

7. Which of the following sets contans unicellular orgaisms only ? **[NSO]**

(A) Paramecium, Allium, Saccharomyces

(B) Euglena, Clorella, Chlamydomonas

(C) Euglena, Saccharomyces, Allium

(D) Rhizopus, Spirogyra, Solanum

8. Consider the following statements and select the option which correctly identifies true (T) and false (F) ones. **[NSO]**

(i) Nucleolus is the site of development of ribosomal RNAs.

(ii) The plasma membrane is made up of a double layer of lipid and protein molecules.

(iii) Chloroplast helps in osmoregulation and maintains the osmotic pressure in a cell.

(iv) In plants, Golgi aparatus are known as dictyosomes.

	(i)	(ii)	(iii)	(iv)
(A)	T	T	F	F
(B)	T	T	F	T
(C)	T	F	T	T
(D)	T	F	F	T

9. Refer to the given terms. **[NSO]**

(i) RBC (ii) WBC

(iii) Blood (iv) Muscle

(v) Skin (vi) Brain

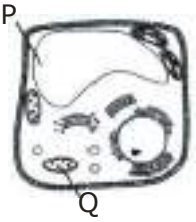
(vii) Heart (viii) Lung

(ix) Sperm (x) Kidney

Select the option which correctly classifies the given terms into cell, tissue and organ.

	Cell	Tissue	Organ
(A)	(i), (ii), (ix)	(iii), (iv)	(v), (vi), (vii), (viii), (x)
(B)	(i), (ii), (iii), (x)	(iv), (v)	(vi), (vii), (viii), (ix)
(C)	(i), (ii), (iv), (ix)	(iii), (v), (vi)	(vii), (viii), (x)
(D)	(i), (ii), (ix)	(iii), (iv), (v)	(vi), (vii), (viii), (x)

10. In the given figure, showing the ultrastrcuture of a lant cell, identify the parts marked as P and Q and select the correct statements regarding these.



[NSO]

(i) Part P helps in osmoregulation.

(ii) Cellular respiration occurs in part Q

(iii) Synthesis of sugar occurs in part Q.

(iv) Part P help in synthesis of protein.

(A) (i) and (ii) only

(B) (i) and (iii) only

(C) (iii) and (iv) only

(D) (ii) and (iv) only

11. Read the given statements and select the option which correctly fills the blanks (i)-(iv). **[NSO]**

(i) ..... is a semiautonomous organelles which is absent in mature mammalian RBC.

(ii) ..... are found in cytoplasm and on endoplasmic reticlum.

(iii) ..... is involved in the formation of lysosome.

(iv) ..... is capable of digesting any microorganism that enters the cell.

	(i)	(ii)	(iii)	(v)
(A)	Ribosome	Lyysosomes	Golgi aparatus	Vacuole

(B)	Mitochondria	Ribosomes	Golgi apparatus	Lysosome
(C)	Endoplasmic reticulum	Lysosomes	Vacuole	Golgi apparatus
(D)	Lysosome	Ribosomes	Vacuole	Golgi apparatus

12. Which of the following statements is/are correct? **[NSO]**

(i) The nucleus and the cytoplasm together make up the protoplasm.

(ii) Chloroplasts are a type of plastid, which occur in plant cells.

(iii) In many multicellular organisms, all cells have projections called cilia and flagella.

(iv) Cell destruction occurs by centrosome.

(A) (i) and (ii) only

(B) (i), (ii) and (iii) only

(C) (i) only

(D) (iii) and (iv) only

13. Which of the following pairs are correctly matched ? **[NSO]**

(i) Discovery of protoplasm - Kolliker

(ii) Discovery of cell - Robert Hooke

(iii) Cell theory - Schleiden and Schwann

(iv) PPLO - Smallest cell in the world

(v) Neuron - Largest cell in the world

(A) (i), (iii) and (iv) only

(B) (i), (iii), (iv) and (v) only

(C) (i), (ii) and (iv) only

(D) (ii), (iii) and (iv) only

14. What is the major difference between a human skin cell and a human egg cell ? **[NSO]**

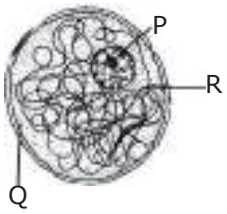
(A) The egg cell has twice as many chromosomes as the skin cell.

(B) The egg cell has half as many chromosomes as the skin cell.

(C) The skin cell has no genetic information in its chromosomes.

(D) Only the egg cell has a nucleus.

15. Refer to the given figre and select the correct statements regarding it. **[NSO]**



(i) P is the site of ribosome synthsis.

(ii) R possess all the genetic information required for growth and development of the organism.

(iii) Q is a dense fluid like agranular substance.

(iv) P contains DNA while R contain RNA.

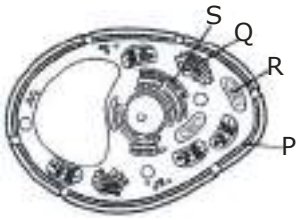
(A) (i) and (ii) only

(B) (i), (ii) and (iv) only

(C) (i), (ii) and (iii) only

(D) (iii) and (iv) only

16. Select the option which correctly matches the marked parts P, Q, R and S in the given figure with their functions given below. **[NSO]**



(i) Oxidation of food during cell respiration.

(ii) Packaging and dispatching of materials synthesised in the cell.

(iii) Allow minerals to pass through

(iv) Transport of substances within cell

	P	**Q**	**R**	**S**
(A)	(iv)	(iii)	(ii)	(i)
(B)	(i)	(iv)	(iii)	(ii)
(C)	(iii)	(ii)	(iv)	(i)
(D)	(iii)	(ii)	(i)	(iv)

17. Endosplamic reticulum is a network of interconnecting membranous structures filled with fluid. Which of the following cells would most likley have high concentration of densely packed rough endoplasmic reticulum ? **[NSO]**

(A) A bioluminescent bacterial cell

(B) A functional phloem at maturity

(C) An amoeba engulfing small cilia

(D) A pancreactic cell engaged in the production of digestive enzymes

18. Refer to te given paragraph.

X and Y are the two types of cells. The X have a well organised nucleus which is separated from the cytoplasm by the nuclear membrane. On the other hand, Y do not have a true nucleus and their nuclear material is in direct contact with cytoplasm. Identify X and Y and select the correct option. **[NSO]**

(A) X could be Mycoplasma whereas Y could be Amoeba.

(B) X could be Amoeba whereas Y could be Mycoplasma.

(C) X could be nerve cells whereas Y could be xylem cells.

(D) X could be xylem cells whereas Y could be nerve cells.

19. Which of the following statements is/are incorrect regarding genes ? **[NSO]**

(i) They control the transfer of hereditary chharacteristics.

(ii) Nucleus carries all the genes.

(iii) They are part of chromosomes.

(iv) They are found only in the nucleus.

(A) (iii) only

(B) (iii) and (iv) only

(C) (i) only

(D) (ii) and (iv) only

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MATHEMATICS

CLASS - VIII

BOOKLET - 1

CONTENTS

RATIONAL NUMBER & RADICALS

LINEAR EQUATION IN ONE VARIABLE

UNDERSTANDING QUADRILATERALS

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DATA HANDLING

SQUARE AND SQUARE ROOTS

CUBE AND CUBE ROOTS

ANSWER KEY

CHAPTER 1

RATIONAL NUMBER & RADICALS

- **PROPERTY OF ADDITION OF RATIONAL NUMBERS**
- **SUBTRACTION OF RATIONAL NUMBERS**
- **MULTIPLICATION OF RATIONAL NUMBERS**
- **DIVISION OF RATIONAL NUMBERS**
- **POWER EXPONENTIAL NOTATION OF RATIONAL NUMBERS**
- **LAW OF EXPONENTS**

INTRODUCTION

A number $\frac{a}{b}$ is a rational number if 'a' and 'b' are integers and 'b' is not equal to zero. 'b' cannot be equal to zero because division by zero is not allowed. Further, a rational number is said to be in the standard form or simplest form when the numerator and denominator have no common factor other than 1.

PROPERTIES OF ADDITION OF RATIONAL NUMBERS

1. CLOSURE PROPERTY

When two rational numbers are added, the result is always a rational number, i.e., if $\frac{a}{b}$ and $\frac{c}{d}$ is a rational number then $\frac{a}{b} + \frac{c}{d}$ is also a rational number. For example, $\frac{2}{5} + \frac{3}{6} = \frac{12+15}{30} = \frac{27}{30}$, which is also a rational number.

2. COMMUTATIVE PROPERTY

When two rational numbers are added, the order of addition does not matter, i.e., if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then $\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$

For example, $\frac{3}{4} + \frac{4}{5} = \frac{15+16}{20} = \frac{31}{20}$ and $\frac{4}{5} + \frac{3}{4} = \frac{16+15}{20} = \frac{31}{20}$. Both results are equal.

3. ASSOCIATIVE PROPERTY

If $\frac{a}{b}$, $\frac{c}{d}$, and $\frac{e}{f}$ are three rational numbers, then $\left(\frac{a}{b}+\frac{c}{d}\right) + \frac{e}{f} = \frac{a}{b} + \left(\frac{c}{d}+\frac{e}{f}\right)$. Consider the rational number $\frac{2}{5}$, $\frac{1}{4}$, and $\frac{2}{3}$.

$\left(\frac{2}{5}+\frac{1}{4}\right)+\frac{2}{3} = \frac{2}{5}+\left(\frac{1}{4}+\frac{2}{3}\right)$

$\left(\frac{8+5}{20}\right)+\frac{2}{3} = \frac{2}{5}+\left(\frac{3+8}{12}\right)$

$\frac{13}{20}+\frac{2}{3} = \frac{2}{5}+\frac{11}{12} = \frac{39+40}{60}$

$\frac{24+55}{60}=\frac{79}{60} = \frac{79}{60}$

4. ADDITIVE IDENTITY

If $\frac{a}{b}$ is a rational number, then there exists a rational number zero such that $\frac{a}{b} + 0 = \frac{a}{b}$. Zero is called the identity element of addition. Addition of zero does not change the value of the rational number.

5. ADDITIVE INVERSE

If $\frac{a}{b}$ is a rational number, then there exists a rational number $\left(\frac{-a}{b}\right)$, called the additive inverse, such that $\frac{a}{b}+\left(\frac{-a}{b}\right)= 0$

The additive inverse is also referred to as 'negative' of the given number.

SUBTRACTION OF RATIONAL NUMBERS

When we have to subtract a rational number, say $\frac{5}{9}$ from $\frac{8}{9}$, we add the additive inverse of $\frac{5}{9}$, i.e., $\frac{-5}{9}$ to $\frac{8}{9}$. Thus, $\frac{8}{9} - \frac{5}{9}=\frac{8}{9} + \left(\frac{-5}{9}\right) = \frac{8-5}{9} = \frac{3}{9}=\frac{1}{3}$

MULTIPLICATION OF RATIONAL NUMBERS

Multiplication is the process of successive addition.

Like 6 × 8 = 8 + 8 + 8 + 8 + 8 + 8 = 48.

Similarly, $6 \times \frac{1}{3} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{6}{3} = 2$

Alternatively, $6 \times \frac{1}{3}=\frac{6}{1}\times\frac{1}{3}=\frac{6\times1}{1\times3}=\frac{6}{3}=\frac{2}{1}$

So, when we multiply two rational numbers, we multiply the numerator with the numerator and the denominator with the denominator.

Thus, – 5 × (–7) $= \frac{-5}{1} \times \left(\frac{-7}{1}\right) = \frac{(-5)(-7)}{1 \times 1} = 35$

and $\frac{-2}{11} \times \frac{3}{5} = \frac{-2 \times 3}{11 \times 5} = \frac{-6}{55}$

Info Bubble

- The set N is infinite i.e. it has unlimited members.
- N has the smallest element namely '1'.
- N has no largest element. i.e., give me any natural number, we can find the bigger number from the given number.
- N does not contain '0' as a member. i.e. '0' is not a member of the set N.

PROPERTIES OF MULTIPLICATION OF RATIONAL NUMBER

1. CLOSURE PROPERTY

The rational number are closed under multiplication. It means that the product of two rational numbers is always a rational number, i.e., if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers then, $\frac{a}{b} \times \frac{c}{d}$ $= \frac{ac}{bd}$ is always a rational number.

For example, $\frac{-3}{7} \times \frac{5}{8} = -\frac{15}{56}$ which is rational number.

2. COMMUTATIVE PROPERTY

If $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then $\frac{a}{b} \times \frac{c}{d} = \frac{c}{d} \times \frac{a}{b}$, i.e., $\frac{ac}{bd} = \frac{ca}{db}$

3. ASSOCIATIVE PROPERTY

If $\frac{a}{b}, \frac{c}{d}$, and $\frac{e}{f}$ are three rational numbers, then $\left(\frac{a}{b} \times \frac{c}{d}\right) \times \frac{e}{f} = \frac{a}{b} \times \left(\frac{c}{d} \times \frac{e}{f}\right)$

i.e. $\frac{ac}{bd} \times \frac{e}{f} = \frac{a}{b} \times \frac{ce}{df}$ or $\frac{ace}{bdf} = \frac{ace}{bdf}$

Thus, rational numbers can be multiplied in any order.

Multiplicative identity

When any rational number, say $\frac{a}{b}$, is multiplied by the rational number 1, the product is always $\frac{a}{b}$.

$\Rightarrow \frac{a}{b} \times 1 = \frac{a \times 1}{b} = \frac{a}{b}$

or $1 \times \frac{a}{b} = \frac{1 \times a}{b} = \frac{a}{b}$

Multiplicative inverse or reciprocal

For every non-zero rational number $\frac{a}{b}$, there exists a rational number $\frac{b}{a}$ such that $\frac{a}{b} \times \frac{b}{a} = 1$.

This is so, because $\frac{a}{b} \times \frac{b}{a}$

$= \frac{a \times b}{b \times a} = \frac{ab}{ba} = 1$

Distributive property

If $\frac{a}{b}, \frac{c}{d}$ and $\frac{e}{f}$ are three rational numbers, then $\frac{a}{b} \times \left(\frac{c}{d} + \frac{e}{f}\right) = \frac{a}{b} \times \frac{c}{d} + \frac{a}{b} \times \frac{e}{f}$.

Multiplication of a Rational Number by Zero

When any rational number $\frac{a}{b}$ is multiplied by 0, the product is always zero.

$\frac{a}{b} \times 0 = \frac{a \times 0}{b} = \frac{0}{b} = 0$

DIVISION OF RATIONAL NUMBERS

Division is the inverse process of multiplication.

If $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

PROPERTIES OF DIVISION OF RATIONAL NUMBERS

1. CLOSURE PROPERTY

When a rational number is divided by another rational number, the quotient is always a rational number.

Thus, if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$, which is again a rational number where b, c, d are non-zero integers.

Division is not commutative

If $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers in which b, c and d $\neq$ 0, then $\frac{a}{b} \div \frac{c}{d} \neq \frac{c}{d} \div \frac{a}{b}$ because,

$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$ and $\frac{c}{d} \div \frac{a}{b} = \frac{c}{d} \times \frac{b}{a} = \frac{cb}{da}$

So $\frac{a}{b} \div \frac{c}{d} \neq \frac{c}{d} \div \frac{a}{b}$

ORDERING OF RATIONAL NUMBERS

1. LAW OF TRICHOTOMY

Given two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, then either $\frac{a}{b} > \frac{c}{d}$, $\frac{a}{b} = \frac{c}{d}$ or $\frac{a}{b} < \frac{c}{d}$.

2. LAW OF TRANSITIVITY

If $\frac{a}{b}, \frac{c}{d}$, and $\frac{e}{f}$ are three rational numbers then

(A) If $\frac{a}{b} > \frac{c}{d}$ and $\frac{c}{d} > \frac{e}{f}$, then $\frac{a}{b} > \frac{e}{f}$.

(B) If $\frac{a}{b} < \frac{c}{d}$ and $\frac{c}{d} < \frac{e}{f}$, then $\frac{a}{b} < \frac{e}{f}$.

(C) If $\frac{a}{b} = \frac{c}{d}$ and $\frac{c}{d} = \frac{e}{f}$, then $\frac{a}{b} = \frac{e}{f}$. (all are equivalent).

3. LAW OF ADDITION

Given $\frac{a}{b}, \frac{c}{d}$, and $\frac{e}{f}$ are three rational numbers.

(A) If $\frac{a}{b} > \frac{c}{d}$ then $\frac{a}{b} + \frac{e}{f} > \frac{c}{d} + \frac{e}{f}$.

(B) If $\frac{a}{b} = \frac{c}{d}$ then $\frac{a}{b} + \frac{e}{f} = \frac{c}{d} + \frac{e}{f}$.

(C) If $\frac{a}{b} < \frac{c}{d}$ then $\frac{a}{b} + \frac{e}{f} < \frac{c}{d} + \frac{e}{f}$.

LAW OF MULTIPLICATION

Let $\frac{a}{b}, \frac{c}{d}$ and $\frac{e}{f}$ be three rational numbers.

If $\frac{e}{f}$ is a positive number, then

1. If $\frac{a}{b} > \frac{c}{d}$, then $\frac{a}{b} \times \frac{e}{f} > \frac{c}{d} \times \frac{e}{f}$.
2. If $\frac{a}{b} < \frac{c}{d}$, then $\frac{a}{b} \times \frac{e}{f} < \frac{c}{d} \times \frac{e}{f}$.
3. If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{b} \times \frac{e}{f} = \frac{c}{d} \times \frac{e}{f}$.

Info Bubble

- Every natural number, whole number and integer is a rational number.
- Every terminating decimal is a rational number.
- Every non-terminating repeating (recurring) decimal is a rational number.
- Between any two rational numbers there are an infinite number of rational numbers, this property is known as the density of rational numbers.

POWERS EXPONENTIAL NOTATION OF RATIONAL NUMBERS

Exponential notation can be extended to rational numbers. For example: $\left(\frac{4}{5}\right) \times \left(\frac{4}{5}\right) \times \left(\frac{4}{5}\right)$ can be written as

$\left(\frac{4}{5}\right)^3$ which is read as $\frac{4}{5}$ raised to the power 3.

(i) $\left(\frac{3}{4}\right)^3 = \left(\frac{3}{4}\right) \times \left(\frac{3}{4}\right) \times \left(\frac{3}{4}\right) = \frac{3^3}{4^3} = \frac{27}{64}$

(ii) $\left(\frac{-5}{6}\right)^2 = \left(\frac{-5}{6}\right) \times \left(\frac{-5}{6}\right) = \frac{(-5)^2}{6^2} = \frac{25}{36}$

(iii) $\left(\frac{-2}{3}\right)^3 = \left(\frac{-2}{3}\right) \times \left(\frac{-2}{3}\right) \times \left(\frac{-2}{3}\right) = \frac{(-2)^3}{3^3} = \frac{-8}{27}$

In general, if $\frac{x}{y}$ is a rational number and a is a positive integer, then

$$\boxed{\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}}$$

Reciprocals with Positive Integral Exponents:

The reciprocal of 2 is $\frac{1}{2}$, reciprocal of 2^3 is $\frac{1}{2^3}$.

Reciprocal of $\left(\frac{2}{3}\right)^4 \Rightarrow \frac{1}{\left(\frac{2}{3}\right)^4} = \frac{1}{\frac{2^4}{3^4}} = \frac{3^4}{2^4} = \left(\frac{3}{2}\right)^4$

Reciprocal of $\left(\frac{-4}{5}\right)^4 \Rightarrow \left(\frac{-5}{4}\right)^4$ and, Reciprocal of $\left(\frac{1}{3}\right)^5 = \left(\frac{3}{1}\right)^5 = 3^5$

Reciprocals with Negative Integral Exponents

Reciprocal of $2 = \frac{1}{2} = \frac{1}{2^1}$. Therefore, the reciprocal of 2 is 2^{-1}. The reciprocal of $3^2 = \frac{1}{3^2} = 3^{-2}$.

Reciprocal of $\left(\frac{4}{5}\right)^2 \Rightarrow \left(\frac{4}{5}\right)^{-2}$, Reciprocal of $\left(\frac{-2}{3}\right)^3 \Rightarrow \left(\frac{-2}{3}\right)^{-3}$, etc.

In general, if x is any rational number other than zero and a is any positive integer, then:

$$\boxed{x^{-a} = \frac{1}{x^a}}$$

PRACTICE YOUR CONCEPTS

1. Find the additive inverse of :

(a) $\frac{5}{9}$ (b) $\frac{-15}{8}$ (c) $\frac{-6}{-7}$

Ans. **(a)** Additive inverse of $\frac{5}{9}$ is $\frac{-5}{9}$

(b) Additive inverse of $\frac{-15}{8}$ is $\frac{15}{8}$

(c) We may write, $\frac{-6}{-7} = \frac{(-6)\times(-1)}{(-7)\times(-1)} = \frac{6}{7}$. Hence, its additive inverse is $\frac{-6}{7}$

2. Find the Reciprocal of −3 and $\frac{-8}{9}$.

Ans. Reciprocal of −3 is $\frac{-1}{3}$, since $\left(-3\times\frac{-1}{3}\right) = \left(\frac{-3}{1}\times\frac{-1}{3}\right) = \frac{(-3)\times(-1)}{1\times3} = \frac{3}{3} = 1$

and Reciprocal of $\frac{-8}{9}$ is $\frac{-9}{8}$, since $\left(\frac{-8}{9}\times\frac{-9}{8}\right) = \left(\frac{-9}{8}\times\frac{-8}{9}\right) = 1$

3. Find the sum :

(i) $\frac{7}{9} + \frac{-11}{9}$ (ii) $\frac{8}{-11} + \frac{3}{11}$

Sol. We have

(i) $\frac{7}{9} + \frac{-11}{9} = \frac{7+(-11)}{9} = \frac{-4}{9}$.

(ii) $\frac{8}{-11} = \frac{8\times(-1)}{(-11)\times(-1)} = \frac{-8}{11}$.

$\therefore \left(\frac{8}{-11}+\frac{3}{11}\right) = \left(\frac{-8}{11}+\frac{3}{11}\right) = \frac{(-8)+3}{11} = \frac{-5}{11}$.

LAW OF EXPONENTS

1. Consider the following.

(i) $3^3 \times 3^4 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^7 = 3^{3+4}$

(ii) $\left(\frac{5}{2}\right)^2 \times \left(\frac{5}{2}\right)^3 = \frac{5}{2}\times\frac{5}{2}\times\frac{5}{2}\times\frac{5}{2}\times\frac{5}{2} = \left(\frac{5}{2}\right)^5 = \left(\frac{5}{2}\right)^{2+3}$

$\therefore$ $\boxed{x^a \times x^b = x^{a+b}}$

2. (i) $2^5 \div 2^2 = \frac{2\times2\times2\times2\times2}{2\times2} = 2 \times 2 \times 2 = 2^3 = 2^{5-2}$

(ii) $\left(\frac{2}{3}\right)^6 \div \left(\frac{2}{3}\right)^2 = \frac{\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}}{\frac{2}{3}\times\frac{2}{3}} = \frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3} = \left(\frac{2}{3}\right)^4 = \left(\frac{2}{3}\right)^{6-2}$

$\therefore$ $\boxed{x^a \div x^b = x^{a-b}}$

3. (i) $(2^3)^2 = (2 \times 2 \times 2)^2 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) = 2^6 = 2^3 \times 2^3$

(ii) $\left\{\left(\frac{2}{3}\right)^3\right\}^2 = \left(\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\right)^2 = \left(\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\right) \times \left(\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\right) = \left(\frac{2}{3}\right)^6 = \left(\frac{2}{3}\right)^{3\times2}$

$\therefore$ $\boxed{(x^a)^b = x^{ab}}$

4. (i) $2^4 \times 3^4 = (2 \times 2 \times 2 \times 2) \times (3 \times 3 \times 3 \times 3)$
$= (2 \times 3) \times (2 \times 3) \times (2 \times 3) \times (2 \times 3) = (2 \times 3)^4$

(ii) $\left(\frac{3}{5}\right)^4 \times \left(\frac{1}{2}\right)^4 = \left(\frac{3}{5}\times\frac{3}{5}\times\frac{3}{5}\times\frac{3}{5}\right) \times \left(\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\right) = \left(\frac{3}{5}\times\frac{1}{2}\right) \times \left(\frac{3}{5}\times\frac{1}{2}\right) \times \left(\frac{3}{5}\times\frac{1}{2}\right) \times \left(\frac{3}{5}\times\frac{1}{2}\right) = \left(\frac{3}{5}\times\frac{1}{2}\right)^4$

$\therefore$ $\boxed{x^a \times y^a = (x \times y)^a}$

5. (i) $2^4 \div 3^4 = \frac{2\times2\times2\times2}{3\times3\times3\times3} = \frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3} = \left(\frac{2}{3}\right)^4$

(ii) $\left(\frac{3}{5}\right)^4 \div \left(\frac{1}{2}\right)^4 = \frac{\frac{3}{5}\times\frac{3}{5}\times\frac{3}{5}\times\frac{3}{5}}{\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}} = \left(\frac{\frac{3}{5}}{\frac{1}{2}}\right)\times\left(\frac{\frac{3}{5}}{\frac{1}{2}}\right)\times\left(\frac{\frac{3}{5}}{\frac{1}{2}}\right)\times\left(\frac{\frac{3}{5}}{\frac{1}{2}}\right) = \left(\frac{\frac{3}{5}}{\frac{1}{2}}\right)^4$

$\therefore$ $\boxed{x^a \div y^a = \left(\frac{x}{y}\right)^a}$

If x is any rational number different from zero and a, b are any integers, then,

Law I: $\boxed{x^a \times x^b = x^{a+b}}$

Law II: $\boxed{x^a \div x^b = x^{a-b}}$

Law III: $\boxed{(x^a)^b = x^{ab}}$

Law IV: $\boxed{x^a \times y^a = (x\times y)^a}$ (where y is a non zero rational number)

Law I: $\boxed{x^a \div y^a = \left(\frac{x}{y}\right)^a}$ (where y is a non zero rational number)

ON YOUR TIPS

- Let x be a rational number whose decimal expansion terminates. Then we can expressed x in the form $\frac{p}{q}$, where p and q are co-primes, and the prime factorisation of q is of the form $2^m \times 5^n$, where m,n are non-negative integers.
- Let x = $\frac{p}{q}$ be a rational number, such that the prime factorisation of q is of the form $2^m \times 5^n$, where m,n are non-negative integers. Then, x has a decimal expansion which terminates.
- Let x = $\frac{p}{q}$ be a rational number, such that the prime factorisation of q is not of the form $2^m \times 5^n$, where m, n are non-negative integers. Then, x has a decimal expansion which is non-terminating repeating.

NCERT QUESTIONS WITH SOLUTIONS

EXERCISE-1.1

1. Using appropriate properties, find :

(i) $-\frac{2}{3}\times\frac{3}{5}+\frac{5}{2}-\frac{3}{5}\times\frac{1}{6}$

(ii) $\frac{2}{5}\times\left(-\frac{3}{7}\right)-\frac{1}{6}\times\frac{3}{2}+\frac{1}{14}\times\frac{2}{5}$.

Sol.

(i) We have,

$$\frac{-2}{3}\times\frac{3}{5}+\frac{5}{2}-\frac{3}{5}\times\frac{1}{6}=\frac{-2}{3}\times\frac{3}{5}-\frac{3}{5}\times\frac{1}{6}+\frac{5}{2}$$

(by commutativity)

$$=\frac{-2}{3}\times\frac{3}{5}+\left(\frac{-3}{5}\right)\times\frac{1}{6}+\frac{5}{2}=\frac{-3}{5}\left(\frac{2}{3}+\frac{1}{6}\right)+\frac{5}{2}$$

(by distributivity)

$$=\frac{-3}{5}\left(\frac{4+1}{6}\right)+\frac{5}{2}=\frac{-3}{5}\left(\frac{5}{6}\right)+\frac{5}{2}=\frac{-1}{2}+\frac{5}{2}=\frac{4}{2}=2$$

(ii) We have,

$$=\frac{2}{5}\times\left(-\frac{3}{7}\right)+\frac{1}{14}\times\frac{2}{5}+\frac{-1}{6}\times\frac{3}{2}$$

$$=\frac{2}{5}\times\left(\frac{-3}{7}+\frac{1}{14}\right)+\frac{-1}{6}\times\frac{3}{2}$$ (by commutativity)

$$=\frac{2}{5}\times\left(\frac{-3}{7}+\frac{1}{14}\right)+\frac{-1}{6}\times\frac{3}{2}$$ (by distributivity)

$$=\frac{2}{5}\times\left(\frac{-6+1}{14}\right)-\frac{1}{6}\times\frac{3}{2}=\frac{2}{5}\times\left(\frac{-5}{14}\right)-\frac{1}{6}\times\frac{3}{2}$$

$$=\frac{-1}{7}-\frac{1}{4}=\frac{-4-7}{28}=\frac{-11}{28}$$

2. Write the additive inverse of each of the following.

(i) $\frac{2}{8}$ (ii) $\frac{-5}{9}$ (iii) $\frac{-6}{-5}$ (iv) $\frac{2}{-9}$

(v) $\frac{19}{-6}$.

Sol.

(i) We have given $\frac{2}{8}$.

The additive inverse of $\frac{2}{8}$ is $\frac{-2}{8}$.

$$\left[\because \frac{2}{8}+\left(\frac{-2}{8}\right)=\frac{2}{8}-\frac{2}{8}=0 \text{ and} \left(\frac{-2}{8}\right)+\left(\frac{2}{8}\right)=0\right]$$

(ii) We have given $\frac{-5}{9}$.

The additive inverse of $\frac{-5}{9}$ is $\frac{5}{9}$.

$$\left[\because \frac{-5}{9}+\frac{5}{9}=0 \text{ and} \frac{5}{9}+\left(\frac{-5}{9}\right)=0\right]$$

(iii) We have given $\frac{-6}{-5}$.

Multiplying numerator and denominator by –1, we get 6/5.

The additive inverse of $\frac{6}{5}$ is $\frac{-6}{5}$.

$$\left[\because \frac{6}{5}+\left(\frac{-6}{5}\right)=\frac{6}{5}-\frac{6}{5}=0 \text{ and} \left(\frac{-6}{5}\right)+\left(\frac{6}{5}\right)=0\right]$$

(iv) We have given $\frac{2}{-9}$.

Multiplying numerator and denominator by –1, we get $\frac{2}{-9}$.

The additive inverse of $\frac{2}{-9}$ is $\frac{2}{9}$.

$$\left[\because \frac{-2}{9}+\frac{2}{9}=0 \text{ and } \frac{2}{9}+\left(\frac{-2}{9}\right)=0\right]$$

(v) We have given $\frac{19}{-6}$.

Multiplying numerator and denominator by −1, we get $\frac{19}{-6}$.

The additive inverse of $\frac{19}{-6}$ is $\frac{19}{6}$.

$$\left[\because \frac{-19}{6}+\frac{19}{6}=0 \text{ and } \frac{19}{6}+\left(\frac{-19}{6}\right)=0\right]$$

3. Verify that −(−x) = x for

(i) $x = \frac{11}{15}$ (ii) $x = -\frac{13}{17}$

Sol.

(i) We have given, $x = \frac{11}{15}$.

So, $-(-x)=-\left(-\frac{11}{15}\right)=\frac{11}{15}$, which is equal to x.

(ii) We have given, $x = \frac{13}{17}$.

So, $-(-x)=-\left(-\left(-\frac{13}{17}\right)\right)=-\left(\frac{13}{17}\right)=\frac{13}{17}$, which is equal to x.

4. Find the multiplicative inverse of the following.

(i) −13 (ii) $\frac{-13}{19}$

(iii) $\frac{1}{5}$ (iv) $\frac{-5}{8}\times\frac{-3}{7}$

(v) $-1\times\frac{-2}{5}$ (vi) −1.

Sol.

(i) We have given, −13

The multiplicative inverse of −13 is $\left(\frac{-1}{13}\right)$.

$$\left[Q(-13)\times\left(\frac{-1}{13}\right)=\left(\frac{-1}{13}\right)\times(-13)=1\right]$$

(ii) We have given, $\frac{-13}{19}$

The multilicative inverse of $\frac{-13}{19}$ is $\left(\frac{-19}{13}\right)$.

$$\left[\because \left(\frac{-13}{19}\right)\times\left(\frac{-19}{13}\right)=\left(\frac{-19}{13}\right)\times\left(\frac{-13}{19}\right)=1\right]$$

(iii) We have given, $\frac{1}{5}$

The multiplicative inverse of $\frac{1}{5}$ is 5.

$$\left[\because \frac{1}{5}\times 5=5\times\frac{1}{5}=1\right]$$

(iv) We have given, $\frac{-5}{8}\times\frac{-3}{7}$

The multiplicative inverse of $\frac{-5}{8}\times\left(\frac{-3}{7}\right)=\frac{15}{56}$

is $\frac{15}{56}$. $\left[\because \frac{15}{56}\times\frac{56}{15}=\frac{56}{15}\times\frac{15}{56}=1\right]$

(v) We have given, $-1 \times \frac{-2}{5}$

The multiplicative inverse of $-1 \times \left(\frac{-2}{5}\right) = \frac{2}{5}$

is $\frac{5}{2}$. $\left[\because \frac{2}{5}\times\frac{5}{2} = \frac{5}{2}\times\frac{2}{5} = 1\right]$

(vi) We have given, –1.

The multiplicative inverse of –1 is –1.

$[\because (-1)\times(-1) = 1]$

5. Name the property under multiplication used in each of the following.

(i) $\frac{-4}{5}\times 1 = 1\times\frac{-4}{5} = -\frac{4}{5}$

(ii) $-\frac{13}{17}\times\frac{-2}{7} = \frac{-2}{7}\times\frac{-13}{17}$

(iii) $\frac{-19}{29}\times\frac{29}{-19} = 1$

Sol.

(i) We have given, $\frac{-4}{5}\times 1 = 1\times\frac{-4}{5} = -\frac{4}{5}$

i.e., 1 is the multiplicative identity.

Thus, it is an identity property under multiplication.

(ii) We have given, $\frac{-13}{17}\times\frac{-2}{7} = \frac{-2}{7}\times\frac{-13}{17}$, which shows the commutativity.

Thus, it is an commutative property under multiplication.

(iii) We have given $\frac{-19}{29}\times\frac{29}{-19} = 1$, which shows that $\frac{29}{-19}$ is a multiplicative inverse of $\frac{-19}{29}$.

Thus, it is a inverse property under multiplication.

6. Multiply $\frac{6}{13}$ by the reciprocal of $\frac{-7}{16}$.

Sol. We have $\frac{6}{13}$ and the reciprocal of $\frac{-7}{16}$ is $\frac{-16}{7}$.

$\Rightarrow \frac{6}{13}\times\left(\frac{-16}{7}\right) = \frac{-96}{91}$

7. Tell what property allows you to compute $\frac{1}{3}\times\left(6\times\frac{4}{3}\right)$ as $\left(\frac{1}{3}\times 6\right)\times\frac{4}{3}$.

Sol. Property used above is associativity under multiplication. $[\therefore a\times(b\times c) = (a\times b)\times c]$

8. Is $\frac{8}{9}$ the multiplicative inverse of $-1\frac{1}{8}$? Why or why not?

Sol. We have given $-1\frac{1}{8} = \frac{-9}{8}$.

So, $\frac{8}{9}$ is not a multiplicative inverse of $\frac{-9}{8}$.

$\because \frac{8}{9}\times\left(\frac{-9}{8}\right)$ gives $-1 \neq 1$.

9. Is 0.3 the multiplicative inverse of $3\frac{1}{3}$? Why or why not?

Sol. Since $3\frac{1}{3} = \frac{10}{3}$ and $0.3 = \frac{3}{10}$ and = i.e., the product of and $\frac{10}{3} \times \frac{3}{10} = 1$ i.e., the product of $\frac{10}{3}$ and $\frac{3}{10} = 1$.

$\Rightarrow \frac{3}{10}$ or 0.3 is the multiplicative inverse of $\frac{10}{3}$ or $3\frac{1}{3}$.

10. Write.

(i) The rational number that does not have a reciprocal.

(ii) The rational numbers that are equal to their reciprocals.

(iii) The rational number that is equal to its negative.

Sol.

(i) 0 is the rational number, which does not have a reciprocal.

(ii) 1 and (–1) are the rational numbers, which are equal to their reciprocals.

(iii) 0 is the rational number which is equal to its negative.

11. Fill in the blanks.

(i) Zero has reciprocal.

(ii) The numbers _____ and _____ are their own reciprocals.

(iii) The reciprocal of –5 is _____ .

(iv) Reciprocal of 1/x, where $x \neq 0$ is _____ .

(v) The product of two rational numbers is always a _____ .

(vi) The reciprocal of positive rational number is _____ .

Sol.

(i) Zero has no reciprocal.

(ii) The numbers 1 and –1 are their own reciprocals.

(iii) The reciprocal of –5 is $\frac{-1}{5}$.

(iv) Reciprocal of 1/x, where $x \neq 0$ is x.

(v) The product of two rational numbers is always a rational number.

(vi) The reciprocal of a positive rational number is positive.

EXERCISE-1.2

1. Represent these numbers on the number line.

(i) $\frac{7}{4}$ (ii) $\frac{-5}{6}$

Sol.

(i) We have to represent $\frac{7}{4}$ on the number line.

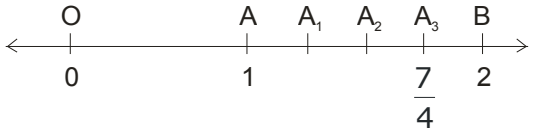
$\frac{7}{4}$ can be written as $1\frac{3}{4}$, which lies between 1 and 2 .

Step-1 : Draw a number line and mark on it to represent '0' (zero).

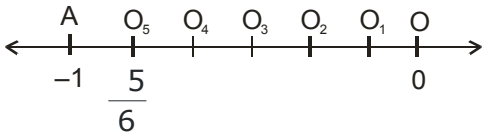
Step-2 : Take a point to represent 1 and to represent 2 at equal distance.

Step-3: Divide the distance between A and B in four equal parts i.e., AA_1, A_1A_2, A_2A_3 and A_3B.

Step-4 : Count from and reach to the third point A_3. Then, A_3 is the required point on number line.



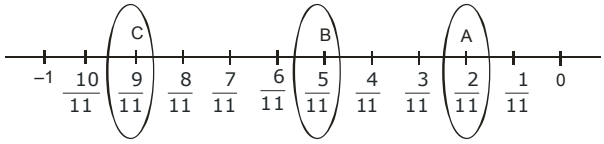
(ii) $\frac{-5}{6}$ lies between 0 and –1. O_5 is the required point.



2. Represent $\frac{-2}{11}, \frac{-5}{11}, \frac{-9}{11}$ on the number line.

Sol. We have to mark $\frac{-2}{11}, \frac{-5}{11}, \frac{-9}{11}$ on the same number line.

Since $\frac{-2}{11}, \frac{-5}{11}, \frac{-9}{11}$ all are less than 0 but greater than –1. So, all these lie between 0 and –1.



A, B and C are required points.

3. Write five rational numbers which are smaller than 2.

Sol. Numbers which are less than 2 lie on the left of 2 on the number line.

$\therefore$ Five rational numbers are $0, \frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$.

4. Find ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$.

Sol. We have given, two rational numbers $\frac{-2}{5}$ and $\frac{1}{2}$.

First we make the denominators of both rational numbers. Since, we have to find five rational numbers between these rational numbers.

$\frac{-2}{5} = \frac{-2}{5} \times \frac{2}{2} = \frac{-4}{10}$ ... (i)

[L.C.M. of (5, 2) = 10]

$\frac{1}{2} = \frac{1}{2} \times \frac{5}{5} = \frac{5}{10}$ ... (ii)

Since, we have to find 10 rational number between $\frac{-4}{10}$ and $\frac{5}{10}$, so we have to multiply the numerator and denominator of (i) and (ii) by a number such that difference between the numerators is atleast 10.

$\frac{-4}{10} \times \frac{2}{2} = \frac{-8}{20}, \frac{5}{10} \times \frac{2}{2} = \frac{10}{20}, \frac{1}{4} = \frac{1}{4} \times \frac{1}{1} = \frac{1}{4}$

$\because \frac{-8}{20} < \frac{-7}{20} < \frac{-6}{20} < \frac{-5}{20} < \frac{-4}{20} < \frac{-3}{20} < \frac{-2}{20} < \frac{-1}{20} <$

$\frac{0}{20} < \frac{1}{20} < \frac{2}{20} < \frac{10}{20}$

$\therefore$ The ten rational numbers between $\frac{-8}{20}$ and $\frac{10}{20}$ are $\frac{-7}{20}, \frac{-3}{10}, \frac{-1}{4}, \frac{-1}{5}, \frac{-3}{20}, \frac{-1}{10}, \frac{-1}{20}, 0, \frac{1}{20}$ and $\frac{1}{20}$ and $\frac{1}{10}$

5. Find five rational numbers between

(i) $\frac{2}{3}$ and $\frac{4}{5}$ (ii) $\frac{-3}{2}$ and $\frac{5}{3}$

(iii) $\frac{1}{4}$ and $\frac{1}{2}$.

Sol. First we make the denominators of both rational number same.

$\frac{2}{3} = \frac{2}{3} \times \frac{5}{5} = \frac{10}{15}$ ...(1)

[L.C.M. of (3, 5) = 15]

and $\frac{4}{5} = \frac{4}{5} \times \frac{3}{3} = \frac{12}{15}$ ... (2)

Since we have to find five rational numbers between $\frac{10}{15}$ and $\frac{12}{15}$, so we multiply the

numerator and denominator of (1) and (2) by a number such that difference between the numerators is atleast 5.

$\frac{10}{15}\times\frac{4}{4}=\frac{40}{60},\frac{12}{15}\times\frac{4}{4}=\frac{48}{60}$

$\therefore$ The five rational numbers between $\frac{2}{3}$ and $\frac{4}{5}$ are $\frac{41}{60},\frac{42}{60},\frac{43}{60},\frac{44}{60}$ and $\frac{45}{60}$.

(ii) First we make the denominators of both rational numbers same.

$\frac{-3}{2}=\frac{-3}{2}\times\frac{3}{3}=\frac{-9}{6}$ ... (1)

[L.C.M. of (2, 3) = 6]

and $\frac{5}{3}=\frac{5}{3}\times\frac{2}{2}=\frac{10}{6}$ ... (2)

Since, we have to find five rational numbers between $-\frac{9}{6}$ and $\frac{10}{6}$, so we don't need to multiply the numerator of (1) and (2) by any number, because we can see 18 numbers between the numerators and 18 > 5.

$\therefore$ Required rational numbers are

$\frac{-8}{6},\frac{-7}{6},0,\frac{1}{6}$ and $\frac{2}{6}$.

(iii) First we make the denominators of both rational numbers same.

$\frac{1}{4}=\frac{1}{4}\times\frac{1}{1}=\frac{1}{4}$ ... (1)

and $\frac{1}{2}=\frac{1}{2}\times\frac{2}{2}=\frac{2}{4}$ ... (2)

Since we have to find five rational numbers between $\frac{1}{4}$ and $\frac{2}{4}$, so we multiply the numerator and denominator of (1) and (2) by a number such that difference between the numerators is atleast 5.

$\frac{1}{4}\times\frac{8}{8}=\frac{8}{32},\ \frac{2}{4}\times\frac{8}{8}=\frac{16}{32}$

The five rational numbers between $\frac{1}{4}$ and $\frac{2}{4}$ are $\frac{9}{32},\frac{10}{32},\frac{11}{32},\frac{12}{32}$ and $\frac{13}{32}$.

6. Write five rational numbers greater than –2.

Sol. Number which are greater than –2 lie on the right side of –2 on number line.

$\therefore$ Any five rational numbers greater than –2 are $\frac{-3}{2},-1,\frac{-1}{2},0,\frac{1}{2}$.

7. Find ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$.

Sol. Make the denominators same

$\frac{3}{5}=\frac{3}{5}\times\frac{4}{4}=\frac{12}{20}$ ... (i) [L.C.M. of (5, 4) = 20]

and $\frac{3}{4}=\frac{3}{4}\times\frac{5}{5}=\frac{15}{20}$ ...(ii)

Since, we have to find ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$, so we multiply the numerator and denominator of (i) and (ii) by a number such that difference between the numerators is atleast 10.

$\frac{12}{20}\times\frac{8}{8}=\frac{96}{160},\frac{15}{20}\times\frac{8}{8}=\frac{120}{160}$

$\therefore$ The ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$ are $\frac{97}{160},\frac{98}{160},\frac{99}{160},\frac{100}{160},\frac{101}{160},\frac{102}{160},$

$\frac{103}{160},\frac{104}{160},\frac{105}{160}$ and $\frac{106}{160}$

EXERCISE - I

MULTIPLE CHOICE QUESTIONS

1. Which of the following statement is true?

(A) Every whole number is a natural number

(B) Every natural number is a whole number

(C) '1' is the least whole number

(D) None of these

2. The two missing numbers shown with asterisk in the equation $5\frac{3}{*}\times *\frac{1}{2} = 19$ are :-

(A) 6, 3 (B) 7, 3

(C) 8, 3 (D) 11, 3

3. Which of the following statements is true?

(A) $\frac{-2}{3}<\frac{4}{-9}<\frac{-5}{12}<\frac{7}{-18}$

(B) $\frac{7}{-18}<\frac{-5}{12}<\frac{4}{-9}<\frac{-2}{3}$

(C) $\frac{4}{-9}<\frac{7}{-18}<\frac{-5}{12}<\frac{-2}{3}$

(D) $\frac{-2}{3}<\frac{-5}{12}<\frac{4}{-9}<\frac{7}{-18}$

4. Which of the following rational numbers lie between $\frac{-3}{7}$ and $\frac{-9}{8}$?

(A) $\frac{-1}{2}$ (B) 0

(C) $\frac{12}{15}$ (D) None of these

5. Which of the following has fractions in ascending order?

(A) $\frac{2}{3},\frac{3}{5},\frac{7}{9},\frac{9}{11},\frac{8}{9}$ (B) $\frac{3}{5},\frac{2}{3},\frac{9}{11},\frac{7}{9},\frac{8}{9}$

(C) $\frac{3}{5},\frac{2}{3},\frac{7}{9},\frac{9}{11},\frac{8}{9}$ (D) $\frac{8}{9},\frac{9}{11},\frac{7}{9},\frac{2}{3},\frac{3}{5}$

6. $5-\left[\frac{3}{4}+\left\{2\frac{1}{2}-\left(0.5+\overline{\frac{1}{6}-\frac{1}{7}}\right)\right\}\right]$:-

(A) $2\frac{23}{84}$ (B) $3\frac{1}{6}$

(C) $3\frac{3}{10}$ (D) $5\frac{1}{10}$

7. If $2805 \div 2.55 = 1100$, then $280.5 \div 25.5 =$

(A) 1.1 (B) 1.01

(C) 0.11 (D) 11

8. Evaluate : $\frac{8-[5-(-3+2)]\div 2}{|5-3|-|5-8|\div 3}$

(A) 2 (B) 3

(C) 4 (D) 5

9. If $x < -2$, then $|1-|1+x||$ equals :

(A) $2+x$ (B) x

(C) $-x$ (D) $-(2+x)$

10. When simplified the product $\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\left(1-\frac{1}{5}\right)....\left(1-\frac{1}{n}\right)$ equals :

(A) $\frac{1}{n}$ (B) $\frac{2}{n}$

(C) $\frac{2(n-1)}{n}$ (D) $\frac{2}{n(n+1)}$

11. The value of $\left(\frac{x^b}{x^c}\right)^{\frac{1}{bc}}\times\left(\frac{x^c}{x^a}\right)^{\frac{1}{ca}}\times\left(\frac{x^a}{x^b}\right)^{\frac{1}{ab}}$ is :

(A) x (B) $\frac{1}{x}$

(C) -1 (D) 1

12. $\left(\frac{a^{-1}b^{-1}}{a^{-1}+b^{-1}}-\frac{a^{-1}b^{-1}}{a^{-1}-b^{-1}}\right)$ equal to :

(A) $\frac{2b}{b^2-a^2}$ (B) $\frac{2b}{a^2-b^2}$

(C) $\frac{2a}{b^2-a^2}$ (D) $\frac{2a}{a^2-b^2}$

13. The decimal representation of $\frac{27}{400}$ is :

(A) Terminating

(B) Non-terminating recurring

(C) Non-terminating non-recurring

(D) None of these

14. Which of the following number are rational ?

(A) $\sqrt{19}$ (B) $\sqrt{16}$

(C) $\sqrt{17}$ (D) $\sqrt{18}$

15. The rational form of $2.74\overline{35}$ is :

(A) $\frac{27161}{9999}$ (B) $\frac{27}{99}$

(C) $\frac{27161}{9900}$ (D) $\frac{27161}{9000}$

16. If $x = 3+\sqrt{8}$ and $y = 3-\sqrt{8}$ then $\frac{1}{x^2}+\frac{1}{y^2}=$

(A) – 34 (B) 34

(C) $12\sqrt{8}$ (D) $-12\sqrt{8}$

17. $1+\frac{1}{1+\frac{1}{1+\frac{1}{3}}}$ is equal to –

(A) $\frac{1}{3}$ (B) $\frac{11}{7}$

(C) 3 (D) $1\frac{1}{3}$

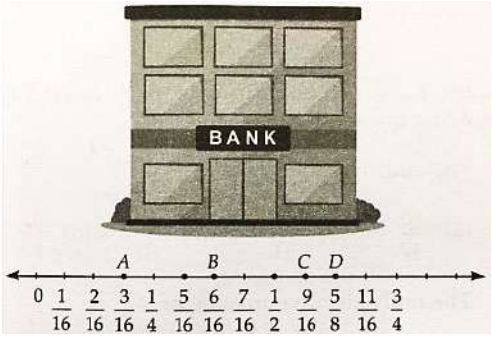
18. $\frac{(x^{a+b})^2(x^{b+c})^2(x^{c+a})^2}{(x^a\times x^b\times x^c)^4}=?$

(A) – 1 (B) 0

(C) 1 (D) None of these

Direction (Q.19 to 23):

Location of four branches of XYZ bank is represented by the four points A, B, C and D respectively on the number line as shown in figure.



On the basis of above information, answer the following questions.

19. Additive inverse of branch B lies

(A) to the right of 0

(B) to the left of 0

(C) between 0 and 1

(D) None of these

20. Which of the following number lies to the left of branch A on the number line ?

(A) $\frac{1}{8}$ (B) $\frac{1}{4}$

(C) $\frac{1}{2}$ (D) $\frac{3}{4}$

21. Multiplicative inverse of branch C lies on _____ .

(A) to the right of 0 (B) to the left of 0

(C) between 0 and 1 (D) None of these

22. Which among the following rational number (s) lie in between –3/2 and 4/3 on the number line ?

(A) –1 (B) 0

(C) 1 (D) All of these

23. A positive rational number and its reciprocal lie _____ on number line.

(A) between 0 and 1

(B) on either side of 0

(C) to the right of 0

(D) None of these

ASSERTION-REASON

Direction: In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statement, 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.

24. **Assertion :** Zero is a rational number.

Reason : Each rational number is a quotient of any two integers, while its divisor should not be zero. Thus, a number of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$ is a rational number.

25. **Assertion :** One of the rational number between $\frac{1}{5}$ and $\frac{1}{4}$ is $\frac{9}{2}$.

Reason : If x and y are any two rational numbers such that x < y, then $\frac{1}{2}(x + y)$ is a rational number between x and y such that $x < \frac{1}{2}(x + y) < y$.

SUBJECTIVE QUESTIONS

Very Short Answer Type Questions

1. What number should be added to $\frac{-5}{11}$ so as to get $\frac{26}{33}$?

2. What number should be subtracted from $\frac{-5}{3}$ to get $\frac{5}{6}$?

3. Simply each of the following and write as a rational number of the from $\frac{p}{q}$:

(i) $\frac{3}{4}+\frac{5}{6}+\frac{-7}{8}$ (ii) $\frac{2}{3}+\frac{-5}{6}+\frac{-7}{9}$

4. Simplify:

(i) $\left(\frac{25}{8}\times\frac{2}{5}\right)-\left(\frac{3}{5}\times\frac{-10}{9}\right)$

(ii) $\left(\frac{1}{2}\times\frac{1}{4}\right)+\left(\frac{1}{2}\times 6\right)$

5. Express each of the following as a rational number in the form $\frac{p}{q}$:

(i) 6^{-1} (ii) $(-7)^{-1}$

(iii) $\left(\frac{1}{4}\right)^{-1}$ (iv) $(-4)^{-1}\times\left(\frac{-3}{2}\right)^{-1}$

Short Answer Type Questions

1. Simplify

(i) $\left\{\left(\frac{3}{2}\right)^{-3} - \left(\frac{1}{2}\right)^{-3}\right\} \div \left(\frac{1}{4}\right)^{-3}$

(ii) $(3^2 - 2^2) \times \left(\frac{2}{3}\right)^{-3}$

2. By what number should $\left(\frac{1}{2}\right)^{-1}$ be multiplied so that the product may be equal to $\left(\frac{-4}{7}^{-1}\right)$?

3. Find x, if

(i) $\left(\frac{1}{4}\right)^{-4} \times \left(\frac{1}{4}\right)^{-8} = \left(\frac{1}{4}\right)^{-4x}$

(ii) $\left(\frac{-1}{2}\right)^{-19} \div \left(\frac{-1}{2}\right)^{8} = \left(\frac{-1}{2}\right)^{-2x+1}$

4. Find the value of x for which $5^{2x} \div 5^{-3} = 5^5$.

5. Express the following numbers in standard form:

(i) 6020000000000000

(ii) 0.00000000000942

6. Write the following numbers in the usual form:

(i) 4.83×10^7

(ii) 3.02×10^{-6}

(iii) 4.5×10^4

(iv) 3×10^{-8}

Long Answer Type Questions

1. Write seven rational numbers which are smaller than 3.

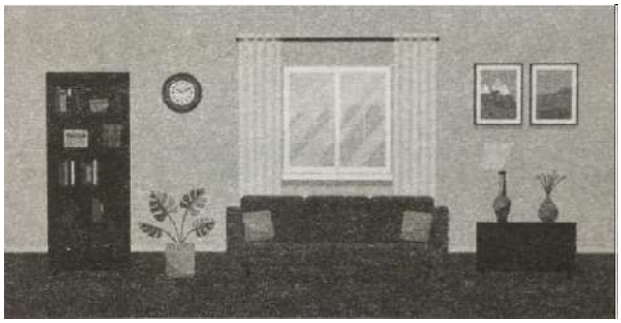
2. Subtract the sum of the two numbers is $\frac{-8}{5}$ and $\frac{-5}{3}$ from the sum of $\frac{3}{2}$ and $\frac{-31}{28}$.

3. Praneeta bought $3\frac{1}{2}$ m ribbon at Rs. $5\frac{3}{7}$ per metre, $4\frac{3}{4}$ m cloth at Rs. $27\frac{1}{2}$ per metre. How much money did she spend?

4. The product of two numbers is $-17\frac{1}{2}$. If one of them is $1\frac{1}{6}$, find the other.

CASE STUDY BASED QUESTIONS

Avya wants to purchase tiles for the living room of his house. The length and breadth (in meters) of living room are $21\frac{3}{4}$ and $11\frac{1}{4}$ respectively.



On the basis of above information, answer the following questions.

1. Find the multiplicative inverse of length and breadth respectively.

2. Find the area of the hall.

3. Find the area of one tile if square tiles is of side $\frac{3}{4}$ m.

4. Find the number of tiles required to make the floor.

5. Which of the following is equal to $\frac{-7}{9}$?

(A) $\frac{-7+3}{9-3}$ (B) $\frac{-7\times 3}{9\times 3}$

(C) $\frac{-9\times 3}{7\times 3}$ (D) $\frac{-7}{-9}$

EXERCISE - II

1. $0.\bar{2} + 0.\bar{3} + 0.\bar{4} + 0.\bar{5}$ is equivalent to **[Aryabhatta 2005]**

(A) $\frac{14}{9}$ (B) $\frac{15}{9}$

(C) $\frac{1}{3}$ (D) 1

2. If a number is divided by 45, then the remainder is 32. If the same number is divided by 15, then the remainder is **[Aryabhatta 2008]**

(A) 2 (B) 3

(C) 16 (D) 4

3. To reduce a rational number in its standard form, we divide its numerator and denominator by their _____ .

(A) L.C.M. (B) H.C.F.

(C) Product (D) Multiple

4. If A : Rational numbers are always closed under division and Division by zero is not defined, then

(A) Both A and R are true

(B) Both A and R are false

(C) A is true and R is false

(D) A is false and R is true

5. Zero is _____ .

(A) The identity for addition of rational numbers.

(B) The identity for subtraction of rational numbers.

(C) The identity for multiplication of rational numbers.

(D) The identity for division of rational numbers.

6. Which of the following statements is always true?

(A) $\frac{x-y}{2}$ is a rational number between x and y

(B) $\frac{x+y}{2}$ is a rational number between x and y

(C) $\frac{x \times y}{2}$ is a rational number between x and y

(D) $\frac{x \div y}{2}$ is a rational number between x and y

7. The numerical expression $\frac{3}{8} + \frac{(-5)}{7} = \frac{-19}{56}$ shows

(A) Rational numbers are closed under addition.

(B) Rational numbers are not closed under addition.

(C) Rational numbers are closed under multiplication.

(D) Addition of rational numbers is not commutative.

8. The number 34 is divided into two parts such that $\frac{4}{7}^{th}$ of the first part is equal to $\frac{2}{5}^{th}$ of the second part. The two parts are respectively

(A) 20,14 (B) 21,13

(C) 13,21 (D) 14,20

9. Which of the following rational numbers does not lie between $\frac{1}{4}$ and $\frac{2}{3}$.

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) $\frac{14}{24}$ (D) $\frac{18}{24}$

10. The numerator and the denominator of a rational number are in the ratio 5:7 When 6 is added to both the numerator and denominator, the ratio becomes 4:5. What is the rational number?

(A) $\frac{7}{5}$ (B) $\frac{5}{7}$

(C) $\frac{2}{5}$ (D) $\frac{13}{14}$

11. A water pump pumps out $14\frac{1}{6}\ell$ of water per minute from a reservoir. How many litres of water will be pumped out in $1\frac{1}{5}$ of an hour ?

(A) 1125 ℓ (B) 1020 ℓ

(C) 6120 ℓ (D) 1560 ℓ

12. Shruti uses $105\frac{7}{8}$ g of wheat flour for making $\frac{1}{2}$ kg of halwa. Approximately how much grams of halwa can she make from $315\frac{3}{4}$ g of wheat flour ?

(A) 1491.145 g (B) 1382.245 g

(C) 1500.471 g (D) 1100.220 g

13. p : Every natural number is a rational number.
q : Every rational number is a natural number.
Which of the following is correct ?

(A) p is true and q is false

(B) p is false and q is true

(C) Both p and q are true

(D) Both p and q are false.

14. Which of the following numbers does not lie between –1 and –2.

(A) $\frac{-16}{10}$ (B) $\frac{-4}{5}$

(C) $\frac{-15}{10}$ (D) $\frac{-13}{10}$

15. Nine times the reciprocal of a rational number equals 6 times the reciprocal of 17. Find the rational number.

(A) $11\frac{1}{3}$ (B) $25\frac{1}{2}$

(C) $10\frac{1}{3}$ (D) None of these

EXERCISE - III

1. A rational number can be expressed as a terminating decimal if the denominator has factors **[NSTSE 2010]**
(A) 2 or 5 (B) 3 or 5
(C) 2, 3 or 5 (D) None of these

2. The product of x^2y and $\left(\frac{x}{y}\right)$ is equal to the quotient obtained when x^2 is divided by **[NSTSE 2010]**
(A) 0 (B) 1
(C) X (D) $\frac{1}{x}$

3. If $1+\frac{1}{x}=\frac{x+1}{x}$, which does 'x' equal to ? **[NSTSE-2011]**
(A) 1 or 2 only
(B) 1 and 0 only
(C) + 1 or – 2 only
(D) any number except '0'

4. Identify a rational number between $\frac{1}{3}$ and $\frac{4}{5}$ **[NSTSE 2012]**
(A) $\frac{1}{4}$ (B) $\frac{9}{10}$
(C) $\frac{17}{30}$ (D) $1\frac{7}{10}$

5. Which of the statements is true about consecutive natural numbers ? **[NSTSE 2012]**
(A) There are 2n + 1 numbers between the difference of squares of consecutive numbers.
(B) There are 2n non-perfect square numbers between the squares
(C) The sum of the squares of two consecutive numbers is not a perfect square
(D) n^2-1 is the standard form of the difference between two consecutive numbers.

6. Identify the ones that is/are greater than 'm' if $m=\frac{9}{11}$ **[NSTSE 2014]**
(i) $\frac{1}{m}$ (ii) $\frac{m+1}{m}$ (iii) $\frac{m+1}{m-1}$
(A) (i) only (B) (ii) and (iii) only
(C) (i) and (iii) only (D) (i) and (ii) only

7. Which number is in the middle if $\frac{-1}{6}, \frac{4}{9}, \frac{6}{-7}, \frac{2}{5}$ and $\frac{-3}{4}$ are arranged in descending order **[NSTSE 2014]**
(A) $\frac{2}{5}$ (B) $\frac{4}{9}$
(C) $\frac{-1}{6}$ (D) $\frac{-6}{7}$

8. If the division N ÷ 5 leaves a remainder of 3, what might be the ones digit of N ? **[NSTSE 2014]**
(A) 2 (B) 3
(C) 4 (D) 6

9. Which of the following numbers does NOT have a multiplicative inverse? **[NSTSE 2014]**
(A) $-\frac{1}{3}$ (B) 0
(C) 1 (D) 3

10. Nalini and three of her friends worked together to make a quilt. The given table lists the fractional part of the quilt that each of the girls made. Which list shows the girls in order from the one who sewed the most to the one who sewed the least? **[NSTSE 2014]**

Girl	Parts Sewn
Nalini	$\frac{3}{8}$
Kamini	$\frac{1}{5}$
Shalini	$\frac{2}{5}$
Reena	$\frac{1}{40}$

(A) Reena, Nalini, Shalini, Kamini

(B) Shalini, Nalini, Kamini, Reena

(C) Reena, Kamini, Nalini, Shalini

(D) Kamini, Shalini, Nalini, Reena

11. The difference between the place value and the face value of 6 in the numeral 856973 is_____. **[NSTSE 2014]**

(A) 973 (B) 6973

(C) 5994 (D) None of these

12. Which of the following expressions is true? **[NSTSE 2014]**

(A) $0.09 > \frac{7}{8}$ (B) $6\% < 0.09$

(C) $\frac{7}{8} < 8.0 \times 10^{-3}$ (D) $8.0 \times 10^{-3} > 6\%$

13. If x:y = 5:2, then (8x + 9y) : (8x + 2y) is **[NSTSE 2014]**

(A) 22 : 29 (B) 26 : 61

(C) 29 : 22 (D) 61: 26

14. Closure property for rational numbers is satisfied in case of _____ . **[NSTSE 2014]**

(A) Addition (B) Subtraction

(C) Multiplication (D) All of these

15. Which of the following statements is INCORRECT for rational numbers? **[NSTSE 2014]**

(A) The rational number O is the additive identity for rational numbers.

(B) The rational number 1 is the multiplicative identity for rational numbers.

(C) Subtraction is associative for rational numbers.

(D) There are infinite rational numbers between any two given rational numbers.

MOTION

HINDI
GRAMMAR
CLASS - VIII

CONTENTS

GRAMMAR AND WRITING

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संज्ञा

परिभाषा : जो शब्द किसी वस्तु, स्थान, व्यक्ति अथवा भाव का बोध कराते हैं, वे **'संज्ञा'** कहलाते हैं। जैसे– मोहन, सीता, वृक्ष, फूल, बाग, बनारस, लखनऊ, घोडा, मनुष्य, ऊँचाई, प्रेम, योग्यता आदि।

संज्ञा का कोशगत अर्थ हैं 'नाम'। अतः संक्षेप में कहें तो किसी नाम को संज्ञा कहते हैं। यह नाम व्यक्ति, जाति, द्रव्य, स्थान, गुण, धर्म किसी का भी हो सकता हैं।

संज्ञा के तीन भेद मुख्य होते हैं–

1. **व्यक्तिवाचक संज्ञा :** जो शब्द किसी विशेष वस्तु, विशेष स्थान, विशेष प्राणी या विशेष व्यक्ति के नाम का बोध कराते हैं, उन्हें व्यक्तिवाचक संज्ञा कहते हैं।

   उदाहरणतया– मोहन, रमा, अशोक, कृष्ण, जवाहर, सीता, संतोष, प्रियांशु (व्यक्ति)।
   टामी (कुत्ता), ऐरावत (हाथी), कपिला (गाय), नीलकंठ (मोर) (प्राणी)।
   दिल्ली, भारत, अमेरिका, मद्रास, आसाम (स्थान)।
   यमुना, हिमालय, गंगा, बाइबिल (वस्तु)।

2. **जातिवाचक संज्ञा :** जो शब्द किसी प्राणी, पदार्थ या समूह की जाति का बोध कराते हैं, उन्हें **'जातिवाचक संज्ञा'** कहते हैं। उदाहरणतया– मनुष्य, कुत्ता, पर्वत, नगर, नदी, पुस्तक, फल, फूल, मुहल्ला, प्रांत, देश आदि। ध्यान देने योग्य हैं कि 'मनुष्य' पूरी मानव–जाति का द्योतक हैं, न कि एक मनुष्य का। 'पर्वत' सभी पहाडों का प्रतिनिधि हैं, न कि किसी एक पहाड का, इसलिए इन्हें जातिवाचक संज्ञा कहते हैं।

   जातिवाचक संज्ञा के दो भेद होते हैं।

   (क) द्रव्यवाचक संज्ञा : जातिवाचक संज्ञा के अंतर्गत कुछ ऐसे शब्द आते हैं जो किसी पदार्थ या द्रव्य का बोध कराते हैं। जैसे– सोना, चांदी, ऊन, लकडी, तांबा आदि। इन पदार्थों की गणना नहीं हो सकती, केवल माप तोल हो सकता हैं।

   (ख) समूहवाचक संज्ञा : जिस शब्द से किसी समूह या समुदाय का बोध होता हैं, उसे **'समूहवाचक संज्ञा'** कहते हैं। जैसे– पुलिस, सेना, परिवार, कक्षा, सभा, भीड, झुंड आदि।

3. **भाववाचक संज्ञा :** जो शब्द किसी भाव, दशा, गुण–धर्म, अवस्था या मानसिक संकल्पना का बोध कराते हैं, उन्हें **'भाववाचक संज्ञा'** कहते हैं। जैसे– सच्चाई, ऊचाँई, प्रेम, घृणा, बचपन, मोटापा, शीतलता, ईमानदारी, अंधकार, चढाई, प्रार्थना आदि।

   भाववाचक संज्ञाओं की रचना

   भाववाचक संज्ञाएँ **पांच प्रकार** के शब्दों से बनती हैं–

1. **जातिवाचक संज्ञाओं से :** बूढा से बुढापा, दोस्त से दोस्ती, पंडित से पंडिताई, लडका से लडकपन, मनुष्य से मनुष्यता, मित्र से मित्रता, बच्चा से बचपन, आदमी से आदमीयत, शत्रु से शत्रुता आदि।
2. **सर्वनामों से :** अपना से अपनापन, स्व से स्वत्व, निज से निजता, अहं से अहंकार, मम से ममता आदि।
3. **विशेषणों से :** चतुर से चतुरता, मीठा से मिठास, गुरू से गुरूता या गौरव, सुंदर से सुंदरता, कटु से कटुता, अच्छा से अच्छाई, बुरा से बुराई, मोटा से मुटापा, लघु से लघुता, गरीब से गरीबी, गंदा से गंदगी।
4. **अव्ययों से :** धिक् से धिक्कार, दूर से दूरी, मना से मनाही, निकट से निकटता आदि।
5. **क्रियाओं से :** चढना से चढाई, खेलना से खेल, उडना से उडान, घबराना से घबराहट, बनाना से बनावट, लिखना से लेख आदि।

वस्तुनिष्ठ प्रश्न

Q.1 'मधुर' विशेषण से बनी भाववाचक संज्ञा हैं?

(1) माधुर्य (2) मधुरिमा (3) माधुरी (4) मधुरता

Q.2 'झूठा आदमी विश्वास के योग्य नहीं होता' – इस वाक्य में 'विश्वास' हैं –

(1) अकर्मक क्रिया (2) जातिवाचक संज्ञा (3) गुणवाचक विशेषण (4) भाववाचक संज्ञा

Q.3 'विद्वान' विशेषण से बनी भाववाचक संज्ञा हैं?

(1) विदुषी (2) विधाता (3) विद्वता (4) वरदान

Q.4 'तुम्हें धोखा नहीं देना चाहिए था' वाक्य में 'धोखा' संज्ञा हैं?

(1) भाववाचक (2) समुदाय वाचक (3) जाति वाचक (4) व्यक्ति वाचक

Q.5 जिन शब्दों का रूप लिंग वचन और कारक के आधार पर बदल जाता हैं, वे कहलाते हैं?

(1) अविकारी (2) एकार्थी (3) अव्यय (4) विकारी

Q.6 निम्न में से कौनसा शब्द संज्ञा हैं?

(1) क्रुद्ध (2) क्रोधी (3) क्रोध (4) क्रोधित

Q.7 इन शब्दों में भाववाचक संज्ञा शब्द कौन–सा हैं?

(1) मित्रता (2) पंडित (3) इच्छा (4) चलना

Q.8 संज्ञा का प्रकार नहीं हैं?

(1) व्यक्तिवाचक (2) जातिवाचक (3) देशवाचक (4) भाववाचक

Q.9 'भारतीय सेना बहुत शक्तिशाली हैं' वाक्य में 'सेना' संज्ञा हैं?

(1) जातिवाचक (2) समुदायवाचक (3) भाववाचक (4) व्यक्तिवाचक

Q.10 'भाववाचक संज्ञा' के अन्तर्गत आते हैं?

(1) पशु–पक्षी आदि (2) गुण–दोष आदि (3) दिशाएँ आदि (4) आभूषण आदि

Q.11 कौन–सा प्रत्यय लगाने से 'मधुर' विशेषण भाववाचक संज्ञा में परिवर्तित हो जाएगा?

(1) त्व (2) ता (3) तम (4) पन

Q.12 जिन शब्दों में प्रयोग के अनुसार कोई परिवर्तन नहीं होता हैं, उन्हें कहा जाता हैं?

(1) पद (2) विकारी शब्द (3) अविकारी (4) पदबंध

Q.13 बुढापा भी एक प्रकार का अभिशाप हैं – शब्द में 'बुढापा' कौनसी संज्ञा हैं?

(1) व्यक्तिवाचक संज्ञा (2) भाववाचक संज्ञा

(3) जातिवाचक संज्ञा (4) इनमें से कोई नहीं

Q.14 निम्नलिखित शब्दों में कौन–सा शब्द 'भाववाचक संज्ञा' के अन्तर्गत रखा जाएगा?

(1) मोहन (2) नदी (3) हरियाली (4) अयोध्या

Q.15 इनमें व्यक्तिवाचक संज्ञा कौनसी हैं?

(1) माण्डवी (2) घरेलू (3) भला (4) स्वतंत्र

Q.16 निम्नलिखित में भाववाचक संज्ञा कौनसी हैं?

(1) शत्रुता (2) वीर (3) मनुष्य (4) गुरू

Q.17 निम्नलिखित में कौन–सा शब्द 'व्यक्तिवाचक' संज्ञा हैं?

(1) गाय (2) पहाड (3) यमुना (4) आम

Q.18 कौन–सा शब्द भाववाचक संज्ञा नहीं हैं?

(1) मिठाई (2) चतुराई (3) लडाई (4) उतराई

Q.19 निम्नलिखित में कौन द्रव्यवाचक संज्ञा नहीं हैं?

(1) लोहा (2) घड़ी (3) तेल (4) दूध

Q.20 निम्नलिखित में कौन व्यक्तिवाचक संज्ञा नहीं हैं?

(1) रामायण (2) पटना (3) औरत (4) गंगा

Q.21 अर्थ के विचार से संज्ञा कितने प्रकार की होती हैं?

(1) 4 (2) 5 (3) 6 (4) 7

Q.22 जातिवाचक संज्ञा बताएँ हैं?

(1) लडका (2) सेना (3) श्याम (4) दुःख

Q.23 व्याकरण की दृष्टि से 'प्रेम' शब्द क्या हैं?

(1) भाववाचक संज्ञा (2) विशेषण (3) क्रिया (4) अव्यय

Q.24 विकारी शब्द हेाता हैं?

(1) संज्ञा (2) सर्वनाम (3) विशेषण (4) अव्यय

Q.25 जातिवाचक संज्ञा से किसका बोध होता हैं?

(1) नाम का (2) पक्षी के नाम का (3) पशु के नाम का (4) आदमी की जाति का

Q.26 किसी व्यक्ति या वस्तु के नाम का बोध कराने वाले शब्द कहलाते हैं?

(1) नामवाची (2) संज्ञा (3) नामधारी (4) विशेष

Q.27 'सोना–चाँदी' में संज्ञा का भेद बताएँ?

(1) समूह वाचक (2) जातिवाचक (3) द्रव्यवाचक (4) इनमें से कोई नहीं

Q.28 'कुंज' में संज्ञा शब्द का भेद बताएँ?

(1) जातिवाचक (2) समूहवाचक (3) भाववाचक (4) इनमें से कोई नहीं

Q.29 निम्नलिखित में कौन व्यक्तिवाचक संज्ञा हैं?

(1) शिक्षक (2) विद्यार्थी (3) मंत्री (4) महेन्द्र

Q.30 'कोयला' में संज्ञा शब्द का भेद बताएँ?

(1) व्यक्तिवाचक (2) समूहवाचक (3) भाववाचक (4) जातिवाचक

Q.31 'मिठास' शब्द हैं?

(1) व्यक्तिवाचक संज्ञा (2) जातिवाचक संज्ञा (3) भाववाचक संज्ञा (4) समूह वाचक संज्ञा

Q.32 'माहात्म्य' शब्द हैं?

(1) क्रिया (2) जातिवाचक

(3) व्यक्तिवाचक (4) भाववाचक

Q.33 निम्नलिखित में से किस विकल्प में सभी शब्द व्यक्तिवाचक संज्ञाएँ हैं?

(1) ममता, बैल, राधेश्याम (2) राधेश्याम, पन्नालाल, हिमालय

(3) आम, साधना, ऊँचाई (4) गाय, मूर्खता, चालाकी

Q.34 निम्नलिखित में से किस विकल्प में सभी शब्द भाववाचक संज्ञाएँ हैं?

(1) धैर्य, चतुराई, प्रेम (2) अकेलापन, वृक्ष, दृढता

(3) खुलापन, फहड़ता, सूर्य (4) उडासी, शेर, चालाकी

Q.35 विशेषण से भाववाचक बनने वाला शब्द हैं?

(1) नहाता (2) शिष्टता (3) खेलता (4) दौडना

उत्तरमाला

Q.1	1	**Q.2**	4	**Q.3**	3	**Q.4**	1	**Q.5**	4	**Q.6**	3	**Q.7**	1
Q.8	3	**Q.9**	2	**Q.10**	2	**Q.11**	2	**Q.12**	3	**Q.13**	2	**Q.14**	3
Q.15	1	**Q.16**	1	**Q.17**	3	**Q.18**	1	**Q.19**	2	**Q.20**	3	**Q.21**	2
Q.22	1	**Q.23**	1	**Q.24**	4	**Q.25**	4	**Q.26**	2	**Q.27**	3	**Q.28**	2
Q.29	4	**Q.30**	4	**Q.31**	3	**Q.32**	4	**Q.33**	2	**Q.34**	1	**Q.35**	2