CAREER POINT

Study Material for Pre foundation Class 6

Prepared by Career Point Kota Experts

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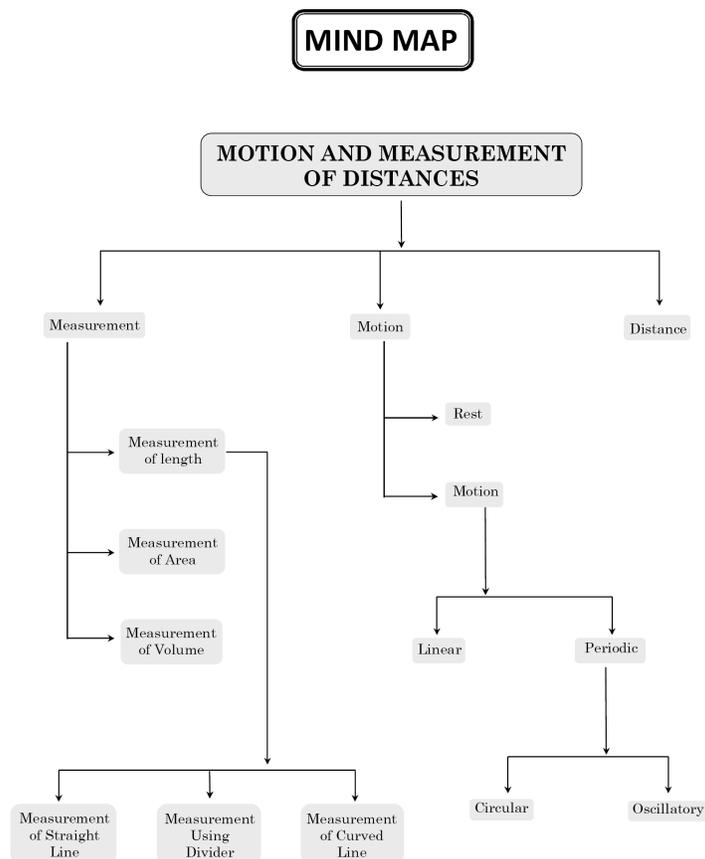♦ Water
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Mind Map

Each chapter contains many articles (Concepts, Theories etc.). Mind map interconnect all these articles logically. By this student can understand whole chapter articles interconnectivity clearly in a single picture frame.

MIND MAP

MOTION AND MEASUREMENT
OF DISTANCES

Measurement

Motion

Distance

Measurement
of length

Measurement
of Area

Measurement
of Volume

Rest

Motion

Linear

Periodic

Measurement
of Straight
Line

Measurement
Using
Divider

Measurement
of Curved
Line

Circular

Oscillatory

Theory & Concepts

Each chapter consist of exhaustive theory which gives conceptual clarity and command over topics. Appropriate explanation of theory with the help of images, diagrams, flowcharts, mind maps, info graphics, and tables.

MOTION AND MEASUREMENT OF DISTANCES

Introduction

Long ago people did not have any means of transport. They used to move only on foot and carry goods either on their back or using animals. For transport along water routes, boats were used from ancient times. To begin with, boats were simple logs of wood in which a hollow cavity could be made. Later, people learnt to put together different pieces of wood and give shapes to the boats. These shapes imitated the shapes of the animals living in water.

Invention of the wheel made a great change in modes of transport. The design of the wheel was improved over thousands of years. Animals were used to pull vehicles that moved on wheels. Until the beginning of the 19th century, people still depended on animal power to transport them from place to place. The invention of steam engine introduced a new source of power. Railroads were made for steam engine driven carriages and wagons.

Later came automobiles. Motorised boats and ships were used as means of transport on water. The early years of 1900 saw the development of aeroplanes. These were later improved to carry passengers and goods. Electric trains, monorail, supersonic aeroplanes and spacecraft are some of the 20th century

Competitive Level

Competitive level is specially designed for competition exam rquirements and to better understanding the concepts, well explained theory, clearly explained formulas with good number of quality examples are given in this.

> **COMPETITIVE LEVEL**
>
> ## Using a Divider to Measure Length
>
> A divider is used to measure the distance between two points. The correct use of a divider can give a fairly accurate measurement. The divider is placed such that its two points are at the two ends of the length to be measured. Then, without disturbing the divider, the distance between the two points is measured with a ruler.

In Chapter Example

To understand the application of concepts, there is **in chapter solved example** are given. It contains large variety of all types of solved examples with explaination to ensure understanding the application of concepts.

Ex.4 How much time a cyclist will take to cover distance of 400 m, while moving with 20 kmph?

Sol. Time = $\dfrac{\text{Distance}}{\text{Speed}} = \dfrac{400}{1000 \times 20} = 0.02$ Hrs

Velocity: It is the rate of change of displacement.

Therefore, velocity = $\dfrac{\text{displacement}}{\text{time}}$ or it is the distance travelled in unit time in a given direction.

velocity = $\dfrac{\text{distance travelledin given direction}}{\text{time taken}}$

S.I. unit of velocity is m/s. It is a vector quantity.

Uniform Velocity (Constant Velocity): If a body covers equal distances in equal intervals of time in a given direction then it is said to be moving with constant velocity.

Practice Exercises

Includes three sets of exercises covering all the topics. Helps the students to assess their strengths and weaknesses and work on them accordingly. Separate exercises for subjective as well as objective questions and previous year competitive exams questions (NTSE, Olympiads)

EXERCISE-1

> ➤ **Very Short Answer Type Questions**

Q.1 The distance between Radha's home and her school is 3250 m. express this distance into km.

Q.2 While measuring the length of a knitting needle, the reading of the scale at one end is 3.0 cm and at the other end 33.1cm. What is the length of the needle?

Q.3 What is the system used for measurements now-a-days?

Q.4 Name the unit of length, which should be used to express the thickness of a coin.

Q.5 Name the SI unit of length.

Q.14 What type of motion do the following objects have?
i. the galloping of a horse
ii. the needle of sewing machine
iii. child sitting in a moving giant wheel
iv. surface of a drum being played
v. an artificial satellite orbiting the Earth at a constant height

Q.15 Explain any five types of motion.
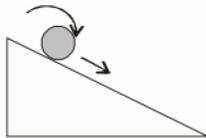
> ➤ **Fill in the Blanks**

Q.16 (i) A kite flying in the sky performance .... motion.

Q.1 The SI unit of length is:
(A) kelvin   (B) metre
(C) ohm   (D) centimeter

Q.2 What is the correct ascending order?
(A) 1cm, 1dam, 1dm, 1m
(B) 1cm, 1dam, 1m, 1dm
(C) 1m, 1dm, 1cm, 1dam
(D) 1cm, 1dm, 1m, 1dam

Q.3 Basic standard unit of time is a
(A) second   (B) hour
(C) minute   (D) milli-second

Q.4 One centimeter is equal to
(A) 10 km.   (B) 0.00001km.
(C) 0.01 km.   (D) 0.001km.

Q.5 1dam is equal to
(A) 10m   (B) 1000 cm
(C) Both (A) and (B) (D) None of these

Q.6 The volume of cube of side 25 cm will be:
(A) 15625cm^3 (B) 625cm^3
(C) 225cm^3 (D) 25cm^3

Q.11 Simple pendulum exhibits
(A) periodic motion
(B) circular motion
(C) non-uniform motion
(D) Rotatory motion

Q.12 The to and fro motion of an object, which moves along the same path is called
(A) rotatory motion
(B) vibratory motion
(C) circular motion
(D) oscillatory motion

Q.13 The blades of a moving fan exhibit
(A) vibratory motion
(B) rotatory motion
(C) oscillatory motion
(D) rectilinear motion

Q.14 Distance between Kolkata and Patna can be measured in
(A) millimetre.   (B) decimetre.
(C) kilometre.   (D) centimetre.

Q.15 An example of rectilinear motion is
(A) a car moving on a curved path
(B) a ballistic between trains and which

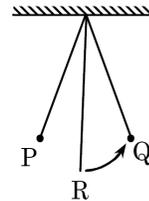**Q.1** The motion exhibited by ball rolling down on inclined plane is

(A) Rotational and circular
(B) Rotational and periodic
(C) Rectilinear and rotational
(D) Uniform motion

Q.2 Match the column-I with column-II and mark the correct option.

Column-I		Column-II	
(a)	300 mm	(i)	3 m
(b)	300 cm	(ii)	30 cm
(c)	300m	(iii)	300000 m
(d)	300 km	(iv)	30000 cm

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

Q.5 A simple pendulum oscillated between point P and Q as shown in figure and its time period is T. If time taken to go from R to Q is t, which of the following relation is correct?

(A) t = T   (B) $t = \dfrac{T}{2}$
(C) $t = \dfrac{T}{4}$ (D) $t = \dfrac{T}{8}$

Q.6 A circular disk with a stick moving about its axis through the centre is shown in the figure.

Answer key is provided at the end of the exercise sheets.

ANSWER KEY

EXERCISE - 1

➢ **Fill in the Blanks:**

16. (i).   translatory and rotational

(ii). measurement

(iii). oscillatory Motion

(iv). oscillatory Motion

(v). circular motion

➢ **True & False:**

17. (i)   True

(ii). True

(iii). False

(iv) False

(v)   True

➢ **Match the Column:**

18. [(a)→ (v), (b)→ (i), (c)→ (iv), (d)→ (ii), (e) →(iii)]

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	B	D	A	B	C	A	A	B	B	A	A	B	B	C	C
Ques.	16	17	18	19	20										
Ans.	A	B	A	B	B										

EXERCISE - 3

Ques.	1	2	3	4	5	6	7	8	9
Ans.	C	B	B	B	C	A	A	C	D

Chapter 1

MOTION & MEASUREMENT OF DISTANCES

Chapter Outline

- ✦ **Physical quantity**
- ✦ **Measurement of length**
- ✦ **Measurement of area**
- ✦ **Measurement of volume**
- ✦ **Rest and motion**
- ✦ **Types of motion**
- ✦ **Distance**
- ✦ **Uniform and non-uniform motion**

MIND MAP

MOTION AND MEASUREMENT OF DISTANCES

- Measurement
  - Measurement of length
    - Measurement of Straight Line
    - Measurement Using Divider
    - Measurement of Curved Line
  - Measurement of Area
  - Measurement of Volume
- Motion
  - Rest
  - Motion
    - Linear
    - Periodic
      - Circular
      - Oscillatory
- Distance

MOTION AND MEASUREMENT OF DISTANCES

Introduction

Long ago people did not have any means of transport. They used to move only on foot and carry goods either on their back or using animals. For transport along water routes, boats were used from ancient times. To begin with, boats were simple logs of wood in which a hollow cavity could be made. Later, people learnt to put together different pieces of wood and give shapes to the boats. These shapes imitated the shapes of the animals living in water.

Invention of the wheel made a great change in modes of transport. The design of the wheel was improved over thousands of years. Animals were used to pull vehicles that moved on wheels. Until the beginning of the 19th century, people still depended on animal power to transport them from place to place. The invention of steam engine introduced a new source of power. Railroads were made for steam engine driven carriages and wagons.

Later came automobiles. Motorised boats and ships were used as means of transport on water. The early years of 1900 saw the development of aeroplanes. These were later improved to carry passengers and goods. Electric trains, monorail, supersonic aeroplanes and spacecraft are some of the 20th century contributions. It is often important to know how far a place is, so that we can have an idea how we are going to reach that place -walk, take a bus or a train, a ship, an aeroplane or even a spacecraft!

In daily life, the importance of measurement is well known. When we have to bring fruits, vegetables etc. from the market then the seller measures their quantity using beam balance and we have to pay him accordingly. The tailor needs exact measurement of our body to stitch our dresses. We always have an approximation that how much time will be spent on a journey for our convenience. Thus we can conclude that measurement is an essential part of everyday life.

◈ **Measurement**

It is the determination of the dimensions, quantity or capacity of an item.

◈ **Physical quantity**

Any quantity in physics that can be measured (e.g. length, mass and time) is called physical quantity. To measure physical quantities such as mass, time and length, we use units such as kilogram, second, and metre.

◈ **Unit**

A physical quantity (Such as length) has to be measured with respect to some known quantity. This known quantity is called a unit.

History of Length Measurement

In ancient times, different body parts were used to measure length. The distance between the tip of the thumb and the tip of the little finger of a fully stretched hand was termed a hand span . The distance between the tip of the middle finger and the elbow was termed a cubit . Foot, stride, fathom, and yard are some more units based on the length of body parts. However, it was soon realized that these units were not very reliable, as the length of body parts can vary from person to person.

We need standard units of length and other physical quantities to obtain the same value for a measurement. However, people across the world might adopt different standard units. For example, gram and pound are units of mass used by people of different countries. To solve this problem, we need a set of standard units which is acceptable throughout the world.

Standard System of Measurement

Standard units are those that have a fixed quantity and, therefore, do not vary from person to person and place to place. For example, the metric system, created by the French in 1790, is a standard set of units.

Adopting standard units of measurement solves only half the problem. People in different countries may be using different sets of standard units for measurement. For example, gram and pound set of units. The adoption of SI units has made it easier for scientists of different countries to communicate their results to one another.

The SI system of units was adopted in 1960 by the General Conference of Weights and Measures. SI is the short form of system of International Units (in French). The SI unit of length is the metre. Other common standard units of length are inch, millimetre, centimetre, kilometre, and so on.

SI unit of mass and time are kilogram and second respectively.

Depending on the size of the object we wish to measure, we have to choose an appropriate unit. For example, we use metres to measure the length of a piece of cloth, kilometres to measure the distance form one place to another, millimetres to measure the thickness of the hair, and so on. Units of length can be interconvert by multiplying or dividing their values by 10, 100, 1000, and so on.

A commonly used unit for measuring large distances is the kilometre (represented as km). Commonly used units for measuring small distances are the centimetre (cm) and millimetre (mm).

1000 m = 1 km

100 cm = 1m 1000 mm = 1 m

For measuring lengths smaller than the metre, its sub-multiples are used. For lengths greater than the metre, its multiples are used, those are given in following table:-

Name of the unit	Symbol	Relation in terms of metre
millimetre	mm	1/1000
centimetre	cm	1/100
decimetre	dm	1/10
metre	m	1
decametre	dam	10
hectametre	hm	100
kilometre	km	1000

Relation between some units:

10 mm =1 cm, 10 cm = 1 dm, 10 dm = 1 m;

10m = 1 dam, 10 dam = 1 hm, 10 hm = 1 km
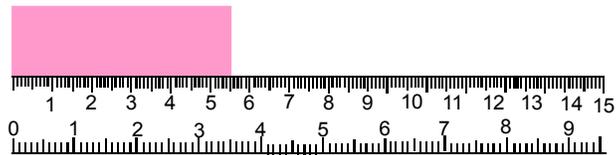
Measurement of Length

The length of an object is the distance between its ends. It can be measured using a ruler, a measuring tape, a metre rod, and so on whichever is convenient for the required purpose.
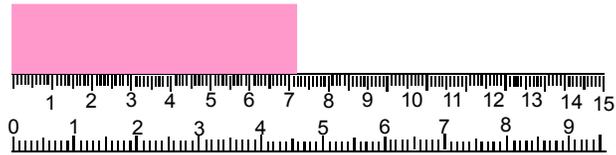
A ruler

While measuring length using a ruler, we have to take the following precautions.

(i) Care should be taken to keep the ruler along the length of the object

The ruler should be kept along the length of the object

(ii) If the edge of the ruler is worn out or broken, the measurement should be stared from any other mark that is fully clear.

Measurement should only be started from a mark that is fully clear

(iii) Eyes should be exactly above of the point where the measurement is to be taken.

◈ **Activity**

To measure the height of a person: Materials required: Measuring tape, a thick book, and a pencil. Procedure: To measure the height of your friend, make him/her stand absolutely straight with his/her back against a wall. Place a thick rigid book on his/her head and make a mark on the wall where the underside of the book touches the wall. Measure the length from this mark to the floor with the help of the measuring tape. This gives the height of your friend make sure he/she is not wearing shoes to gain some extra inches.

COMPETITIVE LEVEL

Using a Divider to Measure Length

A divider is used to measure the distance between two points. The correct use of a divider can give a fairly accurate measurement. The divider is placed such that its two points are at the two ends of the length to be measured. Then, without disturbing the divider, the distance between the two points is measured with a ruler.
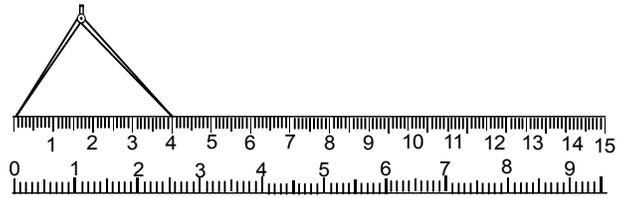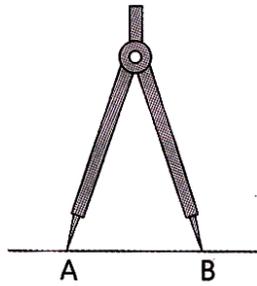
Measuring the length of a Curved Line

We can measure the length of a curved line using a string. The string is placed along the curved line and its ends are marked on the string the length of the string between the marked points is measured with a ruler.
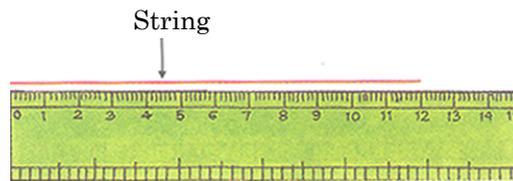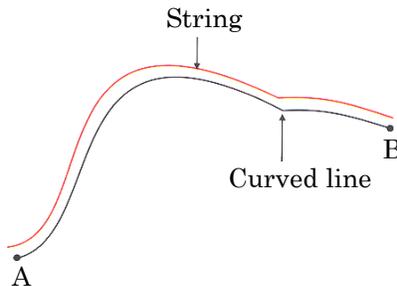
Measurement of Area

The amount of surface covered by the object is called its area. The measurement of area counts two dimensions.

The SI unit of area is square metre, represented as m^2. This is the area covered by a square whose length and breadth are 1 m each.

The area of regular surfaces (squares, rectangles etc.) can be measured by using the following formula:

area of a square = length × length

area of a rectangle = length × breadth

Ex.1 How many cm^2 are equal to 1 m^2 area?

Sol. 1 cm^2 = 1 cm × 1 cm

= (1/100) m × (1/100) m

= (1/10000) m^2 = 10^{-4} m^2

Measurement of Volume

The amount of space occupied by an object is its volume. The SI unit of volume is the cubic metre represented as m^3.

The litre (represented as l) is an important unit of volume used in the everyday life.

1 litre = 1000 ml

$1 m^3$ = 1000 litres

The litre is also known as 1000 cm^3.

Since, 1 litre = (1/1000) m^3.

$$1\,litre = \frac{(100\,cm)^3}{1000} = 1000\,cm^3$$

The volume of a liquid is more often expressed in millilitres.

The volume of a solid that has a regular shape can be calculated using a mathematical formula. The formula for determining the volumes of some regular solids are:

Volume of a cube = l^3

where l is the length of the side of the cube.

Volume of a cuboid = $I \times b \times h$

where I is the length, b is the breadth, and h is the height of the cuboid.

e.g.: Volume of a cube of side 1 m

  = 1m × 1m × 1m

  = 1 × 1 × 1 m^3

  = 1 m^3

  Volume of a cube of side 1 cm

  = 1 cm × 1 cm × 1 cm

  = 1 × 1 × 1 cm^3

  = 1 cm^3

  Volume of a cube with sides 10 cm

  = 10 × 10 × 10 cm^3 = 1000 cm^3

  Volume of a cube with sides 1 dm

  = 1 × 1 × 1 dm^3 = 1 dm^3

  1000 cm^3 = 1 dm^3 = 1

  1 litre = 1000 ml

  = 1000 ml

  or 1 cm^3 = 1 ml

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

where r is the radius and h is the height of the cylinder.

In the laboratory the volume of a liquid needs to be measured accurately. For this purpose, a measuring cylinder is used. A measuring cylinder is a cylindrical glass container that has markings/graduations on it. Measuring cylinders are available in different sizes, ranging from 10 ml to 1000 ml (i.e., 10 cm^3 to 1000 cm^3).

Note: *When we purchase a flour bag of 5kgs, then kilogram is the unit, and 5 is the numerical value.*

SI PREFIXES: In physics we deal from very small (*micro*) to very large (*macro*) magnitudes, as one side we talk about the atom while on the other side of universe, *e.g.*, the mass of an electron is 9.1×10^{-31} *kg* while that of the sun is 2×10^{30} *kg*. To express such large or small magnitudes we use the following prefixes:

Example:

(i) 1 μm = 1 micrometre = 10^{-6} m

(ii) 1 mm = 1 milimetre = 10^{-3} m

(iii) 1 nm = 1 nanometre = 10^{-9} m

(iv) 1 km = 1 kilometre = 10^3 m

Concept of Rest and Motion

(a) Rest: An object is said to be at rest if it does not change its position with respect to its surroundings with the passage of time.

(b) Motion: A body is said to be in motion if its position changes continuously with respect to the surroundings (or with respect to an observer) with the passage of time.

Types of Motion

◈ **According to dimension**

(i) 1-D motion: If only one of the three coordinates specifying the position of object changes with respect to time then the motion of object is called one dimensional (1-D). In such a case the object moves along a straight line and the motion therefore is also known as rectilinear or linear motion.

e.g.:

(a) Motion of train along straight railway track.

(b) An object falling freely under gravity.

(ii) 2-D motion: If two of the three coordinates specifying the position of object changes with respect to time, then the motion of object is called two dimensional (2-D). In such a motion the object moves in a plane.

e.g.:

(a) Motion of queen on carrom board

(b) An insect crawling on the floor of the room.

(iii) 3-D motion: If all the three coordinates specifying the position of object changes with respect to time, then the motion of object is called three dimensional (3-D). In such a motion the object moves in a space.

e.g.:

(a) A bird flying in the sky (also kite).

(b) Random motion of gas molecules.

◈ **Types of motion according to path**

Motion of any body in this universe is a combination of four basic types of motion. They are -

(a) Linear motion (or translatory motion): The straight line motion is called linear motion.

Example: Motion of train between two station, motion of a plane from one city to another, the motion of a moving car, a person running, a stone being dropped.

(b) Circular motion: The motion of a body moving around a fixed point in a circular path is known as circular Motion.

Motion of bucket in circular path

Motion of the tip of the needle

(c) Rotatory motion: Motion of a body around a fix axis is called rotational motion.

Example: rotation of tyres of a car, rotation of blades of a fan, rotation of earth about its axis, spinning of a top etc.

(d) Rolling Motion: Combined motion having both linear and rotatory motion is known as rolling motion.

Example: A ball is rolling on the ground –rotating as well as moving forward on the ground. Thus, the ball undergoes a rectilinear motion as well as rotational motion.

(e) Oscillatory motion: The to and fro periodic motion of a body around a fix point is called oscillatory motion.

Example: Oscillation of swing, oscillation of simple pendulum fluttering of leaves, vibration of string of a musical instrument etc.

The motion of a simple pendulum


The motion of a swing

> ***Note:*** *When a body vibrates, it does not oscillate as a whole but a part of it oscillates about its mean position.*

(f) Periodic motion: when object repeats its path after a certain interval of time.

Example: Motion of pendulum, motion of second hand, hour hand etc.

> ***Note:*** *All oscillatory motions are the examples periodic motion but all periodic motion are not oscillatory motion.*

Distance: Distance is the actual path travelled by a body in a given time. Consider a body travelling from A to B along any path between A and B. The actual length of the path that a body travels between A and B is known as the distance. Here if the body goes from A to B via C, the distance travel will be ACB. The distance travelled will be different for different paths between A and B.
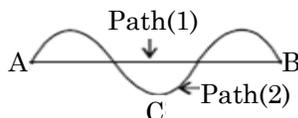
COMPETITIVE LEVEL

Displacement: It is the shortest distance between the initial and final position of the particle. It is a vector quantity. Its S.I. unit is metre (m).

e.g.: Consider a body moving from a point A to a point B along the path shown in figure. Then total length path covered is called distance (path-1). While the length of straight line AB in the direction from A to B is called displacement (path-2).
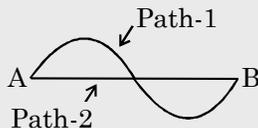
> ***Note:*** *If a body travels in such a way that it comes back to its starting position, then the displacement is zero. However, distance travelled is never zero in case of moving body.*

SPEED: The distance travelled by a body in unit time is called

its speed.

Therefore, speed = Distance/Time

Or s = $\dfrac{d}{t}$ .S.I. unit of speed or average speed is m/s.

(a) Uniform Motion: 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 m/s, will cover equal distances of 10 metre, in every second, so its motion will be uniform.

(b) Non-Uniform Motion: 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 building, we will find that it covers unequal distances in equal intervals of time. It covers:

4.9 metre in the 1st second,

14.7 metre in the 2nd second,

24.5 metre in the 3rd second, and so on.

Ex.2 A train covers a distance of 600 km between two towns in 12 hours. What is the speed of the train?

Sol. Speed = $\dfrac{\text{Distance}}{\text{Time}} = \dfrac{600}{12} = 50$ km/h

Ex.3 A bus leaves Guwahati at 7 PM and reaches shillong at 10 PM. The speed of the bus is 35 km/h. What is the distance between Guwahati and shillong?

Sol. Distance = Speed × Time = 35 × 3 = 105 km   (Time = 10 – 7 = 3 hour)

Ex.4 How much time a cyclist will take to cover distance of 400 m, while moving with 20 kmph?

Sol. Time = $\dfrac{\text{Distance}}{\text{Speed}} = \dfrac{400}{1000 \times 20} = 0.02$ Hrs

Velocity: It is the rate of change of displacement.

Therefore, velocity = $\dfrac{\text{displacement}}{\text{time}}$ or it is the distance travelled in unit time in a given direction.

velocity = $\dfrac{\text{distance travelled in given direction}}{\text{time taken}}$

S.I. unit of velocity is m/s. It is a vector quantity.

Uniform Velocity (Constant Velocity): If a body covers equal distances in equal intervals of time in a given direction then it is said to be moving with constant velocity.

◈ **Non-Uniform Velocity (Variable Velocity)**

When a body does not cover equal distances in equal intervals of time, in a given direction (in this case speed is not constant), then it is known as non uniform velocity. If speed is constant then also body can have a non-uniform velocity.

e.g.: Motion of a car on a circular road with constant speed.

◈ **Average Velocity**

If initial velocity of body is u and final velocity is v then the arithmetic mean of velocity is called average velocity which is given as, $v_{av} = . \dfrac{u + v}{2}$

Average velocity = $\dfrac{\text{Total displacement}}{\text{Total time}}$

Ex.5 A body starts from A and moves according to given figure. Time four each interval is:

$t_{AB} = 2s$, $t_{BC} = 3s$, $t_{CB} = 2s$, $t_{BA} = 3s$, $t_{AD} = 4s$
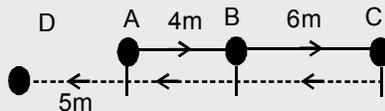
The distance, displacement, speed and velocity are as follows for different path.

Sol.

Path	Distance	Displacement	Speed	Velocity
AB	4m	4m	4/2 m/s	4/2 m/s
ABC	10m	10m	10/5 m/s	10/5 m/s
ABCB	16m	4m	16/7 m/s	4/7 m/s
ABCA	20m	0m	20/10 m/s	0/10 m/s
ABCAD	25m	−5m	25/14 m/s	−5/14 m/s

Acceleration: It is defined as the rate of change of velocity.

(i) It is a vector quantity.

(ii) Its direction is same as that of change in velocity and not of the velocity (That is why acceleration in circular motion is towards the centre)

(iii) There are three ways possible in which change in velocity may occur

When only direction	When only magnitude changes	When both the direction changes and magnitude change
To change the direction net acceleration or net force should be perpendicular to direction of velocity **Example:** Uniform circular motion	In this case, net force or net acceleration should be parallel or anti-parallel to the direction of velocity. (straight line motion) **Example:** When ball is thrown up under gravity	In this case, net force or net acceleration has two components. One component is parallel or anti-parallel to velocity and another one is perpendicular to velocity **Example:** Projectile motion

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$a = \frac{v - u}{t} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

Ex.6 A car is moving at a speed of 50 km/h after two seconds it is moving at 60 km/h. Calculate the acceleration of the car.

Sol. Here u = 50 km/h = $50 \times \frac{5}{18}$ m/s = $\frac{250}{18}$ m/s

and v = 60 km/h = $60 \times \frac{5}{18} = \frac{300}{18}$ m/s

Since a = $\frac{v - u}{t}$

$$= \frac{\dfrac{300}{18} - \dfrac{250}{18}}{2} = \frac{\dfrac{50}{18}}{2} = \frac{50}{36} = 1.39 \text{ m/s}^2$$

Type of Acceleration

◈ **Positive acceleration**

If the velocity of an object increases with respect to time in the same direction, the object has a positive acceleration.

◈ **Negative acceleration (retardation)**

If the velocity of a body decreases with respect to time in the same direction, the body has a negative acceleration or it is said to be retarding.

e.g.: A train slows down, then its acceleration will be negative.

According to the variation pattern of acceleration, motion can be classified as:

EXERCISE-1

➤ Very Short Answer Type Questions

Q.1 The distance between Radha's home and her school is 3250 m. express this distance into km.

Q.2 While measuring the length of a knitting needle, the reading of the scale at one end is 3.0 cm and at the other end 33.1cm. What is the length of the needle?

Q.3 What is the system used for measurements now-a-days?

Q.4 Name the unit of length, which should be used to express the thickness of a coin.

Q.5 Name the SI unit of length.

➤ Short Answer Type Questions

Q.6 How people travelled from one place to another in earlier times before the discovery of wheel?

Q.7 What is the need of measurement?

Q.8 Give two examples each of modes of transport used on land, water and air.

Q.9 Arrange the following lengths in their increasing magnitude.
1 m, 1 centimeter, 1 kilometer, 1 milimeter

Q.10 The height of a person is 1.65 m. express it into cm and mm.

➤ Long Answer Type Questions

Q.11 Write the unit for measuring the following:
i. Distance between Noida and Gurugram
ii. Thickness of compact disc (CD)
iii. Length of a sharpener
iv. Length of a tie
v. Length of a sari

Q.12 How will you measure the length of any curved line?

Q.13 Explain different types of motion. Write few example of each.

Q.14 What type of motion do the following objects have?
i. the galloping of a horse
ii. the needle of sewing machine
iii. child sitting in a moving giant wheel
iv. surface of a drum being played
v. an artificial satellite orbiting the Earth at a constant height

Q.15 Explain any five types of motion.

➤ Fill in the Blanks

Q.16 (i) A kite flying in the sky performance ………….…….. motion.

(ii) The determination of the size or magnitude of something is called …………..

(iii) Motion of a child on a swing is …….…...

(iv) Motion of the needle of a sewing machine is… ……... .

(v) Motion of wheel of a bicycle is………....

➤ True or False

Q.17 (i) Rectilinear motion mean an object travel in the straight the path.

(ii) Km/hr, m/s, km/min, m/min, m/hr are the units of speed.

(iii) We can measure length of curve path by beam balance.

(iv) Amount of surface covered by the object is called its area. The measurement of area counts three dimensions.

(v) We can find volume of cylinder by $\pi r^2 h$.
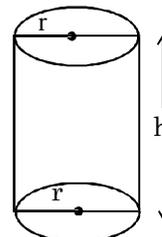
Q.1 The SI unit of length is:
(A) kelvin   (B) metre
(C) ohm   (D) centimeter

Q.2 What is the correct ascending order?
(A) 1cm, 1dam, 1dm, 1m
(B) 1cm, 1dam, 1m, 1dm
(C) 1m, 1dm, 1cm, 1dam
(D) 1cm, 1dm, 1m, 1dam

Q.3 Basic standard unit of time is a
(A) second   (B) hour
(C) minute   (D) milli-second

Q.4 One centimeter is equal to
(A) 10 km.   (B) 0.00001km.
(C) 0.01 km.   (D) 0.001km.

Q.5 1dam is equal to
(A) 10m   (B) 1000 cm
(C) Both (A) and (B) (D) None of these

Q.6 The volume of cube of side 25 cm will be:
(A) $15625cm^3$ (B) $625cm^3$
(C) $225cm^3$ (D) $25cm^3$

Q.7 The area of rectangle is given as the product of length and:
(A) breadth   (B) side
(C) volume   (D) none of these

Q.8 Foot, stride, fathom are the units of:
(A) Time   (B) Length
(C) Mass   (D) Weight

Q.9 Length of curved line is measured by using:
(A) Scale
(B) String
(C) Ruler
(D) Can't be measured

Q.10 How many cm^3 are equal to ------------ m^3
(A) 1/1000000   (B) 1/10000
(C) 1/1000   (D) 1/100

Q.11 Simple pendulum exhibits
(A) periodic motion
(B) circular motion
(C) non-uniform motion
(D) Rotatory motion

Q.12 The to and fro motion of an object, which moves along the same path is called
(A) rotatory motion
(B) vibratory motion
(C) circular motion
(D) oscillatory motion

Q.13 The blades of a moving fan exhibit
(A) vibratory motion
(B) rotatory motion
(C) oscillatory motion
(D) rectilinear motion

Q.14 Distance between Kolkata and Patna can be measured in
(A) millimetre.   (B) decimetre.
(C) kilometre.   (D) centimetre.

Q.15 An example of rectilinear motion is
(A) a car moving on a curved path
(B) a ball tied to a string and whirled around.
(C) a striker moving across a carrom board
(D) the child moving on a swing.

Q.16 Motion of the stone dropped under gravity:
(A) Linear   (B) Circular
(C) Rotational   (D) Vibrational

Q.17 Motion of the point on blade of a moving fan:
(A) Linear   (B) Circular
(C) Oscillatory   (D) Vibrational

Q.18 The motion which repeats itself after a regular interval of time:
(A) Periodic   (B) Non Periodic
(C) Rotational   (D) Vibrational

Q.1 The motion exhibited by ball rolling down on inclined plane is
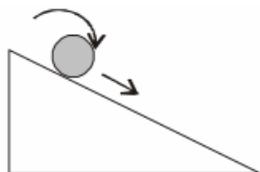
(A) Rotational and circular
(B) Rotational and periodic
(C) Rectilinear and rotational
(D) Uniform motion

Q.2 Match the column-I with column-II and mark the correct option.

Column-I		Column-II	
(a)	300 mm	(i)	3 m
(b)	300 cm	(ii)	30 cm
(c)	300m	(iii)	300000 m
(d)	300 km	(iv)	30000 cm

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

Q.3 Consider the motion of the tip of the minute hand of a clock. In one hour
A. The distance covered is zero
B. The displacement is zero
C. The average speed is zero
D. None of these

Q.4 Match the following using the most convenient unit used to express the area of various sizes as given below.

Column-A		Column-B	
(a)	One rupee coin	(i)	m²
(b)	Cricket field	(ii)	Hectare
(c)	Paddy field	(iii)	Km²
(d)	Country	(iv)	cm²

A. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

B. (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

C. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

D. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

Q.5 A simple pendulum oscillated between point P and Q as shown in figure and its time period is T. If time taken to go from R to Q is t, which of the following relation is correct?
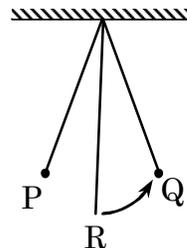
(A) t = T $\qquad$ (B) t = $\dfrac{T}{2}$

(C) t = $\dfrac{T}{4}$ $\qquad$ (D) t = $\dfrac{T}{8}$

Q.6 A circular disk with a stick moving about its axis through the centre is shown in the figure.
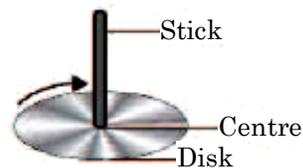
Which of the following type of motion is described by the stick?
(A) Rotatory motion
(B) Periodic motion
(C) Rectilinear motion
(D) Circular motion

Q.7 Which of the following conversions is/are incorrect?
(i) 10 decades = 1 century
(ii) 100 centuries = 1 millennium
(iii) 100 inches = 2.54 metres
(iv) 100 millimetres = 10 centimetres
(A) (ii) only $\qquad$ (B) (iv) only
(C) (i) and (ii) only $\qquad$ (D) (iii) and (iv) only

Q.8 The passengers sitting in a flying aeroplane are in _____ with respect to clouds, but are in _____ with respect to the interior of the aeroplane.
(A) Rest, motion $\qquad$ (B) Rest, rest
(C) Motion, rest $\qquad$ (D) Motion, motion

ANSWER KEY

EXERCISE - 1

➢ **Fill in the Blanks:**

   16. (i).   translatory and rotational

       (ii). measurement

       (iii). oscillatory Motion

       (iv). oscillatory Motion

       (v). circular motion

➢ **True & False:**

   17. (i)   True

       (ii). True

       (iii). False

       (iv) False

       (v) True

➢ **Match the Column:**

   18. [(a)→ (v), (b)→ (i), (c)→ (iv), (d)→ (ii), (e) →(iii)]

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	B	D	A	B	C	A	A	B	B	A	A	B	B	C	C

Ques.	16	17	18	19	20
Ans.	A	B	A	B	B

EXERCISE - 3

Ques.	1	2	3	4	5	6	7	8	9
Ans.	C	B	B	B	C	A	A	C	D

SEPARATION OF SUBSTANCES

Chapter Outline

✧ **Introduction to Separation**
✧ **Components of a Mixture**
✧ **Need for Separation**
✧ **Methods of Separation**
- ◆ **Separation of solid from solids**
- ◆ **Separation of insoluble solids from liquids**
- ◆ **Separation of soluble solids from liquids**
- ◆ **Separation of liquids**
✧ **Separation using more than one method**
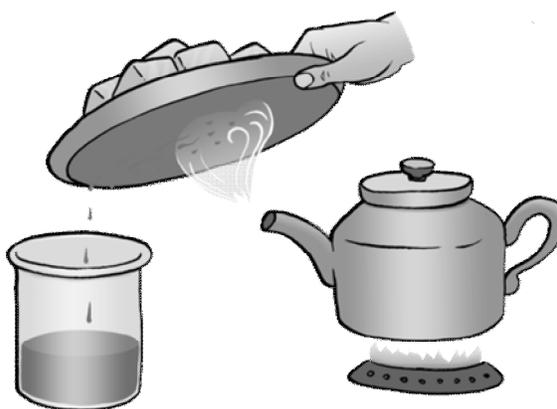
Change of State

Handpicking

Sieving

MIND MAP

SEPARATION OF SUBSTANCES

- Need for separation of substances
  - To remove undesirable and harmful substances
  - To separate two different but useful components

- Method of separation
  - Separation of solids from other solids
    - Handpicking
    - Sieving
    - Threshing
    - Winnowing
  - Separation of insoluble solids from liquids
    - Sedimentation and Decantation
    - Filtration
  - Separation of soluble solids from liquids
    - Evaporation
    - Condensation
  - Separation using more than one method

SEPARATION OF SUBSTANCES

Introduction

Many useful compounds are being mixture of various impurities; it means they need to be separated. They are useful to us only if impurities are separated out from them. That's why we need to separate the substances.

There are many instances when we notice a substance being separated from a mixture of materials. Tea leaves are separated from the liquid with a strainer, while preparing tea.

Grain is separated from stalks, while harvesting. Milk or curd is churned to separate the butter. Perhaps you might have eaten salted daliya or poha. If you found that it had chilies in it, you may have carefully taken them out before eating.

Suppose you are given a basket containing mangoes and guavas and asked to separate them. What would you do? Pick out one kind and place them in a separated container, right?

Seems easy, but what if the materials we want to separate are much smaller than mango or guava? Imagine you are given a glass of sand with salt mixed in it. It is impossible to even think of separating salt from this mixture by picking out grains of sand by hand.

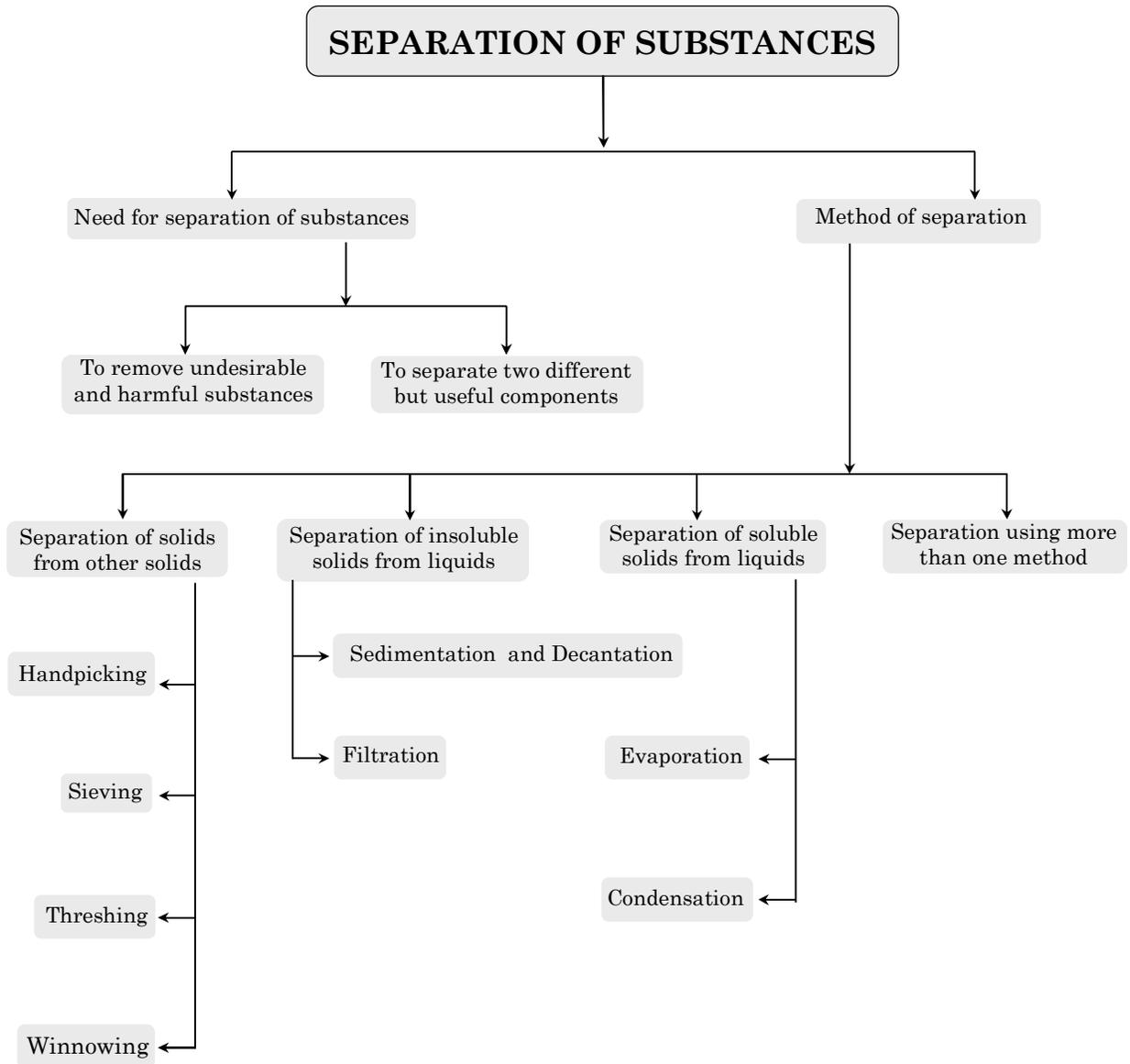| S.No.	Separation process	Purpose of doing separation	What do we do with the separated components ?
1	Separate stones from rice	To remove non-useful components.	We throw away the solid component.
2	Churning milk to obtain butter	To separate two different, but useful components.	We use both the components.
3	Separate tea leaves	To remove impurities or harmful components.	We throw away the impurities.

COMPETITIVE LEVEL

Components of a Mixture

The substances which make a mixture are called components or the constituents of the mixture. In a mixture the components retain their properties.

- **Homogeneous mixture** has a uniform composition throughout and the components cannot be easily differentiated or seen by eyes e.g., salt solution.

- **Heterogeneous mixture** does not have a uniform composition and the components can be seen by eyes and differentiated easily e.g., sand and salt, mud and water.

Need for Separation of Substances from a Mixture

1. **To remove undesirable and harmful substances**

   (i) The milk you drink is not pure it is mixed with substances like pond water containing bacteria.

   (ii) Wheat and rice grains are stored for a long period. The grains may develop insects, larvae and eggs.

   (iii) Wheat is not cleaned after collecting it from the field. It may contain stones and seeds of weeds.

   (iv) The water supplied to your homes is not cleaned and treated by the municipal authorities.

   In all these cases, it is necessary to remove undesirable and harmful substances before use.

2. **To obtain useful components of a mixture**

   Sometimes we separate useful components of a mixture if we need to use them separately.

   For example: preparation of butter from curd.

   Many useful components of crude oil, like petrol, diesel and kerosene are separated and then used separately.
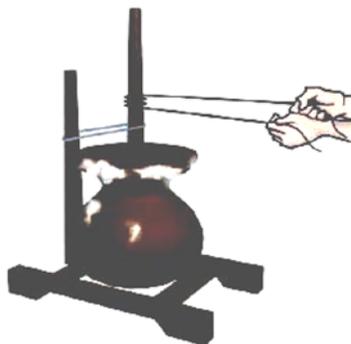
Butter Preparation from Curd

> *Note:* **Mixture:** *Mixture consists of two or more types of particles.*
>
> **Pure substances:** *Pure substances consist of particles of only one kind.*

Methods of Separation

Separation of Solids from Other Solids

◈ **Handpicking**

Handpicking is the practice of separating undesirable solid substances or impurities from useful solids by hand.

Handpicking method is used in the three situations, when:

(i) The quantity of the mixture is not very large.

(ii) The undesirable substance differ from the useful ones in shape, size or colour.

(iii) The undesirable substances are present in small quantities.

Handpicking method of

◈ **Activity**

Aim: To separate undesirable solids from useful ones.

Procedure: Ask your mother to give you a small quantity of grains (wheat or rice). Spread the grains on a white sheet of paper. See if there are other substances also present along with the grains. Note down these substances.

These may be small stones, husk and other grains.

Now separate these undesirable particles by your hand.

Conclusion: Handpicking is a convenient method of separating the undesirable solid substances from other solids.

◈ **Sieving**

Sieving is a method used to separate the components of a mixture which are of different sizes. The fine components pass through the sieve, and the bigger components remains on the sieve.

Sieving Method of Separation

◈ **Activity**

Aim: To separate components of mixture by sieving.

Procedure:

(i) Take wheat flour and mix it with chalk powder or common salt. Pass this mixture through sieve. Note down what happens.

(ii) Now, mix wheat flour with stones or pulses. Pass the mixture through the sieve. Note down what happens in this case.

Conclusion: In the first case, the chalk powder or common salt cannot be separated from the wheat flour by sieving. In the second case, they are separated.

Note: *Sieve is a piece of mesh held in a frame.*

◈ **Threshing**

Threshing is the process of separating grains from the stalks. Threshing can be done in the following three ways:

(i) by beating the stalks with sticks on the ground,

(ii) by allowing animals like bullocks to trample the stalks, and

(iii) by using machines.

**Threshing Method
of Separation**

◈ **Winnowing**

Winnowing is a method used to separate lighter components of a mixture from the heavier ones by wind or by blowing air.

It is used by farmers to separate husk (lighter particles) from grains (heavy particles). While winnowing, the husk particles are carried away by wind. The heavier grains fall near the place of winnowing. Husk is a useful component. It is used as fodder (food for animals).

**Winnowing method
of Separation**

◈ **Activity**

Aim: To separate pieces of paper from cardboard pieces by winnowing.

Procedure: Take a sheet of newspaper and a cardboard of the same dimensions. Cut these into very small pieces of almost equal size. Now keep them in a tray and mix them.

Switch on the fan and raise the tray to the height of your shoulder. Now tilt the tray and allow the pieces to fall down.

Conclusion : We will observe that the pieces of cardboard will fall closer to you than those of paper.

Note: The dry outer covering of grains is called husk. It is lighter than grains.

◈ **Magnetic Separation**

Magnetic impurities like iron can be separated from other components by using a magnet. Magnetic impurities are attracted towards the magnet leaving behind non-magnetic components.

Take a mixture of sand and awl pins in a bowl and run a magnet over it.
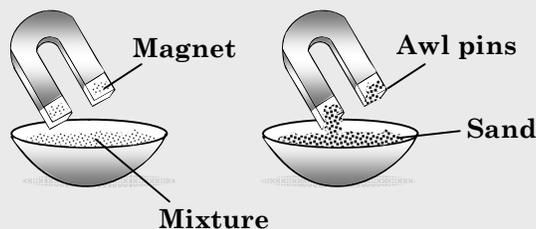
Observations: When the magnet is run over the mixture, awl pins get attracted to it and sand is left behind in the bowl.

Separation of Insoluble Solids from Liquids

◈ **Sedimentation and Decantation**

Sedimentation is a process in which heavier particles of an insoluble solid in a liquid settles down. The solid particles called sediments settle down during sedimentation forming a layer.

Decantation is the process of pouring out the liquid or water (which contains the dust or soil particles) without disturbing the sediments.

**Sedimentation and
Decantation Process**

◈ **Activity**

Aim: To separate sand and water from a mixture

Procedure: To separate a mixture of sand and water, the technique of sedimentation and decantation can be used.

Take a mixture of sand and water in a beaker. Leave the beaker undisturbed for some time. You will find that the sand settles down (sedimentation) while the water forms the upper layer. It can be poured out into another beaker (decantation) and separated.

Conclusion: Sand particles are separated from water by sedimentation and decantation.

◈ **Centrifugation**

This is the process in which lighter components are separated from heavier components by churning. It is done by rotating the liquid on a high speed by hands or with the help of machines like mixers.

Examples: Centrifugation is used for, separating blood cells from plasma cells, removing fat from milk to produce skimmed milk, separating water from clothes by spin-drying in washing machines, separating solid components of blood and urine in forensic and research lab.

Take milk in a pot and churn it with the help of a wooden spoon or ladle used for churning. Keep rotating the ladle at a high speed.

Observations: After rotating the ladle for some time, cream being lighter collects towards the centre. The milk being heavier settles down below the cream layer.
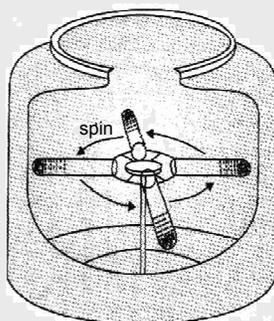
◈ **Filtration**

The process in which two substances (an insoluble solid and a liquid) are separated by using a filter is called filtration. It is commonly used method in our homes.

- ◆ **Some examples of filtration are as follows**:

  (i) Removing pulp from fresh fruit juice.

  (ii) Preparing cottage cheese (paneer) at home.

  (iii) Cleaning muddy water.

  (iv) Separation of tea leaves from the tea.

  During filtration, the insoluble solid particles are retained in the filter, and the liquid passes through it. However, the particles of the insoluble solid should be bigger than the holes in the filter so that these are retained in the filter.

◈ **Activity**

Aim: To separate mud and water from muddy water by filtration.

Procedure:

(i) Take a circular piece of filter paper and fold it twice in the form of a cone.

(ii) Place the cone-shaped filter paper inside a funnel and keep a beaker below the funnel.

(iii) Pour the muddy water into the filter paper cone using a glass rod.

(iv) After some time we find that clean water collects in the beaker, while the mud particles remains inside the cone.

Filtration

Conclusion: We observe that filtration is a better method of separating mud and water.

COMPETITIVE LEVEL

Sometimes alum is added to make the suspended particles heavier to settle down. This process is called loading.

In muddy water, the fine mud and dust particle are suspended which do not settle down easily. Alum which is soluble in water is used to load the particles of clay. They become heavier and settle down.

These particles can be easily removed by filtration.

Separation of Soluble Solids from Liquids

◈ **Evaporation**

It is the process of converting a liquid into its vapour at any temperature below its boiling point.

◆ **Principle:** This method is used for those mixtures in which the solid component is non-volatile and soluble in the liquid component while the liquid component can easily be evaporated.

◆ **Process of obtaining a salt:** Salt is obtained from sea water by evaporation. Sea water is allowed to stand in shallow ponds or pits. Water gets heated due to sunlight and slowly turns into vapour. Salt is left behind. It is purified before consumption.

Process for Obtaining a Salt

Activity

Aim: To separate a mixture of water and salt by evaporation:

Procedure: Take a beaker containing some water. Add a teaspoonful of salt in it and dissolve it with a glass rod. Keep the beaker on a stand and light a spirit lamp under it.

Let the mixture boil for some time.

Conclusion: No water is left in the beaker after some time. Only salt is left behind. This activity shows that water has evaporated.

CAREER POINT

◈ **Condensation**

It is the process of conversion of water vapour into its liquid form.

Condensation process

We will notice that water drops are formed under the plate that was used to cover the boiled milk. The water vapour have condensed into its liquid form, the water drops. This explains the process of condensation.

COMPETITIVE LEVEL

◈ **Crystallisation**

This method is used to get crystals of a pure substance from its solution. This method separates out pure crystals from impurities.

Dissolve impure salt in water by heating it. Filter the solution and keep it for some time.

Observations: When the filtered solution is kept undistorted for some time, white crystals of pure salt are separated.

Crystals are small particles of a solid which have a definite shape and geometry e.g., sugar crystals, alum crystals, etc.

Separation of Liquids

- Liquids may be miscible or immiscible with each other. If two liquids mix with each other and they cannot be seen separately, they are called miscible liquids e.g., milk and water.

- If two liquids do not mix and can be seen as separate layers, they are called **immiscible liquids** e.g., oil and water.

- The mixture of two miscible liquids can be separated by **distillation** which is a process of boiling the liquids and condensing the liquid which is vaporized first. **Condensation** is the process by which vapours are converted into liquid on cooling down e.g., on cooling, the steam is converted to water.

- The mixture of two immiscible liquids can be separated by using separating funnel. This method involves the use of the difference in the densities of the two liquid components of a immiscible liquid-liquid mixture.

    e.g.: Separation of the components of chloroform and water mixture.

EXERCISE-1

Q.1 Name the process which is used at our home to remove stone from wheat.

Q.2 Name the process which is used to separate grains from stalks.

Q.3 Name the process which is used to separate mixture of heavier and lighter particles by blowing wind.

Q.4 Name the process in which heavier component in a mixture settle down after adding water into it.

Q.5 Name the process which is used to remove liquid from the mixture of solid paneer and liquid.

➤ **Short Answer Type Questions**

Q.6 What is winnowing? Where is it used?

Q.7 What is sieving? Where is it used?

Q.8 How will you separate sand and water from the mixture?

Q.9 Explain how will you separate the mixture of salt and sand?

Q.10 Which method is better for separating tea leaves from prepared tea? Explain why?

➤ **Long Answer Type Questions**

Q.11 Is it possible to separate sugar mixture with wheat flour? If yes how will you do it?

Q.12 Explain how will you separate the mixture of oil and water?

Q.13 What is difference between –
(i) Threshing and winnowing.

(ii) Sedimentation and decantation.

Q.14 Both Sarika and Mohan were asked to make salt solution.
Sarika was given twenty teaspoons full of salt and a glass of water.
(i) How would they make salt solutions?
(ii) Who would be able to prepare saturated solution?

Q.15 Arpan was felling thirsty but there was only a pot of water at home which was muddy and unfit for drinking.
How do you think Arpan would have made this water fit for drinking if the following materials were available to him?

➤ **Fill in the Blanks**

Q.16 (i) Water is separated from sand by ....

(ii) ……………….. is the technique which is used to separate impurities from flour particles.

(iii) ………… is the technique in which mixture of heavier and lighter component is separated by blowing air.

(iv) Impurities settled at the bottom when muddy water was kept overnight in a bucket. The clear water was then poured off from the top. The process of separation used in this example is called ……………

(v) In a salt solution, if we further add salt it remains undissolved, then the solution is called ……………. solution.

➤ **True or False**

Q.17 (i) A mixture of milk and water can be separated by filtration.

(ii) Separation of sugar from tea can be done with filtration.

(iii) Grain and husk can be separated with the process of decantation.

(iv) Process of conversion of water into water vapour is called distillation.

(v) Process of conversion of water vapour into its liquid form is called condensation.

Q.1 Process in which heavier components of a mixture settles down when water is added to it -
(A) decantation   (B) filtration
(C) sedimentation   (D) none of these

Q.2 Iron is separated from the mixture of sulphur and iron by -
(A) winnowing   (B) handpicking
(C) sieving   (D) magnet

Q.3 In summer ponds dries up by the process of -
(A) evaporation   (B) decantation
(C) condensation   (D) sedimentation

Q.4 A mixture of sand and water can be separated by using -
(A) handpicking
(B) sedimentation & decantation
(C) threshing
(D) none of these

Q.5 Impurities present in water can be separated by -
(A) sieving   (B) filtration
(C) condensation   (D) winnowing

Q.6 Salt from sea water can be extracted by -
(A) condensation   (B) filtration
(C) evaporation   (D) sedimentation

Q.7 Mud is separated from muddy water by -
(A) condensation   (B) sedimentation
(C) filtration   (D) (B) & (C) both

Q.8 Mixture of pieces of paper and pieces of cardboard can be separated by -
(A) sieving   (B) filtration
(C) winnowing   (D) decantation

Q.9 The method used for removing pulp from fresh fruit juice is -
(A) sedimentation   (B) decantation
(C) filtration   (D) condensation

Q.10 After preparing tea the tea leaves are separated from tea by -
(A) winnowing   (B) threshing
(C) strainer   (D) evaporation

Q.11 Method which is used to separate the component of a mixture which are of different sizes?
(A) Winnowing   (B) Sieving
(C) Threshing   (D) None of these

Q.12 Method used to separate mixture of oil and water -
(A) sedimentation   (B) filtration
(C) decantation   (D) none of these

Q.13 Mixture of sand and salt in water can be separated by using techniques -
(A) filtration and evaporation
(B) decantation and evaporation
(C) sedimentation and evaporation
(D) none of these

Q.14 Husk from heavier seeds of grain is separated by -
(A) threshing   (B) sieving
(C) winnowing   (D) sedimentation

Q.15 In the salt and water solution the salt is separated by evaporation. The liquid component can be recovered through the process of -
(A) evaporation   (B) filtration
(C) sedimentation   (D) condensation

Q.16 Process by which we separate grains from the stalks -
(A) sieving   (B) winnowing
(C) threshing   (D) decantation

Q.17 Lemon juice is added to milk due to which a mixture of solid paneer and liquid formed. This mixture is separated by technique -
(A) sedimentation   (B) decantation
(C) filtration   (D) condensation

EXERCISE-3

Q.1 Two students of Class VI have performed the following experiment 'Separation of Sugar' by different method as shown below:

[2016-17]
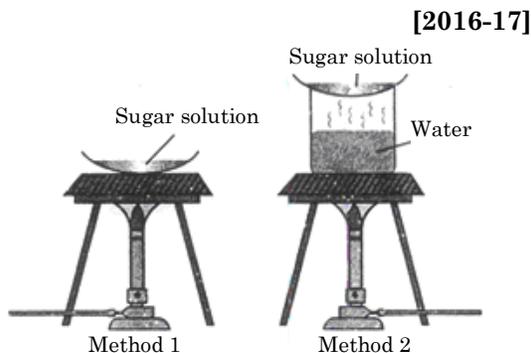
Which of the following statements are correct?

I. Method 1 is faster than method 2.

II. Method 2 leads to the decomposition of sugar to carbon.

III. Method 2 is more appropriate than method 1.

IV. Method 2 is slow but pure sugar is obtained without getting decomposed.

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

(C) III and IV   (D) All of these

Q.2 Four identical towels were hung out to dry under different conditions.
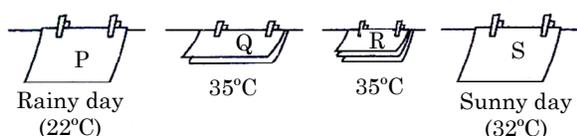
Arrange them in order, beginning with the towel that would take the longest time to dry.

(A) P, Q, R, S   (B) P, R, Q, S

(C) R, P, Q, S   (D) S, Q, R, P

Q.3 Which of the following mixtures cannot be separated by the method of winnowing?

(A) Kidney beans and chickpeas

(B) Potato wafers and biscuits

(C) Rice flakes and corns

(D) Sawdust and sand

Q.4 Study the given flow chart carefully.

[2017-18]
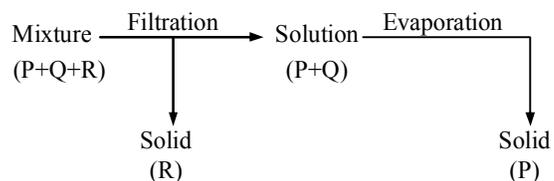
P, Q and R could be respectively

(A) Chalk powder, water and sawdust

(B) Salt, water and sugar

(C) Sugar, water and sawdust

(D) Sawdust, water and sugar

Q.5 Fill in the blank in the given table by choosing an appropriate option.

Type of Mixture	Method of Separation	Example
A heterogeneous solid- liquid mixture in which solid is lighter than liquid	Filtration	P
Q	Sieving	Bran and flour
A heterogeneous solid mixture containing one soluble component	R	Sand and salt
A heterogeneous liquid-liquid mixture	S	Water & mustard oil

	P	Q	R	S
(A)	Husk and water	Heterogeneous solid-solid mixture	Filtration and evaporation	Separating funnel
(B)	Sand and water	Heterogeneous solid-solid mixture	Hand Picking	Decanta-tion
(C)	Water and oil	Homogeneous solid-solid mixture	Winnowing	Sieving
(D)	Sawd-ust and water	Heterogeneous solid-solid mixture	Distillation	Separating funnel

ANSWER KEY

EXERCISE - 1

➢ **Fill in the Blanks:**

16. (i). sedimentation
(ii). evaporation
(iii). threshing
(iv). decantation
(v). sedimentation

➢ **True & False:**

17. (i). False
(ii). False
(iii). False
(iv). False
(v). True

➢ **Match the Column:**

18. [a → (iv); b → (vi); c → (i); d → (ii); e → (iii); f → (v)]

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	C	D	A	B	B	C	C	C	C	C	B	D	B	C	D
Ques.	16	17	18	19	20										
Ans.	C	C	B	B	A										

EXERCISE - 3

Ques.	1	2	3	4	5
Ans.	B	B	A	C	A

FOOD : WHERE DOES IT COME FROM?

Chapter Outline

✧ **Food and its needs**

✧ **Different food varieties**

✧ **Food ingredients**

✧ **Food eaten by animals**

✧ **Sources of food**

Fruits

Cereals

Grass
(Producer)   Grasshopper
(Primary Consumer)   Frog
(Secondary Consumer)
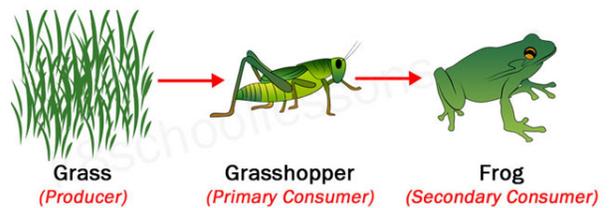
Food Chain

MIND MAP

FOOD : WHERE DOES IT COME FROM?

- **Food and its needs**

- **Different food varieties**
  - Punjab
  - Gujarat
  - Maharashtra
  - Rajasthan
  - Tamil Nadu
  - Uttar Pradesh

- **Food ingredients**

- **Food eaten by animals**
  - Herbivores
  - Carnivores
  - Omnivores

- **Sources of food**
  - Plant & plant products as food source
  - Animals products as food source
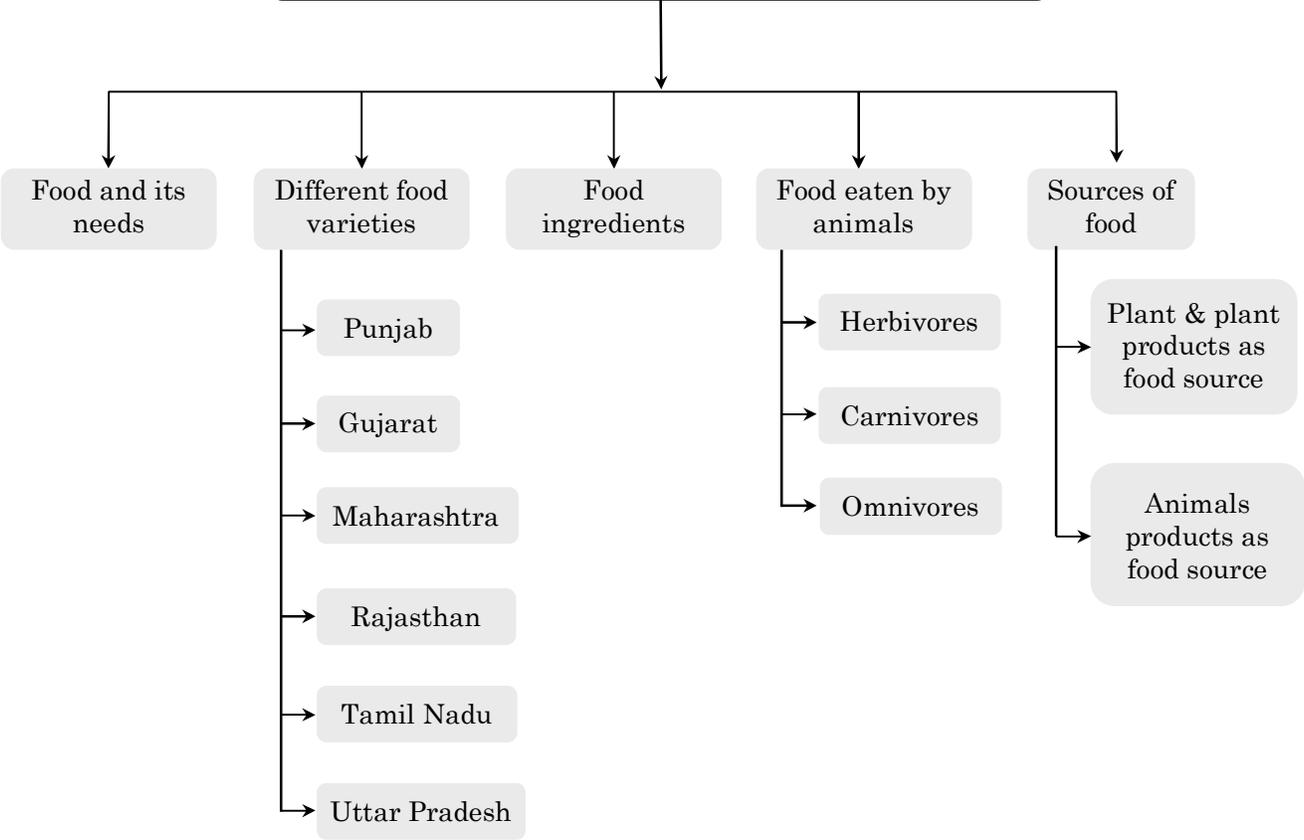
FOOD : WHERE DOES IT COME FROM?

All living things need food in order to stay alive. The food that we eat provides energy to our body and help in growth.

Food and its Needs

Food is edible material which provides energy, many nutrients and substance for the vital processes of an organism.

Food gives nutritional support to our body. Food contains many nutrients like vitamin, carbohydrate, protein, fat etc.

Note :
- In our country, a person eats food 3-4 times in a day. We eat breakfast, lunch, dinner.
- **Meal** - The food consumed at a particular time of the day constitute a meal.
- **Breakfast** - food eaten in the morning constitutes a meal called the break fast.
- **Lunch** - Food eaten in afternoon.
- **Dinner** - Food eaten in evening / night.

◈ **Why food is Required ?**
- After the burning (oxidation) of food we gets energy and this energy is used in various life process & vital activities.
- Food is required for our body growth.
- Food increases our immunity (capacity to fight against disease causing microbes)
- Food is required for repair of damage or injury to our body parts.

Different Food Varieties
- **Punjab -** Makka ki roti - Sarson ka saag, Chole - bhatura, lassi, Rajma - chawal, gajar ka halwa, Dahi bhalla, etc.
- **Gujarat** - Dal-rice, Thepala, Dhokhla, khandvi, handvo, Bhakarvadi.
- **Maharashtra** - Shrikhand, Thalipeeth, Vadapao, modak.
- **Rajasthan** - Dal-Baati , churma , Ker-sangari, Gatte ki sabji, pyaaz ki kachori, Mirchi bada, feni , ghevar.
- **Tamil Nadu** - Idli, Dosa, rice - sambhar, banana chips, sambhar - vada.
- **Uttar Pradesh** - Kabab, biryani, Kachori, halwa, banarasi chat.
- **Menu** - list of dishes or food items.

Food Ingredients

Raw material which are needed to prepare a dish are called ingredients like vegetable, salt, chilli, garlic etc.

Food Eaten by Animals

All living beings need food to remain alive. They either eat plants or animals.

Based on the food eaten, animals can be classified into three categories –

1. Herbivores   2. Carnivores   3. Omnivores

- Herbivores - Organisms which eat only plant & plant products.

  E.g. : buffalo, deer, sheep, elephant etc.

- Carnivores - Organisms which eat other animals.

  E.g. : lion, tiger, fox, wolf etc.

- Omnivores - Organisms which eat plant & plant products as well as other animals.

  E.g. : Crow, human, dog, cockroach etc.

COMPETITIVE LEVEL

- **Detritivores :** Feed on detritus or dead organic remains e.g. Earthworm.
- **Sanguivorous :** Feed on blood e.g. Leech, female mosquito.
- **Frugivorous :** Feed on fruits e.g. Parrot.
- **Insectivores :** Feed on insects e.g. Bats, House sparrow, Nepenthese plant.

Sources of Food

- All living beings need food. Some living things like-plants make their own food by the process of **photosynthesis**, they are known as **autotrophs**.

- Some living things, e.g. animals do not make their own food; they depend on plant & other animals for food so they are called **Heterotrophs.**

- So we can say, plants and plant products, some animals & animal products are used as food source.

1. **Plant & plant products as food source :** Varieties of food materials are obtained by plants like, cereals, pulses, sugar, tea, coffee, oil, Vegetable, fruits, spices etc.

   (A) Cereals : They are important food source for animals & humans. They are rich source of carbohydrate.

   E.g. : Wheat, Rice, Maize

   (B) Pulses or legumes : They are commonly known as "**daals**". They are rich source of protein.

   E.g. : pea, bean, moong bean, chick pea , soyabean.

(C) Vegetables : They are rich source of minerals, vitamins and roughage.

Different Plant Parts Used as Vegetables	
Plant Part	**Vegetable Name**
Roots	Turnip, radish, carrot, beet root, cassava
Stem	Potato, garlic, ginger, onion, colocasia (Kachalu)
Leaf	Cabbage, spinach, lettuce, coriander, fenugreek (methi)
Flower	Cauliflower, broccoli, rose.
Fruit	Lady finger, tomato, pea, beans, brinjal, pumpkin

(D) Fruits : They have high water content, low calorie value. They are rich in minerals and vitamins.

E.g. : Grapes, Banana, Guava, Pineapple, Apple, Kiwi, Papaya, Mango.

(E) Spices : They have no food value. They are added in food to increase the taste and flavour and colour.

E.g. : cloves (laung), ginger (Adrak), turmeric (haldi) pepper (kali mirch), cumin (jeera) asafoetida (heeng), Coriander (dhaniya), chillies (mirch), thyme (ajwain), Cardamon (ilaichi), saffron(kesar).

(F) Oils : Oil is otained from seeds of plants like groundnut, soyabean, sunflower, coconut, mustard, sesame (til). They are rich in fats.

(G) Tea & Coffee : They are used as beverages. Tea is obtained from leaf and coffee is obtains from seeds.

Note :

- **Foods we eat that are roots :** Beet, Radish, Onion, Sweet Potato
- **Foods we eat that are STEMS :** Asparagus, Broccoli, Bamboo Shoots, Rhubarb
- **Foods we eat that are LEAVES :** Brussels Sprouts, Kale, Cabbage, Lettuce, Spinach
- **Foods we eat that are FLOWERS :** Broccoli, Cauliflower
- **Foods we eat that are SEEDS :** Sunflower Seeds, Peas, Pumpkin Seeds, Kidney Beans
- **Foods we eat that are FRUIT :** Apple, Pineapple, Apricot, Plum

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EXERCISE-1

➤ Very Short Answer Type Questions

Q.1 Define producers.

Q.2 What do you mean by carnivorous animals ?

Q.3 Give two examples of herbivores.

Q.4 Which parts of mustard plant are used as food ?

Q.5 Give the names of two decomposers and two scavengers.

➤ Short Answer Type Questions

Q.6 Why do living organisms require food?

Q.7 How are animals classified on the basis of their food habits?

Q.8 Differentiate between autotrophs and heterotrophs.

Q.9 Differentiate between scavengers and decomposers.

Q.10 Is there any food ingredient that is not obtained either from plants or animals? If yes, from where is it obtained?

➤ Long Answer Type Questions

Q.11 What are herbivores? Write two special characteristics of herbivores.

Q.12 What are omnivores ? Write two special characteristics of omnivores.

Q.13 What food items do we obtain from plants? Give examples.

Q.14 Why do we need food? Explain.

Q.15 How are animals classified based on their feeding habits?

➤ Fill in the blanks

Q.16 _____ only eat plants.

Q.17 Eggs of _____ are eaten by human beings.

Q.18 Butterfly is a _____.

Q.19 Carrot and _____ are roots.

Q.20 Spinach is a _____ vegetable.

➤ True & False

Q.21 We require food to get energy for carrying out

Q.22 All organisms need food to survive.

Q.23 Heterotrophs are the living organisms which can prepare their own food by the process of photosynthesis.

Q.24 Honey is a dairy product.

Q.25 Different parts of different plants are eaten as food.

➤ Match the Column

Q.26

Column-A	Column-B
i. Tiger	a. Fruit
ii. Goat	b. Carnivore
iii. Vulture	c. Herbivore
iv. Human beings	d. Scavenger
v. Egg	e. Omnivores
	f. Chicken

Q.1 An edible root is
(A) ginger (B) potato (C) carrot (D) onion

Q.2 The part of sugarcane plant from which sugar is obtained is its
(A) leaf (B) stem (C) flower (D) fruit

Q.3 The product obtained from plants is
(A) chicken (B) ghee
(C) rice (D) milk

Q.4 The useful part of tea plant is its
(A) seeds (B) stem (C) roots (D) leaves

Q.5 Human beings eating rice, chapatti as well as meat, so they are
(A) herbivores (B) carnivores
(C) insectivores (D) omnivores

Q.6 The part of a chilly plant that is used as a spice is
(A) seed (B) fruit (C) leaves (D) flower

Q.7 Select the incorrect statement out of the following
(A) People living in different states of India eat different kinds of food.
(B) Food protects us from diseases.
(C) Materials which are used to prepare food are called ingredients.
(D) All the ingredients of food that we eat come from either plants or animals.

Q.8 Herbivores eat
(A) animals only
(B) plants only
(C) both plants and animals
(D) dead bodies of animals.

Q.9 Which of the following is a carnivore?
(A) Horse (B) Goat
(C) Crocodile (D) Deer

Q.10 The plant part eaten in case of radish is
(A) stem (B) root
(C) flower (D) seed.

Q.11 Select the correct statement out of the following.
(A) There are many people around us who do not get enough food to eat.
(B) Products obtained from milk are called poultry products.

(C) The edible part of spinach is seed.
(D) Honey is prepared by butterflies using nectar of flowers.

Q.12 Which of the following is not a function of food?
(A) Provides us energy
(B) Replaces worn out cells
(C) Provides us oxygen
(D) Keeps us healthy

Q.13 Which of these food is obtained from plants?
(A) Honey (B) Curd
(C) Rice (D) Egg

Q.14 Which of these food is obtained from animals?
(A) Pulses (B) Cheese
(C) Cereals (D) Sugar

Q.15 Which of these food ingredients is not obtained from either plants or animals?
(A) Salt (B) Honey
(C) Milk (D) Wheat

Q.16 The first link in almost all food chains are
(A) herbivores (B) carnivores
(C) producers (D) omnivores

Q.17 Which of these animals feeds feeds upon the food digested by other animal?
(A) Cow (B) Lion
(C) Cockroach (D) Tapeworm

Q.18 Stem of which of the following plants are eaten?
(A) Onion and beetroot
(B) Ginger and radish
(C) Radish and potato
(D) Potato and ginger

Q.19 Which of the following are cereals?
(A) Chickpea and kidney bean
(B) Wheat and rice
(C) Wheat and green gram
(D) Kidney bean and rice

Q.20 Which of the following animals give us eggs?
(A) Goat and hen (B) Camel and goat
(C) Camel (D) Hen and duck

Q.1 Refer to the given figure showing a typical plant with its parts labelled as U, V, W, and X and read the following paragraph.

P is plant where part U is edible, plant Q has edible part W, plant R, has edible part X whereas plant S has edible part V, Select the option that correctly identifies these plants.

	P	Q	R	S
(A)	Clove	Mustard	Cumin	Ginger
(B)	Pomegranate	Rose	Orange	Turmeric
(C)	Pomegranate	Spinach	Clove	Radish
(D)	Cumin	Rose	Spinach	Potato

Q.2 The given relationship is based on eating habits of animals.

Deer : Sparrow : Lion

Which of the following options satisfies the same relationship?
(A) Tiger : Bear : Ant
(B) Cow : Crow : Tiger
(C) Lion : Goat : Leopard
(D) Sheep : Panther : Bear

Q.3 Cinchona, isabgol, neem, Rauwolfia are
(A) Oil yielding plants
(B) Medicinal plants
(C) Fibre yielding plants
(D) Food plants.

Q.4 Identify missing parts P, Q & R in the given flow chart describing preparation of ghee.

Cow → P → Q → R → Ghee

	P	Q	R
(A)	Butter	Milk	Cheese
(B)	Milk	Butter	Cream
(C)	Cheese	Butter	Cream
(D)	Milk	Cream	Butter

ANSWER KEY

EXERCISE - 1

➢ **Fill in the Blanks :**

16. Herbivores   **17.** Poultry animals   **18.** Herbivore   **19.** Raddish   **20.** Leaf

➢ **True and False :**

21. True   **22.** True   **23.** False   **24.** False   **25.** True

➢ **Match the Column :**

26. i-b ; ii-c ; iii-d ; iv-e ; v-f

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	C	B	C	D	D	B	D	B	C	B	A	C	C	B	A
Ques.	16	17	18	19	20										
Ans.	C	D	D	B	D										

EXERCISE - 3

Ques.	1	2	3	4
Ans.	C	B	B	D

Chapter Outline

❖ **Introduction**

❖ **Comparing and ordering numbers**

❖ **Understanding large number**

❖ **Place value**

❖ **Indian and International system of numeration**

❖ **Building Numbers**

❖ **Large numbers in practice**

❖ **Estimation**

❖ **Roman Numerals**

1 = I   6 = VI

2 = II   7 = VII

3 = III   8 = VIII

4 = IV   9 = IX

5 = V   10 = X
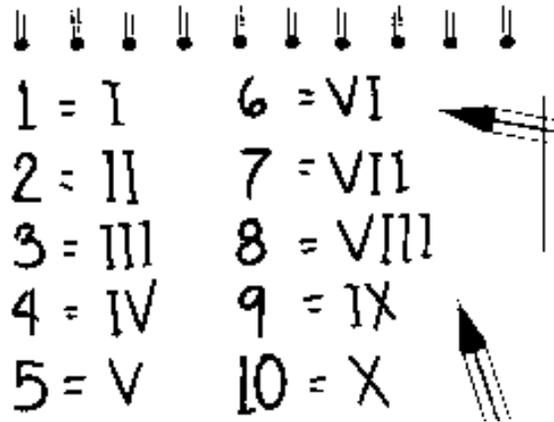
☆ I know the meaning of estimate and rounding.

estimate

You estimate by using what you know or see to make a reasonable guess about an amount.

38 + 19 is about 60.

rounding

When rounding a number, you say what ten the number is closer to.

38 ⟶ 40

14 ⟶ 10

85 ⟶ 90

Face Values → 5   3   0   4   6

| 5 | 3 | 0 | 4 | 6 |

6 x 1 = 6

4 x 10 = 40

Place Values

0 x 100 = 0

3 x 1000 = 3000

5 x 10000 = 50000
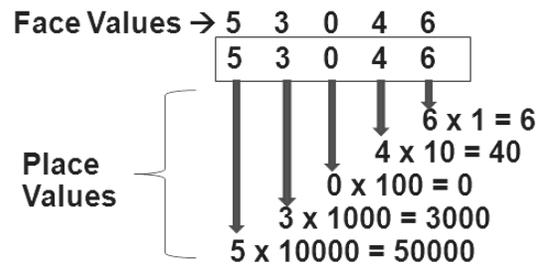
MIND MAP

KNOWING OUR NUMBERS

- Comparing and ordering of numbers
  - Numbers with same number of digits
  - Numbers with difference number of digits

- Value of number
  - Face value
  - Place value

- System of Numeration
  - Indian system of numeration
  - International system of numeration

- Building Numbers
  - With repetition of digits
  - Without repetition of digits

- Estimation
  - Rounding numbers

- Roman Numerals

KNOWING OUR NUMBERS

Introduction

We use numbers or we can say we live with numbers and know many things about them. Numbers help us count concrete objects. They help us to say which collection of objects is bigger and arrange them in order e.g., first, second, etc. We use numbers in many different contexts and in many ways.

Comparing and Ordering Numbers

◈ **Comparing number with different number of digits :**

The number with maximum number of digit is greater than the others and the number with least number of digits is smallest among all.

Ex.1 Find the smallest and greatest number in each row :

    (i) 382, 4972, 18, 59785, 750   (ii)   1473, 89423, 100, 5000, 310

    (iii) 1834, 75284, 111, 2333, 450   (iv)   2853, 7691, 9999, 12002, 124

Sol.

	Greatest	Smallest
(i)	59785	18
(ii)	89423	100
(iii)	75284	111
(iv)	12002	124

◈ **Comparing number with the same number of digits :**

To compare the number with the same number of digits, starts the comparison from left hand side until you get the unequal digits. The number in which digit of same place is greater than the other, is greater than the other number.

Ex.2 Compare 4875 and 3542 ?

Sol. As both are 4 digit numbers, so first check from the left hand side.

    4875 and 3542

    Here 4 is greater than 3.

    Therefore, 4875 is greater than 3542.

    {4875 > 3542}

Ex.3 Compare 4875 and 4879 ?

Sol. 4875 and 4879

    While checking we notice that the digit's at the first three places from left hand side are same. Now, check the digit at the one's place in both the numbers we find that 9 is greater than 5.

    ∴ 4875 < 4879.

- **Ascending order :** Ascending order means arrangement from the smallest to the greatest.
- **Descending order :** Descending order means arrangement from the greatest to the smallest.

Ex.4 Arrange the following numbers in ascending order. 847, 9754, 8320, 571

Sol. 571, 847, 8320, 9754

Ex.5 Arrange the following numbers in descending order. 5000, 7500, 85400, 7861

Sol. 85400, 7861, 7500, 5000

Understanding large number

As we know that the greatest 2-digit number is 99 and if we add 1 to it, it becomes 100 which is the smallest 3-digit number. Similarly the greatest 3 digit number is 999 and if we add 1 to it, it becomes 1000 which is the smallest 4-digit number i.e.,

Greatest 2 digit no. + 1 = Smallest 3 digit no.

    (99)   (1)   (100)

                            (One Hundred)

Greatest 3 digit no. + 1 = Smallest 4 digit no.

    (999)   (1)   (1000)

                            (One thousand)

Greatest 4 digit no. + 1 = Smallest 5 digit no.

    (9999)   (1)   (10,000)

                            (Ten thousand)

Greatest 5 digit no. + 1 = Smallest 6 digit no.

    (99999)   (1)   (1,00,000)

                            (One lakh)

Greatest 6 digit no. + 1 = Smallest 7 digit no.

    (999999)   (1)   (10,00,000)

                            (Tan lakh)

- **Successor :** The successor of a given number is obtained by adding 1 to the given number.
- **Predecessor :** The predecessor of a given number is obtain by subtracting 1 from it.

Place value

The basis of the number system is place value. It is this place value which gives value to the number.

◈ **Definition :**

Face value of a digit in a numeral is the value of the digit itself at whatever place it may be.

Place value of a digit in a given number is the value of the digit because of the place or the position of the digit in the number.

Place-value of a digit = Face-value of the digit × value of the place

The expansion of a 2-digit number like 87 is as follows : $87 = 8 \times 10 + 7$

& the expansion of a 3-digit number like 356 is as follows : $356 = 3 \times 100 + 5 \times 10 + 6$

Similarly the expansion of a 4-digit number, 5-digit's, 6-digits etc. takes place.

Ex.6 Write 892 in expanded form.

Sol. $892 = 8 \times 100 + 9 \times 10 + 2.$

Ex.7 Write 1387 in expanded form.

Sol. $1387 = 1 \times 1000 + 3 \times 100 + 8 \times 10 + 7.$

Indian and International System of Numeration

- **Indian system of numeration :** It is also known as Hindu-Arabic numeral system. In this we starts from the extreme right as :

  Ones, Tens, Hundreds, Thousands, Ten thousands, Lakhs, Ten lakhs, Crores, Ten crores etc.

INDIAN SYSTEM OF NUMBERS

CRORES		LAKHS		THOUSANDS		ONES		
(TC) Ten Crore	(C) One Crore	(TL) Ten Lakh	(L) One Lakh	(TTh) Ten thousand	(Th) One Thousand	(H) One Hundred	(T) Ten	(O) One
+	1,00,00,000	10,00,000	1,00,000	10,000	1,000	100	10	1

Ex.8 Write the number name of the number 7,34,543.

Sol.

TC	C	TL	L	TTh	Th	H	T	O
0	0	0	7	3	4	5	4	3

7,34,543 → Seven lakh thirty four thousand five hundred forty three.

Ex.9 Write the number of sixty five crore thirty two lakh seventy five thousand eight hundred twenty nine.

Sol.

TC	C	TL	L	TTh	Th	H	T	O
6	5	3	2	7	5	8	2	9

65,32,75,829.

- **International system of numeration :** It is adopted by all the countries. It is being used as ones, tens, hundreds, thousands and then millions. One million is a thousand thousands.

INTERNATIONAL SYSTEM OF NUMBERS

MILLIONS			THOUSANDS			ONES		
Hundred million (HM)	Ten million (TM)	One million (M)	Hundred thousand (HTh)	Ten thousand (TTh)	One Thousand (Th)	One Hundred (H)	Ten (T)	One (O)
100,000,000	10,000,000	1,000,000	100,000	10,000	1,000	100	10	1

Ex.10 Express 50,801,592 in international system of numeration.

Sol. 50,801,592 → Fifty million eight hundred one thousand five hundred ninety two.

◈ **Use of commas :**

In our Indian system of numeration we use ones, tens, hundreds, thousands & then lakhs and crores. Commas are used to mark thousand, lakhs & crores. The first comma comes after hundreds place & then after every two digit.

In international system of numeration, commas are used to mark thousands and millions. It comes after every three digits from the right. The first comma marks the thousands & then millions .

Ex.11 Insert commas suitably using Indian system of numeration : (i) 87595762   (ii)
98432701

Sol. (i) 87595762 →   8,75,95,762

    (ii) 98432701 →   9,84,32,701

Ex.12 Insert commas suitably using international system of numeration : (i) 7452283   (ii)
48049831

Sol. (i) 7452283 →   7,452,283

    (ii) 48049831 →   48,049,831

Bulding Numbers

While making the greatest number, we know that the number must starts with 9 & if there is no repetition then the second number is 8 and so on. or we can say write the numbers in descending order. Similarly if we want the smallest number then start the number with 1 (0 can't be on first place) then the second number is 0 & third is 2 & so on. Or we can say after 102 write the numbers in ascending order

(a) Making number without repetition of digits : In case of non-repetition of digits, it is better if we start making the number from left.

Ex.13 Write the greatest and the smallest 5-digit numbers by using each of the digits 8, 4, 7, 0, 2 only once.

Sol. For the greatest number, we write the greatest digit 8 in the T-thousands column. Next smaller digit in the thousands column and so on.

∴ The greatest number = 87420.

T-Th	Th	H	T	O
8	7	4	2	0

For the smallest number, we write the smallest digit in the T-thousands column. But here 0 is the smallest digit. 0 is not written on the extreme left of a number. So, we write 2 in the T-thousands column and 0 in the thousands column. Next digit greater than 2 is written in the hundreds column and so on.

∴ The smallest number = 20478

T-Th	Th	H	T	O
2	0	4	7	8

Ex.14 Make the greatest and the smallest 5-digit numbers using any five different digit with 4 in the tens place.

Sol. First of all write 4 in the tens column. For the greatest number, we write the greatest digit 9 in the T-thousands column, next smaller digit in the thousands column and so on.

T-Th	Th	H	T	O
9	8	7	4	6

∴ The greatest number = 98746

For the smallest number also, write 4 in the tens column first of all. Then write 0 in the thousands column . Write 1 in the T-thousands column. Next greater digit in the hundreds column and so on.

∴ The smallest number = 10243

T-Th	Th	H	T	O
1	0	2	4	3

(b) Making number with repetition of digits : In case of repetition of digit, it is better if we start making number from left.

Ex.15 Write the greatest and smallest numbers of 4 digits using all the digits 8,0, 5.

Sol. For greatest number, select the greatest digit 8 and write in the thousands column next smaller digit 8 is written in the hundreds column next smaller digit 5 is written in the tens column. Now write 0 in ones column.

Th	H	T	O
8	8	5	0
Greatest Number			

∴ The greatest number = 8850

For smallest number, as the smallest digit is 0 and 0 cannot be written at thousand place so next greater number 5 will be written at thousand place now smallest digit 0 will be written at hundred and tens place and write 8 at ones place.

So, we write 5 in the end and repeat 0 in the tens place.

Th	H	T	O
5	0	0	8
Smallest Number			

∴ The smallest number = 5008

Ex.16 Write the greatest & smallest four digit numbers by using 9, 7, 4, 1 as digits ?

Sol. Greatest : 9741

Smallest : 1479

Ex.17 Write the greatest & smallest four digit numbers by using different digits such that the digit 3 is always in the hundred's place.

Sol. Greatest : 9 3 8 7

Smallest : 1 3 0 2

◈ **Shifting digits :**

Moving (Shifting) of numbers from one place to the other is known as Shifting digits.

Ex.18 Write the greatest and smallest 3 digit numbers by Shifting the digits of the number 182 ?

Sol. Greatest : 8 2 1

Smallest : 1 2 8

Note :

i. For greatest number, greatest digit is repeated.

ii. For smallest number, smallest digit is repeated.

Large numbers in practice

Number are used in our everyday life. Small lengths are measured in millimetre (mm) & centimetre (cm) while the bigger lengths are measured in metre (m) & kilometre (km). Metre (m) is the standard unit of length.

1 km = 1000 m

1 m = 100 cm

1 cm = 10 mm

Similarly, the units of weight are as follows :

1 kg (kilogram) = 1000 grams (g)

1 gram = 1000 milligrams (mg)

For volume,

1 Litre (L) = 1000 mL (millilitre)

1 kilo litre (kL) = 1000 L

Ex.19 Population of Sundarnagar was 2,35,471 in the year 1991. In the year 2001 it was found to be increased by 72,958. What was the population of the city in 2001 ?

Sol. Population of the city in 2001 = Population of the city in 1991 + Increase in population

$$= 2,35,471 + 72,958$$
$$= 308429$$

Ex.20 The number of sheets of paper available for making notebooks is 75,000. Each sheet makes 8 pages of a notebook. Each notebook contains 200 pages. How many notebooks can be made from the paper available ?

Sol. Each sheet makes 8 pages.

Hence, 75,000 sheets make 8 × 75,000 pages,

Now,   75000 × 8 = 600000

Thus, 6,00,000 pages are available for making notebooks.

Now, 200 pages make 1 notebook.

Hence, 6,00,000 pages make 6,00,000 ÷ 200 notebooks.

Now, $200 \overline{\smash{\big)}\,600000}$ quotient 3000, − 600, 0000

The answer is 3,000 notebooks.

Ex.21 What must be added to 56,862 to make it equal to 1 lakh.

Sol. 1 lakh = 1,00,000.

∴   Required number = 1,00,000 − 56,862 = 43,138

Ex.22 A tin of biscuits has 14 kg of biscuits. Express the weight in milligrams.

Sol. Since 1 kg = 1000 gm and

1gm = 1000 mg

∴   1 kg = (1000 × 1000) mg = 1000000 mg

So 14 kg = 14 × 1000000 mg

= 14000000 mg

Estimation

Estimation means "making a rough idea or a good guess." We use the word approximately for the estimation. The word approximately itself shows that the number is near about the answer.

◈ **Rounding numbers :**

Rounding means replacing one number with another number which is easier to calculate the answer.

Replacing a number with a higher number is called rounding up.

Replacing a number with a lower number is called rounding down.

◈ **Estimating to the nearest tens by rounding off :**

It means replacing a number with the nearest multiple of 10.

If the ones digit is 5 or more, round up. If the ones digit is 4 or less, round down.

Ex.23 Round the following numbers to the nearest tens. (i) 28 (ii) 41 (iii) 39 (iv) 215

Sol. (i) 30 (ii) 40 (iii) 40 (iv) 220

◈ **Estimating to the nearest hundreds by rounding off :**

It means replacing a number with the nearest multiple of 100.

Numbers 1 to 49 are closer to 0 than to 100, & so are rounded off to 0.

& Numbers from 50 to 99 are rounded off to 100.

If the digit at tens place is 5 or more, round up. If the digit at tens place is 4 or less, round down.

Ex.24 Round the following numbers to the nearest hundreds : (i) 9537 (ii) 5750 (iii) 168 (iv) 9870

Sol. (i) 9500 (ii) 5800 (iii) 200 (iv) 9900

◈ **Estimating to the nearest thousands by rounding off :**

It means replacing a number with the nearest multiple of 1000.

Number 1 to 499 are rounded off to 0 & number 500 to 999 are rounded off to 1000.

If the digit at hundreds place is 5 or more, round up. If the digit at hundreds place is 4 or less, round down.

Ex.25 Round the following numbers to the nearest thousands.

(i) 2573 (ii) 53552 (iii) 3499 (iv) 7805

Sol. (i) 3000 (ii) 54000 (iii) 3000 (iv) 8000

◈ **To estimate sum or difference :**

By using round off to any nearest, we can solve the question.

Ex.26 Estimate 5290 + 17,986.

Sol. As 17,986 > 5290

So, round off to thousands 17,986 is round off to 18,000 & 5,290 is round off to 5,000.

∴ 18,000 + 5,000 = 23,000

Ex.27 Estimate 5673 – 436.

Sol. As 436 < 5673

So, round off to hundred

$5673 \xrightarrow{\text{Round off to}} 5700$

$436 \xrightarrow{\text{Round off to}} 400$

∴ 5700 – 400 = 5300

◈ **To estimate product :**

Round off each factor to its greatest place, then multiply the rounded off factors.

Ex.28 Estimate : (i) 578 × 161   (ii) 5281 × 3491

Sol. (i) $578 \xrightarrow{\text{Round off to}} 600$

$161 \xrightarrow{\text{Round off to}} 200$

∴ 600 × 200 = 1,20,000

(ii) $5281 \xrightarrow{\text{Round off to}} 5000$

$3491 \xrightarrow{\text{Round off to}} 3000$

∴ 5000 × 3000 = 1,50,00,000

◈ **To estimate Quotients :** In the process of estimation in quotients, we round off the dividend and the divisor before the process of division.

Ex.29 Estimate the following quotients :   (a) 81 ÷ 17   (b) 7525 ÷ 365

Sol. (a) 81 is rounded to 80

17 is rounded to 20

To get the estimated quotient think of dividing 80 by 20 or 8 by 2.

∴ Estimated quotient = $\dfrac{8}{2}$ = 4

(b) 7525 is rounded to 8000

365 is rounded to 400

To get the estimated quotient think of dividing 80 by 4.

∴ Estimated quotient = 20

Roman numerals

It is one of the early system of writing numerals. This system is still used in many places.

The numbers 1, 2, 3……10 can be expressed in Roman numerals as follows :

I, II, III, IV, V, VI, VII, VIII, IX, X respectively.

This is followed by XI for 11, XII for 12, …… till XX for 20.

Some more Roman numerals are :

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

Trick : | Indica vista XL car driver, Mojood |

◈ **Rules to form Roman numerals :**

The rules for the system are as follows :

Rule-1: If a symbol is repeated, its value is added as many times as it occurs.

For Ex. II → 1 + 1 = 2

XXX → 10 + 10 + 10 = 30

Rule-2 : A symbol is not repeated more than three times. But the symbols V, L and D are never repeated.

For Ex. III = 3, XXX = 30,

CCC = 300, MMM = 3000

Rule-3 : If a symbol of smaller value is written to the right of a symbol of greater value, its value gets added to the value of greater symbol.

For Ex. VI = 5 + 1 = 6

LXV = 50 + 10 + 5 = 65

Rule-4 : If a symbol of smaller value is written to the left of a symbol of greater value, its value is subtracted from the value of the greater symbol.

For Ex. XL = 50 – 10 = 40

XC = 100 – 10 = 90

Rule-5 : The symbols V, L and D are never written to the left of a symbol of greater value i.e., V, L and D are never subtracted.

Note : I can be subtracted from V and X only.

X can be subtracted from L, M & C only.

Ex.30 Write in Roman numerals : (i) 85 (ii) 98
Sol. (i) 85 = 80 + 5 = 50 + 10 + 10 + 10 + 5 = LXXXV

(ii) 98 = 90 + 8 = (100 – 10) + 8 = XC + VIII = XCVIII

Ex.31 Write in Hindu-Arabic numerals : (i) LXIII (ii) XCI
Sol. (i) LXIII = 50 + 10 + 3 = 63

(ii) XCI = (100 – 10) + 1 = 91

> ➢ **Very Short Answer Type Questions**

Q.1 Find the smallest and greatest number from 326, 588, 213, 1856, 2112.

Q.2 Compare 5637 and 5632.

Q.3 Arrange the following in descending order. 4500, 3156, 4550, 2388.

Q.4 Write the greatest and smallest 3 digit numbers by using the digits of the number 273 ?

Q.5 Write 5632 in expanded form.

> ➢ **Short Answer Type Questions – Type I**

Q.6 What is the successor of greatest 3-digit number?

Q.7 Insert commas suitably using Indian system of numeration :
(i) 562315   (ii) 23467892

Q.8 How many millilitres are there in one kilolitre?

Q.9 Round the number 578 to the nearest tens.

Q.10 Round the following numbers to the nearest thousands : (i) 5678   (ii) 3136

> ➢ **Short Answer Type Questions – Type II**

Q.11 Estimate $\rightarrow$ 8325 – 491 (By nearest hundred)

Q.12 Estimate the product of 1291 × 592.

Q.13 Write the Roman numeral of
(i) 120   (ii) 78

Q.14 Write the Hindu-Arabic numerals of :
(i) LIV (ii) DCC

Q.15 Place commas correctly and write the numerals :
(i) Nine crore fifty two lakh thirty eight thousand & five
(ii) Twenty three lakh thirty three thousand four hundred twenty five.

> ➢ **Long Answer Type Questions**

Q.16 Express 13,079,696 in words as international system of numeration.

Q.17 Write the greatest and smallest 4-digit numbers from : (i) 4, 7, 5, 0 (ii) 3, 2, 6, 4

Q.18 Sachin is a famous cricket player. He has so far scored 7640 runs in test matches. He wishes to complete 10,000 runs. How many more runs does he need ?

Q.19 To stitch a shirt, 215 cm cloth is needed. Out of 40 m cloth, how many shirts can be stitched and how much cloth will remain ?

Q.20 A vessel has 4 litres and 500 ml of curd. In how many glasses, each of 25 ml capacity, can it be filled ?

> ➢ **Fill in the Blanks**

Q.21 (i) 1 lakh = ………… ten thousand.
(ii) The successor of 56 is ………… .
(iii) Shifting of numbers from one ………… to the other is known as Shifting digits.
(iv) The Roman numerals V, L & ………… are never repeated.
(v) ………… can be subtracted from V and X only.

True or False

Q.22 (i) One crore is equal ten million.

(ii) There is no difference between the Indian and International system of numeration.

(iii) Replacing a number with a lower number is called rounding up.

(iv) A Roman numeral is not repeated more than three times.

(v) XXV is a Hindu-Arabic numeral.

Match the Column

Q.23 Match column I to column II in the following:

Column-1	Column-2
(i) Two hundred thousand	(a) Two hundred crore
(ii) Two billion	(b) Two lakh
(iii) 287 round off to nearest ten	(c) 3 times
(iv) I, X, C, M can be repeated of	(d) repeated
(v) V, L, D are never	(e) 290
	(n) 290

Q.1 Correct ascending order of 847, 9754, 8320, 571 :
(A) 571, 8320, 847, 9754
(B) 571, 847, 8320, 9754
(C) 9754, 847, 3820, 571
(D) 9754, 8320, 847, 571

Q.2 Mrs. Martin wanted her students to practice comparing numbers so they would be prepared for their math test on Friday. She asked Jonathan to draw 4 numbers out of a paper bag. Each student was asked to create the least possible number using each number only one time. Using the same numbers shown below, which is the correct answer?

| 4 | 8 | 5 | 6 |

(A) 8,654   (B) 6,548
(C) 4,658   (D) 4,568

Q.3 Which number is between 8,209 and 9,003?

| 8,209 | | 9,003 |

(A) 8,041   (B) 8,207
(C) 8,501   (D) 9,010

Q.4 Carlos wanted to find out the longest river in the world. He did some research and listed the rivers and their lengths in random order in the chart below. What is the second longest river listed in the chart below?

Rivers	Length in Miles
Mississippi	3,870
Nile	4,135
Amazon	3,980
Chang Jiang (Yangtze)	3,917

(A) Mississippi
(B) Nile
(C) Amazon
(D) Chang Jiang (Yangtze)

Q.5 Jamie read two thousand, four hundred seventeen pages last summer. Which number listed below is greater than this number?
(A) 2,399   (B) 2,420
(C) 2,417   (D) 1,879

Q.6 Mrs. Helm makes copies of worksheets for the teachers in the copy room each day. She keeps a count of the number of worksheets she copies each month and turns it into the principal. Last month she copied 2,480 math worksheets and 2,097 reading worksheets for third grade. Which of the following compares the math and reading worksheets correctly?
(A) 2,480 < 2,097   (B) 2,480 = 2,097
(C) 2,097 < 2,480   (D) 2,097 > 2,480

Q.7 Julie stayed after school one day to help her teacher in the classroom. Mrs. Mason asked Julie to write the following numbers in order from least to greatest on one of her sentence strips. Julie was given the following numbers: 807, 729, 834, and 738. Which of the following has the numbers correctly written from least to greatest?
(A) 729, 738, 834, 807
(B) 738, 807, 729, 834
(C) 834, 807, 738, 729
(D) 729, 738, 807, 834

Q. 8 Sam played 325 minutes of computer games last week and Dave played 331 minutes of computer games last week. Which of the following comparisons is true?
(A) 325 = 331   (B) 325 > 331
(C) 325 < 331   (D) 331< 325

Q.9 The difference between the face value and place value of 4 in 2416 is :
(A) 100   (B) 396   (C) 1000   (D) 50

Q.10 The corresponding numeral of $5 \times 100000 + 8 \times 10000 + 1 \times 1000 + 6 \times 100 + 2 \times 10 + 3 \times 1$ is :
(A) 581623   (B) 5081623
(C) 5810623   (D) 5816023

Q.11 The difference between the place value and face value of 3 in the numeral 6,530 is:
(A) 3   (B) 27   (C) 33   (D) 0

Q.12 Find the difference between the place value of 9 in 7,64,985 and face value of 9.
(A) 891   (B).899   (C) 989   (D) 981

Q.13 If we add 1 more to the greatest 6 digit number we get :
(A) Ten lakh   (B) One lakh
(C) Ten lakh one   (D) One lakh one

Q.14 Write the numeral for the number Nine crore five lakh forty one :
(A) 9,50,00,041   (B) 9,05,00,041
(C) 9,05,041   (D) 9,500,041

Q.15 In the international system of numeration we write one billion for :
(A) 1 crore   (B) 10 crore
(C) 100 crore   (D) 1000 crore

Q.16 Make the greatest and the smallest four digit number using any four-digits with digit 5 always at thousand place :
(A) 5986, 5012   (B) 5987, 5012
(C) 5999, 5000   (D) 5789, 5120

Q.17 What is the difference between the greatest and the least number that can be written using the digits 6, 2, 7, 4, 3 each only once ?
(A) 50000   (B) 52965
(C) 52865   (D) 51965

Q.18 A box contains 500000 medicine tablets each weighing 10 mg. What is the total weight of all the tablets in the box in kilograms :
(A) 5,00,000 kg   (B) 50,000 kg
(C) 5 kg   (D) 500 kg

Q.19 The sum of the number 765432 and the number obtained by reversing its digits is :
(A) 930865   (B) 980356
(C) 999999   (D) 999998

Q.20 In 1999, the population of Capital City was 7,255,831 and the population of Spring City was 3,942,652. Round each population off the nearest hundred-thousand to estimate the difference in the populations of the two cities.
(A) 3,400,000   (B) 3,500,000
(C) 3,313,000   (D) 3,300,000

Q.21 The Pan family took a trip and traveled 87, 165, 449, 439, 598, and 560 miles on 6 consecutive days. Round each distance off to the nearest hundred to estimate the distance they traveled.
(A) 2400 miles   (B) 2200 miles
(C) 2300 miles   (D) 2500 miles

Q.22 Estimate the perimeter by first rounding off each length to the nearest hundred.
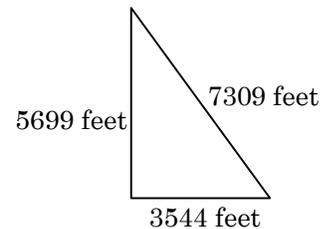
(A) 10,098,600 ft   (B) 16,600 ft
(C) 8300 ft   (D) 16,500 ft

Q.23 Which of the following is meaning less :
(A) XIII   (B) XIX   (C) XVV   (D) XL

Q.24 The equivalent of 44 in Roman numeral is:
(A) XXXXIV   (B) XLIIII
(C) XLIV   (D) IVIV

Q.25 Which of the following numbers in Roman numerals is incorrect?
(A) LXXX   (B) LXX
(C) LX   (D) LLX

Q.1 The difference between place values of digit 5 in 456.385 is _____.
[IMO Stage I 2017]
(A) 49995 (B) 499.95
(C) 49.9950 (D) 49.999

Q.2 Find the value of CXVI + XII + CCLXV – XVI. **[IMO Stage I 2017]**
(A) CD (B) CCCLXXVII
(C) CCCLXXXV (D) M

Q.3 Estimate the following by rounding off each number to nearest hundreds.
78203 – 16427
[IMO Stage I 2017]
(A) 61700 (B) 62000
(C) 61800 (D) 61500

Q.4 Mini has some pencils. If she gives 3 pencils to each pupil, she will have 20 pencils left. If she gives 4 pencils to each pupil, she will have none left. How many pencils does she have?
[IMO Stage I 2017]
(A) 40 (B) 60 (C) 80 (D) 120

Q.5 The value of CMLXXXII + CCLIV is _____. **[IMO Stage I 2018]**
(A) CDLXV (B) MCCCLXV
(C) MCCXXXVI (D) MCMXCVI

Q.6 Find the successor of smallest 7-digit number **[IMO Stage I 2018]**
(A) 10000 (B) 1000001
(C) 999999 (D) 9999999

Q.7 Find the difference between 7234042 rounded to the nearest thousands and 42568 rounded to the nearest hundreds.
[IMO Stage I 2018]
(A) 7191400 (B) 7191470
(C) 7192000 (D) 7191000

Q.8 Observe the following patterns and find the sum of 1 + 3 + 5 + 7 + 9 + … + 19.
[IMO Stage I 2018]
$$1 = 1 \times 1 = 1$$
$$1 + 3 = 2 \times 2 = 4$$
$$1 + 3 + 5 = 3 \times 3 = 9$$
$$1 + 3 + 5 + 7 = 4 \times 4 = 16$$
$$1 + 3 + 5 + 7 + 9 = 5 \times 5 = 25$$
(A) 121 (B) 81 (C) 100 (D) 64

ANSWER KEY

EXERCISE - 1

1. Greatest → 2112, Smallest → 213   **2.** 5637 > 5632   **3.** 4550, 4500, 3156, 2388

4. Greatest → 732, Smallest → 237   **5.** $5 \times 1000 + 6 \times 100 + 3 \times 10 + 2$

6. Smallest 4 digit number i.e., 1000.   **7.** (i) 5,62,315   (ii) 2,34,67,892

8. 1 kL = 10,00,000 mL   **9.** 580   **10.** (i) 6000   (ii) 3000   **11.** 7800

12. 7,80,000   **13.** (i) CXX   (ii) LXXVIII   **14.** (i) 54   (ii) 700

15. (i) 9,52,38,005   (ii) 23,33,425

16. Thirteen million seventy nine thousand six hundred ninety six.

17. (i) Greatest → 7540, Smallest → 4057   (ii) Greatest → 6432, Smallest → 2346   **18.** 2360

19. 18, 1m 30cm   **20.** 180 glasses.

21. (i) Ten   (ii) 57   (iii) Place   (iv) D   (v) I

22. (i) True   (ii) False   (iii) False   (iv) True   (v) False

23. (i) → (b); (ii) → (a); (iii) → (e); (iv) → (c); (v) → (d);

EXERCISE - 2

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	B	D	C	C	B	C	D	C	B	A	B	A	A	B	C
Ques.	16	17	18	19	20	21	22	23	24	25					
Ans.	C	B	C	C	A	C	D	C	C	D					

EXERCISE - 3

Ques.	1	2	3	4	5	6	7	8
Ans.	C	B	C	C	C	B	A	C

NUMBER SERIES

Number Series problems deal with numbers. While attempting to solve the question, you have to check the pattern of the series. Series moves with certain mathematical operations like :

- Consecutive odd/even numbers.
- Consecutive prime / composite numbers.
- Squares/cubes of some numbers with/without variation of addition or subtraction of some number.
- Sum/product/difference of preceding number(s) .
- Addition/subtraction/multiplication/division by some number.
- Many more combinations of the relationship given above.

Some Steps to solve the series

Step I : If it is a simple series you will be able to solve it easily.

Step II: If you fail to determine the trend of the series. Determine whether it is increasing, decreasing or alternating.

Step III : If a series is increasing or decreasing. Use the following rules :

(a) If the rise of a series is **slow or gradual**, the series is likely to have an **addition-based increase**; successive numbers are obtained by adding some numbers.

(b) If the rise of a series is **very sharp** initially **but slows down later** on, the series is likely to be formed by adding **squared or cubed** numbers.

(c) If the rise of a series is throughout **equally sharp**, the series is likely to be **multiplication-based**; successive terms are obtained by multiplying by some terms (and, maybe, some addition or subtraction could be there, too).

(d) If the rise of a series is **irregular**, there may be two possibilities. Either there may be a **mix of two series** or two **different kinds of operations** may be going on alternately. (The first is more likely when the increase is very irregular : the second is more likely when there is a pattern, even in the irregularity of the series).

Type of questions asked in the examination:

(i) Find the missing term(s).

(ii) Find the wrong term(s).

◈ **Find the Missing Term**

Ex.1 325, 259, 204, 160, 127, 105 , ?
    (A) 84   (B) 100
    (C) 90   (D) 94

Sol. **(D)** Gradual slow decrease. Check the differences of successive terms. They are 66, 55, 44, 33, 22. Hence, next decrease will be : 11.
Next term = 105 – 11 = 94.

Ex.2 54, 43, 34, 27, 22, 19 ,?
    (A) 18   (B) 17
    (C) 16   (D) 15

Sol. **(A)** Gradual slow decrease. Likely to be arithmetical decrease. Check the differences. They are 11, 9, 7, 5, 3. Hence, next decrease will be 1. Next term = 19 – 1 = 18.

Ex.3 16, 17, 21, 30, 46, 71 , ?
    (A) 81   (B)90
    (C) 97   (D) 107

Sol. **(D)** Each term is obtained by adding 1^2, 2^2, 3^2, 4^2, 5^2...... respectively.
Next term = $71 + 6^2 = 107$

Ex.4 3, 4, 8, 17, 33, 58 , ?
    (A) 69   (B)94
    (C) 74   (D) 89

Sol. **(B)** Sharp increase that slows down later on, likely to be addition of squared or cubed numbers. On checking the series is:
$+ 1^2 + 2^2, + 3^2, + 4^2, + 5^2, ?$
Next term $= 58 + 6^2 = 94$.

Ex.5 0, 6, 24, 60, 120, 210, ?
(A) 240   (B) 290
(C) 336   (D) 504

Sol. **(C)** Clearly, the given series is
$1^3 - 1, 2^3 - 2, 3^3 - 3, 4^3 - 4, 5^3 - 5, 6^3 - 6$.
∴ Next number $= 7^3 - 7 = 343 - 7 = 336$

Ex.6 –2, 4, 22, 58, 118, 208 , ?
(A) 250   (B) 334
(C) 310   (D) 294

Sol. **(B)** Series increases sharply but then its speed of rise slows down, likely to be addition of squared or cubed numbers. On checking, the series is: $1^3 - 3, 2^3 - 4, 3^3 - 5, 4^3 - 6....$
Next term $= 7^3 - 9 = 334$.

Ex.7 3, 3, 6, 18, 72, 360 , ?
(A) 720   (B) 1890
(C) 2160   (D) None of these

Sol. **(C)** Sharp increase.
The series is : $\times 1, \times 2, \times 3, \times 4, \times 5, ...$
Next term $= 360 \times 6 = 2160$

Ex.8 8, 14, 26, 50, 98, 194 , ?
(A) 388   (B) 384
(C) 386   (D) 382

Sol. **(C)** Sharp increase and terms roughly doubling every time. On checking with 2 as multiple the series is:
next term = previous term $\times 2 - 2$. Next term = $194 \times 2 - 2. = 386$

Ex.9 6, 16, 36, 76, 156, 316 , ?
(A) 632   (B) 636
(C) 642   (D) 650

Sol. **(B)** Sharp increase with terms roughly doubling each time. Likely to have geometrical nature with 2 as multiple. On checking the series is: $\times 2 + 4$.
Next term $= 316 \times 2 + 4 = 636$

Ex.10 824, 408, 200, 96, 44, 18 , ?

(A) 10   (B) 8
(C) 7   (D) 5

Sol. **(D)** Sharp decrease and terms roughly being halved every time. Checking with 2 as divisor the series is :
Next term (previous term – 8) ÷ 2.
Next term = 5.

Ex.11 8, 8, 9, 9, 11, 10, 14, 11 , ?
(A) 14   (B) 18
(C) 19   (D) 20

Sol. **(B)** Irregular. Very irregular. Likely to be, therefore, mixed. On checking it is a mix of two series:
8, 9, 11, 14, (+1, +2, +3 etc.) and 8, 9, 10, 11.
Next term = 14 + 4 + 18.

**Ex.12** 4, 6, 12, 14, 28, 30, ?
(A) 32   (B) 60
(C) 62   (D) 64

Sol. **(B).** The given sequence is a combination of two series :
I. 4, 12, 28, ? and II. 6, 14, 30.
Now, the pattern followed in each of the above two series is : +8, +16, +32 ....
So, missing number = (28 + 32) = 60

Ex.13 1, 3, 3, 6, 7, 9, ?, 12, 21.
(A) 10   (B) 11
(C) 12   (D) 13

Sol. **(D)** Clearly, the given sequence is a combination of two series :
I. 1, 3, 7, ?, 21 and II. 3, 6, 9, 12
The pattern followed in I is + 2, + 4, +6, +8 ...; and the pattern followed in II is +3. Thus, missing number = 7 + 6 = 13.

Ex.14 3, 6, 24, 30, 63, 72, ?, 132
(A) 128   (B) 122
(C) 120   (D) 124

Sol. **(C)** The difference between the terms is given below as:

3   6   24 30 63 72 ?   132

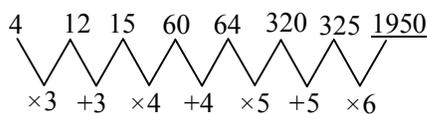Difference   3   18 6   33 9   48 ?

Difference   3   15 3   15 ?
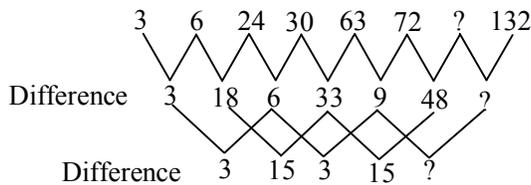
Therefore alternate difference between the difference is 3 and 15 respectively.

Hence, the next term would be 72 + 48 = 120.

Ex.15 4, 12, 15, 60, 64, 320, 325, ?

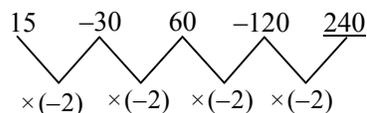   (A) 1950   (B) 1850

    (C) 1935   (D) 1955

Sol.   **(A)**

4   12 15 60 64 320 325 1950

    ×3 +3 ×4 +4 ×5 +5 ×6

Ex.16 15, −30, 60, −120, ?

    (A) 150   (B) 240

    (C) 270   (D) 180

Sol.   **(B)**

15 −30 60 −120 240

  ×(−2) ×(−2) ×(−2) ×(−2)

◈ **Find the Wrong Term**

Ex.17 2, 5, 9, 11, 14

    (A) 2   (B) 5

    (C) 9   (D) 11

Sol.   **(C)** Series : + 3, + 3, + 3, ...

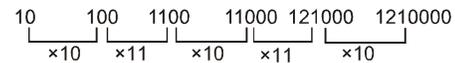The next term is got by adding 3 in preceding term.

∴ 2 + 3 = 5, 5 + 3 = 8

Hence, 9 is wrong term.

Ex.18 10, 100, 1100, 11000, 111000, 1210000.

    (A) 1100   (B) 11000

    (C) 100   (D) 111000
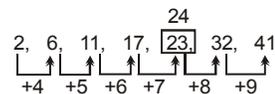
Sol.   **(D)** Given series is :

10   100   1100   11000 121000 1210000

  ×10 ×11 ×10 ×11 ×10

Hence, the wrong term is 111000 .

Ex.19 2, 6, 11, 17, 23, 32, 41

    (A) 6   (B) 17

    (C) 23   (D) 32

Sol.   **(C)** Given series is :

                  24

2, 6, 11, 17, 23, 32, 41

  +4 +5 +6 +7 +8 +9

Hence, the wrong term is 23.

Ex.20 61, 52, 63, 95, 46, 18

    (A) 95   (B) 63

    (C) 46   (D) 52

Sol.   **(A)** On interchanging the digits of each term, we get a number which is a perfect square of a natural number.
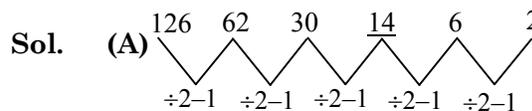
$4^2 = 16 \Rightarrow 61$, $5^2 = 25 \Rightarrow 52$, $6^2 = 36 \Rightarrow 63$,

$7^2 = 49 \Rightarrow 94$,

Hence, the wrong term is 95.

Ex.21 126, 62, 30, 15, 6, 2

    (A) 15   (B) 30

    (C) 6   (D) 62

Sol.   **(A)** 126 62 30 14 6   2

    ÷2−1 ÷2−1 ÷2−1 ÷2−1 ÷2−1

Hence, the wrong term is 15.

Directions (1 to 24) : Find the missing term

Q.1 7, 12, 19, ?, 39.
(A) 29 (B) 28
(C) 26 (D) 24

Q.2 6, 11, 21, 36, 56, ?
(A) 42 (B) 51
(C) 81 (D) 91

Q.3 1, 6, 13, 22, 33, ?
(A) 44 (B) 45
(C) 46 (D) 47

Q.4 1, 9, 17, 33, 49, 73, ?
(A) 97 (B) 98
(C) 99 (D) 100

Q.5 3, 7, 15, 31, 63, ?
(A) 92 (B) 115
(C) 127 (D) 131

Q.6 1, 6, 15, ?, 45, 66, 91
(A) 25 (B) 26
(C) 27 (D) 28

Q.7 1, 2, 3, 5, 8, ?
(A) 9 (B) 11
(C) 13 (D) 15

Q.8 77, 49, 36, 18, ?
(A) 8 (B) 9
(C) 4 (D) 12

Q.9 18, 35, 69, 137, ?
(A) 270 (B) 273
(C) 271 (D) 272

Q.10 6, 12, 7, 11, 8, 10, 9, ?

(A) 8 (B) 15
(C) 9 (D) 14

Q.11 9, 11, 15, 23, ?
(A) 25 (B) 21
(C) 39 (D) 31

Q.12 2, 3, 5, 7, 11, 13, ?
(A) 12 (B) 14
(C) 16 (D) 17

Q.13 7, 11, 13, 17, 19, 23, 25, ?
(A) 25 (B) 27
(C) 24 (D) 29

Q.14 2, 5, 11, 23, 47, ?
(A) 82 (B) 95
(C) 110 (D) 118

Q.15 1, 1, 2, 4, 3, 9, 4, ?
(A) 10 (B) 12
(C) 16 (D) 20

Q.16 5, 8, 14, 26, 50, ?
(A) 60 (B) 98
(C) 68 (D) 78

Q.17 100, 91, 83, 76, 70, ?
(A) 65 (B) 60
(C) 62 (D) 63

Q.18 101, 100, ?, 87, 71, 46.
(A) 92 (B) 88
(C) 89 (D) 96

Q.19 2, 3, 5, 8, 13, 21, ?
(A) 34 (B) 28
(C) 26 (D) 25

Q.20 1, 1, 2, 6, 24, 120, ?
(A) 729 (B) 720
(C) 600 (D) 480

Q.21 28, 15, 6, ?, 0
(A) 3   (B) 2
(C) 1   (D) 0

Q.22 96, 90, 78, ?, 36, 6
(A) 60   (B) 54
(C) 72   (D) 48

Q.23 3, 6, 18, 72, 360, ?
(A) 720   (B) 1080
(C) 1600   (D) 2160

Q.24 480, 480, 240, 80, 20, ?
(A) 4   (B) 1
(C) 5   (D) 10

Directions (25 to 29) : Find the wrong terms

Q.25 5, 10, 12, 24, 26, 48, 54
(A) 10   (B) 24
(C) 26   (D) 48

Q.26 5, 8, 11, 14, 16, 20
(A) 11   (B) 14
(C) 20   (D) 16

Q.27 2, 6, 11, 17, 23, 32, 41
(A) 6   (B) 17
(C) 23   (D) 32

Q.28 121, 143, 165, 186, 209
(A) 143   (B) 165
(C) 186   (D) 209

Q.29 3, 1, 4, 5, 10, 14, 23
(A) 5   (B) 10
(C) 14   (D) 23

Q.30 1, 2, 4, 8, 16, 32, 64, 96
(A) 4   (B) 32
(C) 64   (D) 96