

**FOUNDATION & OLYMPIAD**

**CLASS-VII**

**Specimen Copy**

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### Terminologies

**Measurement, Unit, Numerical value, Physical quantities, Fundamental quantities, Derived quantities, SI Prefixes, Scalar and vector.**

## INTRODUCTION

Measurements plays an important role in our daily life. Measurement is the comparison of an unknown quantity with a known standard quantity of the same kind. The standard quantity used for comparison is called the unit. To express the measurement the following things are essential.

- (i) **Unit** : A unit of measurement is a definite magnitude of a quantity, defined and adopted by convention or by law and used as standard for measurement of the same quantity.
- (ii) **Numerical value** : which expresses the magnitude of quantity i.e. how many times the amount is in the quantity.

So, the measure of a physical quantity can be expressed as

$$\text{Measure of a physical quantity}(M) = \text{Numerical value}(N) \times \text{Unit}(U)$$

Example : If the mass of certain quantity of rice is 8 kilogram, it means the unit of mass is kilogram (kg) and the magnitude of the given quantity of rice is eight times this unit.

## 1.1 SYSTEM OF UNITS AND PHYSICAL QUANTITIES:

### (a) Systems of unit

- (i) **F.P.S. System** : In this system the unit of length, mass and time are foot, pound and second respectively.
- (ii) **C.G.S. System** : In this system the unit of length is centimetre, the unit of mass is gram and the unit of time is second.
- (iii) **M.K.S. System** : In this system the unit of length, mass and time are metre, kilogram and second respectively.
- (iv) **S.I. System** : In 1960, International Bureau of weights and measurements set up a new system which is the extension of M. K. S. system and units of all physical units can be expressed in these terms. The new system is called 'International system of units or S.I. units. In 1960 seven fundamental units and two supplementary units were decided, which are shown in the following

| Basic Quantity      | S.I. Unit |        |
|---------------------|-----------|--------|
|                     | Name      | Symbol |
| Length              | metre     | m      |
| Mass                | kilogram  | kg     |
| Time                | second    | s      |
| Electric Current    | ampere    | A      |
| Temperature         | kelvin    | K      |
| Amount of Substance | mole      | mol    |
| Luminous Intensity  | candela   | Cd     |

### (b) Physical quantities

The quantities which can be measured by an instrument are called physical quantities, and follows laws of physics.

Eg. : length, velocity, acceleration, force, time, pressure, mass, density etc.

Physical quantities are of two types



#### (i) Fundamental quantities :

The physical quantities that are independent of one another are called fundamental quantities.

The unit of these fundamental quantities are called fundamental units.

For example mass,length,time,temperature

#### (ii) Derived quantities :

The physical quantities, that can be expressed in terms of fundamental quantities are called derived quantities, units of derived quantities are called derived units.

For example, speed of a particle can be written as distance travelled in unit time

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{\text{length}}{\text{time}}$$

(c) **Derived units of some physical quantities:**

| Derived Physical Quantity | Formula or Relation with other Physical Quantities | Derived unit   | symbol             |
|---------------------------|--|--|--------------------|
| Area                      | Length × Breadth                                   | $m \times m$   | $m^2$              |
| Volume                    | Length × Breadth × Height                          | $m \times m \times m$                                | $m^3$              |
| Frequency                 | $\frac{1}{\text{Time period}}$                     | $\frac{1}{\text{second}}$                            | Hz                 |
| Density                   | $\frac{\text{Mass}}{\text{Volume}}$                | $\frac{\text{kg}}{\text{m}^3}$                       | $\text{kg m}^{-3}$ |
| Speed                     | $\frac{\text{Distance}}{\text{Time}}$              | $\frac{\text{m}}{\text{s}}$                          | $\text{ms}^{-1}$   |
| Velocity                  | $\frac{\text{Displacement}}{\text{Time}}$          | $\frac{\text{m}}{\text{s}}$                          | $\text{ms}^{-1}$   |
| Acceleration              | $\frac{\text{Change in velocity}}{\text{Time}}$    | $\frac{\text{m/s}}{\text{s}}$                        | $\text{ms}^{-2}$   |
| Force                     | Mass × Acceleration                                | $\text{kg} \times \text{m/s}^2 = \text{kg.m.s}^{-2}$ | newton = N         |
| Pressure                  | $\frac{\text{Force}}{\text{Area}}$                 | newton/m <sup>2</sup>                                | pascal=Pa          |

(d) **S.I. Prefixes**

The magnitude of physical quantities vary over a wide range. So in order to express the very large magnitude as well as very small magnitude more compactly, "CGPM"(General conference on weight and measures) recommended some standard prefixes for certain power of 10.

| Power of 10 | Prefix | Symbol |
|-------------|--------|--------|
| $10^{18}$   | exa    | E      |
| $10^{15}$   | peta   | P      |
| $10^{12}$   | tera   | T      |
| $10^9$      | giga   | G      |
| $10^6$      | mega   | M      |
| $10^3$      | kilo   | k      |
| $10^2$      | hecto  | h      |
| $10^1$      | deca   | da     |
| $10^{-1}$   | deci   | d      |
| $10^{-2}$   | centi  | c      |
| $10^{-3}$   | milli  | m      |
| $10^{-6}$   | micro  | $\mu$  |
| $10^{-9}$   | nano   | n      |
| $10^{-12}$  | pico   | p      |
| $10^{-15}$  | femto  | f      |
| $10^{-18}$  | atto   | a      |

**(e) Some special units:****(i) For length :****(A) Micron ( $\mu$ )**

It is one millionth ( $10^{-6}$ )<sup>th</sup> part of a metre and is denoted by the symbol  $\mu$ . It is also called micrometre.

$$1 \text{ micron} = 10^{-6} \text{ metre}$$

$$= 10^{-4} \text{ cm}$$

$$= 10^{-3} \text{ mm}$$

**(B) Angstrom ( $\text{\AA}$ ) :**

It is ( $10^{-10}$ ) part of a metre. It is denoted by the symbol  $\text{\AA}$ .

$$1 \text{ \AA} = 10^{-10} \text{ m} = 10^{-8} \text{ cm}$$

**(C) Light year**

A light year is the distance travelled by light in vacuum in one year.

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

**(D) Parsec :**

$$1 \text{ parsec} = 3.26 \text{ light year}$$

**(ii) For mass :****(A) Quintal :** One quintal is equal to hundred kg

$$1 \text{ quintal} = 100 \text{ kg} = 10^2 \text{ kg}$$

**(B) Metric tonne**

One metric tonne is equal to thousand kg.

$$1 \text{ metric tonne} = 1000 \text{ kg} = 10^3 \text{ kg}$$

**(iii) For time :****(A) Year :** The time taken by the earth to complete one revolution round the sun.

$$1 \text{ year} = 365 \frac{1}{4} \text{ days}$$

**(B) Lunar month :** One lunar month is the time in which the moon completes one revolution around the earth.

$$1 \text{ Lunar month} = 27.3 \text{ days}$$

**(C) Millennium :** A millennium is of 1000 years**(D) Solar day :** The time taken by the earth to complete one rotation on its own is called solar day.

$$1 \text{ solar day} = 86400 \text{ sec}$$

**(E) Shake:**  $1 \text{ shake} = 10^{-8} \text{ second}$ **(iv) The smallest and the biggest units :**

The smallest practical unit of distance → Fermi

$$1 \text{ fermi} = 10^{-15} \text{ m}$$

The biggest unit of distance → parsec

$$1 \text{ parsec} = 3.26 \text{ light year}$$

The smallest unit of time → shake

$$1 \text{ shake} = 10^{-8} \text{ second}$$

The largest unit of time → Millennium

$$1 \text{ millennium} = 1000 \text{ year}$$



**Example :**

- (i)  $1 \mu\text{m} = 1 \text{ micrometre} = 10^{-6} \text{ m}$
- (ii)  $1 \text{ mm} = 1 \text{ millimetre} = 10^{-3} \text{ m}$
- (iii)  $1 \text{ nm} = 1 \text{ nanometre} = 10^{-9} \text{ m}$
- (iv)  $1 \text{ MHz} = 1 \text{ megahertz} = 10^6 \text{ Hz}$
- (v)  $1 \text{ km} = 1 \text{ kilometre} = 10^3 \text{ m}$
- (vi)  $1 \text{ GHz} = 1 \text{ gigahertz} = 10^9 \text{ Hz}$

**Illustration 1.1** A football field is 0.5 km long. How many meters long is the football field ?

**Sol.**  $1000 \text{ m} = 1 \text{ km}$

$$\therefore 0.5 \text{ km} = 0.5 \times 10^3 \text{ m} = 500 \text{ m}$$

**Illustration 1.2** Sunita bought 700 grams of sugar to make a cake. How many kg of sugar did she buy

**Sol.**  $1000 \text{ grams} = 1 \text{ kg}$

$$700 \text{ g} = \frac{700}{1000} \text{ kg} = 0.7 \text{ kg}$$

**Illustration 1.3** Convert 64 km/h into m/s.

**Sol.**  $64 \frac{\text{km}}{\text{h}} = \frac{64 \times 1000 \text{ m}}{60 \times 60 \text{ s}} = \frac{160}{9} \frac{\text{m}}{\text{s}}$

**Illustration 1.4** Convert 36 g/cm<sup>3</sup> into kg/m<sup>3</sup>

**Sol.**  $36 \text{ g/cm}^3$

$$36 \times \frac{1}{1000} \text{ kg} \times \frac{1}{(100)^{-3} \text{ m}^3} = 36 \times 10^3 \text{ kg/m}^3$$

**NOTE :** To convert  $\frac{\text{km}}{\text{hour}}$  into  $\frac{\text{m}}{\text{sec}}$ , multiply by  $\frac{5}{18}$

**Ask yourself**

1. Convert the following in metre :

- |                       |                             |
|-----------------------|-----------------------------|
| (i) $5 \mu\text{m}$ . | (ii) $3 \text{ km}$         |
| (iii) $20 \text{ mm}$ | (iv) $73 \text{ picometer}$ |
| (v) $7.5 \text{ nm}$  |                             |

2. Convert 5 metric tonne into gram

3. Convert 1560 gram in kilogram

4. Density of mercury is  $13.6 \text{ g cm}^{-3}$ , then its value in MKS system will be?

5. How many metres are there in 1 light year

6. The volume of a cube of side 1 cm is equal to..... $\text{m}^3$

7. A vehicle moving with a speed of  $18 \text{ km h}^{-1}$  covers....m in 1 s

## 1.2 SCALAR AND VECTOR

In physics, we study about large number of physical quantities, which are broadly classified into two categories :

- (a) Scalar
- (b) Vector

### (a) Scalar :

The physical quantities which have magnitude only and no direction are called scalar quantities.

(i) **Eg.** : Mass, time, temperature, distance etc. A scalar has magnitude only and no direction is associated with it.

(ii) **Scalar** can be **added, subtracted, multiplied or divided** by using the **rules of ordinary algebra**

**Eg.** : adding 20 kg mass to 10 kg mass gives 30 kg mass.

### (b) Vector :

The physical quantities which have magnitude as well as direction and also follow laws of vector algebra are called vector quantities.

(i) **Eg.** : Displacement, velocity, acceleration, force etc. The direction of a vector is as important as its magnitude.

When we say that the displacement of a particle is 5m, the description is incomplete because direction of the displacement is not given. However, the statement that the displacement of a particle is 5m towards east is correct and meaningful. Thus the description of a vector must be associated with magnitude as well as direction.

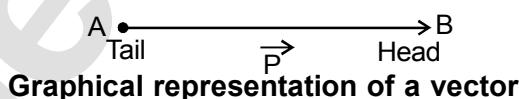
(ii) The **vector** are **added, subtracted or multiplied** by the **rules of vector algebra**. However, division of a vector by another vector is not an operation in vector algebra.

### (c) Representation of a Vector :

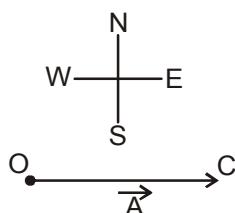
A vector has two things : (i) Magnitude      (ii) Direction.

A vector is represented by a line with arrow head .Length of line shows its magnitude and arrow head shows its direction. Figure represents a vector  $\vec{P} = \overrightarrow{AB}$  . Point A is called **tail** and point B is called **head** of the vector  $\vec{P} = \overrightarrow{AB}$  .

Sometime, a vector  $\vec{P}$  is represented by bold faced letter **P**. The magnitude of vector  $\vec{P}$  can be written as  $|\vec{P}|$  , modulus of  $\vec{P}$  or simply P.



**Eg.** : A car travels 30 km due east. In order to represent this vector (displacement), we select a convenient scale say  $1\text{ cm} = 10\text{ km}$ . Then we draw a straight line 3 cm with an arrow head on it towards east. The vector  $\vec{OC} = \vec{A}$  represents a displacement of 30 km towards east.



**Illustration 1.5 :** How is a vector quantity represented graphically? Represent two forces one of 50 N due south and the other of 25 N due east, acting simultaneously on a particle.

**Sol:** Here we have to represent two forces of 50 N and 25 N. Let our scale be:

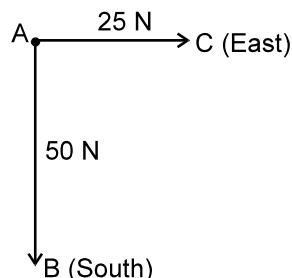
1 cm represents 10 N

Now since  $10 \text{ N} = 1 \text{ cm}$

$$\therefore 50 \text{ N} = (1/10) \times 50 \text{ cm} \\ = 5 \text{ cm}$$

Again,  $10 \text{ N} = 1 \text{ cm}$

$$\therefore 25 \text{ N} = (1/10) \times 25 \text{ cm} = 2.5 \text{ cm}$$



Thus in order to represent 50N force due south we draw a 5 cm long straight line AB from north to south with the arrow head pointing towards south. Now  $\vec{AB}$  represents a force of 50 N due south (on a scale of  $1 \text{ cm} = 10 \text{ N}$ ). In order to represent the other force of 25 N, we draw a 2.5 cm long straight line AC pointing towards east. So  $\vec{AC}$  represents a force of 25 N due east (on scale  $1 \text{ cm} = 10 \text{ N}$ )

**Illustration 1.6 :** Draw vector corresponding to the following displacement

(i) 6m,  $60^\circ$  north – east

(ii) 6m, west

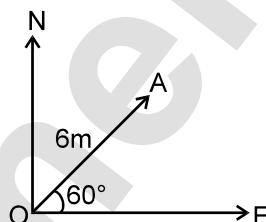
(iii) 25 m,  $30^\circ$  south – east

**Sol.** (i) We will first draw a vector representing a displacement of 6m, at  $60^\circ$  in the north east direction. Let our scale be :

1 cm represents 1m.

Now,  $1 \text{ m} = 1 \text{ cm}$

$$\therefore 6 \text{ m} = 6 \text{ cm}$$



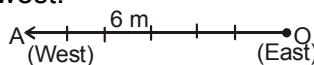
Then we draw a 6 cm long straight line OA making an angle of  $60^\circ$  with east direction (towards north). We also put an arrowhead at point A. Now, vector OA represents a displacement of 6m,  $60^\circ$  north-east (on a scale :  $1 \text{ cm} = 1 \text{ m}$ ).

(ii) Let  $1 \text{ cm} = 1 \text{ m}$

or,  $1 \text{ m} = 1 \text{ cm}$

$$\therefore 6 \text{ m} = 6 \text{ cm}$$

In this case displacement is towards the 'West' direction. So, from the origin O we draw a 6 cm long straight line OA pointing towards west. So, the  $\vec{OA}$  given below represents a displacement of 6m towards west.



(iii) Scale :

1 cm represents 5m

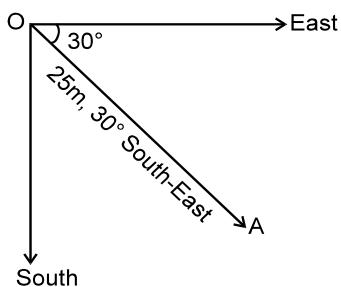
or,  $5 \text{ m} = 1 \text{ cm}$

$$\therefore 25 \text{ m} = (1/5) \times 25 = 5 \text{ cm}$$

Thus, a displacement of 25 m can be represented by a 5 cm long straight line. Here, the displacement is  $30^\circ$  towards south of east, so first of all we draw south and east direction. We now draw a 5 cm long straight line OA making an angle of  $30^\circ$  with east direction (towards South).

So the  $\vec{OA}$  shown in the figure below represents a displacement of 25 m,  $30^\circ$  south – east (on a scale  $1 \text{ cm} = 5 \text{ m}$ ).



**Ask yourself**

1. Mark the following as scalar and vectors
 

|                  |                   |             |               |
|------------------|-------------------|-------------|---------------|
| (i) distance     | (ii) displacement | (iii) speed | (iv) velocity |
| (v) acceleration | (vi) force        |             |               |
2. Which of the following is not a vector?
 

|          |            |              |           |
|----------|------------|--------------|-----------|
| (A) Mass | (B) Weight | (C) Velocity | (D) Force |
|----------|------------|--------------|-----------|
3. Draw vector corresponding to the following displacement
 

|                            |
|----------------------------|
| (i) 10m, 30° south – east  |
| (ii) 50m, north            |
| (iii) 20 m, 30° north–west |
4. Which of the following are vector quantities
 

|  |
|--|
| (A) The velocity of frisbee  |
| (B) The width of crater made by an asteroid                              |
| (C) The speed of car on highway  |
| (D) The displacement of a billiard ball after it is struck by a cue ball |

**Add to Your Knowledge****Scientific Definitions:****Metre:**

The metre is the length of the path travelled by light in vacuum during a time interval of  $1/299,792,458$  of a second. (1983)

**Kilogram:**

The kilogram is equal to the mass of the international prototype of the kilogram (a platinum-iridium alloy cylinder) kept at International Bureau of Weights and Measures, at Sevres, near Paris, France. (1889)

**Second:**

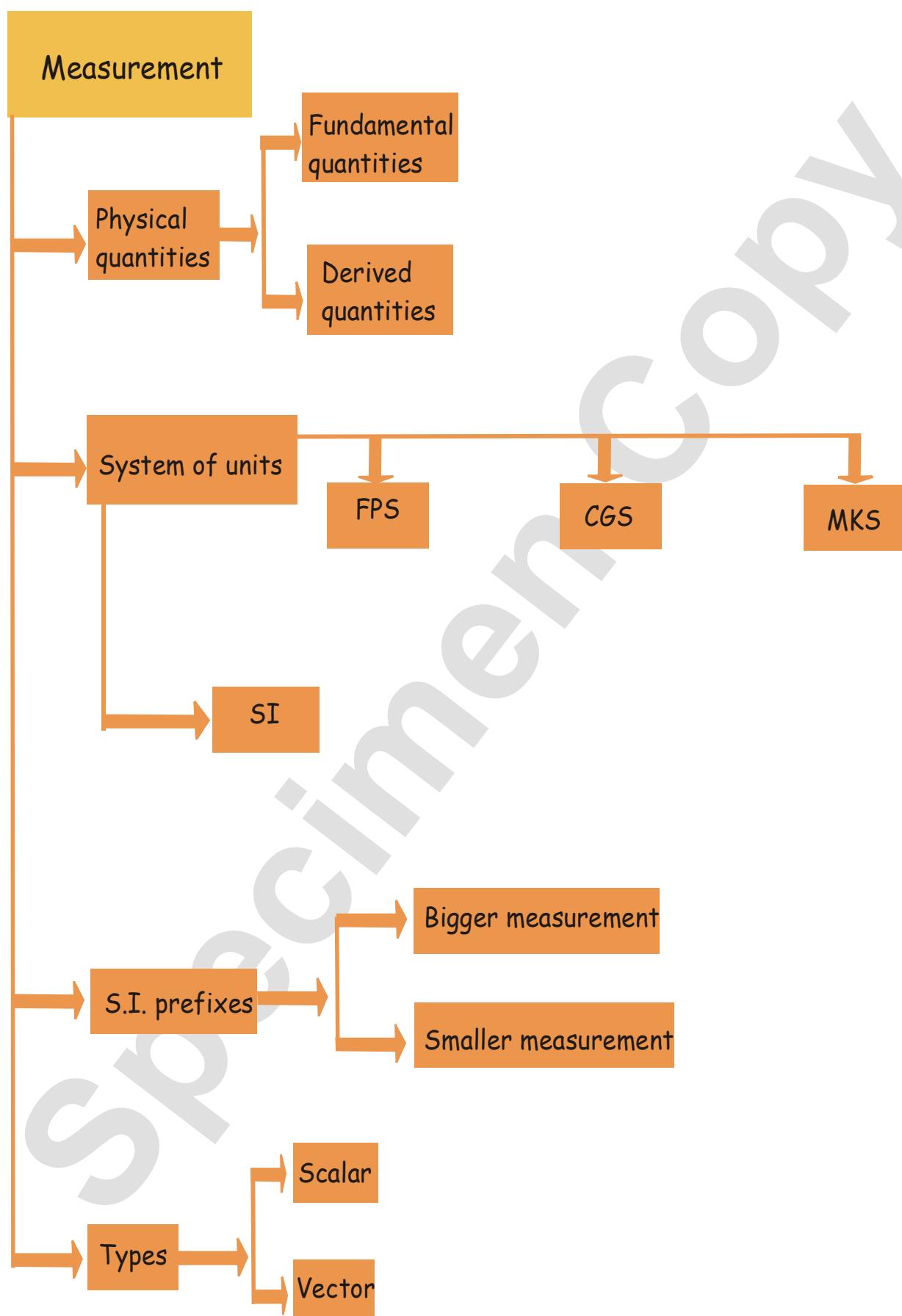
The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom. (1967)

**Summary**

1. Measurement is the comparison of an unknown quantity with a known standard quantity of the same kind.
2. **Unit :** A unit of measurement is a definite magnitude of a quantity
3. **Numerical value :** which expresses the magnitude of quantity

4. Measure of a physical quantity(M) = Numerical value(N)×Unit(U)
5. There are following system of units.  
(a) F.P.S. System                   (b) C.G.S. System  
(c) M.K.S. System                   (d) S.I. System
6. **Physical quantities** : The quantities which can be measured by an instrument are called physical quantities.
7. Physical quantities are of two types.  
(a) Fundamental quantities  
(b) Derived quantities
8. **Scalar** : The physical quantities which have magnitude only and no direction are called scalar quantities
9. **Vector** : The physical quantities which have magnitude as well as direction and also follow laws of vector algebra are called vector quantities.

## CONCEPT MAP



**EXERCISE > 01****SECTION -A (FIXED RESPONSE TYPE)****MULTIPLE CHOICE QUESTIONS**

1. Density of a cuboid of mass 200g with dimension length 2cm, breadth 4 cm and height 5 cm  
 (A)  $1000 \text{ kg m}^{-3}$       (B)  $3000 \text{ kg m}^{-3}$       (C)  $5000 \text{ kg m}^{-3}$       (D)  $2000 \text{ kg m}^{-3}$
2. The total mass of two objects of masses 1050kg and 12 tonnes  
 (A) 130.5 quintals      (B) 225 tonnes      (C) 11.2 quintals      (D) 12 tonnes
3.  $10^4 \text{ cm}^{-3}$  is equal to  
 (A)  $\frac{1}{1000} \text{ m}^3$       (B)  $\frac{1}{100} \text{ m}^3$       (C)  $10 \text{ m}^3$       (D)  $100 \text{ m}^3$
4. Express a speed of  $360 \text{ cm h}^{-1}$  in  $\text{km s}^{-1}$   
 (A)  $10^{-6}$       (B)  $10^{-5}$       (C)  $36 \times 10^{-6}$       (D)  $360 \times 10^{-6}$
5. 1 litre is equal to  
 (A)  $10^3 \text{ cm}^3$       (B)  $1 \text{ dm}^3$       (C)  $10^{-3} \text{ m}^3$       (D) all the above
6. Converting  $2 \text{ kg m}^2 \text{ s}^{-2}$  to  $\text{g cm}^2 \text{ s}^{-2}$  we get.  
 (A)  $1 \times 10^7 \text{ g cm}^2 \text{ s}^{-2}$       (B)  $2 \times 10^7 \text{ g cm}^2 \text{ s}^{-2}$       (C)  $3 \times 10^7 \text{ g cm}^2 \text{ s}^{-2}$       (D)  $4 \times 10^7 \text{ g cm}^2 \text{ s}^{-2}$
7. What is the SI unit of pressure :  
 (A) mm of Hg      (B) pascal      (C) bar      (D) dyne/cm<sup>2</sup>
8. The unit of time is  
 (A) light year      (B) angstrom      (C) leap year      (D) newton
9. In the SI system, the unit of temperature is:  
 (A) degree celsius      (B) degree centigrade  
 (C) degree Fahrenheit      (D) Kelvin
10. One light year distance is equal to:  
 (A)  $9.46 \times 10^{12} \text{ km}$       (B)  $9.46 \times 10^{14} \text{ km}$       (C)  $9.46 \times 10^{12} \text{ m}$       (D)  $9.46 \times 10^{15} \text{ km}$
11. Which of the following is not a vector quantity  
 (A) Force      (B) Acceleration      (C) Time      (D) velocity
12. Minimum number of vectors of equal magnitude required to produce zero resultant is :  
 (A) two      (B) three      (C) four      (D) five
13. Scalars have only  
 (A) Magnitude      (B) direction      (C) both (A) and (B)      (D) None of these
14. Time is  
 (A) scalar      (B) vector      (C) tensors      (D) none of these
15. Electric current has magnitude as well as direction than it will be  
 (A) scalar      (B) vector      (C) tensors      (D) none of these

**FILL IN THE BLANKS**

1. The Unit of speed is centimeter/second in \_\_\_\_\_ System of unit.
2. The weight of a body  $60\text{kg} \cdot \text{m} \cdot \text{sec}^{-2}$  is equal to \_\_\_\_\_ Newton(N).
3. One micrometer is equal to \_\_\_\_\_ meter.
4. light year is unit of \_\_\_\_\_
5. C.G.S unit of time is \_\_\_\_\_
6. Quantity of matter contained in a body is called as \_\_\_\_\_
7. Physical quantity velocity is \_\_\_\_\_ quantity.
8. Physical quantity Distance is \_\_\_\_\_ quantity.
9. Temperature is a \_\_\_\_\_ quantity
10. Vector can be added, subtracted, multiplied by using \_\_\_\_\_ algebra

**TRUE / FALSE**

1. The unit of length is light year.
2.  $1\text{km/h}$  is equal to  $5/18\text{ m/s}$ .
3. The time taken by the earth to complete one rotation on its own is called solar day.
4. Light year is unit of speed
5. Force is scalar quantity.
6. Displacement is vector quantity.
7. Vectors can be added using simple rules of algebra

**MATCH THE COLUMN**

- |                      |                 |
|----------------------|-----------------|
| <b>1. Column-1</b>   | <b>Column-2</b> |
| 1. Unit of time      | (a) Pascal      |
| 2. Unit of pressure  | (b) Leap year   |
| 3. Unit of distance  | (c) Light year  |
| 4. Unit of frequency | (d) newton      |
| 5. Unit of force     | (e) Hertz       |

**SECTION -B (FREE RESPONSE TYPE)****VERY SHORT ANSWER TYPE**

1. Convert  $1\text{m}^2$  into  $\text{cm}^2$ .
2. Convert  $0.25\text{ kg m/s}^2$  into  $\text{g cm/s}^2$ .
3. Convert  $16\text{ m/s}$  into  $\text{km/h}$ .
4. Convert  $1\text{ km/h}$  into  $\text{m/s}$ .
5. What is light year ?
6. What is relation between parsec & light year ?
7. How do we represent vectors?



## **SHORT ANSWER TYPE**

8. A satellite was orbiting the earth at an altitude of 300 km.what is the altitude in millimeters?
  9. Name the different systems of units.
  10. What are the basic Quantities?
  11. Define the system of unit ?
  12. What are vector quantities? Explain with the help of examples.
  13. How many basic physical quantities are there? Define them with examples.

## **LONG ANSWER TYPE**



# EXERCISE > 02

## **SECTION -A (COMPETITIVE EXAMINATION QUESTION)**

## MULTIPLE CHOICE QUESTIONS :

1. A spaceship travels 36,000km in 1 hour. Express its speed in  $\text{km s}^{-1}$   
(A)  $10 \text{ km s}^{-1}$  (B)  $20 \text{ km s}^{-1}$  (C)  $100 \text{ km s}^{-1}$  (D)  $40 \text{ km s}^{-1}$

2. If the multiple  $10^{-12}$  is named pico and is used as a prefix. Express picosecond in terms of microsecond  
(A)  $10^{-6}$  microsecond (B)  $10^{-4}$  microsecond (C)  $10^{-2}$  microsecond (D)  $10^{-8}$  microsecond

3. 4.15 p.m in 12 hours is written as \_\_\_\_\_ in 24 hours clock system  
(A) 11 hours 45 minutes (B) 4 hours 45 minutes  
(C) 22 hours 15 minutes (D) 16 hours 15 minutes

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

5. The instrument used to measure the volume of milk is  
(A) metre scale. (B) vernier caliper. (C) measuring cylinder. (D) stop watch.

6. To measure the girth of a tree one may use  
(A) measuring tape. (B) beam balance. (C) balance wheel. (D) spring balance.

7. The S.I. system of measurement is the abbreviation of  
(A) International Measurement System.      (B) Standard of India.  
(C) International System of Units.      (D) International Standard of Units
8. A scalar quantity:  
(A) Always has a mass  
(B) Is a quantity that is completely specified by its magnitude  
(C) Shows direction  
(D) Does not have unit
9. A vector quantity:  
(A) Specifies magnitude  
(B) Specifies direction  
(C) Specifies both magnitude and direction  
(D) None of these
10. \_\_\_\_\_ is an example of scalar quantity  
(A) Velocity      (B) Force      (C) Distance      (D) Acceleration

### **SECTION -B (TECHIE STUFF)**

11. A student measures the thickness of a human hair by looking at it through a microscope of magnification 100. He makes 20 observations and finds that the average width of the hair in the field of view of the microscope is 3.5 mm. What is the estimate on the thickness of hair?
12. Your scale is broken from one end at 1.5 cm. How do you measure the length of your identity card ?

**ANSWER KEY ➤**

**EXERCISE # 1**  
**SECTION -A (FIXED RESPONSE TYPE)**  
**MULTIPLE CHOICE QUESTIONS**

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

**FILL IN THE BLANKS**

- |          |                  |                     |             |            |
|----------|------------------|---------------------|-------------|------------|
| 1. C.G.S | 2. 60 Newton(N). | 3. $10^{-6}$ meter. | 4. Distance | 5. Second  |
| 6. Mass  | 7. Vector        | 8. Scalar           | 9. Scalar   | 10. Vector |

**TRUE/FALSE**

- |         |          |         |          |          |
|---------|----------|---------|----------|----------|
| 1. True | 2. True  | 3. True | 4. False | 5. False |
| 6. True | 7. False |         |          |          |

**MATCH THE COLUMN**

1. (1) → (b),    (2) → (a),    (3) → (c),    (4) → (e),    (5) → (d)

**SECTION -B (FREE RESPONSE TYPE)**  
**SUBJECTIVE ANSWERS**

- |                                     |                               |              |                       |
|-------------------------------------|-------------------------------|--------------|-----------------------|
| 1. $10^4 \text{ cm}^2$              | 2. $25 \times 10^3$           | 3. 57.6 km/h | 4. $5/18 \text{ m/s}$ |
| 5. $9.46 \times 10^{12} \text{ km}$ | 6. 1 parsec = 3.26 light year |              |                       |
| 14. 35 m (due West)                 | 15. 2358720 sec.              |              |                       |

**EXERCISE # 2**

**SECTION -A (COMPETITIVE EXAMINATION QUESTION)**  
**MULTIPLE CHOICE QUESTIONS**

|       |   |   |   |   |   |   |   |   |   |    |
|-------|---|---|---|---|---|---|---|---|---|----|
| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Ans.  | A | A | D | B | C | A | C | B | C | C  |

**SECTION -B (TECHIE STUFF)**

11. Magnification of the microscope = 100  
 Average width of the hair in the field of view of the microscope = 3.5 mm  
 ^Actual thickness of the hair is =  $3.5/100 = .035 \text{ mm}$

**Terminologies**

**Matter, Atom, Dalton Atomic Theory, Modern Atomic Theory, Atomic Number, Mass Number, Electronic Configuration, Valence Shell, Valence Electron, Ions, Molecule, Chemical Formula, Atomic Mass, Molecular Mass.**

**INTRODUCTION**

Chemistry is defined as that branch of science which deals with the composition and properties of matter and the changes in that matter undergoes by various interactions.

**1.1 MATTER**

Anything that occupies space, has mass and offer resistance is called matter.

The food that we eat, the water that we drink, the air that we breathe and the clothes that we wear are all made up of matter.

- The space anything occupies is called its volume.
- The amount of matter anything contains is called its mass.

**(a) Charge Particle in Matter**

The electrical nature of matter was known in 600 BC. It was produced by rubbing two articles together such as glass rod or ebonite rod with silk or fur. As a result of rubbing, they got electrically charged.

**Activity****To Show the nature of charge particles present in matter.**

- Materials required : Two pieces of glass and two pieces of resin.
- Procedure :
  - Take two pieces of glass or two pieces of resin
  - Rub glass pieces with each other, bring in contact
  - Rub resin pieces with each other, bring in contact
  - Bring glass and resin pieces in contact with each other.
- Observations :
  - Both glass pieces repel each other.
  - Both resin pieces repel each other.
  - Glass and resin pieces attract each other.
- Conclusion : This experiment shows that nature of charged particles present in matter may be different. The electrical nature of two pieces of glass are similar to each other but opposite to those of the two pieces of resin.

### (b) State of Matter-

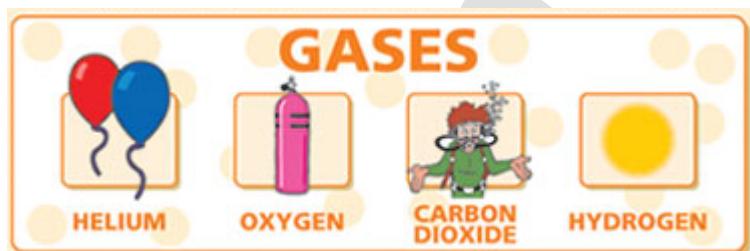
**(i) Solid-** A solid has a fixed volume and a definite shape & definite mass.



**(ii) Liquid-** A liquid has a fixed volume but not a definite shape. It takes the shape of the container.



**(iii) Gas** - A gas has neither a fixed volume nor a definite shape. It assumes the volume and shape of the container.



Ask yourself






## 1.2 ATOM AND ATOMIC THEORIES

An atom is the smallest particle of an element that can take part in a chemical reaction. The size of an atom is indicated by its radius which is called "atomic radius" (radius of an atom). Atomic radius is measured in "nanometre"(nm).

1 metre =  $10^9$  nanometre or 1nm =  $10^{-9}$  m.

Hydrogen atom is the smallest atom of all having an atomic radius 0.037nm or 0.37 Å  
 $(1 \text{ Å} = 10^{-10} \text{ metre})$

**(a) Discovery of Atom :**

Ancient Indian and Greek philosophers have been thinking about what matter is ultimately made up of. It was around 500 BC that an Indian philosopher, Maharishi Kanad had postulated that matter is divisible i.e., if we go on breaking matter, we will get smaller and smaller particles and ultimately, the particles obtained may be so small that they cannot be further divided. These indivisible particles were named as "paramanu". Almost during the same period, ancient Greek philosophers, Democritus and Leucipphous, also put forward the same idea. However, they called the smallest indivisible particles as "atoms" (Greek : means un-cutable)

**(b) How big are the atoms ? Can we see them ?**

Atoms are extremely small particles, so small in size that they cannot be seen even under a microscope. To imagine about their size, it is interesting to mention here that if millions of atoms are stacked one above the other, the thickness produced may not be equal to the thickness of the sheet of a paper.

**(c) Symbol**

"A symbol is a brief representation of the name of the element". Berzelius, a Swedish chemist, was the first to introduce the system of using letters as symbols for the elements.

Symbol and Name of some elements

| Atomic No. | Element   | Symbol | Atomic No. | Element     | Symbol |
|------------|-----------|--------|------------|-------------|--------|
| 1          | Hydrogen  | H      | 11         | Sodium      | Na     |
| 2          | Helium    | He     | 12         | Magnesium   | Mg     |
| 3          | Lithium   | Li     | 13         | Aluminium   | Al     |
| 4          | Beryllium | Be     | 14         | Silicon     | Si     |
| 5          | Boron     | B      | 15         | Phosphorous | P      |
| 6          | Carbon    | C      | 16         | Sulphur     | S      |
| 7          | Nitrogen  | N      | 17         | Chlorine    | Cl     |
| 8          | Oxygen    | O      | 18         | Argon       | Ar     |
| 9          | Fluorine  | F      | 19         | Potassium   | K      |
| 10         | Neon      | Ne     | 20         | Calcium     | Ca     |

- Symbols may be derived from the first letter of the English name of the element.
- Symbols may be derived from the first letter and another significant letter of the name of element.
- Symbols may be derived from their Latin names of the elements.

| Name of element | Chemical Symbol | Name of element (Language)    |
|-----------------|-----------------|-------------------------------|
| Potassium       | K               | Kalium (Latin)                |
| Iron            | Fe              | Ferrum (Latin)                |
| Copper          | Cu              | Cuprum (Latin)                |
| Silver          | Ag              | Argentum (Latin)              |
| Tin             | Sn              | Stannum (Latin)               |
| Gold            | Au              | Aurum (Latin)                 |
| Mercury         | Hg              | Hydrargyrum (Latinized Greek) |
| Lead            | Pb              | Plumbum (Latin)               |
| Tungsten        | W               | Wolfram (German)              |

**Note :** Dalton was the first to use symbols to represent elements.

**(d) Dalton atomic theory**

Dalton put forward his atomic theory of matter in 1808. The various postulates (or assumptions) of Dalton's atomic theory of matter are as follows:

- Matter consists of small indivisible particles called atoms.
- All atoms of an element are identical in nature.
- The atoms of an element are different from the atoms of any other element.
- A compound is formed by combination of atoms of two or more elements in simple ratio.  
e.g. Ratio between H and O in water is 2 : 1 by volume.
- Atoms take part in chemical reactions.
- Atoms can neither be created nor be destroyed.

**(i) Merit**

- Dalton's atomic theory explains the law of conservation of mass and law of constant proportion.
- Atoms of elements take part in chemical reaction this is true till today.

**(ii) Demerit**

- The atom is no longer supposed to be indivisible.
- He could not explain that why do atoms of same element combined with each other.
- Atoms of the same element may not necessarily be identical in all aspects. e.g. isotopes.
- Atoms of different elements may not necessarily be different in all aspects. e.g. isobars.

**(e) Modern atomic theory****(i) Structure of An Atom :** An atom consists of two parts -**(A) Nucleus :** Nucleus is situated in the centre of an atom.

All the protons & neutrons are situated in the nucleus, therefore, the entire mass of an atom is almost concentrated in the nucleus.

The overall charge of nucleus is positive due to the presence of positively charged protons.

The protons & neutrons are collectively called nucleons.

The radius of the nucleus of an atom is of the order of  $10^{-13}$  cm and its density is of the order of  $10^{17}$  kg/m<sup>3</sup>.

**(B) Extra nuclear region :** In extra nuclear part electrons are present which revolve around the nucleus in orbits of fixed energies.

**(ii) Composition of an Atom :** The atom is not the ultimate particle. There are still smaller particles which the atom itself is made of. These are electrons, protons and neutrons called the fundamental or subatomic particles.

| S.No. | Property        | Electron                  | Proton                     | Neutron                    |
|-------|-----------------|---------------------------|----------------------------|----------------------------|
| 1     | Discovery       | J.J. Thomson              | E. Goldstein               | James chadwick             |
| 2     | Symbol          | e                         | p                          | n                          |
| 3     | Nature          | Negatively charged        | Positively charged         | Neutral                    |
| 4     | Relative charge | -1                        | 1                          | 0                          |
| 5     | Absolute charge | $1.602 \times 10^{-19}$ C | $1.602 \times 10^{-19}$ C  | 0                          |
| 6     | Relative mass   | 1/1837                    | 1                          | 1                          |
| 7     | Absolute mass   | $9.109 \times 10^{-28}$ g | $1.6725 \times 10^{-24}$ g | $1.6748 \times 10^{-24}$ g |

**(f) Atomic number (Z)**

In 1913, moseley introduced an atomic parameter called atomic number.

Atomic number of an element is equal to the number of proton present in the nucleus of an atom of that element.

For example,

Number of protons in hydrogen atom and carbon atom are 1 and 6 respectively. So, their atomic numbers are 1 and 6 respectively.

The number of protons in an atom is equal to the number of electrons since atom as a whole is electrically neutral.

Thus,

Atomic number of an element = Number of protons in the nucleus

= Number of electrons in the extra nuclear part (in neutral atom)

Atomic number of an element is generally denoted by the symbol 'Z'.

$$\begin{array}{llll} \text{e.g. } & {}_{13}\text{Al} & Z & = 13 \\ & & p & = 13 \\ & & e & = 13 \end{array}$$

Each element has a unique atomic number.

**(g) Mass number (A)**

Mass number is the sum of number of protons and neutrons present in the atom of an element. It is denoted by "A". The mass number is represented either on the left hand side (LHS) or on the right hand side (RHS) of the symbol of the element as superscript

$A = \text{no. of protons} + \text{no. of neutrons}$  (total no. of nucleons)

$$A = p + n$$

$$A = Z + n$$

How to Determine the Number of Electrons, Protons and Neutrons is an atom:

From the knowledge of atomic number and mass number of an element, the number of electrons, protons and neutrons can be easily predicted.

For an atom

Atomic number (Z) = No. of protons (p) = No. of electrons (e)

Mass number (A) = No. of protons (p) + No. of neutron (n)

But, No. of protons = Atomic number (Z)

$$\therefore A = Z + n$$

$$n = A - Z$$

Number of neutrons = Mass number – Atomic Number

For example, lithium has atomic number (Z) = 3 and mass number (A) = 7, Therefore,

Number of electrons = Atomic number = 3, Number of protons = Atomic number = 3

Number of neutrons = Mass number – Atomic number =  $A - Z = 7 - 3 = 4$ .

Nucleus consist of protons and neutrons and these are collectively known as **nucleons**. Since the electrons are of negligible mass, the entire mass of the atom is due to the nucleus i.e. nucleons.

$$\text{e.g. } Z = 13$$

$$A = 27$$

$$p = 13$$

$$e = 13$$

$$n = A - Z = 27 - 13 = 14$$



Ask yourself \_\_\_\_\_

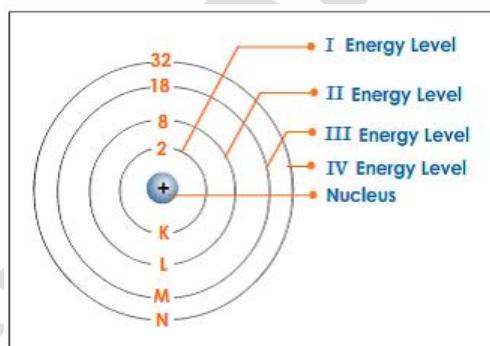
- Q.1** Write down the merit and demerit of Dalton's atomic theory.
- Q.2** Define the term "Nucleus".
- Q.3** Write down the name of fundamental particles of atom.
- Q.4** Define atomic number and mass number.
- Q.5** Define the term shell.

### 1.3 ELECTRONIC CONFIGURATION AND SIGNIFICANCE

We have studied that atoms of different elements differ in their atomic numbers as well as mass numbers. Therefore, they have also different number of electrons. These are distributed in the various energy shells (or energy levels) which are given by Bohr i.e. K, L, M, N, ..... etc. This distribution of the electron in the energy shells is known as electronic configuration. It is based on certain guide-lines or rules given by Bohr and Bury. This is known as Bohr-Bury scheme.

#### (a) Bohr-Bury Scheme for Distribution of Electrons in Various Shells :

- The maximum number of electrons which can be present in a particular energy shell of an atom is given by  $2n^2$ . Here 'n' is the number of the energy shells or energy levels.



|  |   |   |    |    |
|--|---|---|----|----|
| Name of shells                         | K | L | M  | N  |
| Number of shells                       | 1 | 2 | 3  | 4  |
| Maximum Number of electrons ( $2n^2$ ) | 2 | 8 | 18 | 32 |

- The outermost energy shell in an atom cannot have more than eight electrons even if it has a capacity to take up more electrons according to first rule.
- It is not necessary for a given shell to complete itself before another shell starts forming. As a rule, the new shell is formed as soon as the outermost shell acquires eight electrons. For example, the atomic number (Z) of the element potassium is 19. Its electronic configuration is expected to be 2,8,9. But actually it is not so. The third shell (M-shell) which is the outermost shell in this case is shown to have nineteen electrons. However, it cannot have more than eight electrons. Therefore, the N-shell builds up as soon as the M-shell acquires eight electrons. The actual electronic configuration of potassium is 2,8,8,1.

|   |
|---|
| K   L   M                               |
| 2   8   9                               |
| (Expected electronic distribution in K) |

|                                       |
|---------------------------------------|
| K   L   M   N                         |
| 2   8   8   1                         |
| (Actual electronic distribution in K) |

Similarly for the next element calcium ( $Z = 20$ ), N shell can have two electrons.

| K  | L | M  |
|--|---|----|
| 2  | 8 | 10 |
| (Expected electronic distribution in Ca) |   |    |

| K                                      | L | M | N |
|--|---|---|---|
| 2                                      | 8 | 8 | 2 |
| (Actual electronic distribution in Ca) |   |   |   |

### (b) Electronic Configuration of Some Elements :

| Name of Element | Symbol | Atomic Number | Number of Protons | Number of Neutrons | Number of Electrons | Distribution of Electrons | K | L | M | N | Vale-<br>nacy |
|-----------------|--------|---------------|-------------------|--------------------|---------------------|---------------------------|---|---|---|---|---------------|
| Hydrogen        | H      | 1             | 1                 | -                  | 1                   | 1                         | - | - | - | - | 1             |
| Helium          | He     | 2             | 2                 | 2                  | 2                   | 2                         | - | - | - | - | 0             |
| Lithium         | Li     | 3             | 3                 | 4                  | 3                   | 2                         | 1 | - | - | - | 1             |
| Beryllium       | Be     | 4             | 4                 | 5                  | 4                   | 2                         | 2 | - | - | - | 2             |
| Boron           | B      | 5             | 5                 | 6                  | 5                   | 2                         | 3 | - | - | - | 3             |
| Carbon          | C      | 6             | 6                 | 6                  | 6                   | 2                         | 4 | - | - | - | 4             |
| Nitrogen        | N      | 7             | 7                 | 7                  | 7                   | 2                         | 5 | - | - | - | 3             |
| Oxygen          | O      | 8             | 8                 | 8                  | 8                   | 2                         | 6 | - | - | - | 2             |
| Fluorine        | F      | 9             | 9                 | 10                 | 9                   | 2                         | 7 | - | - | - | 1             |
| Neon            | Ne     | 10            | 10                | 10                 | 10                  | 2                         | 8 | - | - | - | 0             |
| Sodium          | Na     | 11            | 11                | 12                 | 11                  | 2                         | 8 | 1 | - | - | 1             |
| Magnesium       | Mg     | 12            | 12                | 12                 | 12                  | 2                         | 8 | 2 | - | - | 2             |
| Aluminium       | Al     | 13            | 13                | 14                 | 13                  | 2                         | 8 | 3 | - | - | 3             |
| Silicon         | Si     | 14            | 14                | 14                 | 14                  | 2                         | 8 | 4 | - | - | 4             |
| Phosphorus      | P      | 15            | 15                | 16                 | 15                  | 2                         | 8 | 5 | - | - | 3.5           |
| Sulphur         | S      | 16            | 16                | 16                 | 16                  | 2                         | 8 | 6 | - | - | 2             |
| Chlorine        | Cl     | 17            | 17                | 18                 | 17                  | 2                         | 8 | 7 | - | - | 1             |
| Argon           | Ar     | 18            | 18                | 22                 | 18                  | 2                         | 8 | 8 | - | - | 0             |



Pictorial diagram for electronic configuration

### (c) Significance of Electronic Configuration :

- Electronic configuration of an atom helps us to understand the chemical reactivity of the element.
- When the outermost shell of an atom is completely filled as per Bohr-Bury scheme then the element is unreactive.
- When the outermost shell of an atom is not completely filled according to Bohr-Bury rule, the element is reactive.  
An atom can get the noble gas electronic configuration in three ways -
  - By losing one or more electrons.
  - By gaining one or more electrons.
  - By sharing one or more electrons with other atom or atoms.

### (d) Valence shell and valence electrons

The outermost shell of an atom is known as the valence shell. The electrons present in the valence shell of an atom are known as valence electrons.

The remainder of the atom i.e. the nucleus and other electrons is called the core of the atom. Electrons present in the core of an atom are known as **core electrons**.

#### (i) Significance of valence electrons

- The valence electrons of an atom are responsible for chemical reaction and take part in chemical changes.
- The valence electron determine the combining capacity or the valency of the atom.
- Elements having the same number of valence electrons in their atoms possess similar chemical properties. For example, all alkali metals have one valence electron in their atoms. Hence, their chemical properties are similar.

e.g.

The electronic configuration of the sodium (Na) atom is :-

|         |   |   |   |
|---------|---|---|---|
| Na (11) | K | L | M |
|         | 2 | 8 | 1 |

Thus, valence electrons in Na atom = 1 and core electrons in Na atom =  $2 + 8 = 10$

**(ii) Valency :** Element,other than noble gas elements,contain less than 8 electron in their outermost shells. These elements are chemically reactive and unstable. They tend to acquire the stable outermost electronic configuration of the noble gases. It is the tendency on the part of elements that leads to chemical reactions. The noble gas configuration is achieved by elements by losing, gaining or sharing electrons.

The number of electrons gained, lost or shared by the atom of an element so as to complete its octet (or duplet in case of elements having only K shell) is called the valency of the element.

The valency of an element = number of valence electrons

(when number of valence electrons are from 1 to 4)

The valency of an element =  $8 - \text{number of valence electrons}$ . (when number of valence electrons are more than 4)

**(iii) Variable Valency :** Certain elements (metals and non - metals ) exhibit more than one valency.

(A) Among the metals iron, copper, silver etc. show variable valency. For lower valency a suffix -ous and for higher valency a suffix -ic is attached at the end of the name of the metals and non - metals.

e.g.

Ferrous =  $\text{Fe}^{+2}$

Ferric =  $\text{Fe}^{+3}$

(B) Among the non - metals nitrogen, phosphorus, sulphur etc. show variable valency.

#### (iv) How Do Atoms Exist ?

The atoms of only a few elements called noble gases (such as helium, neon, argon and krypton etc.) are chemically unreactive and exist in the free state (as single atoms). Atoms of most of the elements are chemically very reactive and do not exist in the free state (as single atoms).

Atoms usually exist in two ways:

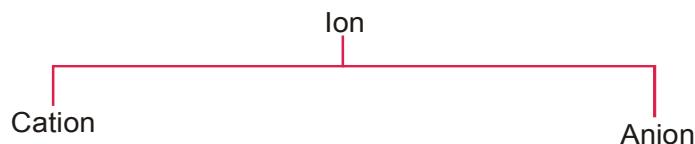
- In the form of ions and
- In the form of molecules

When atoms form molecules or ions, they become stable (because in doing so they acquire the stable electron arrangement of noble gases).



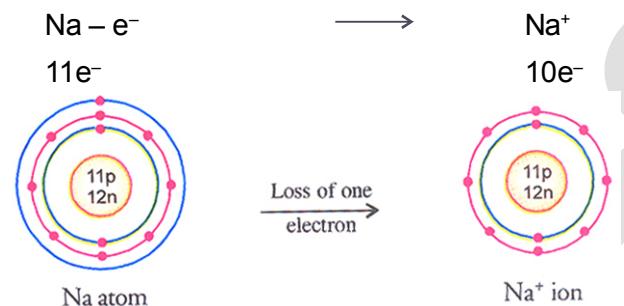
### (A) Ions

The charged particles formed by an atom on the gain or loss of one or more electron(s) is called ions.



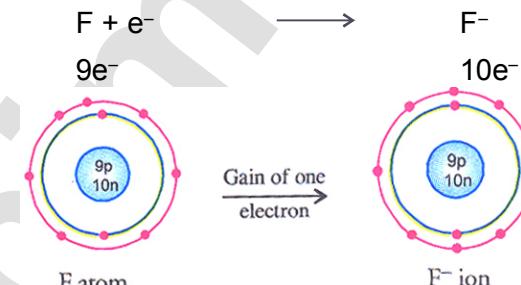
**(1) Cation :** A positive ion gets formed in case atom of an element loses one or more electrons. For example, the electronic distribution in sodium i.e. Na is 2,8,1. It loses one electron to form a positive ion with electronic distribution 2,8. Since in the ion, the number of electrons ( $2 + 8 = 10$ ) is one less than the number of protons (11), it has one unit positive charge. It may be represented as follows :

e.g.



**(2) Anion :** A negative ion gets formed in case atom of an element gains one or more electrons. For example, electronic distribution in fluorine i.e. F is 2, 7. It gains one electron to form a negative ion with electronic distribution 2,8. Since in the ion, the number of electrons ( $2 + 8 = 10$ ) is one more than the number of protons (9), it has one unit negative charge. It may be represented as follows.

e.g.



#### LIST OF COMMON ELECTROVALENT POSITIVE RADICALS

| Monovalent Electropositive              | Bivalent Electropositive                    | Trivalent Electropositive               | Tetravalent Electropositive             |
|---|---|---|---|
| 1. Hydrogen $\text{H}^+$                | 1. Magnesium $\text{Mg}^{2+}$               | 1. Aluminium $\text{Al}^{3+}$           | 1. Stannic [Tin (IV)] $\text{Sn}^{4+}$  |
| 2. Ammonium $\text{NH}_4^+$             | 2. Calcium $\text{Ca}^{2+}$                 | 2. Ferric [Iron (III)] $\text{Fe}^{3+}$ | 2. Plumbic [Lead (IV)] $\text{Pb}^{4+}$ |
| 3. Sodium $\text{Na}^+$                 | 3. Zinc $\text{Zn}^{2+}$                    | 3. Chromium $\text{Cr}^{3+}$            |   |
| 4. Potassium $\text{K}^+$               | 4. Plumbous [Lead (II)] $\text{Pb}^{2+}$    |   |   |
| 5. Cuprous [(Copper (I))] $\text{Cu}^+$ | 5. Cupric [(Copper) (II)] $\text{Cu}^{2+}$  |   |   |
| 6. Argentous [Silver (I)] $\text{Ag}^+$ | 6. Argentic [Silver(II)] $\text{Ag}^{2+}$   |   |   |
| 7. Mercurous [Mercury(I)] $\text{Hg}^+$ | 7. Stannous [Tin (II)] $\text{Sn}^{2+}$     |   |   |
|   | 8. Ferrous [Iron (II)] $\text{Fe}^{2+}$     |   |   |
|   | 9. Mercuric [Mercury (II)] $\text{Hg}^{2+}$ |   |   |
|   | 10. Barium $\text{Ba}^{2+}$                 |   |   |

## LIST OF COMMON ELECTROVALENT NEGATIVE RADICALS

| Monovalent Electronegative                     | Bivalent Electronegative      | Trivalent Electronegative | Tetraivalent Electronegative |
|--|-------------------------------|---------------------------|------------------------------|
| 1. Fluoride $F^-$                              | 1. Sulphate $SO_4^{2-}$       | 1. Nitride $N^{3-}$       | 1. Carbide $C^{4-}$          |
| 2. Chloride $Cl^-$                             | 2. Sulphite $SO_3^{2-}$       | 2. Phosphide $P^{3-}$     |                              |
| 3. Bromide $Br^-$                              | 3. Sulphide $S^{2-}$          | 3. Phosphate $PO_3^{3-}$  |                              |
| 4. Iodide $I^-$                                | 4. Thiosulphate $S_2O_3^{2-}$ | 4. Phosphate $PO_4^{3-}$  |                              |
| 5. Hydride $H^-$                               | 5. Zincate $ZnO_2^{2-}$       |                           |                              |
| 6. Hydroxide $OH^-$                            | 6. Oxide $O^{2-}$             |                           |                              |
| 7. Nitrite $NO_2^-$                            | 7. Peroxide $O_2^{2-}$        |                           |                              |
| 8. Nitrate $NO_3^-$                            | 8. Dichromate $Cr_2O_7^{2-}$  |                           |                              |
| 9. Bicarbonate or Hydrogen carbonate $HCO_3^-$ | 9. Carbonate $CO_3^{2-}$      |                           |                              |
| 10. Bisulphite or Hydrogen sulphite $HSO_3^-$  | 10. Silicate $SiO_3^{2-}$     |                           |                              |
| 11. Bisulphide or Hydrogen sulphide $HS^-$     |                               |                           |                              |
| 12. Bisulphate or Hydrogen sulphate $HSO_4^-$  |                               |                           |                              |
| 13. Acetate $CH_3COO^-$                        |                               |                           |                              |

**(B) Molecule :** A molecule is an electrically neutral group of two (or more) atoms chemically bonded together by means of attractive forces.

Or

A molecule is the smallest particle of a substance (element or compound) which has the properties of that substance and can exist in the free state. Molecules can be formed either by the combination of atoms of the "same element" or of "different elements".

There are two types of molecules: molecules of elements and molecules of compounds.

**(1) Molecules of Elements :** The molecule of an element contains two (or more) similar atoms chemically bonded together. For example, a molecule of hydrogen contains 2 hydrogen atoms combined together and it is written as  $H_2$  representing Hydrogen gas. Similarly, Ozone gas has 3 oxygen atoms combined together, so ozone exists in the form of  $O_3$ . The noble gases like helium, neon, argon and krypton etc., exist as single atoms He, Ne, Ar and Kr respectively. So, their atoms and molecules are just the same.

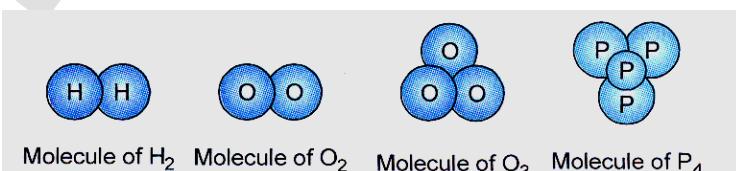
**(2) Molecules of Compounds :** The molecule of a compound contains two (or more) different types of atoms chemically bonded together. For example, molecule of hydrogen chloride (HCl) contains one atom of hydrogen (H) chemically bonded with one atom of chlorine (Cl). Some more examples of the molecules of compounds are : sulphur dioxide ( $SO_2$ ), methane ( $CH_4$ ) and ammonia ( $NH_3$ ).

**(3) Atomicity :** The number of atoms present in one molecule of an element is called its atomicity.

The atomicity of an element is indicated by writing the number as a subscript on the right hand side bottom of the symbol.

For example,  $H_2$  shows that the atomicity of hydrogen is 2.  $P_4$  shows that the atomicity of phosphorus is 4,  $He$  shows that the atomicity of helium is 1.

On the basis of their atomicities, the elements may be classified as monoatomic, diatomic, triatomic, tetra atomic, etc.



| Name of the element | Symbol of the element | Atomicity   | Representation of molecule |
|---------------------|-----------------------|-------------|----------------------------|
| Argon               | Ar                    | Monoatomic  | Ar                         |
| Helium              | He                    | Monoatomic  | He                         |
| Hydrogen            | H                     | Diatomeric  | H <sub>2</sub>             |
| Oxygen              | O                     | Diatomeric  | O <sub>2</sub>             |
| Chlorine            | Cl                    | Diatomeric  | Cl <sub>2</sub>            |
| Ozone               | O                     | Triatomic   | O <sub>3</sub>             |
| Phosphorus          | P                     | Tetraatomic | P <sub>4</sub>             |
| Sulphur             | S                     | Octaatomic  | S <sub>8</sub>             |

### (e) Chemical formula

Molecule of an element or a compound may be represented by symbols of the elements present in one molecule of the compound. It is known as a chemical formula.

E.g. HCl is the formula of hydrogen chloride and NaCl is that of sodium chloride.

#### (I) Significance of a Chemical Formula :

Name of the substance.

- Name of various elements present in that substance.
- Chemical formula of a substance represents one molecule of that substance.
- Relative number of atoms of various elements present in one molecule of that element or compound.
- Relative masses of various elements in the compound.
- We can calculate the gram molecular mass of that substance.

#### (II) Writing a Chemical Formula :

**Step-I :** Write the symbol of the positive ion or the radical to the left and that of the negative ion or radical to the right.

**Step-II :** Put the valency of each radical or the ion on its top right. Divide the valency by the highest common factor, if any, to get a simple ratio. Now ignore the (+) and (-) signs. Interchange the valency of radicals or ions.

**Step-III :** Shift the valency to the lower right side of the radical or ion. If the compound radical receives number more than 1, enclose it within brackets. Do not enclose simple radicals within brackets.

| Names of compounds   | Symbols with valence numbers (I and II steps)  | Shifting valence numbers (III step) | Formula   |
|----------------------|--|-------------------------------------|---|
| Calcium chloride     | Ca <sup>+2</sup> Cl <sup>-1</sup>  | Ca<br>Cl                            | CaCl <sub>2</sub>                               |
| Magnesium sulphate   | Mg <sup>+2</sup> SO <sub>4</sub> <sup>-2</sup> or Mg <sup>+1</sup> SO <sub>4</sub> <sup>-1</sup> | Mg<br>SO <sub>4</sub>               | MgSO <sub>4</sub>                               |
| Aluminium sulphate   | Al <sup>+3</sup> SO <sub>4</sub> <sup>-2</sup>   | Al<br>SO <sub>4</sub>               | Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> |
| Ammonium phosphate   | NH <sub>4</sub> <sup>+1</sup> PO <sub>4</sub> <sup>-3</sup>                                      | NH <sub>4</sub><br>PO <sub>4</sub>  | (NH <sub>4</sub> ) <sub>3</sub> PO <sub>4</sub> |
| Potassium dichromate | K <sup>+1</sup> Cr <sub>2</sub> O <sub>7</sub> <sup>-2</sup>                                     | K<br>Cr <sub>2</sub> O <sub>7</sub> | K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>   |

| S.No. | Compounds   | Common Names     | Chemical Names                |
|-------|---|------------------|-------------------------------|
| 1     | CaO   | Lime             | Calcium oxide                 |
| 2     | NaHCO <sub>3</sub>                                  | Baking soda      | Sodium hydrogen carbonate     |
| 3     | Na <sub>2</sub> CO <sub>3</sub> .10H <sub>2</sub> O | Washing soda     | Sodium carbonate decahydrate  |
| 4     | CaCO <sub>3</sub>                                   | Limestone        | Calcium carbonate             |
| 5     | Ca(OH) <sub>2</sub>                                 | Slaked lime      | Calcium hydroxide             |
| 6     | CuSO <sub>4</sub> . 5H <sub>2</sub> O               | Blue vitriol     | Copper sulphate pentahydrate  |
| 7     | NaCl  | Common salt      | Sodium chloride               |
| 8     | Na <sub>2</sub> CO <sub>3</sub>                     | Soda ash         | Sodium carbonate              |
| 9     | NaOH  | Caustic soda     | Sodium hydroxide              |
| 10    | KOH   | Caustic potash   | Potassium hydroxide           |
| 11    | CaOCl <sub>2</sub>                                  | Bleaching powder | Calcium oxychloride           |
| 12    | CaSO <sub>4</sub> .1/2 H <sub>2</sub> O             | Plaster of paris | Calcium sulphate hemihydrate  |
| 13    | CaSO <sub>4</sub> . 2H <sub>2</sub> O               | Gypsum           | Calcium sulphate dihydrate    |
| 14    | FeSO <sub>4</sub> . 7H <sub>2</sub> O               | Green vitriol    | Ferrous sulphate heptahydrate |
| 15    | H <sub>2</sub> SO <sub>4</sub>                      | Oil of vitriol   | Sulphuric acid                |

Ask yourself \_\_\_\_\_



- Q.1** What is molecule? Explain with example.
- Q.2** Write down the atomicity for following :  
 (a) S<sub>8</sub>      (b) CO<sub>2</sub>      (c) P<sub>4</sub>      (d) H<sub>2</sub>O
- Q.3** Write down the common name of following  
 (a) CaO      (b) CuSO<sub>4</sub>.5H<sub>2</sub>O      (c) NaOH      (d) H<sub>2</sub>SO<sub>4</sub>
- Q.4** Write down the chemical formula of following  
 (a) calcium nitrate      (b) calcium phosphate
- Q.5** What is ion ? Define cation and anion.

## 1.4 ATOMIC MASS AND MOLECULAR MASS

### (a) Atomic Mass

Actual masses of the atoms of the elements are very, very small. For example, one atom of hydrogen (H) has a mass of  $1.673 \times 10^{-24}$  gram. To avoid the inconvenience in using such small and complicated figures in our calculations, it was necessary to define atomic mass in such a way that we get simple figures for them. Carbon-12 atom is that atom of carbon which has 6 protons and 6 neutrons in its nucleus, so that its mass number is 12.

Carbon-12 atom has been assigned an atomic mass of exactly 12 atomic mass units, written as 12 u.

**Definition of atomic mass :** Atomic mass express as to how many time mass of an atom of an element is heavier than  $\frac{1}{12}$  the mass of carbon -12 atom.

Atomic Mass Unit (u) = One-twelfth the mass of a Carbon-12 atom.

$$1\text{u} = 1.6605 \times 10^{-24} \text{ g.}$$

One atomic mass unit (1u) is defined as exactly one-twelfth the mass of an atom of Carbon-12. The atomic mass of an element is the relative mass of its atom as compared with the mass of a Carbon-12 atom taken as 12 units.

### (b) Molecular Mass

The molecular mass of a substance may be defined as the relative mass of its molecule as compared to the mass of an atom of carbon (carbon-12) taken as 12 units.

**OR**

Molecular mass expresses as to how many times a molecule of a substance is heavier than  $1/12^{\text{th}}$  of the mass of an atom of carbon (carbon-12).

Eg. A molecule of water is 18 times heavier than  $1/12^{\text{th}}$  of the mass of carbon atom. Therefore, the molecular mass of water is 18u. Similarly, the molecular mass of  $\text{CO}_2$  is 44u.

**Calculation :** The molecular mass is equal to sum of the atomic masses of all the atoms present in one molecule of the substance.

Eg. The molecular mass of Sulphuric Acid ( $\text{H}_2\text{SO}_4$ ) can be calculated as follows:

$$\begin{aligned}\text{Molecular mass of } \text{H}_2\text{SO}_4 &= \text{Mass of 2 H atoms} + \text{Mass of 1 S atom} + \text{Mass of 4 O atoms} \\ &= (2 \times 1) + (1 \times 32) + (4 \times 16) = 2 + 32 + 64 = 98\text{u.}\end{aligned}$$

Thus, the molecular mass of Sulphuric acid is 98u.

#### List of atomic masses of some common elements :

| Atomic Number | Element    | Symbol | Atomic mass |
|---------------|------------|--------|-------------|
| 1             | Hydrogen   | H      | 1           |
| 2             | Helium     | He     | 4           |
| 3             | Lithium    | Li     | 7           |
| 4             | Beryllium  | Be     | 9           |
| 5             | Boron      | B      | 11          |
| 6             | Carbon     | C      | 12          |
| 7             | Nitrogen   | N      | 14          |
| 8             | Oxygen     | O      | 16          |
| 9             | Fluorine   | F      | 19          |
| 10            | Neon       | Ne     | 20          |
| 11            | Sodium     | Na     | 23          |
| 12            | Magnesium  | Mg     | 24          |
| 13            | Aluminium  | Al     | 27          |
| 14            | Silicon    | Si     | 28          |
| 15            | Phosphorus | P      | 31          |
| 16            | Sulphur    | S      | 32          |
| 17            | Chlorine   | Cl     | 35.5        |
| 18            | Argon      | Ar     | 40          |
| 19            | Potassium  | K      | 39          |
| 20            | Calcium    | Ca     | 40          |



## Ask yourself

- Q.1** Define atomic mass. Give three example.
- Q.2** Define molecular mass. Give three example.
- Q.3** Write down the molecular mass of the following :  
 (a)  $\text{CaCO}_3$       (b)  $\text{H}_3\text{PO}_4$       (c)  $\text{C}_6\text{H}_{12}\text{O}_6$
- Q.4** What is the molecular mass of sulphur ?
- Q.5** What is molecular mass of phosphorous ?



## Add to Your Knowledge

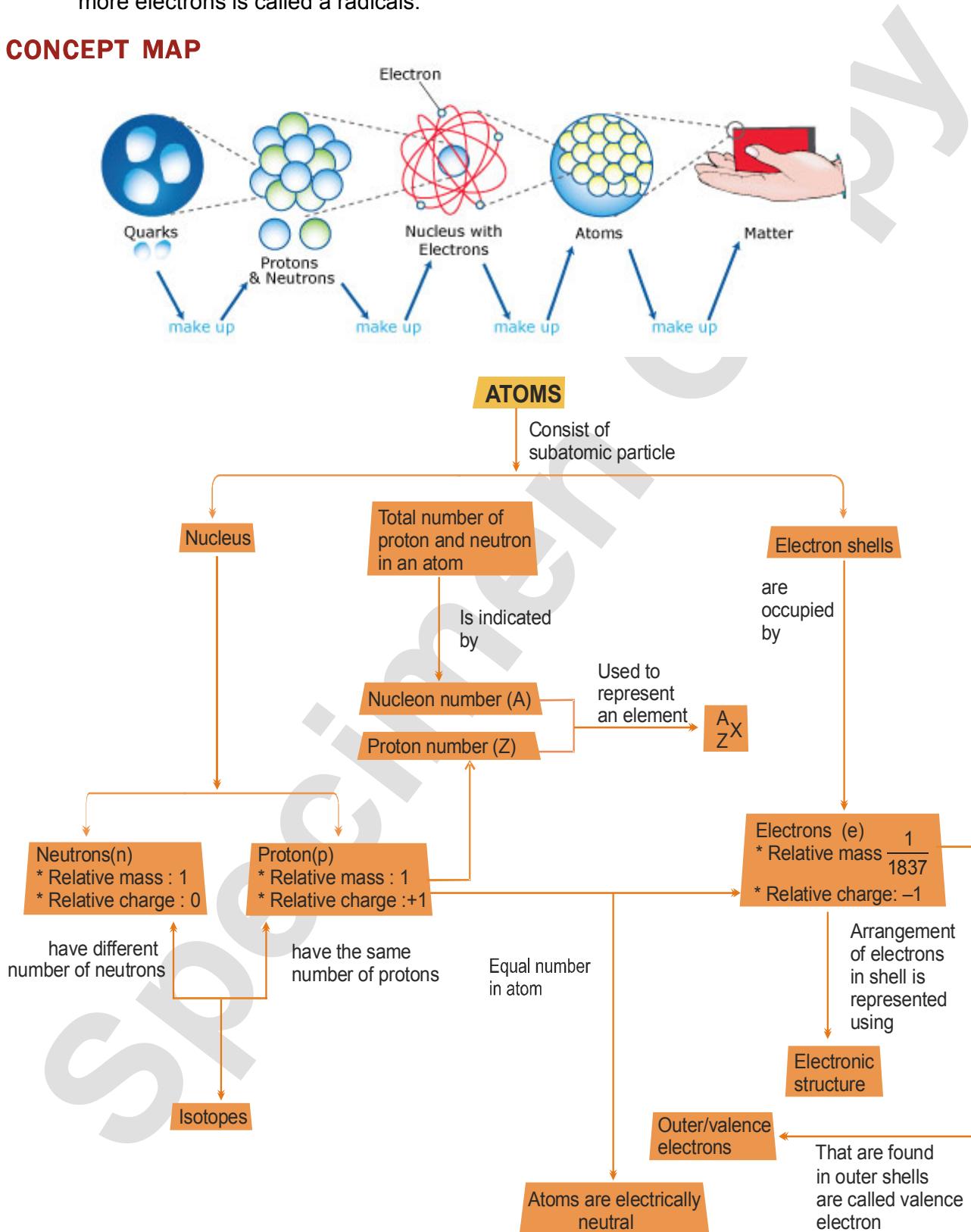
1. All atoms except hydrogen contain neutrons, thus the atomic mass of hydrogen is same as that of a proton.
2. In the elements having atomic number more than 18, electron may go into a new shell even before the inner shell is completely filled.
3. The atoms of noble gas elements are quite stable and can exist independently. These are therefore, monoatomic in nature. For example, helium (He), neon (Ne), argon (Ar), krypton (Kr) and xenon (Xe)

## Summary

- An electron has  $-1$  unit ( $1.6 \times 10^{-19}$  C) charge and negligible ( $9.1 \times 10^{-31}$  kg) mass.
- An electron is regarded as a universal particle i.e. its charge and mass remain the same.
- A proton has  $+1$  unit ( $1.6 \times 10^{-19}$  C) charge and  $1$  u ( $1.67 \times 10^{-27}$  kg) mass.
- Protons and neutrons present in the nucleus of an atom are also called nucleons.
- The mass of an atom is due to protons and neutrons present in the nucleus. Electrons do not contribute towards the mass of an atom.
- According to Bohr's theory, the different energy shells for the electrons are designated as : K, L, M, N, O, ..... etc.
- The order of the energy of the energy shells is :  $K < L < M < N < O$  ..... etc.
- Atomic number (Z) of an element is equal to number of protons.
- When an atom changes to an ion, the protons present in the nucleus remain the same. Only the electrons change.
- Element He, Ne and Ar are known as inert elements and have zero valency.
- The formula of a compound should be written in such a way that the positive and negative charges are neutralized.
- Atoms of the same elements, having the same atomic number but different mass numbers are called isotopes of the elements.
- Atoms of the different elements, having the same mass number but different atomic numbers are called isobars of the elements.
- Atoms of the different elements with same number of neutron but different atomic number and mass number are called isotope of the element.
- Atoms of the different elements with same number of electrons but different atomic numbers and mass number are called isoelectron.

- The protons and neutrons are concentrated in a small region at the centre of an atom. This central part is known as nucleus.
- The protons and neutrons present inside the nucleus are called nucleons.
- The outermost shell is called valence shell.
- A group of atoms possessing either positive or negative charge by losing or gaining one or more electrons is called a radicals.

## CONCEPT MAP



**EXERCISE > 01****SECTION -A (FIXED RESPONSE TYPE)****OBJECTIVE QUESTIONS**

1. The compressibility of which state of matter is high -  
 (A) liquid                    (B) solid                    (C) gas                    (D) all of these
2. A state of matter which has neither definite shape nor definite volume :  
 (A) liquid                    (B) solid                    (C) gas                    (D) all of these
3. Which of the following substance is not a liquid -  
 (A) Oil                      (B) Syrup                    (C) Petrol                    (D) CNG
4. Which of the following occurs as a gas -  
 (A) Sand                    (B) Ozone                    (C) Soil                    (D) Milk
5. Liquids have :  
 (A) fixed volume and fixed shape                    (B) fixed shape and no fixed volume  
 (C) fixed volume and no fixed shape                (D) neither fixed volume nor fixed shape
6. The protons and neutrons are collectively called -  
 (A) deuterons                (B) positrons                (C) mesons                (D) nucleons
7. Atomic number of an element represents -  
 (A) number of neutrons in the nucleus.                (B) atomic mass of an element.  
 (C) valency of an element                                (D) number of protons in the nucleus.
8. Atomic size of the order of -  
 (A)  $10^{-8}$  cm                (B)  $10^{-10}$  cm                (C)  $10^{-13}$  cm                (D)  $10^{-6}$  cm
9. An element with atomic number 9 is :  
 (A) a rare gas                (B) a halogen gas            (C) an alkali metal            (D) None of these
10.  $^{11}\text{Na}^{23}$  has :  
 (A) 11 protons and 23 neutrons                        (B) 11 neutrons and 11 protons  
 (C) 11 electrons and 11 protons                        (D) None of these
11. The difference between ions and atoms is of -  
 (A) relative size                (B) electronic configuration  
 (C) presence of charge                                    (D) all of these

# FILL IN THE BLANKS

1. There is no particle of matter smaller than an \_\_\_\_\_.
  2. Zincate ion is \_\_\_\_\_.
  3. The chemical formula of nitric acid is \_\_\_\_\_.
  4. Nucleons is collectively called the sum of \_\_\_\_\_ and \_\_\_\_\_.
  5. Nucleus is situated in the \_\_\_\_\_ of an atom.

**TRUE / FALSE**

1. Discovery of electron is done by rutherford
2. One atomic mass unit is defined as exactly one twelfth the mass of an atom of carbon-12.
3. The overall charge of nucleus is positive.
4. J.J. Thomson was the first to introduce the system of using letters as symbols for the elements.
5. The negatively charged radical is called acidic radical.

**MATCH THE COLUMN**

| <b>Column-A</b>               | <b>Column-B</b>      |
|-------------------------------|----------------------|
| 1. Monovalent electronegative | a. $O_2^{2-}$        |
| 2. Sulphite                   | b. $NO_2^-$ , $HS^-$ |
| 3. Peroxide                   | c. $SiO_3^{2-}$      |
| 4. Silicate                   | d. $SO_3^{2-}$       |

**SECTION -B (FREE RESPONSE TYPE)****SUBJECTIVE QUESTIONS****VERY SHORT ANSWER TYPE**

1. What are the fundamental particles of an atom.
2. What is an electron? State its relative mass and charge.
3. Define the following terms: a) Nucleons b) Atomic number c) Mass number d) Nucleus
4. How many elements are present in calcium carbonate.
5. Calculate number of electrons, protons and neutrons.  
 a.  ${}_{18}Ar^{40}$       b.  ${}_7N^{14}$       c.  ${}_{19}K^{39}$

**SHORT ANSWER TYPE**

6. Write the electronic configuration of potassium ( $Z = 19$ ). What is the number of valence electrons in it ?
7. What is the difference between valency and valence electrons.
8. What do you mean by an ion. Define cation and anion.
9. Write the formulae of following compound with the help of the valency of their constituent particle.  
 (i) Ferric sulphate      (ii) Mercuric chloride      (iii) Calcium bicarbonate

**LONG ANSWER TYPE**

10. Write the postulates of Dalton's atomic theory.
11. Differentiate between electron, proton & neutron with respect to their charge and mass.

12. What is the significance of electronic configuration ?
13. Write molecular mass of the following  
 a.  $\text{ZnSO}_4$       b.  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$       c.  $\text{AgBr}$       d.  $\text{Hg}_2\text{Cl}_2$

## EXERCISE > 02

### SECTION -A (COMPETITIVE EXAMINATION QUESTION)

#### MULTIPLE CHOICE QUESTIONS

1. Which is not true about neutron ?  
 (A) It is a neutral particle      (B) It is present in the nucleus of atom  
 (C) It is highly unstable in nature      (D) It contributes to the mass of the atom
2. The number of valence electrons in  $\text{Cl}^-$  ion are :  
 (A) 16      (B) 8      (C) 17      (D) 18
3. Which is the correct electronic configuration of the element Mg ?  
 (A) 2, 8      (B) 2, 8, 1      (C) 2, 8, 2      (D) 8, 2, 2
4. Positive ion is formed from the neutral atom by the loss of :  
 (A) protons      (B) neutrons      (C) alpha particles      (D) electron
5. Maximum number of electrons which can be filled in the third shell of an atom is :  
 (A) 8      (B) 18      (C) 10      (D) 32
6. The mass number A, atomic number Z and number of neutrons n are related as :  
 (A)  $n = A - Z$       (B)  $n = A + Z$   
 (C)  $n = A \times Z$       (D) none of these is correct
7. Which of the following elements has same number of protons, electrons and neutrons ?  
 (A) Al      (B) Mg      (C) P      (D) Cl
8. Protons, neutrons and electrons are present in chlorine atom in the sequence :  
 (A) 17, 17, 18      (B) 17, 18, 17      (C) 18, 17, 17      (D) 17, 17, 17
9. Which of the following has/have 18 electrons ?  
 (A)  $\text{K}^+$       (B)  $\text{Ca}^{2+}$       (C)  $\text{Cl}^-$       (D) all have 18 electrons
10. No. of valence electrons in an element  ${}_{7}^{14}\text{X}$  is :  
 (A) 5      (B) 1      (C) 7      (D) 3

### SECTION -B (TECHIE STUFF)

1. The electronic configuration of an element Z is 2, 8, 6. How many electrons does it require to have a stable configuration ?
2. A species 'A' has 9 protons and 8 electrons. What does it represent ?
3. There are 14 protons and 13 neutrons in the nucleus of an element. What is its mass number ?
4. Indicate the number of electrons, protons and neutrons in element  ${}_{19}^{39}\text{K}$ .
5. From the following nuclei, choose the isotopes and isobars :  
 (i)  $8\text{p} + 8\text{n}$       (ii)  $8\text{p} + 9\text{n}$       (iii)  $18\text{p} + 22\text{n}$       (iv)  $20\text{p} + 20\text{n}$ .

# EXERCISE > 03

## **SECTION -A (PREVIOUS YEAR EXAMINATION QUESTIONS)**

1. An element X of valency 3 combines with another element Y of valency 2. The formula of the compound formed is :  
(A)  $XY_3$       (B)  $X_2Y_3$       (C)  $X_2Y_2$       (D)  $XY_2$

2. Read the given statements and mark the correct option :  
Statement-1 : Relative atomic mass of chlorine is 35.5.  
Statement-2 : Chlorine gas is diatomic element.  
(A) Both statements 1 and 2 are true and statement-2 is the correct explanation statement-1.  
(B) Both statements 1 and 2 are true but statement-2 is not the correct explanation statement-1.  
(C) Statement-1 is true and statement-2 is false.  
(D) Both Statement-1 is true and statement-2 is false.

3. The number of atoms present in a molecule of a substance is called its :  
(A) Molecularity      (B) Atomicity      (C) Valency      (D) Reactivity

4. The atomic mass of oxygen is 16 and the molecular mass of ozone is 48. What is the atomicity of ozone if it is an allotrope of oxygen ?  
(A) 1      (B) 2      (C) 3      (D) 4

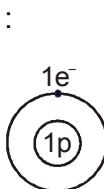
5. The nucleus of the atom consist of :  
(A) Proton and neutron      (B) Proton and electron  
(C) Neutron and electron      (D) Proton, neutron and electron

6. Which one of the following atoms has a mass number of 40 ?

| Atom | Number of protons | Number of neutrons |
|------|-------------------|--------------------|
| i    | 13                | 14                 |
| ii   | 18                | 22                 |
| iii. | 20                | 22                 |
| iv.  | 20                | 51                 |

(A) i      (B) ii      (C) iii      (D) iv

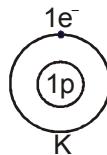
7. The given atomic diagram represents :



(A) Hydrogen atom      (B) Nitrogen      (C) Helium atom      (D) Neon atom

8. Which is not true about neutron ?  
(A) It is a neutral particle      (B) It is present in the nucleus of the atom  
(C) It is highly unstable in nature      (D) It contributes to the mass of the atom

9. Which of the following species has more number of protons than the number of electrons ?  
(A)  $F^-$       (B)  $Na^+$       (C)  $O^{2-}$       (D)  $Ne$



- (A) Hydrogen atom    (B) Nitrogen                (C) Helium atom    (D) Neon atom

**ANSWER KEY ➤****EXERCISE # 1****SECTION -A (FIXED RESPONSE TYPE)****MULTIPLE CHOICE QUESTIONS :**

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

**FILL IN THE BLANKS**

1. Atom      2.  $\text{ZnO}_{\frac{-2}{2}}$       3.  $\text{HNO}_3$       4. protons & neutrons      5. Centre

**TRUE / FALSE**

1. False      2. True      3. True      4. False      5. True

**MATCH THE COLUMN**

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

**EXERCISE # 2****SECTION -A (COMPETITIVE EXAMINATION QUESTION)****MULTIPLE CHOICE QUESTIONS**

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|---|---|---|---|---|---|---|---|---|----|
| Ans.  | C | B | C | D | B | A | B | B | D | A  |

**EXERCISE # 3****(PREVIOUS YEAR EXAMINATION QUESTIONS)**

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------|---|---|---|---|---|---|---|---|---|
| Ans.  | B | B | B | B | A | B | A | A | B |

**Terminologies**

Natural number, whole number, integers, successor, predecessor, modulus, additive identity, additive inverse, multiplicative identity, multiplicative inverse, operator precedence.

## INTRODUCTION

The sum of two whole numbers is always a whole number, so the set of whole number is closed under addition, but is this true for subtraction also ? The answer is no. For example, when 4 is subtracted from 9, the answer is 5, which is a whole number, but when we subtract 9 from 4 what do we get?

We get – 5, which is not a whole number. Thus, this operation cannot be performed if we have only the set of whole numbers to work with. So we extend this set and include negative natural numbers also. So lets study about this topic in broad.

## 1.1 INTEGERS

### (a) Natural numbers

Counting numbers are called **natural numbers**.

Thus 1, 2, 3, 4, 5, 6 ...., etc., are all natural numbers.

### (b) Whole numbers

All natural numbers together with 0 (zero) are called **whole numbers**.

Thus, 0, 1, 2, 3, 4 ..... , etc., are whole numbers.

Clearly, every natural number is a whole number but every whole number is not a natural number as 0 is a whole number which is not a natural number.

### (c) Integers

All natural numbers, 0 and negatives of natural numbers are called **integers**.

Set of integers is denoted by  $\mathbb{Z}$  or  $\mathbb{I}$

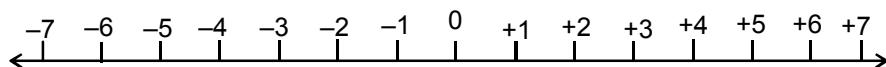
$\mathbb{I} \text{ or } \mathbb{Z} = \{ \dots, -3, -2, -1, 0, 1, 2, 3, \dots \}$  is the set of integers.

(i) **Positive integers** : 1, 2, 3, 4, 5 ..... etc., are all **positive integers**.

(ii) **Negative integers** : -1, -2, -3, -4,....., etc., are all **negative integers**.

(iii) Zero is an integer which is neither positive nor negative.

## (d) Representation of numbers on number line



We draw a line and mark a point O in the middle of that line. This point denotes the number 0. Since negative numbers are opposites of positive numbers, therefore if positive numbers  $+1, +2, +3, +4, \dots$  are marked at 1 unit, 2 units, 3 units, 4 units and so on from the 0-mark to right of it, then points at distances 1 units, 2 units, 3 units, 4 units and so on from the 0-marks to the left of it shall represent negative integers  $-1, -2, -3, -4, \dots$  and so on.

## (e) Predecessor

One less than a given integer is called its predecessor.  
e.g predecessor of 390 is 389 , while that of  $-390$  is  $-391$

## (f) Successor

One more than a given integer is called its successor.  
e.g successor of 390 is 391 , while that of  $-390$  is  $-389$

## (g) Comparison of integers

1. Every positive integer is greater than the negative integer , e.g.  $2 > -2, 7 > -12$
2. Zero is less than every positive integer , e.g.  $0 < 5, 0 < 9$
3. Zero is greater than every negative integer , e.g .  $0 > -7, 0 > -99$
4. The greater the number , the lesser is its opposite , i. e , if a and b are two integers such that  $a > b$  , then  $-a < -b$  .Likewise if  $a < b$  then  $-a > -b$  , e.g . if  $7 > 9$  the  $-7 < -9$  and if  $3 < 6$  then  $-3 > -6$

## (h) Modulus or absolute value of an integer

Absolute value of an integer is the numerical value of the integer regardless of its sign. The symbol  $| |$  is used to represent the absolute value of an integer. Thus  $|8| = 8, |-8| = 8$  .

Ask yourself \_\_\_\_\_



- 1\_. Write all integers between  $-20$  to  $20$ .
- 2\_. A number line representing integer is given below  

  
b, e are marked by  $-7$  and  $-4$ . Find m , n , o
- 3\_. Arrange  $-13, -10, 10, 5, 0, -2$  in ascending order and mark on number line.
- 4\_. Write 5 integers less than  $-6$  and 5 integer greater than  $-6$ .
- 5\_. Write predecessor of
  - (a) largest five digit number
  - (b) smallest six digit number
- 6\_. Simplify :  $|18-3| + |-10|$

## 1.2 OPERATION ON INTEGERS

### (a) Addition of Integers

**Rule : 1** If two positive or two negative integers are added, we add their values regardless of their signs and give the sum with their common sign.

**For example :** Add  $-31$  and  $-25$ .

$$\begin{array}{r} \text{Sol. } -31 \\ \quad -25 \\ \hline \quad -56 \end{array}$$

**Rule : 2** To add a positive and a negative integer, we find the difference between their numerical values regardless of their signs and give the sign of the integer with the greater value to it.

**For example :** Add :  $-47$  and  $18$

$$\begin{array}{r} \text{Sol. } -47 \\ \quad +18 \\ \hline \quad -29 \end{array}$$

#### Properties of Addition on Integers

##### Closure property of Addition :

The sum of two integers is always an integer.

**For example :**

- (i)  $5 + 4 = 9$ , which is an integer.
- (ii)  $4 + (-8) = -4$ , which is an integer.

##### Commutative law of addition :

If  $a$  and  $b$  are any two integers, then  $a + b = b + a$

**For example :**

- (i)  $(-4) + 9 = 5$  and  $9 + (-4) = 5$
- $\therefore (-4) + 9 = 9 + (-4)$

##### Associative Law of addition :

If  $a$ ,  $b$ ,  $c$  are any three integers, then  $(a + b) + c = a + (b + c)$

**For example :**

Consider the integers  $(-6)$ ,  $(-8)$  and  $5$ . We have

$$\{(-6) + (-8)\} + 5 = (-14) + 5 = -9.$$

$$\text{And, } (-6) + \{(-8) + 5\} = (-6) + (-3) = -9$$

$$\therefore \{(-6) + (-8)\} + 5 = (-6) + \{(-8) + 5\}.$$

##### Existence of Additive Identity :

For any integer  $a$ , we have  $a + 0 = 0 + a = a$

$0$  is called the additive identity for integers.

**For example :**

- (i)  $9 + 0 = 0 + 9 = 9$
- (ii)  $(-6) + 0 = 0 + (-6) = (-6)$

**Existence of Additive Inverse :**

For any integer  $a$ , we have  $a + (-a) = (-a) + a = 0$

The opposite of an integer  $a$  is  $(-a)$ .

The sum of an integer and its opposite is 0.

Additive inverse of  $a$  is  $(-a)$ .

Similarly, additive inverse of  $(-a)$  is  $a$ .

**For example :**

We have  $5 + (-5) = (-5) + 5 = 0$ .

So, the additive inverse of 5 is  $(-5)$ .

And, the additive inverse of  $(-5)$  is 5.

**(b) Subtraction of Integers**

For any integers  $a$  and  $b$ , we define,  $a - b = a + (-b)$ .

**For example :**

Subtract (i) 8 from 5 (ii) –6 from 3.

**Sol.** We have :

$$(i) 5 - 8 = 5 + (\text{negative of } 8) = 5 + (-8) = -3$$

$$(ii) 3 - (-6) = 3 + \{\text{negative of } (-6)\} = 3 + 6 = 9.$$

**Properties of subtraction****Closure Property of Subtraction :**

If  $a$  and  $b$  are any two integers. Then  $(a - b)$  is always an integer.

**Subtraction of Integers is not Commutative :****For example :**

$$3 - 5 = 3 + (-5) = -2, 5 - 3 = 5 + (-3) = 2$$

Thus,  $3 - 5 \neq 5 - 3$ .

**Subtraction of integers is not associative :****For example :**

Consider the integers 3, –4 and –5 we have

$$\begin{aligned} \{3 - (-4)\} - (-5) &= \{3 + (\text{additive inverse of } -4)\} - (-5) \\ &= (3 + 4) - (-5) = 7 - (-5) \\ &= 7 + (\text{additive inverse of } -5) = (7 + 5) = 12 \end{aligned}$$

$$\text{And, } 3 - \{(-4) - (-5)\} = 3 - \{(-4)\} + (\text{additive inverse of } -5)\}$$

$$= 3 - \{-4 + 5\} = (3 - 1) = 2$$

Hence,  $\{3 - (-4)\} - (-5) \neq 3 - \{(-4) - (-5)\}$ .

**(c) Multiplication of Integers**

**Rule : 1** To find the product of two integers with unlike signs. Find the product of their values regardless of their signs and give a minus sign to the product.

**For example :**

Find the product of  $6 \times (-5)$ .

$$\text{Sol. } 6 \times (-5) = -30$$

**Rule : 2** To find the product of two integers with the same sign. We find the product of their values regardless of their signs and give a plus sign to the product.

**For example :**

Find the product of :  $(-8) \times (-14)$

**Sol.**  $(-8) \times (-14) = (8 \times 14) = 112$ .

**Properties of multiplication**

The multiplication of integers possesses the following properties.

**Closure property :**

The product of two integers is always an integer.

That is, for any two integers  $a$  and  $b$ ,  $a \times b$  is an integer.

**Verification :** We have

- (i)  $4 \times 3 = 12$ , which is an integer.
- (ii)  $3 \times (-5) = -15$ , which is an integer.
- (iii)  $(-7) \times (-6) = 42$ , which is an integer.

**Commutativity :**

For any two integers  $a$  and  $b$ , we have  $a \times b = b \times a$  that is multiplication of integers is commutative.

**Verification :** We have ,

- (i)  $7 \times (-6) = -(7 \times 6) = -42$   
and  $(-6) \times 7 = -(6 \times 7) = -42$   
 $\therefore 7 \times (-6) = (-6) \times 7$   
Commutative property holds good.
- (ii)  $(-5) \times (-9) = 5 \times 9 = 45$   
and  $(-9) \times (-5) = 9 \times 5 = 45$   
 $\therefore (-5) \times (-9) = (-9) \times (-5)$ .

**Associativity :**

The multiplication of integers is associative, i.e., for any three integers  $a, b, c$  , we have :  
 $a \times (b \times c) = (a \times b) \times c$

**Verification :** we have

- (i)  $(-3) \times \{4 \times (-7)\} = (-3) \times (-28) = 3 \times 28 = 84$   
and,  $\{(-3) \times 4\} \times (-7) = (-12) \times (-7) = 12 \times 7 = 84$   
 $\therefore (-3) \times \{4 \times (-7)\} = \{(-3) \times 4\} \times (-7)$

Thus, associative property holds good.

- (ii)  $(-2) \times \{(-3) \times (-5)\} = (-2) \times 15 = -(2 \times 15) = -30$   
and  $\{(-2) \times (-3)\} \times (-5) = 6 \times (-5) = -(6 \times 5) = -30$   
 $\therefore (-2) \times \{(-3) \times (-5)\} = \{(-2) \times (-3)\} \times (-5)$ .

**Distributive property of multiplication over addition :**

The multiplication of integers is distributive over their addition. That is, for any three integers  $a, b, c$ , we have:

- (i)  $a \times (b + c) = a \times b + a \times c$
- (ii)  $(b + c) \times a = b \times a + c \times a$

**Verification :** We have ,

$$(-4) \times \{(-2) + (-3)\} = (-4) \times (-5) = 4 \times 5 = 20$$

$$\text{and, } (-4) \times (-2) + (-4) \times (-3) = (4 \times 2) + (4 \times 3) = 8 + 12 = 20$$

$$\therefore (-4) \times \{(-2) + (-3)\} = (-4) \times (-2) + (-4) \times (-3).$$

**NOTE :**

A direct consequence of the distributivity of multiplication over subtraction is :  
 $a \times (b - c) = a \times b - a \times c$ .

**Existence of multiplicative identity :**

For every integer  $a$ , we have

$$a \times 1 = a = 1 \times a$$

The integer 1 is called the multiplicative identity for integers.

**Existence of multiplicative inverse :**

Multiplicative inverse of a nonzero integer  $a$  is the number  $\frac{1}{a}$ , as

$$a \cdot \left(\frac{1}{a}\right) = \left(\frac{1}{a}\right) \cdot a = 1$$

**For example :** Multiplicative inverse of 6 is  $\frac{1}{6}$ .

**Property of Zero :**

For any integer, we have

$$a \times 0 = 0 = 0 \times a$$

**NOTE :**

(i) We know that  $(-a)$  is additive inverse or opposite of  $a$ . Thus, to find the opposite or additive inverse or negative of an integer, we multiply the integer by  $-1$ .

(ii) Since, multiplication of integers is associative. Therefore, for any three integers  $a, b, c$ , we have

$$(a \times b) \times c = a \times (b \times c)$$

Thus, we will write  $a \times b \times c$  for the equal products of  $(a \times b) \times c$  and  $a \times (b \times c)$ .

(iii) When the number of negative integers in a product is odd, the product is negative.

(iv) When the number of negative integers in a product is even, the product is positive.

(v) If  $a, b, c$  are integers, such that  $a > b$ , then

(a)  $a \times c > b \times c$ , if  $c$  is positive

(b)  $a \times c < b \times c$ , if  $c$  is negative.

**For example :**

Find each of the following products :

$$(i) (-115) \times 8 \quad (ii) 9 \times (-3) \times (-6)$$

**Sol.** (i) We have,

$$(-115) \times 8 = -(115 \times 8) = -920$$

(ii) We have,

$$\begin{aligned} 9 \times (-3) \times (-6) \\ = \{9 \times (-3)\} \times (-6) \\ = -(9 \times 3) \times (-6) \\ = -27 \times (-6) \\ = 27 \times 6 = 162. \end{aligned}$$

And, the additive inverse of  $(-5)$  is 5.

**(d) Division of Integers**

We know that division is an inverse process of multiplication.

**Rule 1 :** For dividing one integer by the other, the two having unlike signs, we divide their values regardless of their signs and give a minus sign to the quotient.

**For example :** Evaluate  $(-48) \div 12$ .

**Sol.**  $(-48) \div 12 = \frac{-48}{12} = -4$ .

**Rule 2 :** For dividing one integer by the other having like signs. we divide their values regardless of their signs and give a plus sign to the quotient.

### Properties of division

Division of integers has the following properties :

(i) If a and b are integers , then  $a \div b$  is not necessarily an integer.

**For example ,**  $15 \div 4, -14 \div 3$  are not integers.

(ii) If a is an integer different from 0, then  $a \div a = 1$ .

(iii) For every integer a , we have  $a \div 1 = a$ .

(iv) If a is a non-zero integer, then  $0 \div a = 0$

(v) If a is an integer, then  $a \div 0$  is meaningless.

(vi) If a, b , c are integers, then

(A)  $a > b \Rightarrow a \div c > b \div c$ , if c is positive.

(B)  $a > b \Rightarrow a \div c < b \div c$ , if c is negative.

### Illustration 1.1

In a test (+ 5) marks are given for every correct answer and (- 2) marks are given for every incorrect answer. (i) Radhika answered all the questions and scored 30 marks though she got 10 correct answers.

(ii) Jay also answered all the questions and scored (-12) marks though he got 4 correct answers.

How many incorrect answers had they attempted ?

**Sol.** (i) Marks given for one correct answer = 5

So, marks given for 10 correct answers =  $5 \times 10 = 50$

Radhika's score = 30

Marks obtained for incorrect answers =  $30 - 50 = -20$

Marks given for one incorrect answer = (- 2)

Therefore, number of incorrect answers =  $(-20) \div (-2) = 10$

(ii) Marks given for 4 correct answers =  $5 \times 4 = 20$

Jay's score = - 12

Marks obtained for incorrect answers =  $-12 - 20 = -32$

Marks given for one incorrect answer = (- 2)

Therefore number of incorrect answers =  $(-32) \div (-2) = 16$ .

### Illustration 1.2

Evaluate  $(-48) \div (-16)$ .

**Sol.**  $(-48) \div (-16) = \frac{-48}{-16} = 3$ .

**Ask yourself**

1. Alisha participated in a quiz, she won Rs 80 for answering correct in first round , but had to pay Rs. 30 as penalty for answering wrong . In second round she again won Rs 100 , but loss Rs 25 for some wrong answers. How much she scored at the end of quiz
2. The sum of two integers is – 40. If one of them is 25. Find the other.
3. Write two integers which are smaller than – 3, but their difference is greater than – 3.
4. A tanker contains 500 litres of milk. Due to small hole in a tanker, the quantity of milk is decreasing at the rate of 9 litres every hour. What will be the quantity of milk after 10 hours?
5. Find the value of following.
  - (a)  $175 + (-177) + 165 + 95 + 88 + (-77)$
  - (b)  $41 + (-25) + (-137) + (-107) + 14 + 51 + (-64) + (-37) + 91$
6. Use the sign  $>$ ,  $<$ ,  $=$ 
  - (a)  $29 + (-18) - 15 \quad 36 - (-15) + 28$
  - (b)  $-241 + 76 + 86 \quad -399 + 163 + 45$
7. (a) Write a negative integer and a positive integer whose sum is –10.  
 (b) Write a negative integer and a positive integer whose difference is –16.  
 (c) Find the value of  $[( -4 ) \times ( -9 ) \times ( -25 )] \div [(-2) \times (-3) \times (-5)]$
8. Product of two numbers is –315. If one of the number is –7 ,find the other.
9. A cinema hall is to be constructed in which each row have 36 seats . Determine the minimum number of rows required to seat 612 persons at a time.
10. Simplify :  $\frac{-4256}{-56} + \frac{-3780}{-54} + \frac{2132}{41} + \frac{4224}{-66}$ .

### 1.3 OPERATOR PRECEDENCE

Generally, the order in which we perform operations sequentially from left to right is : bracket, of, division, multiplication, additions & subtraction. This order is expressed in short as 'BODMAS'

#### Illustration 1.3

Simplify :  $(-20) + (-8) \div (-2) \times 3$ .

**Sol.** We have,

$$\begin{aligned} & (-20) + (-8) \div (-2) \times 3 \\ & = (-20) + 4 \times 3 \\ & = (-20) + 12 \\ & = -8. \end{aligned}$$

#### (a) Use of brackets

In order to simplify expression involving more than one brackets, we use the following steps.

**Step-I** See whether the given expression contains a vinculum or not. If a vinculum is present, then perform operations under it. Otherwise go to next step.

**Step-II** See the innermost bracket and perform operations within it.

**Step-III** Remove the innermost bracket by using following rules :

**Rule 1 :** If a bracket is preceded by a plus sign, remove it by writing its terms as they are.

**Rule 2 :** If a bracket is preceded by minus sign, change positive signs within it to negative and vice-versa.

**Rule 3 :** If there is no sign between a number and a grouping symbol, then it means multiplication.

**Rule 4 :** If there is a number before some brackets then we multiply the number inside the brackets with the number outside the brackets.

**Step-IV** See the next innermost bracket and perform operations within it. Remove the second innermost bracket by using the rules given in step III. Continue this process till all the brackets are removed.

#### Illustration 1.4

Simplify :  $48 - [18 - \{16 - (5 - 4 - 1)\}]$ .

**Sol.** We have,

$$48 - [18 - \{16 - (5 - 4 - 1)\}] = 48 - [18 - \{16 - (5 - 3)\}]$$

$$= 48 - [18 - \{16 - 2\}] = 48 - [18 - 14] = 48 - 4 = 44.$$

#### Illustration 1.5

Simplify :  $222 - \left[ \frac{1}{3} \{42 + (56 - 8 + 9)\} + 108 \right]$ .

**Sol.** We have,

$$222 - \left[ \frac{1}{3} \{42 + (56 - 8 + 9)\} + 108 \right] = 222 - \left[ \frac{1}{3} \{42 + (56 - 17)\} + 108 \right]$$

$$= 222 - \left[ \frac{1}{3} \{42 + 39\} + 108 \right] = 222 - \left[ \frac{81}{3} + 108 \right] = 222 - [27 + 108] = 222 - 135 = 87.$$

#### Ask yourself



1. Simplify :  $429 - \left[ \frac{1}{2} \{-2 - (5 - (4 - (-1))) + 108\} \right]$

2. Simplify :  $3 \times (5 \times 2 - 4) + 10 - 15 \div 5$

3. Simplify :  $4 - [6 - \{7 - (8 - 6 - 3)\}]$

4. Simplify :  $7 - [3 - 2\{5 + 6(7 - 8 + 9 - 10)\}]$ .

5. Simplify :  $-4 - [4 + 15 \div 5 - \{6 - (2 + 8)\}]$



## Add to Your Knowledge

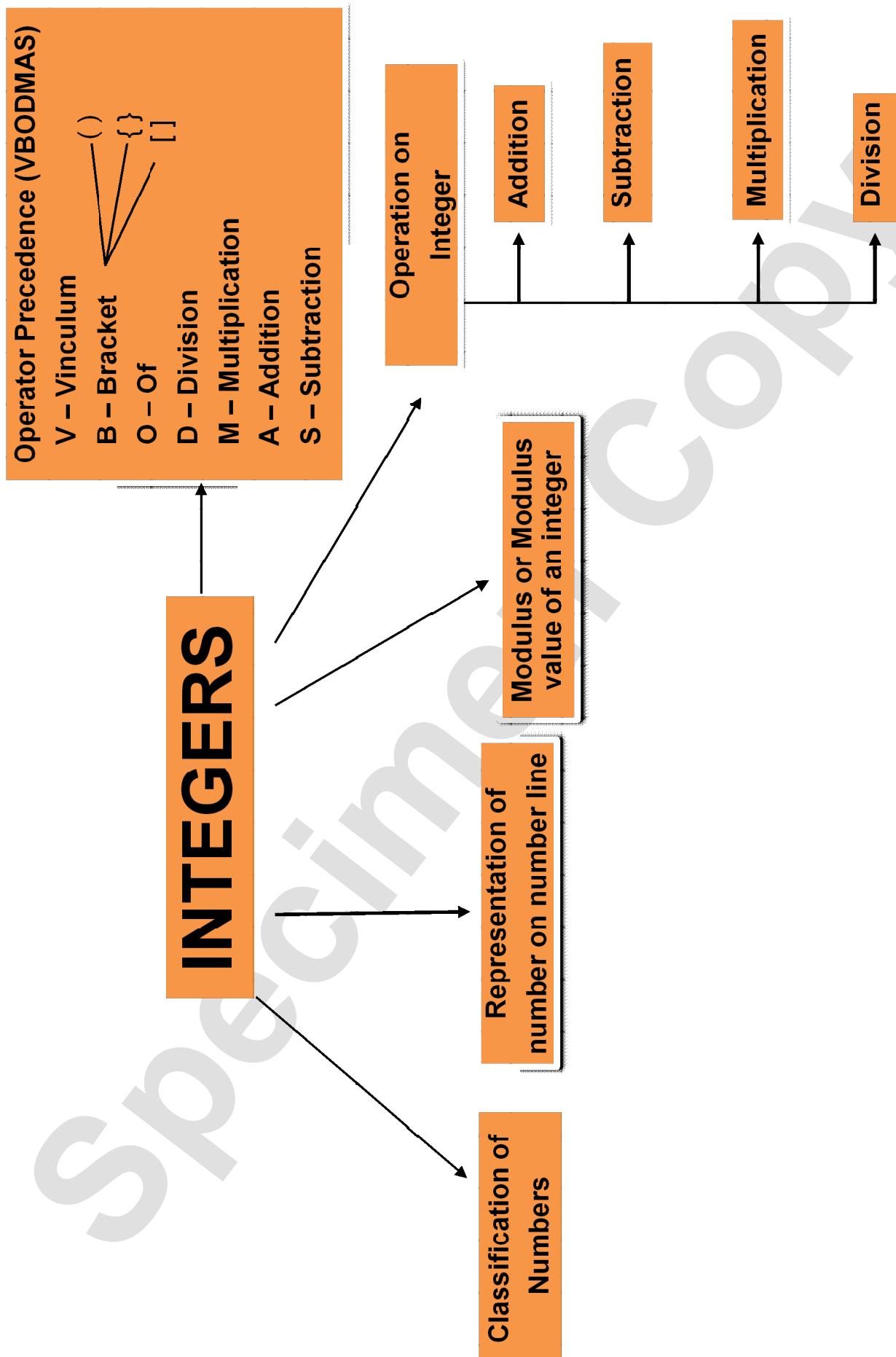
In this chapter we have studied modulus , but can you solve  $|10 - k| = 3$  .

After solving you will say  $k = 7$  satisfy above equation , but what is wrong with  $k = 13$ . Confused !!!!!!!

**Explanation :**  $|x| = \begin{cases} +x & , x > 0 \\ -x & , x < 0 \end{cases}$

so first we will solve above equation taking  $(10 - k)$  positive, and again by considering it negative e.g.  $-(10 - k)$  and by solving both we will get  $K = 7$  and  $K = 13$  respectively .

## Concept Map



## Summary :

1. I or Z = { ..... -3, -2, -1, 0, 1, 2, 3, ..... } is the set of integers.
2. (i) Positive integers : 1, 2, 3, 4, 5 ..... etc., are all positive integers.  
 (ii) Negative integers : -1, -2, -3, -4,..... etc., are all negative integers.  
 (iii) Zero is an integer which is neither positive nor negative.
3. The absolute value of an integer a is its numerical value regardless of its sign and is denoted by |a|
4. The sum of two integers with like signs is the sum of the absolute values of the addends having the sign of the addends. e. g .  $2 + 3 = 5$  and  $-2 + -3 = -5$
5. The sum of two integers with unlike signs is the difference of the absolute values of the addends having the sign of the integer with greater numerical value e. g .  $-2 + 4 = 2$  and  $-8 + 2 = -6$
6. The operation of addition has closure , commutative , associative , addition of zero , additive inverse properties.
7. To subtract b from a , we add the additive inverse of b , to a , i.e.  $a - b = a + (-b)$  ,  
e.g.  $-4 - 5 = -4 + (-5) = -9$  and  $-7 - (-5) = -7 + (5) = -2$
8. The product of two integers with like signs is the product of the absolute values, with a positive sign. e.g.  $8 \times 9 = 72$  and  $-8 \times -9 = 72$
9. The product of two integers with unlike signs is the product of the absolute values, with a negative sign. e.g.  $-8 \times 9 = -72$  and  $8 \times -9 = -72$
10. The operation of multiplication has closure , commutative , associative properties .
11. The quotient of two integers with same sign is a positive integer obtained by dividing the absolute value of the dividend by the absolute value of the divisor. e.g .  $8 \div 2 = 4$  and  $(-10 \div -5) = 2$ .
12. The quotient of two integers with unlike sign is a negative integer obtained by dividing the absolute value of the dividend by the absolute value of the divisor. e.g .  $\{-8 \div (2)\} = -4$  and  $\{10 \div (-5)\} = -2$ .
13. Division by zero is not allowed.
14. Priority of brackets in BODMAS is ( ) , { } , [ ]

**EXERCISE > 01****SECTION -A (FIXED RESPONSE TYPE)****MULTIPLE CHOICE QUESTIONS :**

1. The sum of which of the following is the smallest?  
 (A)  $923 + 456$       (B)  $701 + 632$       (C)  $602 + 788$       (D)  $513 + 998$
2.  $1384 + 5580 + 47218$   
 (A) 54182      (B) 54178      (C) 51184      (D) 51178
3. Harshita earns Rs 3500. If she spent Rs 1249 on buying earphones ,what is the balance of her salary?  
 (A) Rs 2751      (B) Rs 2251      (C) Rs 2151      (D) Rs 2059
4. Sandhya bought 19 boxes of sweets. Each box contains 228 sweets. How many sweets would be left with her after giving 519 sweets to friends?  
 (A) 766      (B) 3813      (C) 4332      (D) 4851
5. Riddhima saves Rs. 46.3 everyday. Find the minimum number of days for which she needs to save to get her savings as a whole number.  
 (A) 10      (B) 20      (C) 5      (D) 15
6. For any integer  $x$  what is true :  
 (A)  $x / 0$  is not defined      (B)  $x / 1 = a$  (where  $x \neq a$ )  
 (C) option (A) and (B) both are wrong      (D) option (A) and (B) both are right
7. Which of the following integer has the greatest value?  
 (A)  $-11$       (B)  $-89$       (C)  $-8$       (D)  $-6$
8. Evaluate :  $|5 - 3| - |5 - 8| + |13 - 67|$   
 (A) 53      (B) 33      (C) 43      (D) 67
9. Simplify :  $|2| + |-12| - |-2| + |-101| - |-101|$   
 (A) 24      (B) 12      (C) 0      (D) 22
10. Find predecessor of successor of  $-110$   
 (A)  $-111$       (B)  $-108$       (C)  $-112$       (D)  $-110$
11. The additive inverse of  $-6$  is :  
 (A) 6      (B) 0      (C)  $-5$       (D)  $-7$
12. On subtracting  $(-6)$  from 0, we get :  
 (A)  $-6$       (B) 6      (C) 7      (D) None of these
13. By how much does  $-3$  exceed  $-5$  ?  
 (A)  $-2$       (B) 2      (C) 8      (D)  $-8$



**FILL IN THE BLANKS**

1. Greatest negative integer is \_\_\_\_\_
2. 0 is greater than every \_\_\_\_\_ integer.
3. \_\_\_\_\_ is an integer which is neither positive nor negative.
4. Product of 11 negative integers and 3 positive integers is \_\_\_\_\_
5. In \_\_\_\_\_ inverse ,  $a + (-a) = (-a) + a = 0$
6. One less than a given integer is called its \_\_\_\_\_.
7.  $12 \div 3 \times 5 - 8$  is equal to :
8.  $3 - 0 (5 + 9)$  is equal to :

**TRUE / FALSE**

1. Every whole number is a natural number but every natural number is not a whole number.
2. Successor of a largest three digit number is 1000.
3. The product of two numbers with opposite sign is always negative.
4. The difference of two numbers with opposite sign is always negative.
5. The sum of two negative is less than either of the addends.
6. When the number of negative integers in a product is even, the product is positive.
7. When the number of negative integers in a product is odd, the product is negative.
8.  $3 + 4 - 5 \times 2 = -3$ .
9.  $5 - [3 + \{5 + 2 - 1\}] = 4$ .

**MATCH THE COLUMN**

- | 1. <b>COLUMN – I</b>        | <b>COLUMN-II</b> |
|-----------------------------|------------------|
| (A) $a \div (-a)$           | (p) $-a$         |
| (B) $a \times (-1)$         | (q) $0$          |
| (C) $-a \div (-1)$          | (r) $-1$         |
| (D) $a \div 0$              | (s) $a$          |
| (E) $-3 \times -6 \times 0$ | (t) not defined  |

**2. COLUMN – I**                   **COLUMN-II**

- |     |                                |     |     |
|-----|--------------------------------|-----|-----|
| (A) | Reciprocal of $\frac{1}{8}$    | (p) | -11 |
| (B) | $-8 + (-3)$                    | (q) | 8   |
| (C) | $27 \div 3 \div 3$             | (r) | -63 |
| (D) | $-4 \times -4 \times -4 + 1$   | (s) | 3   |
| (E) | $(14 \div 2) \div (49 \div 7)$ | (t) | 1   |

**SECTION -B (FREE RESPONSE TYPE)**

**VERY SHORT ANSWER TYPE**

- 1\_. Write successor of
  - (a) largest five digit number
  - (b) smallest six digit number
- 2\_. In exam, student scored 18 , - 2 , 15 , - 10 , 20 in 5 consecutive test, arrange marks in descending order.
3. Find the additive inverse of :
 

|     |      |      |    |       |   |      |    |
|-----|------|------|----|-------|---|------|----|
| (i) | - 26 | (ii) | 12 | (iii) | 0 | (iv) | -1 |
|-----|------|------|----|-------|---|------|----|
4. Solve :  $-a \times -b \times 0 \times -c \times -d$
5. The product of two numbers is -180. If one number is 12, find the other number.
6. Sum of the two integers is 63. If one of them is -37, find the other
7. Calculate:  $(-6) + (6) + (-6) + (6) + (6)$
- 8\_. Simplify:  $3 + 2 - 8 \div 4$

**SHORT ANSWER TYPE**

- 9\_. Find the pattern and answer it.
  - (a) 8 , 5 , 2 , -1 , -4 , \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
  - (b) 20 , 15 , 10 , 5 , 0 , \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
  - (c) -3 , -6 , -9 , -12 , \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
- 10\_. Find the sum of successor of largest three digit number and predecessor of smallest two digit number.
- 11\_. Arrange the given integer in ascending order: 3,7,-8,-10,12,15,-20
12. The temperature at 12 noon was 10°C above zero. If it decreases at the rate at 2°C per hour until midnight, at what time would the temperature be 8° C below zero ?

**For Q. 13 & 14**

In a class test containing 15 questions, 4 marks are given for every correct answer and (-2) marks are given for every incorrect answer.

13. Gurpreet attempts all questions but only 9 of her answers are correct. What is her total score?
14. One of her friends gets only 5 answers correct. What will be her score ?

- 15.** Solve :  $25 - 5 \times 2 + 3 - 8 \div 2$ .

**16.** Simplify each of the following and find the correct answer in the same order :

(i)  $39 - [23 - \{29 - (17 - \overline{9-3})\}]$ .

(ii)  $15 - (-3) \{ 4 - \overline{7-3} \} \div [3 \{ 5 + (-3) \times (-6) \}]$ .

## **LONG ANSWER TYPE**

17. What is the difference between sum of even number and sum of odd numbers between 10 and 30 .

18\_. Three schools take part in a campaign to raise funds for eradicating hunger. School 1 raise Rs. 1914380 as part of the campaign, School 2 raises Rs. 9974365 and School 3 raises Rs. 2608589. Find the total amount raised by all three school ?

19. An elevator descends into a mine shaft at the rate of 5 metre per minute. What will be its position after one hour ?

20. An elevator begins to descends from 15 m above the ground at the rate of 5 metre per minute, what will be its position after 45 minutes?

21. A shopkeeper earns a profit of Re 1 by selling one pen and incurs a loss of 40 paise per pencil while selling pencils of his old stock. In a particular months he incurs a loss of Rs 5. In this period, he sold 45 pens. How many pencils did he sell in this period ?

22. Simplify:  $118 - [121 \div (11 \times 11) - (-4) - \{ 3 - \overline{9-2} \}]$ .

# EXERCISE > 02

## **SECTION -A (COMPETITIVE EXAMINATION QUESTION)**

## MULTIPLE CHOICE QUESTIONS



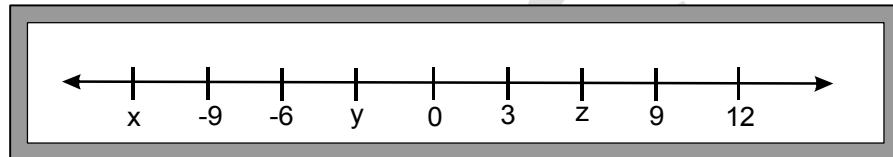
## **SECTION -B (TECHIE STUFF)**



# EXERCISE > 03

## (PREVIOUS YEAR EXAMINATION QUESTIONS)

- 1.** In the figure given below,





- 2.** If 23 integers are multiplied and the product is negative then which of the following statements can be true about them : (NSTSE 2012)  
(A) 10 are negative, 13 are positive      (B) 14 are negative, 9 are positive  
(C) 12 are negative, 21 are positive      (D) 17 are negative, 6 are positive

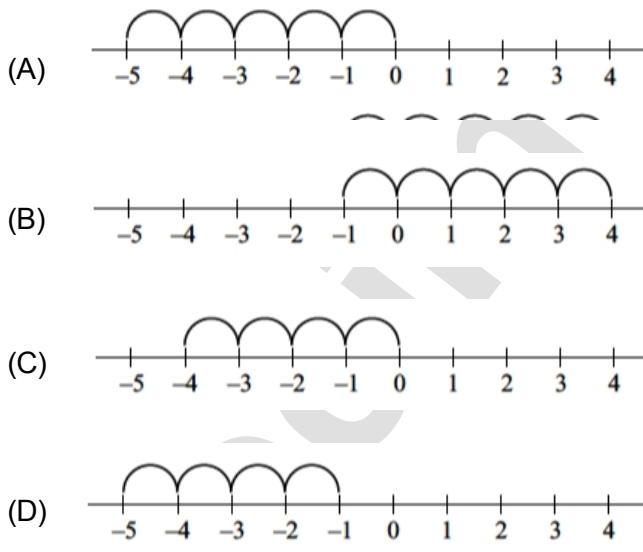
**3.** Which of the following divisions has the greatest quotient ? (NSTSE 2012)  
(A)  $20 \div (-4)$       (B)  $20 \div 4$       (C)  $(-20) \div (-5)$       (D)  $(-30) \div 5$

**4.** Find the value of the expression below :  
$$0 - 1 + 2 - 3 + 4 - 5 + 6 - 7 + 8 - 9 + \dots - 17 + 18 - 19 + 20.$$
 [NSTSE 2012]  
(A) 10      (B) 0      (C) -10      (D) 20

**5.** A place P is 82 m above the sea-level and another place is 13 m below the sea-level. What is the distance between the two places? [IMO-2012]  
(A) 95 m      (B) 69 m      (C) -95 m      (D) -69 m

**6.** Find the value of the given expression  $(-35) - (-15) + 8 - 9 - (-152) - 25 + (-8)$  [IMO-2012]  
(A) -78      (B) 32      (C) -55      (D) 98

**7.** The temperature of a city at 1 p.m. was  $15^{\circ}\text{C}$ . Every hour it decreases by  $3^{\circ}\text{C}$ . The temperature at 6 p.m. was [IMO-2012]  
(A)  $3^{\circ}\text{C}$       (B)  $0^{\circ}\text{C}$       (C)  $-3^{\circ}\text{C}$       (D)  $-6^{\circ}\text{C}$



15. Study the below statements carefully and answer the question given below. [IMO-2014]

  - (i) The successor of  $0 \times (-52)$  is  $1 \times (-52)$ .
  - (ii) Integers are closed under division.
  - (iii)  $(-20) \times (5 - 3) = (-20) \times (-2)$
  - (iv)  $(-2) + (-9)$  is less than  $(-9) - (-2)$ .

Which of the following statements is/are correct?

(A) Only (i)                    (B) Both (i) and (iv)            (C) Only (iv)                    (D) Both (i) and (iii)

16. Temperature of a place at 12:00 noon was  $5^{\circ}\text{C}$ . Temperature increased by  $3^{\circ}\text{C}$  in first hour and decreased by  $1^{\circ}\text{C}$  in the second hour. What was the temperature at 2:00 pm?

[IMO-2014]

- (A)  $5^{\circ}\text{C}$       (B)  $7^{\circ}\text{C}$       (C)  $8^{\circ}\text{C}$       (D)  $6^{\circ}\text{C}$

17. Which of the following options hold with respect to given below statements? [IMO-2014]

**Statement 1:** Value of  $(-85) \times 43 - 43 (-15) = (-85 + (-15)) \times 43 = 4300$

**Statement 2 :** If  $*$  is a multiply operation for integers p, q and r, then we have  $p*(q+r) = (p*q)+(p*r)$

- (A) Statement 1 is true and statement 2 is false.  
 (B) Statement 1 is false and statement 2 is true.  
 (C) Both statements 1 and 2 are true.  
 (D) Both statements 1 and 2 are false.

18. Simplify :  $\left[ 15 \div 3 + 10 \left\{ 60 - 8 \div 4 + 3(5 \text{ of } \overline{3-7}) \right\} \right]$  [IMO-2014]

- (A) -20      (B) -15      (C) 12      (D) 16

19. In the given calculation the answer 11418 is incorrect due to a mistake in one of the digits. The incorrect digit is

$$\begin{array}{r}
 267 \\
 \times \quad 54 \\
 \hline
 1068 - \text{Step-1} \\
 + 10350 - \text{Step-2} \\
 \hline
 11418 - \text{Step-3}
 \end{array}$$

[IMO-2014]

- (A) 0 in step-1      (B) 1 in step-1      (C) 0 in step-2      (D) 1 in step-2

20. Which of the following statements is true? [IMO-2014]

- (A) When we multiply two integers their product is always greater than both the integers.  
 (B) Integers are not closed under multiplication.  
 (C)  $99 \times 101$  can be written as  $(100 - 1) \times (100 + 1)$ .  
 (D) When we change the order of integers their difference remains the same.

21. You have Rs. 1500 in your savings account at the beginning of the month. The record below shows all of your transactions during the month. How much money is in your account after these transactions?

| Date         | Withdraw     | Deposit      | [IMO-2014]   |
|--------------|--------------|--------------|--------------|
| 4/9/14       | Rs.1200      | Rs.2000      |              |
| 22/9/14      | Rs.2100      | Rs.2500      |              |
| (A) Rs. 2000 | (B) Rs. 3100 | (C) Rs. 2500 | (D) Rs. 2700 |

**ANSWER KEY >****EXERCISE > 01****SECTION -A (FIXED RESPONSE TYPE)****MULTIPLE CHOICE QUESTIONS :**

| Ques. | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------|----|----|----|----|----|----|----|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans.  | B  | A  | B  | B  | A  | A  | D  | A | B | D  | A  | B  | B  | A  | A  | D  | C  | C  | B  | C  |
| Ques. | 21 | 22 | 23 | 24 | 25 | 26 | 27 |   |   |    |    |    |    |    |    |    |    |    |    |    |
| Ans.  | D  | D  | C  | C  | A  | D  | B  |   |   |    |    |    |    |    |    |    |    |    |    |    |

**FILL IN THE BLANKS**

1.  $(-1)$       2. negative integer      3. 0      4. Negative  
 5. additive inverse      6. predecessor      7. 12      8. 3

**TRUE / FALSE**

1. False      2. True      3. True      4. False  
 5. True      6. True      7. True      8. True  
 9. False

**MATCH THE COLUMN**

1. (A) – r , (B) – p, (C) – s, (D) – t, (E) – q      2. (A)– q, (B) – p, (C) – s, (D) – r, (E) – t

**SECTION -B (FREE RESPONSE TYPE)****VERY SHORT ANSWER TYPE**

- |         |        |      |           |       |                    |
|---------|--------|------|-----------|-------|--------------------|
| 1_. (a) | 100000 | (b)  | 100001    | 2_.   | 20,18,15,-2,-10    |
| 3_. (i) | 26     | (ii) | -12       | (iii) | 0      (iv)      1 |
| 4.      | 0      | 5.   | $x = -15$ | 6.    | $x = 100$          |
| 7.      | 6      | 8._  | 3         |       |                    |

**SHORT ANSWER TYPE**

- 9.\_ (a)  $-7, -10, -13$       (b)  $-5, -10, -15$       (c)  $-15, -18, -21$   
 10.\_  $1000 + 9 = 1009$       11.\_  $-20, -10, -8, 3, 7, 12, 15$       12. Time is 9 pm  
 13. 24      14. 0      15. 14  
 16. (i) 34      (ii) 15

**LONG ANSWER TYPE**

17. 20                    18\_. 14497334

19. – 300 m, i.e., 300 m below ground level

20. – 210 m, i.e., 210 m below ground level.

21. 125 pencils.        22. 109

**EXERCISE > 02****SECTION -A (COMPETITIVE EXAMINATION QUESTION)****MULTIPLE CHOICE QUESTIONS**

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

**EXERCISE > 03****(PREVIOUS YEAR EXAMINATION QUESTIONS)**

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

### Terminologies

Nutrients, Autotrophic, Heterotrophic, Holozoic, Saprophytic, Symbiosis, Parasitism, Photosynthesis, Chlorophyll, Ingestion, Digestion, Absorption, Assimilation, Egestion, Incisors, Canines, Premolars, Molars, Ruminant.

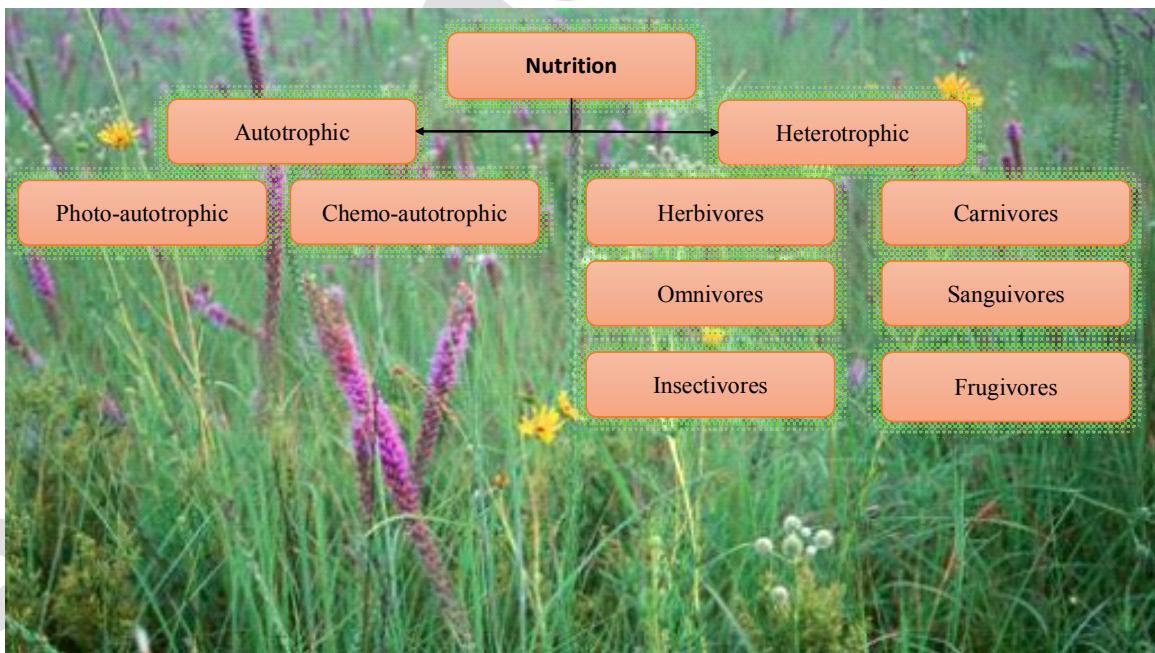
## INTRODUCTION

All organisms need food. They need food for obtaining energy and to get materials required for growth, development and repair of damaged cells and tissues. Though different organisms eat different kinds of food but one thing is common in all food types, that is, all food items contain nutrient.

**"Nutrients** are the substances that a body needs to live and grow. The energy from nutrients is the fuel that allows the body to carry out all functions — run, jump, walk and swim. Nutrients also provide material for the repair of tissues. They also keep the body healthy." To use nutrients, the body must first get food and then the food must be broken down to provide energy. The process by which the body obtains food and utilizes the nutrients present in it is called **nutrition**.

## 1.1 MODES OF NUTRITION

There are several modes of nutrition on the basis of which organisms are classified as follows :



### (a) **Autotrophic : (Auto = self, trophic = food)**

It is a mode of nutrition in which organisms prepare their own food. Inorganic molecules like  $\text{CO}_2$  &  $\text{H}_2\text{O}$  are converted into organic molecules like carbohydrates in the presence of sunlight & chlorophyll. E.g. Green plants.

- ◆ Autotrophs are further categorized as :
- (i) **Photoautotrophs** : Those which utilize sunlight for preparing their food e.g. All green plants , Blue green algae.
- (ii) **Chemoautotrophs** : Those which utilize chemical energy for preparing their food e.g. H<sub>2</sub>S for sulphur bacteria.

**(b) Heterotrophic (Hetero = different ; trophic = food)**

It is a mode of nutrition in which organisms derive their food from some other animals or plants. They cannot prepare their own food e.g. human being. Heterotrophs are further categorized depending on the nature of food they consume :

- (i) **Herbivores** : Animals which eat only plants,  
e.g. Cow, goat.
- (ii) **Carnivores** : They feed on flesh of other animals, e.g. Lion , Tiger.
- (iii) **Omnivores** : They feed on plants and animals both, e.g. Dog, human.
- (iv) **Detritivores** : Feed on detritus or dead organic remains, e.g. Earthworm.
- (v) **Sanguivorous** : Feed on blood, e.g. Leech, female mosquito.
- (vi) **Frugivorous** : Feed on fruits, e.g. Parrot.
- (vii) **Insectivores** : Feed on insects, e.g. Bats, House sparrow, Pitcher plant, Venus flytrap.



**Fig.1.1 Pitcher plant**



**Fig.1.2 Venus flytrap**

**On the Basis of Mode of Feeding**

- ◆ Heterotrophic Organisms are Categorised As :
- (i) **Holozoic** : They ingest mostly solid but sometimes liquid food. Digestion of food takes place inside the body of the organism with the help of digestive enzymes. e.g. Amoeba, Human.



**Fig.1.3 Fungi**

- (ii) **Saprotrophic** : They absorb organic matter from dead and decaying organisms with the help of their enzymes (Extracellular Digestion).  
e.g., Bacteria , fungi.
- (iii) **Parasitic** : They derive their nutrition from other living plants or animals. e.g. Plasmodium, Round worms, Cuscuta plant.

**Knowledge Booster**

Cuscuta (Dodder/ Amarbel) is a parasitic plant which grow on other plant (Host). It wraps itself around the host plant and get nutrition from it by using sucking apparatus

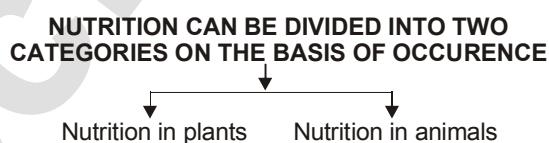


**Fig.1.4 Cuscuta**

- ◆ **Symbiotic Association** : Two organism that live in close physical association and are of mutual benefit to each other, are called symbionts. This condition is known as symbiosis. The common example of symbionts are lichens (association between algae and fungi) and mycorrhiza (association between fungi and the roots of some higher plants).



**Fig.1.5 Lichen**



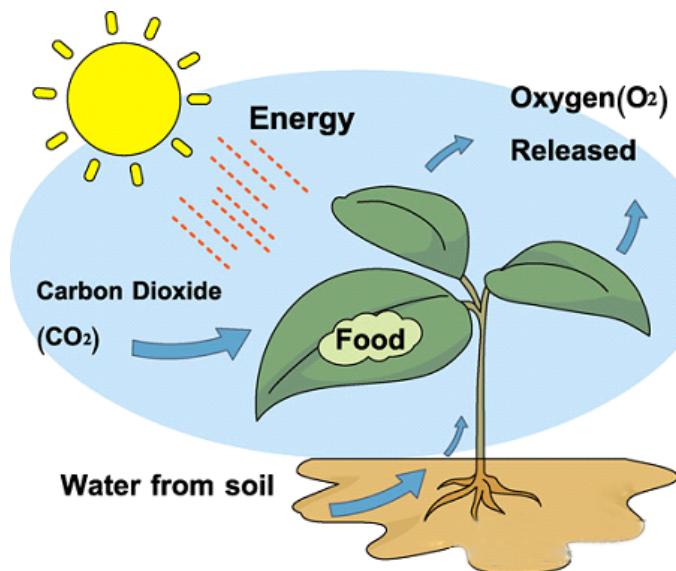
### Ask yourself

- Q.1 Does insectivorous plants show photosynthesis.  
 Q.2\_ What is the difference between autotropic and heterotrophic mode of nutrition?  
 Q.3\_ In chemoautotrophs why chlorophyll is absent?  
 Q.4\_ Name the organisms which feed on blood?  
 Q.5\_ Explain how lichens show symbiosis?  
 Q.6\_ In chemoautotrophs why chlorophyll is absent?

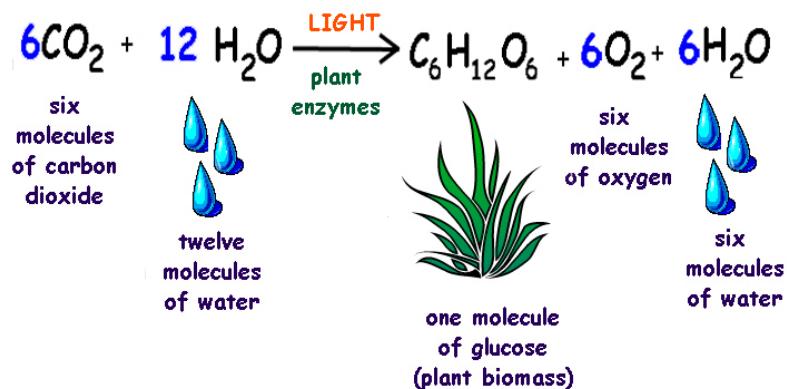


## 1.2 NUTRITION IN PLANTS (PHOTOSYNTHESIS)

The synthesis of organic compounds like glucose from simple inorganic molecules like  $\text{CO}_2$  and  $\text{H}_2\text{O}$  by the cells of green plants having chlorophyll in the presence of sunlight is called as **photosynthesis**.



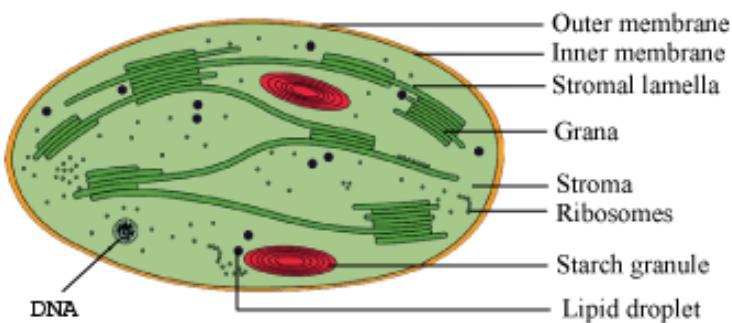
**Fig.1.6 Process of Photosynthesis**



**Fig.1.7 Equation of Photosynthesis**

### (a) Requirements Of Photosynthesis :

- (i) **Sunlight** : Sun is the ultimate source of energy for all living organism.
- (ii) **Chlorophyll** : These are the green pigments present in chloroplast. They are found in green leaves in a maximum amount as well as in other green aerial parts of plant.
- (iii) **Site of photosynthesis-Chloroplast** : Pigments containing double membrane bounded cell organelle is called chloroplast.
  - ◆ Chloroplast is also called as green plastid.
  - ◆ Chloroplast also have variable shapes, for example cup shaped, ribbon shaped etc. in algae while it is discoidal in higher plants.



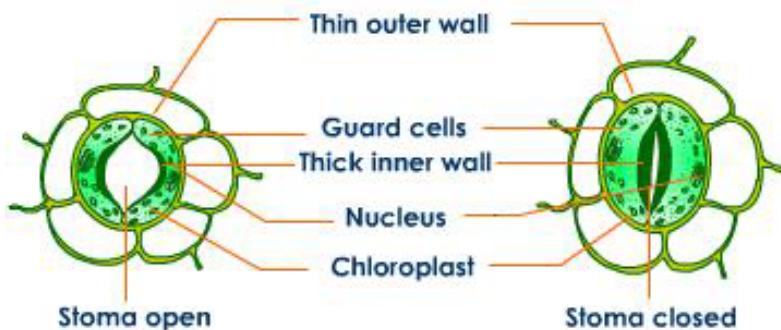
**Fig.1.8 Ultra Structure of Chloroplast**

Each chloroplast is double membranous cell organelle and consists of two parts :-

- (A) **Grana** : It constitutes the lamellar system. These are bound layered on top of each other, these stacks are called as **Grana**.
  - ◆ Each granum of the chloroplast is formed by superimposed closed compartments called **Thylakoids**.
- (B) **Stroma** : It is a granular transparent substance present in chloroplast also called as matrix.
  - ◆ Grana are embedded in it. Besides grana, they also contain lipid droplets, starch grains, ribosomes etc.

#### (iv) Raw Materials of Photosynthesis :

- (A) **Carbon dioxide** : Terrestrial plants obtain carbon dioxide from the atmosphere through the small openings present on leaves called as stomata. '**Stomata**' are the small pores present on the surface of leaves. They help in exchange of gases and water vapour. Stomatal opening is guarded by the presence of guard cells (kidney shaped).



**Fig.1.9 Process of Photosynthesis**

Aquatic plants obtain  $\text{CO}_2$  dissolved in water through their general body surface so they perform more photosynthesis than terrestrial plants.

- (B) **Water** : Plants absorb water from the soil by the process of osmosis. This water is transported to leaves by a special type of tissue called as xylem.

#### (b) Factors affecting photosynthesis :

- (i) **Light** : Normally plants utilize sunlight but marine algae can perform photosynthesis even in the moon light. Plants can also perform photosynthesis in the artificial lights.

Highest rate of photosynthesis in red,  
minimum photosynthesis in green light.

- (ii) **Temperature** : Optimum range =  $25^{\circ}$  to  $30^{\circ}$  C are used for photosynthesis.
- (iii) **Carbon dioxide** : The atmospheric concentration of  $\text{CO}_2 \propto$  rate of photosynthesis.
- (iv) **Chlorophyll** : Chlorophyll content is directly proportional to rate of photosynthesis.

**(b) Significance of photosynthesis :** It has following significance :

- (i) Production of food material.      (ii) Atmospheric control and purification of air.

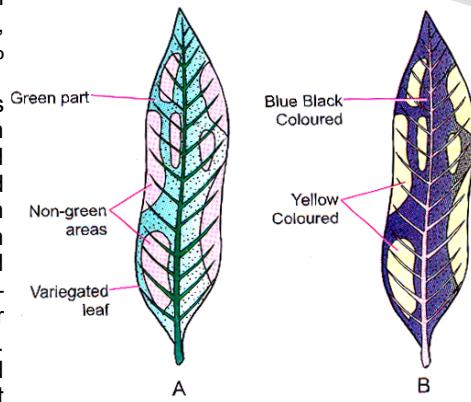
**ACTIVITY-1**

**Aim.** Chlorophyll is Necessary for Photosynthesis.

**Apparatus.** A destarched potted plant of Croton, Pothos (Money Plant) or coleus having variegated leaves, (with green and non-green parts), rice paper, Soft pencil, Beakers, Petridishes, Burner or spirit lamp, spirit (or 70% alcohol), iodine solution, water, forceps.

**Procedure.** Destarch a potted plant of Croton or Pothos (Money Plant) having variegated leaves by keeping it in complete darkness for 2-3 days. Expose the destarched potted plant to sunlight for 2-6 hours. Pluck a variegated leaf. Place a rice paper over it. Draw the outline of green and non-green areas. The green areas contain chlorophyll. The non-green areas are pale in colour and devoid of chlorophyll. Place the leaf in boiling water for 5-10 minutes. Boiling kills the leaf. Dip the leaf in spirit or alcohol kept at  $50^{\circ}$ - $60^{\circ}$  C with the help of a water bath. After 30-45 minutes, the leaf will be decolourised completely. Take out the decolourised leaf, dip in hot water for softening the same. Spread the leaf in a petri dish. Pour dilute iodine solution over the leaf. After 4-5 minutes, rinse off excess ioding and observed.

**Observation.** The leaf has two types of patches, bluish black and yellowish. The bluish black areas are the ones which have starch. The bluish black colour is due to reaction of iodine with starch. The yellow areas are without starch. Compare the bluish black and pale areas with green and non-green areas sketched on rich paper. Bluish-black areas are the ones which were green previously while non-green areas remain pale coloured.



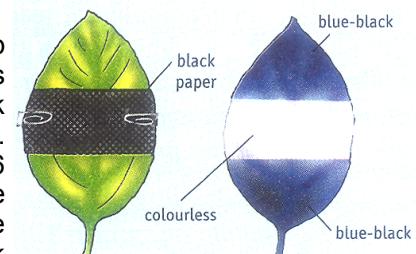
**Fig.** Chlorophyll is necessary for photosynthesis.

**ACTIVITY 2**

**Aim.** To test light is necessary for photosynthesis.

**Procedure.** Take any potted plant with broad leaves and keep it in a dark room for two days. This is done to make the leaves starch free as no photosynthesis will take place in the dark room. Cover a part of the leaf on both sides with a black paper. Now keep the plant in sunlight. Remove the leaf after 5-6 hours and test it for the presence of starch as described in the earlier activity(Fig.). Which part of the leaf will show the presence of starch ? Will the portion covered by the black paper show the presence of starch ? Try and give reasons for your answer.

- **Results.** These experiment shows light is necessary for photosynthesis.



**Fig.** Light is necessary for photosynthesis.

**Ask yourself**

- Q.1 Does moonlight support photosynthesis.
- Q.2 What are other functions of stomata ?
- Q.3\_ What is the site of photosynthesis ?
- Q.4\_ Name the raw materials for photosynthesis ?
- Q.5\_ What is the optimum range of temprature for photosynthesis ?
- Q.6\_ Does photosynthesis occurs in leaves which are coloured other than green ?



## 1.3 NUTRITION IN ANIMALS

- ◆ In unicellular organisms a single cell is responsible for carrying out all the vital activities.
- ◆ In multicellular organisms a well developed digestive system is present.
- ◆ Digestion in animals consist of following steps :
- **Ingestion** : The process of intake of food.
- **Digestion** : It is the breakdown of large and complex molecules into simpler, smaller and soluble forms.
- **Absorption** : Taking up of the digested food through intestinal wall to blood.
- **Assimilation** : In this process absorbed food is taken by body cells.
- **Egestion** : The process by which undigested matter is expelled out.

### (a) Nutrition in Amoeba :

- ◆ It is a unicellular organism living in water.
- ◆ Mode of nutrition is holozoic.
- ◆ The process of obtaining food is by phagocytosis. (cell eating)
- ◆ Steps involved in digestion of amoeba are :
- (i) **Ingestion** : Since it is unicellular so a single cell is responsible for carrying out all the vital activities. Food is ingested with the help of pseudopodia. Amoeba engulfs the food particle lying near it by forming pseudopodia around it and forming a food vacuole which is considered as its temporary stomach.
- (ii) **Digestion**: The enzymes from surrounding cytoplasm enter the food vacuole and break down the food into smaller & soluble form.
- (iii) **Absorption**: The digested food is now absorbed by cytoplasm by simple diffusion and then food vacuole disappears.
- (iv) **Assimilation**: The food absorbed in amoeba is used to obtain energy from respiration for its growth and development.
- (v) **Egestion** : Undigested food is thrown out from the body.

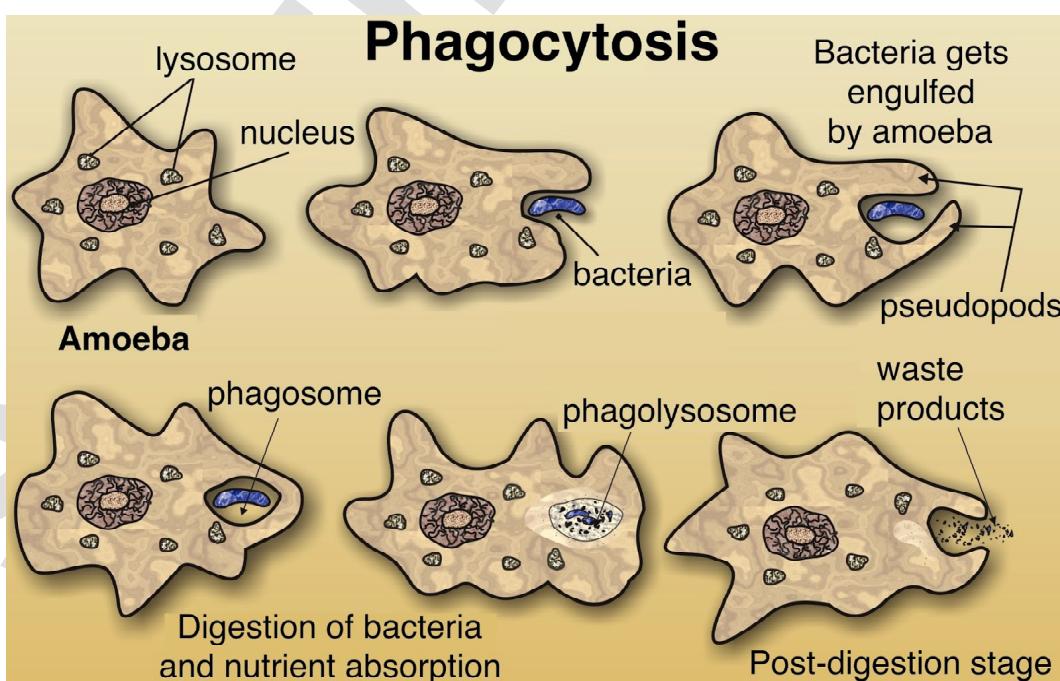


Fig.1.10 Nutrition in Amoeba

## (b) Nutrition in Humans

- Humans have highly evolved and complicated digestive system consisting of an alimentary canal & different types of digestive glands.

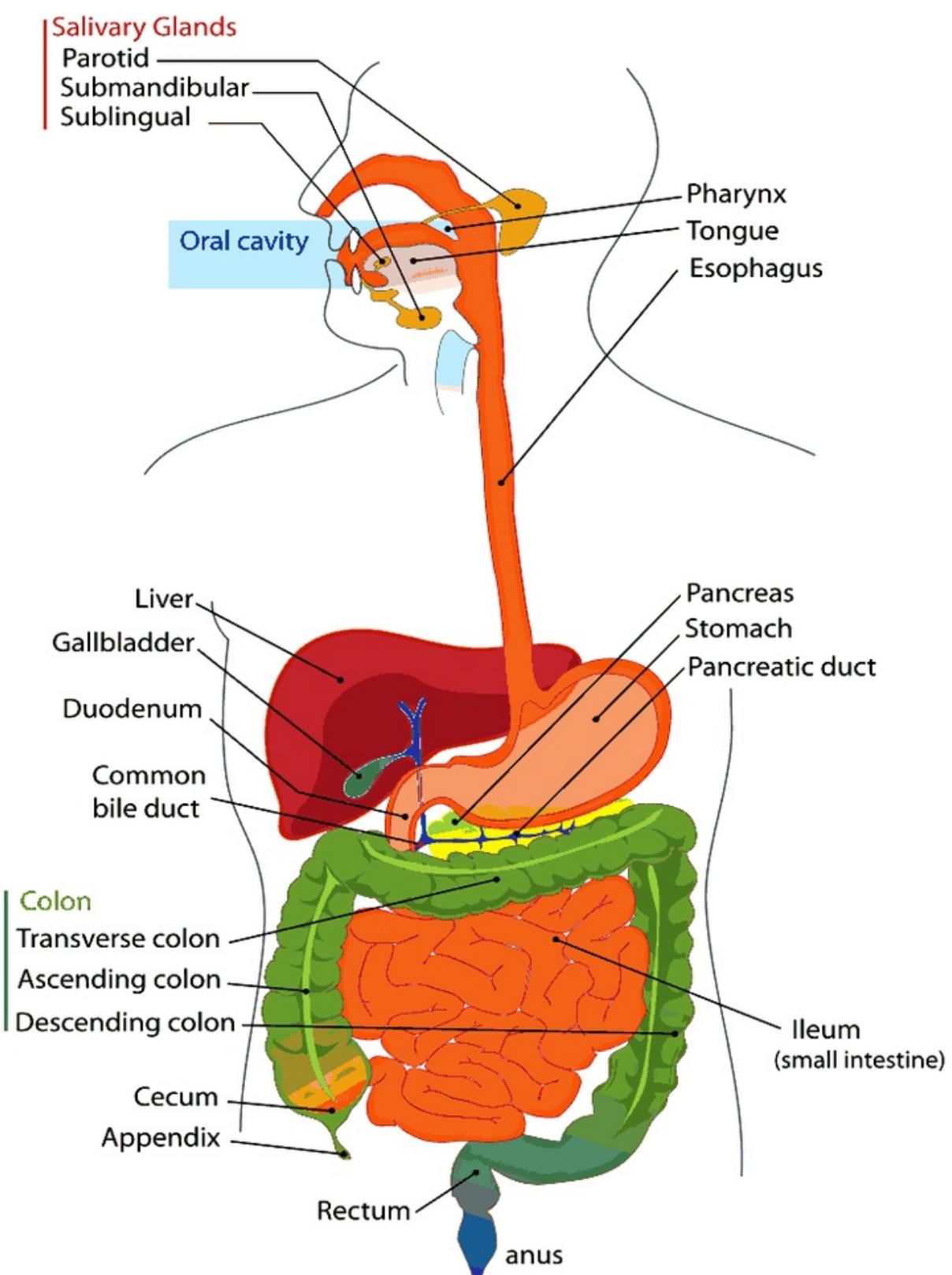
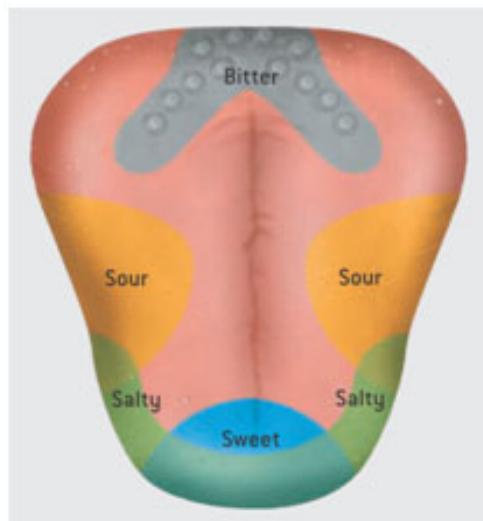


Fig.1.11 Human Digestive system

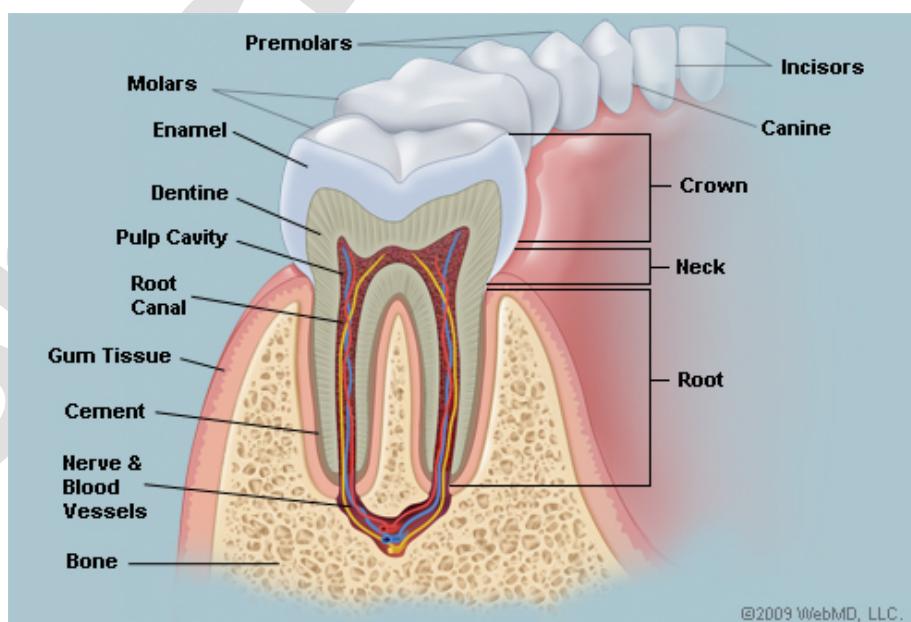
- (i) **Alimentary Canal** : Long, hollow, tubular structure consisting of various organs for digestion. Alimentary canal consists of following organs :
- (A) **Mouth** : It is a small slit through which food is ingested.
- (B) **Buccal Cavity** : Mouth opens into a chamber called as buccal cavity. Roof of buccal cavity is called **hard palate**. At the floor of this cavity thick muscular structure is present called **tongue**. It helps in chewing, swallowing, and speaking. Human tongue having taste buds for taste of food.



**Fig.1.12 Location of Taste Buds on tongue**

(C) **Teeth** :

- ◆ These are hard bony structure which helps in chewing. Human have four different types of teeth which are fixed in jaw.
- ◆ Jaws present in buccal cavity are provided with four different types of teeth :
  - ◆ Incisors : For cutting
  - ◆ Canines : For tearing
  - ◆ Premolars : For grinding
  - ◆ Molars : For grinding



**Fig.1.13 Teeth**

- ◆ Dental formula of humans :
- ◆ Milk teeth → These are temporary , arise at 6 – 11 month age, 20 in number.

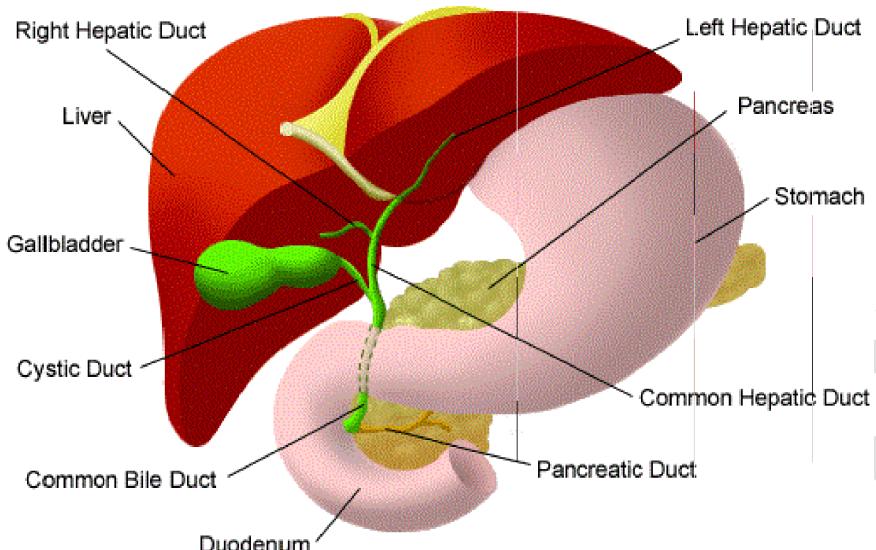
$$\frac{\text{Half upper jaw}}{\text{Half lower jaw}} = \frac{2102}{2102}$$

- ◆ Permanent teeth → arise at 6 – 12 years, 32 in number.

$$\frac{\text{Half upper jaw}}{\text{Half lower jaw}} = \frac{2123}{2123}$$

- ◆ Three pairs of salivary glands are found in mouth which release their secretions into the buccal cavity. They secrete salivary amylase for starch digestion. So digestion of starch starts from mouth.

- (D) Pharynx :** It is the part where mouth and nose meets in buccal cavity.
- (E) Oesophagus :** It is also called as **food pipe**. It leads the food from mouth to stomach. Oesophagus has highly muscular walls, no digestion occurs here.
- (F) Stomach :** It is a '**J**' shaped bag present on left side of abdomen. It contains several glands present on the inner surface of its wall, which secrete gastric juice.
- (G) Intestine :**
- Small Intestine :** It is a coiled and narrow tube which is 6.5 m long having 3 regions : duodenum, jejunum, ileum.
- ◆ On the inner wall of small intestine numerous finger like projections are found which are called as villi, they increase the surface area of absorption.
- Large Intestine :** Small intestine opens into large intestine which is wider and shorter and is above 1.5 m in length. From here the undigested food material is passed to anus through rectum. It is divided into three parts :
- ◆ Caecum
  - ◆ Colon
  - ◆ Rectum
- (H) Anus :** Last part of digestive system which is helpful in egestion.
- (ii) Digestive Glands :** These glands secrete enzymes and hormones which help in the process of digestion. These digestive glands include:
- (A) Salivary Glands :** 3 pairs of salivary glands are found in mouth cavity which secrete saliva. Saliva contains an enzyme Salivary Amylase or ptyalin which helps indigestion of starch in mouth.
- (B) Gastric Glands :** These are present in stomach and secrete hydrochloric acid (HCl), protein digesting enzymes and mucus.
- (C) Liver :** It is the largest gland of body. It secretes bile juice into small intestine which helps in emulsification of fats.
- (D) Pancreas :** It lies just below the stomach. It secretes pancreatic juice into small intestine. Pancreatic juice contains **trypsin and pancreatic amylase** which is released into the duodenum by a common duct along with bile. Besides these 2 enzymes pancreas secretes 2 hormones also i.e :- Insulin and glucagon so it has both exocrine as well as endocrine functions.

**Fig.1.14 Liver and pancreas****A sk yourself**

- Q.1\_ What is the mode of nutrition in Amoeba and how food is ingested ?
- Q.2 Why we feel any taste on whole tongue, when taste buds are at limited area for particular taste.
- Q.3 Why human cannot digest cellulose.
- Q.4\_ Write the name and function of different types of teeth.
- Q.5\_ What is the common passage for food and air ?
- Q.6\_ What is the role of villi present in the small intestine ?
- Q.7\_ Why is small intestine longer than large intestine ?

## 1.4 NUTRITION PROCESS

This system involves following processes :

**(a) Ingestion :**

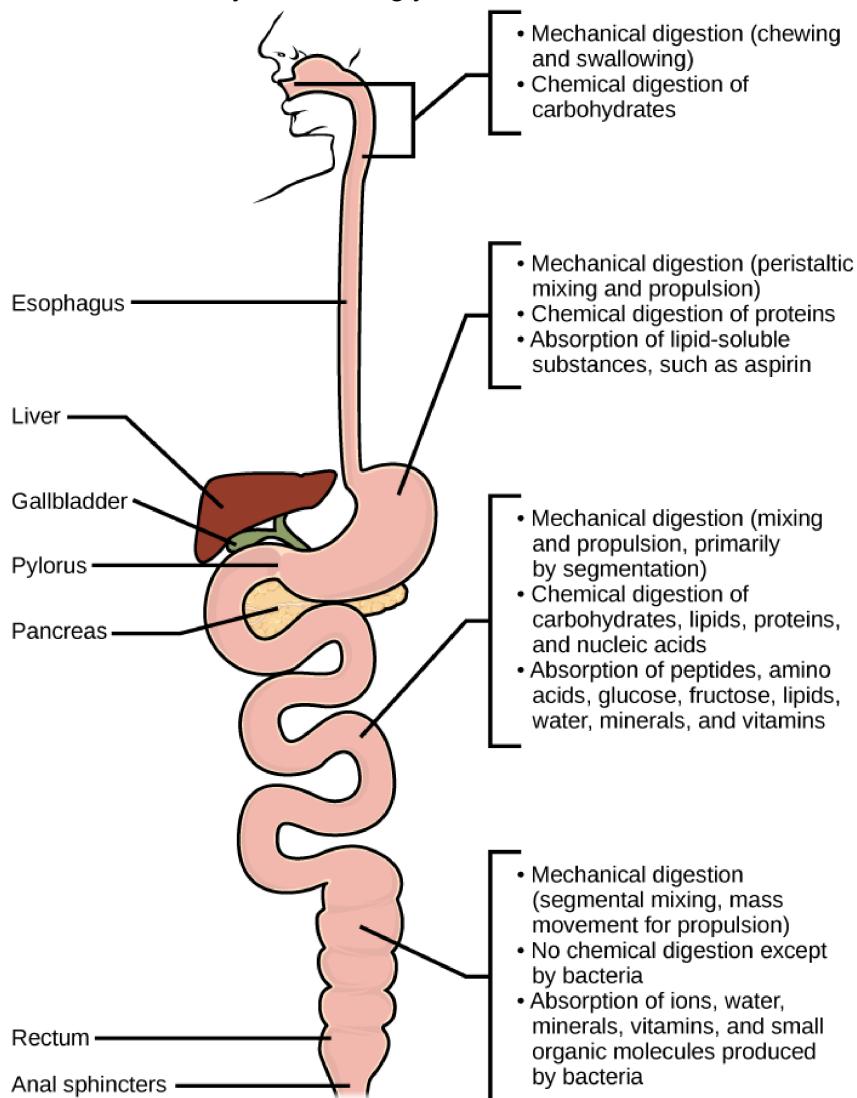
Intake of food is done through mouth, food is then chewed and masticated and sent to oesophagus through pharynx by swallowing.

**(b) Digestion :**

Saliva secreted in buccal cavity starts digestion of starch into maltose. This partially digested food is then passed to stomach by oesophagus through peristaltic movement. Food is churned in stomach for about three hours and broken down into smaller pieces. Due to presence of hydrochloric acid, medium of stomach becomes acidic. In acidic medium protein digesting enzyme pepsin breaks down proteins into peptones. Gastric lipase is also secreted here which partially breaks down lipids.

- ◆ Duodenum receives the secretion from liver and pancreas through a common duct they are bile and pancreatic juice, and alkaline in nature. So the digestion and emulsification of fats occurs at this place.
- ◆ Here in the duodenum fats are emulsified by bile, remaining proteins are digested by trypsin and starch by pancreatic amylase.

- ◆ This partially digested food now enters in the ileum where intestinal juice i.e. "Succus entericus" is secreted. At this place digestion is completed.
- Carbohydrates → Glucose
- Proteins → Amino acids
- Fats → Fatty acids and glycerol



**Fig.1.15 Process of Digestion**

### (c) Absorption of Digested Food :

- ◆ **Absorption of Food in Small Intestine :** The digested food is absorbed mainly in small intestine. For efficient absorption of nutrients, the intestine has the following features:
  - ◆ Intestine is very long.
  - ◆ The lining of intestine is thin to allow rapid entry of substances.
  - ◆ The inner wall of intestine contains numerous finger-like projections called villi (Sing. villus).
  - ◆ The villi increase surface area of intestine to about five times for the absorption of digested food.
  - ◆ Each villus is supplied with an arteriole, a venule and blood capillaries, a lymph vessel or lacteal and lymph capillaries.

- ◆ **Absorption in Large Intestine :** Large intestine is about 1.5 metres long. It absorbs water and some salts from undigested food.

**(d) Assimilation or The fate of Absorbed Nutrients :**

The absorbed nutrients are passed into the blood vessels and transported to different parts of the body. Inside the body cells, these nutrients are utilised for different activities. This is called assimilation. The future of absorbed nutrients is as follows:

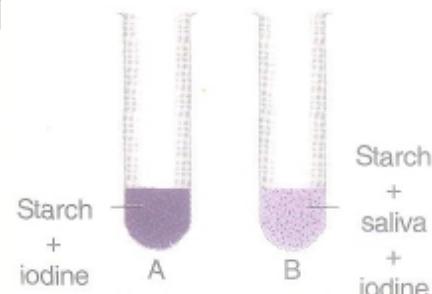
- ◆ Glucose is used as a source of energy by the body. It is burned (oxidised) to release energy inside the cells. Excess of glucose is stored in the cells of liver as glycogen.
- ◆ The amino acids are used to build new living material of the cells.
- ◆ Fats are stored in the fatty tissues in various parts of the body.

**(e) Egestion of Undigested Food :**

The undigested food is then collected in large intestine where water is absorbed and remaining waste is expelled out or egested through anus. The semisolid undigested food is pushed out of the anus. This is called egestion or defecation. The undigested food residue that enters the rectum from large intestine is called the faeces. This faeces defecate out by anus.

**ACTIVITY-3**

- **Aim** To show that saliva breaks down starch into sugar
- **Materials Required** Two test tubes, marker pen, boiled rice, water, spoon and iodine solution.
- **Procedure** Take two test tubes. With a marker, mark them as A and B. Put one teaspoonful of boiled rice in test tube A. Chew one teaspoonful of boiled rice for 2 minutes and put them into test tube B. Add about 3 mL of water and 3 drops of iodine solution in each test tube.
- **Observation** The iodine becomes blue-black in test tube A but remains unchanged in test tube B.
- **Explanation** Test tube A contains starch and starch makes iodine blue-black. In test tube B, starch of rice is broken down into sugars (maltose) by saliva in buccal cavity. Due to the absence of starch, the iodine solution in test tube B remains unchanged.



**Ask yourself**

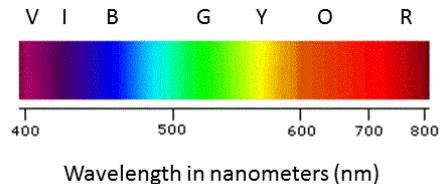
- Q.1\_ Where is ptyalin secreted and what is its role in digestion?
- Q.2\_ What is the function of Gall bladder ?
- Q.3\_ Why length of small intestine is more than that of large intestine?
- Q.4\_ Why humans cannot digest cellulose?
- Q.5\_ Name the hormones secreted by pancreas?
- Q.6\_ How are various nutrients assimilated after absorption?



**Add to Your Knowledge**

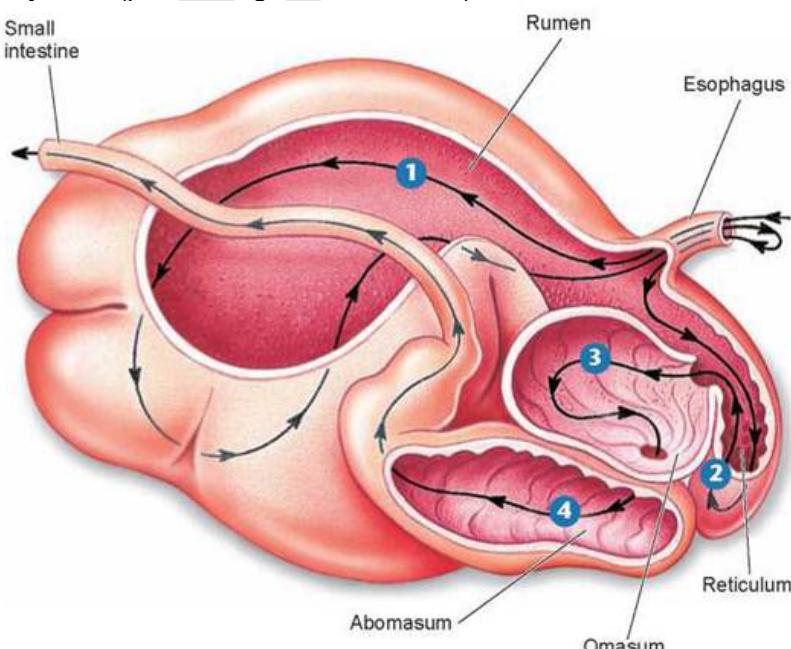
- ◆ **Nutrients for Plants :** Plants need some elements for their growth and development, which are called plant nutrient. All these plant nutrients are derived from air, water, and soil. Out of 30 to 40 elements that are found in plants, only 16 elements are essential for growth and development. Some of them are carbon, oxygen, hydrogen, phosphorus and potassium. The plant nutrients are classified into two categories based on the quantity in which they are required by plants. They are macronutrients and micronutrients.

- ◆ **Macronutrients** are used by the plants in relatively large quantities, for example, nitrogen, phosphorus and potassium.
- ◆ **Micronutrients** are those, utilized by plants in small quantities, for example iron, copper and so on.
- ◆ Photosynthesis can occur in visible light.



**Fig.1.16 Visible spectrum**

- ◆ Maximum photosynthesis occurs in Red and Blue region.
- ◆ There is minimum photosynthesis in **Green** region.
- ◆ Euglena, a unicellular animal has dual mode of nutrition. It is green and autotrophic in presence of light. But in absence of light it becomes heterotrophic.
- ◆ **Emulsification** : The process in which bile juice mix with fat to convert into small droplets, so that its easier to digest by the action of lipase.
- ◆ **Ruminant stomach** : Ruminants are mammals that are able to acquire nutrients from plant-based food by fermenting it in a specialized stomach prior to digestion, principally through microbial actions. The process typically requires the fermented ingesta (known as cud) to be regurgitated and chewed again. The process of rechewing the cud to further break down plant matter and stimulate digestion is called rumination. The word "ruminant" comes from the Latin ruminare, which means "to chew over again" The primary difference between a ruminant and non-ruminant is that ruminants have a four-compartment stomach. The four parts are the rumen, reticulum, omasum, and abomasum. In the first two chambers, the rumen and the reticulum, the food is mixed with saliva and separates into layers of solid and liquid material. Solids clump together to form the cud or bolus. The cud is then regurgitated and chewed to completely mix it with saliva and to break down the particle size. Fibre, especially cellulose and hemicellulose, is primarily broken down in these chambers by microbes (mostly bacteria, as well as some protozoa, fungi and yeast) into in small and non-structural carbohydrate (pectin, sugars, and starch) are also fermented.



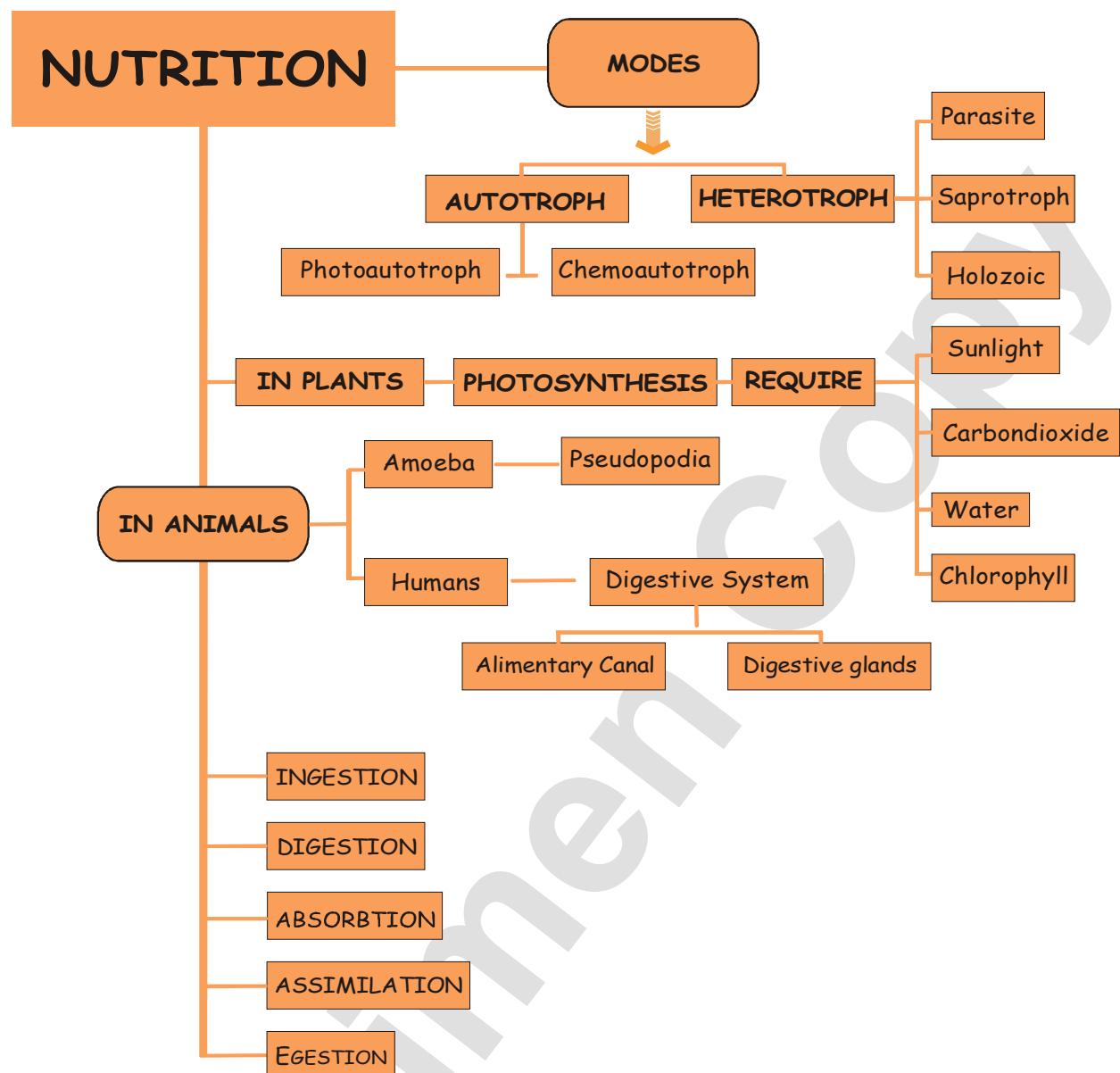
**Fig.1.17 Stomach of ruminant (cow)**

- ◆ **Chloroplast** : The organelle, or “mini organ,” in plant cells and a few other eukaryotic cells that carries out photosynthesis, or the conversion of  $\text{CO}_2$  &  $\text{H}_2\text{O}$  into food. Chloroplast contain chlorophyll, the magical green pigment that absorbs light and is found in all plants, algae, and cyanobacteria. Photosynthesis cannot happen without chlorophyll. ATP : Adenosine triphosphate. ATP is a major energy molecule in cells.
- ◆ **Carbohydrates** : The term carbohydrate refers to any one of a huge group of compounds that contain the elements carbon (C), oxygen (O) and hydrogen (H) and have the general formula  $\text{C}_n(\text{H}_2\text{O})_y$ . Examples of carbohydrates include sugars and starch. It is the main energy source of living organisms.
- ◆ **Proteins** : Protein are a category of compounds formed from the elements carbon (C), hydrogen (H), Oxygen (O) and Nitrogen, and in some cases also Sulphur (S) and Phosphorus (P).
- ◆ **Peptides** : Peptides are large protein fragments that result from the action of enzymes on proteins in the initial stages of breaking-up proteins.
- ◆ **Enzyme** : Enzymes are proteinaceous that increase the rate of biological reactions without being used-up in the reactions themselves. That is enzymes can act as catalysts. Enzymes form within living cells and may act either within the cell or outside it.
- ◆ **Peristalsis** : Peristalsis is a wave-like movement (motion) that progresses along some of the hollow tubes of the body that have circular and longitudinal muscles, such as the intestine. Peristalsis happens involuntarily.

## Summary

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- All organisms take food and utilise it to get energy for growth and maintenance of body functions.
- There are various modes of nutrition which vary with different organisms.
- Autotrophs : An organism that can use light energy and the photosynthetic process to produce organic food (containing carbon and hydrogen) from inorganic molecules.
- Heterotrophs : An organism that consume organic matter created by auto trophs. Autotrophs produce organic compounds from inorganic molecules using either photosynthesis or chemosynthesis (chemical reactions using inorganic molecules).
- Heterotrophs cannot fix carbon and only use organic carbon to grow.
- Fungi are saprotrophs which depend on dead, decaying matter. Plants like Cuscata are parasites which take food from host plant.
- Green plants are autotrophs and prepare their own food with the help of photosynthesis.
- Chlorophyll and sunlight are essential requirements for photosynthesis.
- The products of photosynthesis are complex carbohydrates and  $\text{O}_2$ .
- Nutrition is a complex process involving:
  - (i) ingestion
  - (ii) digestion
  - (iii) absorption
  - (iv) assimilation
  - (v) egestion.
- Animal nutrition includes nutrient requirement, mode of intake of food and its utilisation in the body.
- The human digestive tract consists of alimentary canal and digestive glands.
- Digestion of carbohydrates, begins in the buccal cavity. The digestion of proteins starts in the stomach while digestion of fats takes place in small intestine.
- The absorbed substances are transported to different parts of the body. Water and some salts are absorbed from the undigested food in the large intestine.
- the undigested and unabsorbed residues are expelled out of the body as faeces through the anus.

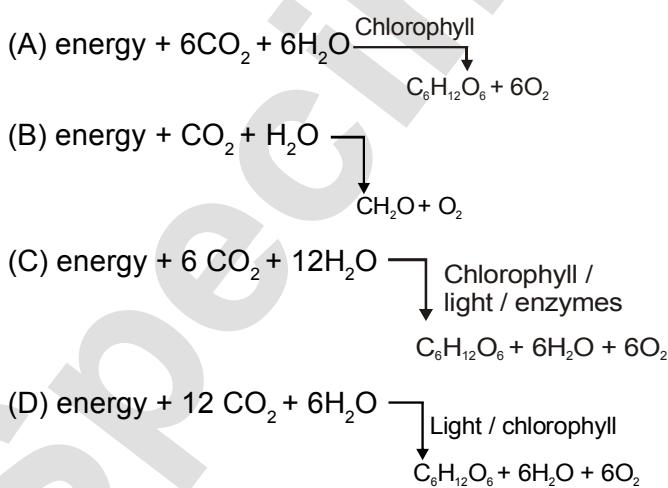
**CONCEPT MAP****EXERCISE > 01****SECTION -A (FIXED RESPONSE TYPE)****MULTIPLE CHOICE QUESTIONS :****1.1 MODES OF NUTRITION**

1. Which organisms feed on blood ? (E)  
 (A) Omnivores      (B) frugivorous      (C) Sanguivorous      (D) Insectivores
2. Heterotrophs are organisms which depend on :- (E)  
 (A) Living host      (B) Dead matter      (C) Sunlight      (D) Both (A) and (B)
3. Insectivorous plant is - (M)  
 (A) Mustard      (B) Cuscuta      (C) Nepenthes      (D) Neem
4. Identify the odd one out : (M)  
 (A) Neem      (B) Amaranthus      (C) Rose      (D) Cuscuta

5. Organisms who work together for mutual benefit for food and habitat : (E)  
 (A) Symbiotic      (B) Parasitic      (C) saprophyte      (D) Autotrophic
6. Animals which feeds upon dead organic matter are known as : (E)  
 (A) Omnivores      (B) Carnivores      (C) Detritivores      (D) Herbivores
7. Plants are – (E)  
 (A) autotrophic      (B) heterotrophic      (C) saprophytic      (D) holozoic
8. Cuscuta is (M)  
 (A) Endoparasite of sheep      (B) Endoparasite of human beings  
 (C) A parasitic plant      (D) A parasite on fishes

## 1.2 NUTRITION IN PLANTS

9. The phenomenon which converts light energy to chemical energy is – (E)  
 (A) respiration      (B) photosynthesis      (C) transpiration      (D) none of these
10. Element which is a component of chlorophyll ? (M)  
 (A) Fe      (B) Zn      (C) Cl      (D) Mg
11. Chlorophyll absorbs – (M)  
 (A) red light only      (B) blue light only  
 (C) red and blue light      (D) green light only
12. Most of the photosynthesis (80%) which takes place on this earth is carried on by (M)  
 (A) green plants on land  
 (B) algae present in fresh water  
 (C) algae found in ocean  
 (D) algae present in ocean and fresh water sources
13. The role of chlorophyll in photosynthesis is to – (M)  
 (A) absorb water and minerals      (B) absorption of  $\text{CO}_2$   
 (C) absorption of light and photolysis of water      (D) absorption of light
14. Which one of the following is the best equation representing photosynthesis ? (E)



15. Chlorophyll is present in – (M)  
 (A) grana      (B) stroma      (C) leucoplast      (D) chromoplast
16. In which light, plants show maximum rate of photosynthesis ? (E)  
 (A) Green      (B) Red      (C) Orange      (D) Violet

17. The raw materials for photosynthesis are – (E)  
 (A) CO<sub>2</sub> & O<sub>2</sub> (B) sunlight and CO<sub>2</sub>  
 (C) water and chlorophyll (D) CO<sub>2</sub> and water
18. What is not necessary for the process of photosynthesis : (E)  
 (A) carbon dioxide (B) Nitrogen (C) Water (D) Sunlight
19. Plants are green in colour because – (M)  
 (A) they absorb green light only (B) they reflect green light  
 (C) they absorb green light but reflect all other lights (D) none of the above are correct
20. Chlorophyll is present in – (E)  
 (A) Chloroplast (B) Ribosome (C) Leucoplast (D) Chromoplast

### 1.3 NUTRITION IN ANIMALS

21. In amoeba the digestion of food is – (M)  
 (A) extracellular (B) intracellular (C) intercellular (D) none of the above
22. In amoeba absorption of the digested nutrients occurs in – (E)  
 (A) cytoplasm (B) plasma membrane (C) contractile vacuole (D) pseudopodia
23. Teeth involved in cutting of food material are called – (E)  
 (A) canines (B) incisors (C) molars (D) premolars
24. Dental formula of adult human is (M)  
 (A)  $\frac{2122}{2122}$  (B)  $\frac{2114}{2114}$  (C)  $\frac{2123}{2124}$  (D)  $\frac{2123}{2123}$
25. Total number of canines in permanent dental set of human is – (M)  
 (A) 4 (B) 6 (C) 2 (D) 12
26. In human being number of stomach is - (E)  
 (A) 1 (B) 2 (C) 3 (D) 4
27. Digestion of starch starts from – (M)  
 (A) stomach (B) intestine (C) oesophagus (D) mouth
28. Number of permanent teeth in humans is : (M)  
 (A) 28 (B) 30 (C) 32 (D) 34
29. Which of the followig is a part of small intestine ? (M)  
 (A) Caecum (B) Colon (C) Rectum (D) Duodenum
30. Oesophagus opens into (E)  
 (A) Caecum (B) Stomach (C) Duodenum (D) Ileum

### 1.4 PROCESS OF NUTRITION

31. In human being gastric juice is secreted by – (E)  
 (A) Liver (B) Stomach (C) Pancreas (D) Small intestine
32. Enzyme which breaks up starch into sugar is – (E)  
 (A) hydrolase (B) amylase (C) lipase (D) nuclease
33. The folds present in small intestine which increase the area of absorption are called as - (E)  
 (A) Cristae (B) Villi (C) Cilia (D) Flagella
34. Main function of bile juice is to - (M)  
 (A) Digest protein (B) Digest vitamins  
 (C) help in fat digestion (D) digest carbohydrates

35. The main organ for digestion and absorption of food is – (M)  
 (A) large intestine      (B) small intestine      (C) stomach      (D) liver
36. Digestion is completed in (M)  
 (A) Duodenum      (B) Ileum      (C) Stomach      (D) Large Intestine
37. Where is bile stored in the human body ? (M)  
 (A) Liver      (B) Gall bladder      (C) Spleen      (D) Blood
38. Maximum digestion occurs in (E)  
 (A) Small intestine      (B) Oesophagus      (C) large intestine      (D) Stomach
39. Which is not a protein digestion enzyme ? (E)  
 (A) Trypsin      (B) Amylase      (C) Pepsin      (D) Rennin
40. The process of covering large fat droplets into small ones is called (E)  
 (A) Egestion      (B) Assimilation      (C) Emulsification      (D) None of these

**FILL IN THE BLANKS**

- (i) Lowest rate of photosynthesis takes place in \_\_\_\_\_ light.
- (ii) Organisms those feed on fruits \_\_\_\_\_
- (iii) \_\_\_\_\_ is the ultimate source of energy
- (iv) Gas released during photosynthesis is \_\_\_\_\_
- (v) Intestinal juice is called as \_\_\_\_\_
- (vi) After complete digestion proteins break down into \_\_\_\_\_
- (vii) Largest gland of body is \_\_\_\_\_
- (viii) Saliva is secreted in mouth by \_\_\_\_\_
- (ix) Food is pushed down into the stomach by \_\_\_\_\_

**TRUE / FALSE**

- (i) Plants obtain nitrogen from soil.
- (ii) Human being is an omnivorous organism.
- (iii) Plant intake carbon dioxide during respiration.
- (iv) Solar energy is captured by leaves.
- (v) Mushroom is a saprophytic organisms.
- (vi) Absorption and assimilation are similar processes.
- (vii) Tongue gives the sense of smell.
- (viii) Pointed teeth in buccal cavity are called canines.
- (ix) Formula of half upper jaw of permanent teeth is 2123.
- (x) Tongue help in mixing of food with saliva.
- (xi) Rhythmic contraction and relaxation of food pipe is called peristalsis.

**MATCH THE COLUMN**

| I. | <b>Column A</b>    | <b>Column B</b>           |
|----|--------------------|---------------------------|
|    | (i) Lichens        | (a) Herbivores            |
|    | (ii) Pitcher plant | (b) Parasitic             |
|    | (iii) Amarbel      | (c) Insectivores          |
|    | (iv) Deer          | (d) Exchange of gasses    |
|    | (v) Stomata        | (e) Symbiotic association |

|              |                          |                             |
|--------------|--------------------------|-----------------------------|
| <b>II.</b>   | <b>Column A</b>          | <b>Column B</b>             |
|              | (i) Herbivores           | (a) Amarbel                 |
|              | (ii) Carnivores          | (b) Yeast                   |
|              | (iii) Omnivores          | (c) Cow                     |
|              | (iv) Saprophytes         | (d) Lion                    |
|              | (v) Parasite             | (e) Cat                     |
| <b>III .</b> | <b>Column A</b>          | <b>Column B</b>             |
|              | (i) Mastication          | (a) Large intestine         |
|              | (ii) Absorption of water | (b) Liver                   |
|              | (iii) Villi              | (c) Mouth                   |
|              | (iv) Hydrochloric acid   | (d) Stomach                 |
|              | (v) Bile                 | (e) Small intestine         |
| <b>IV .</b>  | <b>Column A</b>          | <b>Column B</b>             |
|              | (i) Carbohydrate         | (a) Do not contain nutrient |
|              | (ii) Proteins            | (b) Glucose                 |
|              | (iii) Fats               | (c) Amino acid              |
|              | (iv) vitamins            | (d) Fatty acid              |
|              | (v) Roughage             | (e) Provide immunity        |

### SECTION -B (FREE RESPONSE TYPE)

#### **VERY SHORT ANSWER TYPE**

1. Write the name of photosynthetic organ in plants.
2. CO<sub>2</sub> in photosynthesis provided by.
3. Why plant appear green in colour.

#### **SHORT ANSWER TYPE**

4. Explain holozoic mode of nutrition.
5. What is the mode of nutrition in fungi ?
6. What are raw material for photosynthesis.
7. Define term autotrophics and heterotrophic.

#### **LONG ANSWER TYPE**

8. Explain the importance of photosynthesis.
9. Why plants appear green in colour ?
10. What are the raw materials required for photosynthesis ?
11. Define the terms – autotrophic & heterotrophic.
12. Explain various modes of nutrition.

## EXERCISE > 02

### SECTION -A (COMPETITIVE EXAMINATION QUESTION)

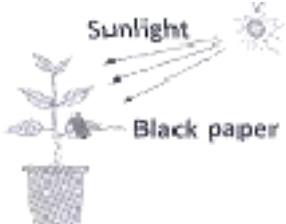
#### **MULTIPLE CHOICE QUESTIONS**

1. Which of the following is insectivorous ? (M)  
 (A) Mushroom      (B) Cuscuta      (C) Mucor      (D) Nepenthes
2. Which of the following statements is true about croton plants ? (T)  
 (A) Croton plants do not contain chlorophyll.  
 (B) Croton plants are dark red in colour Hence they depend on other plants for food.  
 (C) Croton plants have chlorophyll but it is hidden by dark red colour pigments.  
 (D) Croton plants are parasites

3. Which of the following statement is/are true about photosynthesis ? (M)  
 P. Carbon dioxide is essential for photosynthesis to take place.  
 Q. The products of photosynthesis are simple sugars.  
 R. Photosynthesis occurs in the green leaves of plants.  
 S. Sunlight is not used as an energy source by plants to make food during photosynthesis.

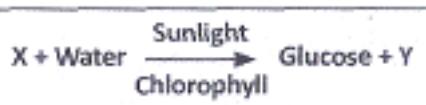
(A) P and S only    (B) Q, R and S only    (C) P, Q and R only    (D) P, Q, R and S

4. What is the aim of the given experiment ? (M)



- (A) To show that air is a basic need of plants.  
 (B) To show that food is a basic need of plants.  
 (C) To show that water is a basic need of plants.  
 (D) To show that sunlight is a basic need of plants.

5. The equation given below represents photosynthesis. (M)



Which of the following is represented by X and Y in the given equation ?

- (A) X - Carbon dioxide, Y- Oxygen    (B) X - Oxygen, Y- Carbon  
 (C) X - Carbon dioxide, Y- Hydrogen    (D) X - Oxygen, Y - Carbon dioxide

6. How does photosynthesis help to maintain the percentage of oxygen and carbon dioxide in the atmosphere? (M)

- (A) By giving off carbon dioxide and absorbing oxygen.  
 (B) By giving off oxygen and absorbing carbon dioxide.  
 (C) By releasing oxygen and carbon dioxide.  
 (D) By absorbing oxygen and carbon dioxide.

7. Which part of the leaf controls the rate of loss of water in the air ? (T)

- (A) Midrib    (B) Stomata    (C) Vascular bundles    (D) Veins

8. What role does the insect play in the insectivorous plant ? (T)

- (A) Fertilization process.    (B) Provides nutrients to the plant.  
 (C) Dispersal of seeds.    (D) Provides carbon dioxide to the plant.

9. What is the role of the bacteria in leguminous plants ? (T)

- (A) Convert oxides of nitrogen into soil nitrates.  
 (B) Convert atmospheric nitrogen gas into soil nitrates.  
 (C) Convert soil nitrates into gaseous nitrogen.  
 (D) Convert plant proteins into ammonia.

10. Which of the following is true about parasitic plants ? (T)

- (i) They absorb food from their host.  
 (ii) They compete with the host for sunlight.  
 (iii) They kill the host plant eventually.

- (A) (i) and (ii) only    (B) (i) and (iii) only    (C) (ii) and (iii) only    (D) (i), (ii) and (iii)

11. Chlorophyll and melanin are both : (T)  
 (A) Proteins      (B) Carbohydrates      (C) Nucleic acids      (D) Pigments
12. Out of total solar energy reaching earth, the amount utilized by the green plants is (T)  
 (A) 0.5%      (B) 1.0%      (C) 2.5 %      (D) 5.0%
13. On Saturday, Sumit after having his lunch, forgot his lunch box in the school. When he opened it on Monday, he found that it had some blackish-brown, cottony stuff in it. Which of the following organisms can it most likely be ? (T)  
 (A) Mushroom      (B) Amoeba      (C) Rhizopus      (D) Either (A) or (C)
14. Match column - I with column - II and select the correct option from the codes given below. (T)
- | <b>Column - I</b>            | <b>Column - II</b> |
|------------------------------|--------------------|
| (a) Chlorophyll              | (i) Rhizobium      |
| (b) Symbiosis                | (ii) Starch        |
| (c) Insectivorous plant      | (iii) Lichen       |
| (d) Nitrogen fixing organism | (iv) Mistletoe     |
| (e) Partial parasite         | (v) Pitcher plant  |
- (A) (a) - (i), (b) - (iv), (c) - (iii), (d) - (ii), (e) - (v)  
 (B) (a) - (iii), (b) - (v), (c) - (ii), (d) - (i), (e) - (iv)  
 (C) (a) - (ii), (b) - (iii), (c) - (v), (d) - (i), (e) - (iv)  
 (D) (a) - (v), (b) - (iv), (c) - (i), (d) - (ii), (e) - (iii)
15. Match column - I with column - II and select the correct option from the codes given below. (T)
- | <b>Column - I</b>   | <b>Column - II</b> |
|---|--------------------|
| (a) Energy value of food is measured in calories.                         | (i) True           |
| (b) Starch and sugar are proteins.  | (ii) False         |
| (c) Cellulose can be digested in our digestive system.                    |                    |
| (d) In absence of peristalsis, food from oesophagus cannot enter stomach. |                    |
- (A) (a) - (i), (b) - (ii), (c) - (ii), (d) - (i)      (B) (a) - (ii), (b) - (i), (c) - (ii), (d) - (i)  
 (C) (a) - (i), (b) - (i), (c) - (ii), (d) - (ii)      (D) (a) - (ii), (b) - (i), (c) - (i), (d) - (ii)
16. What is common among pancreatic amylase, rennin and pepsin – (T)  
 (A) All these are protein      (B) All these are protein digesting enzymes  
 (C) All these are not produced in stomach      (D) All these act at lower pH
17. Which one of the following enzyme acts efficiently at pH 2.0 (T)  
 (A) Pepsin      (B) Trypsin      (C) rennin      (D) Both (A) & (C)
- SECTION -B (TECHIE STUFF)**
18. Which of the following statement is correct about Euglena. (M)  
 (A) It is exclusively autotrophic.  
 (B) It is exclusively heterotrophic.  
 (C) It does not possess chlorophyll.  
 (D) It is autotrophic in presence of light and heterotrophic in absence of light.
19. Humans are unable to digest the cellulose of the food because : (T)  
 (A) Their stomach is not divided into compartments.  
 (B) The lumen of the small intestine is narrow.  
 (C) They are unable to chew cellulose.  
 (D) Certain bacteria that are present in ruminants are not present in humans.
20. Which of the following has ability to fix carbon into organic products. (M)  
 (A) Autotrophs      (B) Heterotrophs      (C) Parasites      (D) All of these

# EXERCISE > 03

## (PREVIOUS YEAR EXAMINATION QUESTIONS)

1. A group of students of class 7th were performing an experiment . Among them a student poured alcohol on a plant continuously for a long time. The plant could not prepare food on its own any more. Which of the following statements explains the reason behind it ?

(NSO-2010)

- (A) Alcohol absorbed all the food prepared by the plant.
- (B) Alcohol does not let the plant absorb carbon dioxide from the air.
- (C) Alcohol dissolved all the minerals present in the plant.
- (D\*) Alcohol dissolved the chlorophyll present in the plant.

2. From which of the four chambers of ruminant stomach, semi-digested food is moved back to mouth ?

(NSO-2011)

- (A\*) Rumen                    (B) Abomasum                    (C) Omasum

(D) All of these

3. Which one of the following is a correct match ?

| Type of teeth          | Function               |
|------------------------|------------------------|
| (A*) Incisors          | Biting and cutting     |
| (B) Canines            | Crushing and grinding  |
| (C) Molars & premolars | Piercing and tearing   |
| (D) Molars             | Smaller than premolars |

4. The function of scissors is synonymous with the function of

(NSO-2012)

- (A) Incisors                    (B) Premolars                    (C) Canines                    (D\*) Molars

5. Match Column-I with Column-II and select the correct option from the codes given below.

(NSO-2012)

**Column I**

- (a) Salivary gland
- (b) Intestinal gland
- (c) Pancreas
- (d) Liver
- (A) (a)-(iv),(b)-(iii),(c)-(ii),(d)-(i)
- (C\*) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)

**Column - II**

- (i) Breaks down fats
- (ii) Breaks down proteins into peptides
- (iii) Breaks down peptides into amino acids
- (iv) Breaks down starch into sugar
- (B) (a)-(i),(b)-(ii),(c)-(iii),(d)-(iv)
- (D) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

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

(NSO-2012)

Statement 1: Plants serve as the ultimate food source for all the organisms whether herbivores or carnivores.

Statement 2 : Plants use solar energy to prepare their own food.

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

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

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

(D) Both statements 1 and 2 are false.

7. Tanmay took a potted plant and covered one of its leaves entirely with black paper and marked it as X and left the plant in sunlight for 6 hours. After 6 hours, he plucked three leaves X, Y and Z. He immersed leaves X and Z immediately in water but smeared leaf Y with petroleum jelly prior to immersion. Bubbles were seen on the surfaces of leaves X, Y and not on leaf Z. Which of the following is most likely the reason for it ?

(NSO-2012)

(A) Bubbles on leaf Z are of oxygen, produced in photosynthesis.

(B) Bubbles on leaf X are of carbon dioxide, produced in respiration.

(C) Stomata on leaf Y are blocked with petroleum layer, thus oxygen cannot come out from leaf.

(D) All of these



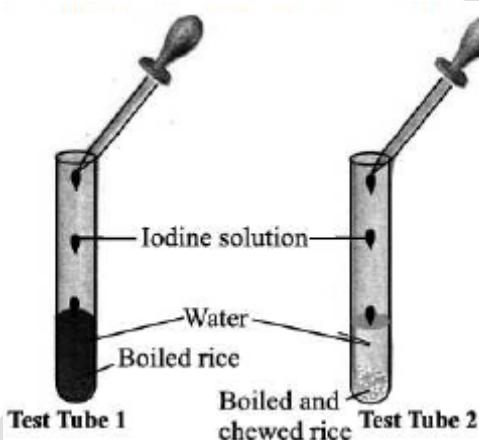
Direction (Q. 8 & 9) : Refer the given passage and answer the following questions. (NSO-2012)

Some organisms like fungi, etc. take in nutrients in solution form from dead and decaying matter. and are called saprotrophs. Fungi also grow on pickles, leather clothes and other articles that are left in hot and humid weather for long time. Certain fungi live in the roots of trees and share shelter and nutrients. This is called symbiotic relationship.

8. Which of the following statements is/are incorrect ? (NSO-2012)
  - (i) Fungi are called saprotrophs because they grow on pickles, leather and clothes.
  - (ii) Saprotophs lack chlorophyll. so cannot make food by photosynthesis.
  - (iii) Like some fungi, lichens also show symbiotic relationship.
  - (iv) The bacterium called Rhicobium shows symbiotic relationship as it provides shelter, water and minerals to legumes and, in return. the legumes provide food which they prepare by photosynthesis.

(A) (i) and (iv)      (B) (i) and (ii)      (C) (ii) and (iii)      (D) (iv) only
9. Which of the following organisms shows symbiotic relationship ? (NSO-2012)
 

(A) All fungi      (B) Lichens      (C) Rhizobium      (D) Both B & C
10. Ridhima took two test tubes labelled as 1 and 2 as shown in the figure. In test tube 1. she put one table spoon of boiled rice and in test tube 2, she put one table spoon of boiled rice after chewing it for 3-5 minutes. Then she added 3-4 mL of water in both the test tubes. . (NSO-2013)



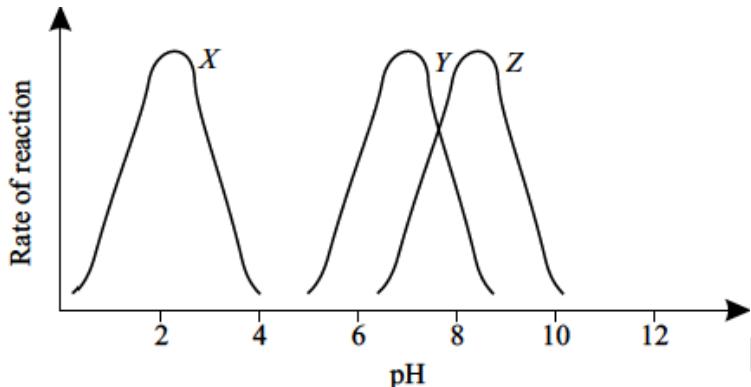
Which of the following would be the expected observation b Ridhima?

- (A) Colour changes to blue-black in test tube 1 as rice is rich in starch.  
 (B) Colour changes to blue-black in test tube 2 as saliva breaks down the starch into sugars.  
 (C) Colour changes to blue-black in both the test tubes.  
 (D) Colour does not change in either of the test tubes
11. Which of the following statements is/are true (T) or false (F) regarding nutrition in organisms ? (NSO-2014)
  - (i) Photosynthesis also occurs in leaves having colour other than green.
  - (ii) The process of photosynthesis first produces a simple carbohydrate called glucose which then gets converted into a complex carbohydrate called starch.
  - (iii) Cuscuta is a yellow-coloured plant but it can synthesize its own food by photosynthesis.
  - (iv) In a symbiotic association. Rhizobium bacteria derive their nutrition from fungus.

(NSO-2014)

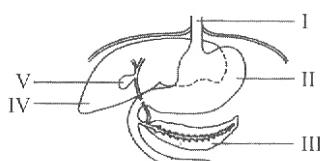
- |     | (i) | (ii) | (iii) | (iv) |
|-----|-----|------|-------|------|
| (A) | F   | T    | T     | T    |
| (B) | T   | T    | T     | F    |
| (C) | F   | F    | F     | T    |
| (D) | T   | T    | F     | F    |

12. Refer to the given graph which shows the effect of pH on the activities of three enzymes. X, Y and Z. (NSO-2014)



The three enzyme samples. X, Y and Z are taken from which parts of the human alimentary canal ?

- |     | X        | Y        | Z        |
|-----|----------|----------|----------|
| (A) | Duodenum | Mouth    | Stomach  |
| (B) | Mouth    | Stomach  | Duodenum |
| (C) | Stomach  | Duodenum | Mouth    |
| (D) | Stomach  | Mouth    | Duodenum |
13. The given graph shows the percentage of undigested carbohydrates, proteins and fats through successive parts of the human alimentary canal. (NSO-2014)  
Why does the percentage of undigested carbohydrates remain constant in part X ?  
 (A) All the starch has been digested and only other carbohydrates remain.  
 (B) Protease at part X prevents the salivary amylase from acting on starch.  
 (C) The acidic conditions of part A -prevent salivary amylase from acting on starch.  
 (D) All the carbohydrates have been digested before reaching part X.
14. Which of the following statements support(s) the fact that the upper surface of a leaf is usually greener than the lower surface ? (NSO-2014)  
 (i) More chlorophyll is present on the upper surface to absorb more light.  
 (ii) There are more stomata present on the upper surface than the lower surface.  
 (iii) More sugar is formed on the lower surface.  
 (iv) The green leaves look greener under the hot Sun.
15. Refer to the given diagram which shows various parts of human digestive system labelled as I, II, III, IV and V. (NSO-2015)



Identify the organs and select the incorrect statement regarding them.

- (A) Organ V is involved in storage of bile not its production.  
 (B) Organ II secretes digestive juice which contains mucus, hydrochloric acid and digestive enzymes.  
 (C) Organ IV is the largest gland of the body.  
 (D) Organ I is involved in the absorption of water from food.

16. Read the given statements and select the correct option. (NSO-2015)

Statement 1 : Chemical digestion of food involves breaking down of food by chewing and churning.

Statement 2 : Mechanical digestion of food involves conversion of complex substances such as carbohydrates into their simpler forms such as glucose by enzymatic action.

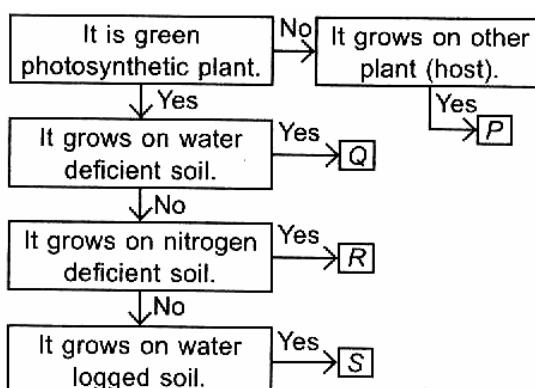
(A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

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

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

(D) Both statements 1 and 2 are false.

17. Refer to the given flow chart and select the correct option regarding P, Q, R and S. (NSO-2016)



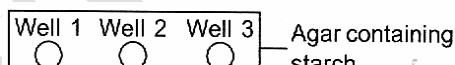
(A) Plant P derives nutrition from the host plant with the help of haustoria and possesses hygroscopic roots which absorb moisture directly from atmosphere.

(B) Plant Q possesses broad thin leaves with superficial stomata.

(C) Plant R possesses special leaf modifications to catch and digest insects.

(D) Plant S possesses stilt roots which help in aeration.

18. Digestive juices were collected from three different regions of the alimentary canal. Drops of these juices were added to wells made in an agar of starch as shown below. (NSO-2016)



After an hour, the wells were rinsed with distilled water and flooded with iodine solution. The results are shown below.

| Well                      | 1          | 2              | 3              |
|---------------------------|------------|----------------|----------------|
| Colour of iodine solution | Blue-black | Yellow - brown | Yellow - brown |

Which of the following correctly identifies the regions of the alimentary canal from which the three digestive juices were obtained ?

|    | Well 1          | Well 2          | Well 3          |
|----|-----------------|-----------------|-----------------|
| A. | Mouth cavity    | Small intestine | Stomach         |
| B. | Mouth cavity    | Stomach         | Small intestine |
| C. | Small intestine | Mouth cavity    | Stomach         |
| D. | Stomach         | Mouth cavity    | Small intestine |

19. Read the given paragraph where few words have been italicised. (NSO-2016)

Buccal cavity of humans contains two pairs of salivary glands which secrete digestive juices that help in digestion of proteins present in food. From here food enters stomach where digestion of mainly fats takes place. As this semi-digested food enters small intestine complete digestion of food occurs. Small intestine receives bile juice from pancreas which digests fats. Most absorption of water occurs in large intestine.

Select the correct option regarding this.

- (A) Two should be replaced by four whereas proteins should not be replaced as it is correctly mentioned.
- (B) Fats should be replaced by carbohydrates and pancreas should be replaced by liver.
- (C) Digests should be replaced by emulsifies.
- (D) Large should be replaced by small.

## ANSWER KEY ➤

### 1. NUTRITION IN ORGANISMS

#### EXERCISE-1

#### MULTIPLE CHOICE QUESTIONS

| Q  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| A  | C  | D  | C  | D  | A  | C  | A  | C  | B  | D  | C  | D  | D  | C  | A  |
| Q. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| A  | B  | D  | B  | B  | A  | B  | A  | B  | D  | A  | A  | D  | C  | D  | B  |
| Q. | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |    |    |    |    |    |
| A  | B  | B  | B  | C  | B  | B  | B  | A  | B  | C  |    |    |    |    |    |

#### FILL IN THE BLANKS

- |                      |                  |             |                        |
|----------------------|------------------|-------------|------------------------|
| (i) Green            | (ii) Frugivorous | (iii) Sun   | (iv) Oxygen            |
| (v) Succus entericus | (vi) Amino acids | (vii) Liver | (viii) Salivary glands |
| (ix) Peristalsis     |                  |             |                        |

#### TRUE / FALSE

- |           |            |             |             |
|-----------|------------|-------------|-------------|
| (i) True  | (ii) True  | (iii) True  | (iv) True   |
| (v) True  | (vi) False | (vii) False | (viii) True |
| (ix) True | (x) True   | (xi) True   |             |

#### MATCH THE COLUMN

- |   |  |
|---|--|
| (I) (i)-(e), (ii)-(c), (iii)-(b), (iv)-(a), (v)-(d)   | (II) (i)-(c), (ii)-(d), (iii)-(e), (iv)-(b), (v)-(a) |
| (III) (i)-(c), (ii)-(a), (iii)-(e), (iv)-(d), (v)-(b) | (IV) (i)-(b), (ii)-(c), (iii)-(d), (iv)-(e), (v)-(a) |

### EXERCISE-2 (COMPETITIVE EXAMINATION QUESTION)

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

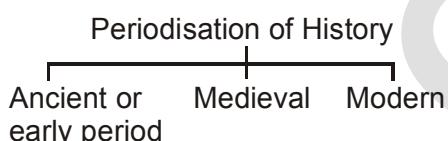
### EXERCISE-3 (PREVIOUS YEAR EXAMINATION QUESTIONS)

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

# 01 TRACING CHANGES THROUGH A THOUSAND YEARS

## INTRODUCTION

History is the study of the past. How far back in time we would like to go? Of course as far as possible. If we go back too far behind into the past we do not get any material evidence to study from. There are only geological remains and need to be interpreted and understood with great care. As we come closer to the present, records and testimonies of some things are available from scriptures which give us a fair idea of development of human settlements and society. More and more physical proofs and evidences are available as we come closer to the present. The study of history is divided in three periods as the Ancient, the Medieval and the Modern. You have already studied about history of ancient times in the previous class. In this class you shall study about the Medieval period.



- (i) **Period one** - Ancient or Early Period (Period upto 8th century A.D.)
- (ii) **Period two** - Medieval or Middle period (Period between 8th century A.D. and 18th century A.D.), and
- (iii) **Period three** - Modern Period (Period between 19th and 21st centuries A.D.)

### 1.1 THE MEDIEVAL PERIOD

The word 'Medieval' comes from the Latin words '**medius**' and '**aevum**' which means '**middle age**.' In Europe, the Medieval Period is referred to by many historians as the Middle Ages. It covers the period between the 8th and 18th centuries AD. It is generally divided into two periods-the Early Medieval Period (between the 8th and 12th centuries AD) and the Later Medieval Period (between the 13th and 18th centuries AD). India witnessed varied political, social, economic and cultural changes during this period. Compared to the Ancient Period, this period is close to us in time and there are plenty of sources available to us for studying this period.

### 1.2 HOW INDIA GOT ITS NAME

Have you ever noticed changes in a person's name over a period of time? No. But that may not be the case when we think of the name of a place, region or country. Take for instance, the name of our country. It has undergone several changes during the course of history. Present-day India, together with other countries of the Indian subcontinent such as Pakistan, Nepal, Bhutan and Bangladesh, has been referred to by various names in the past. Most famous among these names are listed below:

- **Jambudvipa** (the land of the blackberry tree): This name is mentioned in ancient Buddhist texts.
- **Bharatavarsha**: The country was so named after the Bharata tribe that existed in the Rig Vedic times.
- **Aryavarta (the land of the Aryans)**: This name was given around 150 BC to the northern part of India.

- **Sapta-Sindhu:** The Persians used this term for India.
- **Inde:** The Greeks called it Inde, basing it on the river Indus.
- **Tien Chu and Yin Tu:** The Chinese used these terms for India.
- **Hindustan:** This term is derived from the Greek word Indus or Indos.
- **Hind:** The Arabs called it by this name.
- **India:** The British used this term.
- The name **Bharata** is derived from the times of the Vedic Civilization after King Bharata. He is said to have conquered all the known world at that time. The land was named after him. His descendants came to be known as 'Bharatas'.



Amir Khusrao



Babur

### 1.3 SALIENT FEATURES OF THE MEDIEVAL PERIOD IN INDIA

The Medieval Period in India was quite eventful. During this period, several changes took place in the country's socio-cultural and political milieus. Let's take a brief look at the major features of this period.

- Rise of feudalism
- Coming into existence of several Rajput kingdoms in northern and western India
- Tripartite struggle between the Palas, Pratiharas and Rashtrakutas
- Arrival of the Turks from the northwest and establishment of the Delhi Sultanate
- Spread of the Bhakti and Sufi Movements
- Establishment of the Mughal Empire
- Rise of the Marathas and Sikhs
- Economic prosperity of India that captured the attention of European powers
- Independence of several provincial kingdoms in the eastern as well as peninsular India

### 1.4 SOURCES OF HISTORY

#### (a) Archaeological Sources

Archaeology can be defined as the study of the past in the light of material remains left behind by our ancestors.

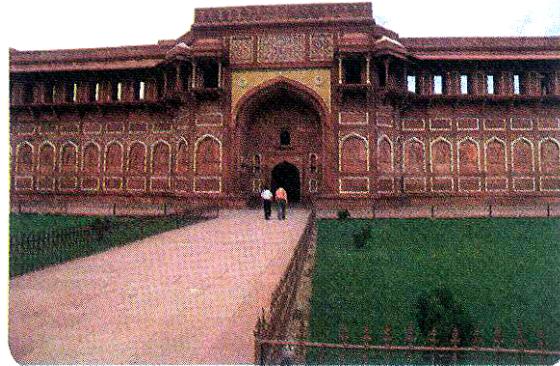
#### Do you Know

**Epigraphy** is the science of studying inscriptions epigraphs. The person who studies the epigraphs is known as epigraphist.

### Buildings or Monuments

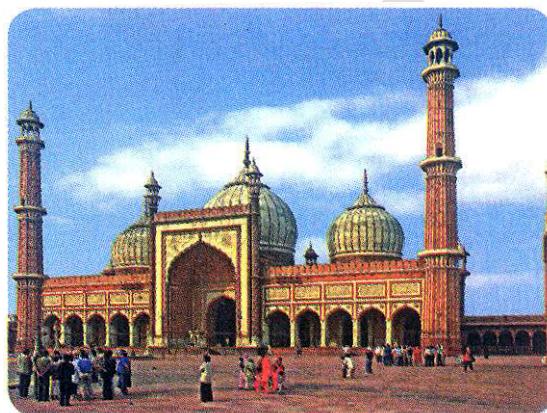
In the medieval times different types of buildings like temples, mosques, forts, tombs, palaces etc. were constructed. Careful study of these buildings tells us a lot about the art, architecture and social, economic and political life of the period in which they were constructed. Some of the examples are as follows:

- **Important Forts and Palaces :** Red Fort, Agra Fort, Gwalior Fort, Palace at Jaipur and Jaisalmer, Golconda Fort, Mandu Fort.



Agra Fort

- **Important Mosques :** Jama Masjid, Moti Masjid.



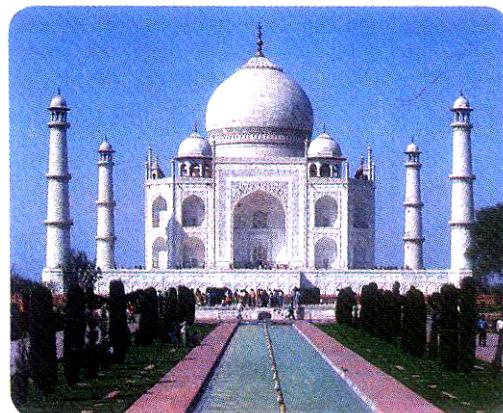
Jama Masjid

- **Temples :** Brihadeswara Temple at Tanjore, Khajuraho in Madhya Pradesh, Sun Temple at Konark, Dilwara Temple, Golden Temple.



Brihadeswara Temple

- **Tombs** : Humayun's Tomb, Taj Mahal, Safdarjung Tomb.



Taj Mahal

- **Miscellaneous** : Besides those mentioned above, buildings like Qutab Minar, Char Minar, Victory Tower etc. were also constructed.



Char Minar

### (b) Coins

Coins were issued by various rulers which depict the date and at times show the picture of the ruler. Metals used in these coins tell us about the economic state of the kingdom.



Coins

#### Do you Know

**Numismatics** is the science of systematic collection and study of coins. The person who studies coins these coins is called as **numismatists**.

**(c) Biographies and Autobiographies**

It give an insight of the ruler and social, economic and political life. For example, Ain-i-Akbari written by Abul Fazal gives an insight of Akbar's administration and Tuzk-i-Jahangiri by Jahangir about Jahangir, Babarnama by Babar. Similarly we come to know about Prithviraj from Prithviraj Raso written by Chandbardai. Thus biographies and autobiographies are a descriptive source.

**Historical Accounts by scholars and Documents relating to that period :**

- (i) Tahrique -i- Hind (11th century A.D.) by Al - Beruni
- (ii) Tarikh - i -Subuktikin (10th century A.D.) by Baihaki
- (iii) Tarikh - i - Firoz Shahi (13th century A.D.) by Zia - ud - Barni
- (iv) Tuzuk - i - Babri (Memoirs of Babar) by Babar
- (v) Humayun Nama (16th century A.D.) by Begum Gul Badan
- (vi) Ain - i - Akbari (16th century A.D.) by Abul Fazal
- (vii) Akbar Nama (16th century A.D.) by Abul Fazal
- (viii) Tuzuk -i - Jahangiri (17th century A.D.) by Jahangir
- (ix) Fatuhali -i- Aurangzeb (17th century A.D.) by Muhammad Masum
- (x) Shahnama (10th century A.D.) by Firdausi
- (xi) Rajtarangini (11th century A.D.) by Kalhan
- (xii) Prithvi Raj Raso (12th century A.D.) by Chandbardai
- (xiii) Padmavat (14th century A.D.) by Malik Mohammad Jayasi

**(d) Travelogues**

A number of foreign travellers visited India during medieval times and have left an account of what they observed. It really helps us to know about the India of that period. Some of the people who wrote **Travelogues are**: Ibn Battuta about Muhammad Tughluq, Marco Polo about South India, Al Beruni about Balban , Abdul Razzaq about Vijayanagara Kingdom.

**Historical Accounts and Documents by Foreign Travellers :**

- (i) Tuhfat - un - Nuzzar Gharibi - il - Amsar by Ibn - e - Batuta
- (ii) Accounts of Marco Polo (13th century A.D.)
- (iii) Accounts of Nicolo Conti (16th century A.D.)
- (iv) Tarikh - i- firishta (16th century A.D.) by Firish



Painting of Ibn Battutah

## 1.5 HISTORIANS AND THEIR USES OF THESE SOURCES

- (i) Historians use different types of sources to learn about the past depending upon the period of their study and the nature of their investigation.
- (ii) There is some continuity in the sources used by historians for the study of this period. They still rely on coins, inscriptions, architecture and textual records for information. But there is also considerable discontinuity.
- (iii) The number and variety of textual records increased dramatically during this period. They slowly displaced other types of available information. Through this period paper gradually became cheaper and more widely available.
- (iv) People used it to write holy texts, chronicles of rulers, letters and teachings of saints, petitions and judicial records, and for registers of accounts and taxes.
- (v) Manuscripts were collected by wealthy people, rulers, monasteries and temples. They were placed in libraries and archives.
- (vi) These manuscripts and documents provide a lot of detailed information to historians but they are also difficult to use.
- (vii) There was no printing press in those days so scribes copied manuscripts by hand.
- (viii) As scribes copied manuscripts, they also introduced small changes - a word here, a sentence there. These small differences grew over centuries of copying until manuscripts of the same text became substantially different from one another.
- (ix) This is a serious problem because we rarely find the original manuscript of the author today. We are totally dependent upon the copies made by later scribes.

## 1.6 PROBLEMS FACED BY HISTORIANS

### (a) Quality of Source

In the days of historical times records were maintained for their immediate use and not for people to interpret after thousands of years. The following aspects also affected the quality of source:

- There were no printing machines.
- No common languages existed.
- The material used for inscriptions were derived from stones, metals, parchments, barks and paper.
- With time they have eroded in quality and faded in colour.
- As copying was not with the help of carbon papers or reprints, there are variations in the versions available at different places.

### (b) Interpretation of Source

It is an extremely difficult task to understand a script which is not currently in use. Even more difficult is to understand words and phrases which are not in use in modern languages. As all the writings were manuscripts (handwritten) it is something like reading from your friend's notebook who has a poor handwriting. There are differences in understanding and interpretations of things which were written in those times. Historians find differences in copies and different versions which give out varied meanings. Therefore it is not easy to reconstruct historical happenings of the past. There were no calendars and clocks and dates and timings are vague. The places and their identity is not clear as the maps were poor and not accurate.

It is due to these variations in understanding that historians have to be very meticulous in understanding, interpreting and reconstructing things of the past for our understanding.

### Do you Know

**Persian was the court language of the Mughal. Urdu was developed out of the mixture of Persian, Arabic and Hindi.**

### Key Words :

|                      |   |
|----------------------|---|
| <b>AUTOBIOGRAPHY</b> | : a person's account of life written by himself or herself;   |
| <b>ARTEFACT</b>      | : relic or work or object of art                              |
| <b>CHRONICLES</b>    | : written records of events arranged in order                 |
| <b>BIOGRAPHER</b>    | : a person who writes an account of someone's life.           |
| <b>EPIGRAPHY</b>     | : science of studying inscriptions or epigraphs               |
| <b>INSCRIPTION</b>   | : religious instruction or record of royal proclamations      |
| <b>NUMISMATICS</b>   | : science of systematic collection and study of coins.        |
| <b>NUMISMATIST</b>   | : a person who studies the coins                              |
| <b>POLITY</b>        | : a society as a political unit                               |
| <b>TENET</b>         | : belief  |
| <b>TRAVELOGUES</b>   | : accounts written by travellers visiting different countries |

### Let's Recall

- ❖ The medieval period starts from the beginning of the 8th century to the end of the 18th century.
- ❖ The two main sources of medieval history are the archaeological sources and the literary sources.
- ❖ The medieval history is known for many powerful dynasties that ruled Hindustan and their interest in culture, traditions, literature and architectural designs.
- ❖ Historians make use of sources such as the coins, inscriptions, monuments and architectural styles and textual records for political as well as social information that are in abundance.

## EXERCISE > 01

### FIXED RESPONSE TYPE

#### MULTIPLE CHOICE QUESTIONS :

1. Indian history of the medieval times began from  
 (A) 6th century AD    (B) 7th century AD    (C) 10th century AD    (D) 8th century AD
2. The land to the East of Indus came to be called the Hindustan by the  
 (A) Greeks                (B) Persians                (C) Arabs                (D) Both b & c

3. Which Veda has the reference of a name of a king named Bharat ?  
(A) Rigveda                   (B) Yajurveda                   (C) Samaveda                   (D) Atharvaveda

4. Ain-i-Akbari was written by :  
(A) Chandbardai               (B) Abul Fazal                   (C) Minhaj-i-Siraj                   (D) None of these

5. We come to know about Muhammad Tughluq from the account written by  
(A) Abdul Razzaq               (B) Al Beruni                   (C) Ibn Battutah                   (D) Marco Polo.

6. The Arabs called India by this name  
(A) Hind                       (B) Sindh                           (C) Bharat                           (D) Inde

7. Ain-i-Akbari gives us an insight of  
(A) Babar's administration                   (B) Humayun's administration  
(C) Akbar's administration                   (D) Jahangir's administration

8. The court language of the Mughals was  
(A) Hindi                       (B) Sanskrit                           (C) Persian                           (D) Urdu

9. Urdu is a mixture of  
(a) hindi and arabic                   (B) persian, hindi and arabic  
(C) arabic and sanskrit                   (D) none of these

10. Tahqiq-i-Hind was written by  
(A) Kalhan                      (B) Alberuni                           (C) Firdausi                           (D) Masum

## FILL IN THE BLANKS

1. Later Medieval period is from \_\_\_\_\_ to \_\_\_\_\_ century AD.
  2. In earlier times there were no \_\_\_\_\_ maps.
  3. The region of Indian subcontinent extends from Afghanistan to \_\_\_\_\_
  4. The name India came to English usage from the \_\_\_\_\_ century onwards.
  5. Abdul Razzaq wrote about the \_\_\_\_\_ Kingdom.

## TRUE / FALSE

1. In the later Medieval period of Indian history we study about Turks, Afghans and Mughals.
  2. The 'h' in Persian is similar to 'i' in Sanskrit.
  3. Prithviraj Raso was written by Abul Fazal.
  4. Historians face lots of difficulties in reading the various sources.
  5. Saints and sufis preached harmony in the society.

## MATCH THE COLUMN

| <b>Column-I</b>                       | <b>Column-II</b>                      |
|---------------------------------------|---------------------------------------|
| (i) Amir Khusrau                      | (a) Babur                             |
| (ii) Brihadeswara Temple              | (b) Balban                            |
| (iii) Baburnama                       | (c) Poet                              |
| (iv) Al Beruni                        | (d) Chandbardai                       |
| (v) Abdul Razzaq                      | (e) Tanjore                           |
| (vi) Prithviraj Raso                  | (f) Vijayanagara Kingdom              |
| (A) i-c, ii-c, iii-a, iv-b, v-f, vi-d | (B) i-c, ii-c, iii-a, iv-b, v-d, vi-f |
| (C) i-c, ii-c, iii-b, iv-a, v-f, vi-d | (D) i-c, ii-a, iii-c, iv-b, v-d, vi-f |

**EXERCISE >> 02****FREE RESPONSE TYPE****SUBJECTIVE QUESTIONS****SHORT ANSWER TYPE**

1. Explain the term Medieval.
2. What do you understand by Numismatics?
3. Why are coins considered as an important source of information ?
4. Name some of the foreign travellers who visited India during the medieval period.

**LONG ANSWER TYPE**

5. How has the name of India undergone a change over a period of time ? Explain.
6. List the various aspects that affected the quality of source in the study of history.
7. Explain the different sources of history with examples.
8. How biographies and autobiographies were descriptive source. Suggest some name of them.
9. How sources were useful for historians?
10. State the salient features of Medieval Period.

**ANSWER KEY >>**

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|---|---|---|---|---|---|---|---|---|----|
| Ans.  | D | D | A | B | C | B | C | C | B | B  |

**Fill in the Blanks :**

1. 13, 18                  2. Country                  3. Myanmar                  4. 17th                  5. Vijayanagar

**True and False :**

1. True                  2. False                  3. False                  4. True                  5. True

**Match the Column :**

- (A) i-c, ii-c, iii-a, iv-b, v-f, vi-d



### Terminologies

**Noun:** Common noun, Proper noun, Abstract noun, Collective noun, Material noun, Countable noun, Uncountable noun, Masculine gender, Feminine gender, Common gender, Neuter gender

## INTRODUCTION

The English word noun has its roots in the Latin word nomen, which means "name." Every language has words that are nouns. A noun is a part of speech, and parts of speech simply refer to types of words.

### 1.1 DEFINITION AND KINDS OF NOUN

A noun is a word that refers to a thing (book), a person (Betty Crocker), an animal (cat), a place (Omaha), a quality (softness), an idea (justice), or an action (yodeling).

**Example:**

- Paul and Carla will meet at the coffee shop on Tuesday.
- For me, birthdays are just ordinary days.

All of the underlined words in the above sentences are nouns.

**NOUNS**

|                 |   |                                    |
|-----------------|---|------------------------------------|
| <b>A Person</b> |  | <i>Joe, teacher, cook, child</i>   |
| <b>A place</b>  |  | <i>lake, Africa, store, home</i>   |
| <b>A Thing</b>  |  | <i>phone, desk, tree, car, cat</i> |
| <b>An Idea</b>  |  | <i>thought, success, peace</i>     |

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#### NOUN CAN BE CLASSIFIED AS:

- |                      |                   |                    |
|----------------------|-------------------|--------------------|
| (a) Common Noun      | (b) Proper Noun   | (c) Abstract Noun  |
| (d) Collective Noun  | (e) Material Noun | (f) Countable Noun |
| (g) Uncountable Noun |                   |                    |

**(a) Common Noun:**

Common nouns are the words that represent common people, places, animals and things of the same class or kind.

**Example:**



- My **dog** sleeps in his **kennel** at **night**.
- My **neighbour** lives in a big **house** with a lovely **garden**.

**(b) Proper Noun:**

A proper noun or proper name is a noun representing unique entities. Proper noun is always written with a capital letter at the beginning of the word.

**Example:**



- **Amitabh Bachchan** is a versatile Indian actor
- **Mr. Pranab Mukherje'e**, the President of India lives in **Rashtrapati Bhawan**.

**(c) Abstract Noun:**

An abstract noun is usually the name of a feeling, idea, action, state and characteristic, or quality considered apart from the object to which it belongs to.

**Example :**



- The Gurkhas are famous in the world for their **bravery**.
- Mr. Bose, our Principal explained the **importance** of **punctuality**.

**(d) Collective Noun:**

A collective noun is a name of a number (collection) of persons or things taken together and spoken of as one whole.

**Example :**



- The naughty boys were attacked by a **swarm** of bees.
- The police have arrested a **gang** of car thieves.

**Following is the list of collective nouns used to describe :-**  
**People :**

|                                  |                        |
|----------------------------------|------------------------|
| A class of students              | Group of teachers      |
| HR department of an organization | Orchestra of musicians |
| Crew of sailors in a ship        | Crowd of people        |
| Dynasty of kings                 | Staff of employees     |
| Gang of thieves                  | Team of cricketers     |

**Animals and Birds:**

|                   |                  |
|-------------------|------------------|
| Troop of apes     | Herd of sheep    |
| Army of ants      | Flock of camels  |
| Brood of chickens | Murder of crows  |
| Herd of buffalo   | Team of dolphins |
| Kit of pigeons    | Walk of snails   |
| Nest of snakes    | Herd of swans    |
| Streak of tigers  | Colony of bats   |
| Herd of antelope  | Flock of sheep   |
| Flock of goose    | Pod of whales    |
| Pack of dogs      | Nest of ants     |
| Colony of bees    | Clutch of eggs   |
| Litter of puppies | School of whales |

**Things or Objects:**

|                       |                      |
|-----------------------|----------------------|
| A cluster of diamonds | Pile of dung         |
| Packet of cigarettes  | A bunch of bananas   |
| Hover of helicopters  | Cache of jewels      |
| Knot of shoelaces     | Pair of shoes        |
| Set of tools          | Forest of trees      |
| A string of pearls    | Network of computers |
| Fold of chairs        | Hug of teddy bears   |
| Pack of suitcases     | Atlas of maps        |
| Cluster of things     | Flight of steps      |

(e)

**Material Noun:**

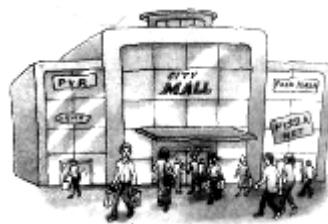
Material nouns are the words that stand for the matter or substance of which things are made.  
**Example:**



- The **iron** pillar at Qutub Minar is admired by all tourists.
- The farmer cut the tree for its **wood**.

(f) **Countable Noun:**

Countable noun refers to nouns that can be counted. They can be both singular and plural.  
**Example :**



- My **sons** are playing with our dog, **Caesar**.
- This **mall** is always crowded with **shoppers**.

(g) **Uncountable Noun:**

Uncountable noun refers to nouns that cannot be counted.

**Example :**



- Many people in Asia eat **rice**.
- **Tea** is a popular drink in India.

**Ask yourself**

1. A \_\_\_\_\_ of soldiers has marched away. (regiment / mob)
2. The soldiers showed great courage during the battle. Courage is an example of (abstract noun / collective noun)
3. The bread my mother prepares is delicious. Which kind of 'bread' is ? (countable / uncountable)
4. Which word is a noun in this sentence? They are forecasting rain later.(rain / forecasting)
5. The children are having a great time in the park. The following sentence has \_\_\_\_\_ (two noun / three noun) used.

**1.2 GENDER OF NOUN**

**GENDER OF A NOUN CAN BE CLASSIFIED AS:**

(a) **Masculine gender:**

A noun is said to be in the masculine gender if it refers to a male character or male member of a species.

**Example:**

- A **boy** is playing in the play-ground.
- **Hero** of the movie is not a native of this country.



**(b) Feminine gender:**

A noun is said to be in the feminine gender if it refers to a female member of a species.

**Example:**

- A **girl** is playing in the play-ground.
- **Heroine** of the movie is not a native of this country.

**(c) Common gender:**

A noun is said to be in common gender if it refers to a member of species which can be a male or a female.

**Example:**

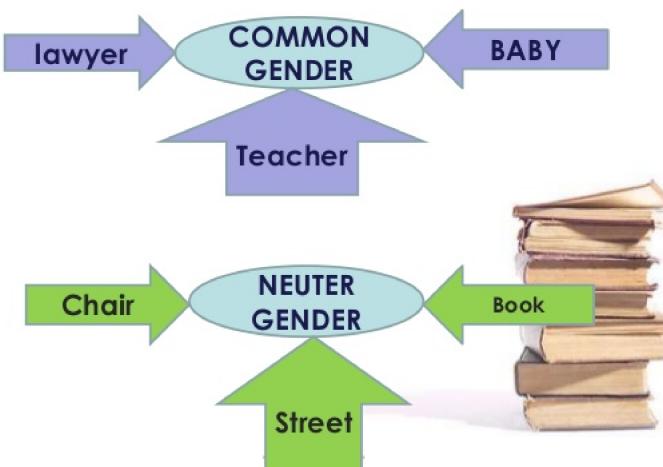
- A **child** is playing in the play-ground.
- A **Parliamentarian** should have command over his language.

**(d) Neuter gender:**

A noun is said to be in the neuter gender if it refers to a member of a species which is neither a male nor a female. Normally nouns referring to lifeless objects are neuter nouns.

**Example:**

- **Computer** has brought about drastic changes in our lives.
- **Stars** are not visible in the day-time.



Ask yourself \_\_\_\_\_



1. Masculine form of lass is \_\_\_\_\_ . (lord / lad )
2. Which of the following noun completes the analogy 'cock is to hen as boar is to \_\_\_\_\_?' (sow / sheep)
3. What is the gender of the noun 'prophet\_\_\_\_\_?' (common / masculine)
4. The (man / woman)\_\_\_\_\_ felt the loss of \_\_\_\_\_ (his / her) husband when he died.
5. My \_\_\_\_\_ (niece / nephew) is a dancer and she is famous for her performance as Draupadi.

### 1.3 Rules of Noun

**(a) Rule 1**

Some noun like tongs, pincers, scissors, spectacles, goggles, gallows, fangs, alms, amends, trousers, pants, particulars, proceeds, regards, riches, savings, troops, thanks, braces, wages, belongings, etc. exist in plural forms only. Thus 's' can not be removed from such nouns to make them singular. They take plural helping verb with them.

**Example :**

- Where **are** my pants ?
- Alms **are** given to beggars.

**(b) Rule 2**

News, politics, summons, physics, economics, mathematics, measles, athletics, linguistics, rickets, innings, etc. are certain nouns that look plural in form but singular in meaning. They take singular helping verb.

**Example:**

- No news **is** bad news.
- Mathematics **is** a difficult subject.
- Politics **is** a dirty game.

**(c) Rule 3**

Scenery, poetry, hair, information, business, bread, knowledge, stationery, crockery, luggage, baggage, jewellery, news, percentage, dirt, dust, traffic, music, etc. are uncountable nouns and hence will take singular verb. These nouns will not take definite article before them.

**Example:**

- I passed the exam but the percentage of marks **was** not good.
- Her hair **is** brown.
- The scenery of Kashmir **has** enchanted us.

**(d) Rule 4**

Cattle, infantry, poultry, peasantry, children, gentry, police, people, etc. are certain nouns that are singular in form but plural in meaning. They take plural verb.

**Example:**

- Cattle **are** grazing in the field.
- Police **have** arrested the thieves.

**(e) Rule 5**

Deer, sheep, series, species, fish, crew, team, jury, aircraft are certain nouns that are used with both singular and plural verb. If they are used in plural sense they take plural helping verb.

**Example:**

- A sheep **is** grazing in the field.
- Two sheep **are** grazing in the field.

**(f) Rule 6**

If a preposition comes after a noun and then the same noun is repeated, the noun should be in singular form.

**Example:**

- Row upon **row** of marble looks beautiful.
- Ship after **ship** is arriving.

**(g) Rule 7**

When the definite numeral adjectives is added before the following noun (pair, score, gross, dozen, hundred, million, billion, thousand, etc.), they take singular form.

**Example :**

- I have two **hundred** rupees only.
- He has already donated five **thousand** rupees

**Ask yourself**

1. Where are my \_\_\_\_\_ (spectacle / spectacles)?
2. She wants a pair of new \_\_\_\_\_ ( shoe / shoes)
3. The scenery of Shimla \_\_\_\_\_(are / is) very charming.
4. Mathematics \_\_\_\_\_ (is / are ) not easy to learn.
5. Measles \_\_\_\_\_ broken out in the city. (has / have)





## Add to Your Knowledge

### We must never say

His family members have come.

There is no place for you in this compartment. There is no room for you in this compartment.

Always help poors.

This blotting is mine.

We had a good play of hockey.

He gave me a ten-rupees note.

He is a five-years-old boy.

This is a three feet rule.

We have purchased a ground on Harrison Road.

### We should always say

The members of his family have come.

Always help the poor.

This blotting paper is mine.

We had a good game of hockey.

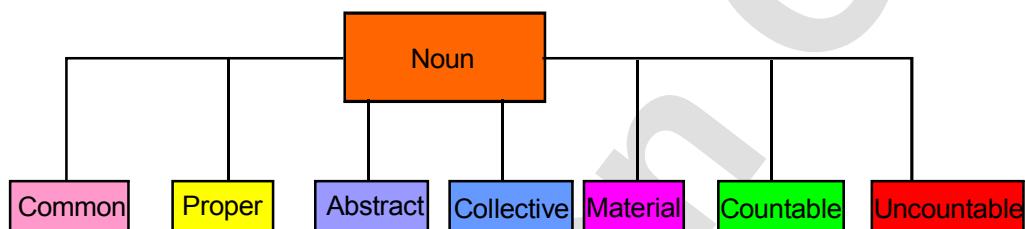
He gave me a ten-rupee note.

He is a five-year-old boy.

This is a three-foot rule.

We have purchased a piece of ground on Harrison Road.

## CONCEPT MAP



# **EXERCISE**

01

## (FIXED RESPONSE TYPE)

## MULTIPLE CHOICE QUESTIONS



# FILL IN THE BLANKS

10. Fill the blank using abstract noun. \_\_\_\_\_ and \_\_\_\_\_ are two sides of a coin.  
(happy, sad / happiness ,sadness)
  11. Fill the blank using collective noun. The poachers were attacked by a \_\_\_\_\_ of wild elephants. (herd / litter)
  12. Fill in the blank with a suitable masculine or a feminine noun. The steward and the \_\_\_\_\_ look after the passengers on the plane.(stewardess / stewards)
  13. Fill in the blank with a suitable masculine or a feminine noun. The host and the \_\_\_\_\_ welcomed their guests. (hostess / hostese)
  14. The \_\_\_\_\_ are very sharp. (scissor / scissors)
  15. He saw 2 \_\_\_\_\_ in the jungle. (deer / deers)

# TRUE / FALSE

16. Gold is a countable noun \_\_\_\_\_. (True / False)

17. Masculine form of doe is antelope \_\_\_\_\_. (True / False)

18. The plural of the compound noun sister in law is sister in laws\_\_\_\_\_. (True / False)

**EXERCISE > 02****(FIXED / FREE RESPONSE TYPE)****MULTIPLE CHOICE QUESTIONS :**

1. The feminine form of the noun 'lord' is  
(A) lady. (B) lordess. (C) lordy. (D) sister.
2. The abstract noun of 'Dangerous' is  
(A) danger. (B) dangerly. (C) dangerousness. (D) dangerful.
3. The correct sentence is  
(A) Whose books are these?  
(C) Whom books are these?  
(B) Who books are these?  
(D) Where books are these?
4. The meaning of 'pharmacy' is  
(A) a kids store. (B) a fancy store. (C) a drug store. (D) a pet store.
5. The feminine gender of horse is  
(A) colt. (B) mare. (C) filly. (D) stag.
6. The plural form of mouse is  
(A) mice. (B) mouses. (C) mices. (D) mouse.
7. The antonym of the abstract noun 'gloom' is  
(A) happily (B) happiness (C) happier (D) happy
8. The collective noun of 'thieves' is  
(A) a swarm of thieves. (B) a team of thieves. (C) a den of thieves. (D) a spring of thieves.

**SUBJECTIVE QUESTIONS :****Direction(9 to 13): Pick out the noun in the given sentences and state its kind**

9. Always speak the truth.
10. We all love honesty.
11. I have two children.
12. The lion is the king of the beasts.
13. Solomon was the wisest of all kings.

**Direction(14 to 16): Correct the following sentences**

14. Womans usually live longer than mans.
15. Farmer Johnson has 3 sheeps and 2 deers in pens.
16. We need more knives and forks as well as potatos and tomatos.



**ANSWER KEY ➤****EXERCISE ➤ 01**

(FIXED RESPONSE TYPE)

**MULTIPLE CHOICE QUESTIONS**

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

**FILL IN THE BLANKS**

- |                           |             |
|---------------------------|-------------|
| 10. Happiness and sadness | 11. Herd    |
| 12. Stewardess            | 13. Hostess |
| 14. Scissors              | 15. Deer    |

**TRUE / FALSE**

- |           |          |           |
|-----------|----------|-----------|
| 16. False | 17. True | 18. False |
|-----------|----------|-----------|

**EXERCISE ➤ 02**

(FIXED / FREE RESPONSE TYPE)

**MULTIPLE CHOICE QUESTIONS :**

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

**SUBJECTIVE QUESTIONS :**

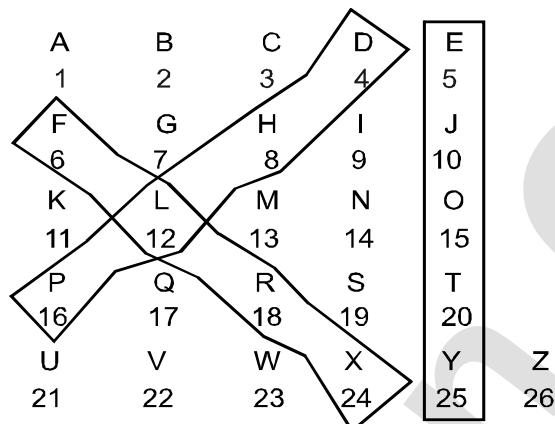
9. Truth - abstract noun
10. Honesty - abstract noun
11. Children - common noun
12. Lion - common; king - common; beasts - common
13. Solomon - proper noun; kings - common noun
14. Women usually live longer than men
15. Farmer Johnson has 3 sheep and 2 deer in pens.
16. We need more knives and forks as well as potatoes and tomatoes.



## INTRODUCTION

Tell me the 4th letter to the left of 2nd letter from your right in the word INFORMATION.

### 1.1 POSITION OF ALPHABETS



We can make some group of letters.

**EJOTY** the table of 5

**DHLP** the table of 4

**FLRX** the table of 6

### 1.2 ALPHABETICAL ORDER

You have to arrange the given words in order in which they are arranged in a dictionary. In a dictionary the words are placed in alphabetical order w.r.t. first alphabet of the words then the second alphabet of the words and so on (that is, third alphabet, fourth alphabet....).

#### Illustration : 1.1

Arrange the given words in the correct alphabetical order.

Late, Long, Liver, Last, Load, Luminous, Loan, Lock.

**Sol.** The given words can be arranged in the alphabetical order as  
Last, Late, Liver, Load, Loan, Lock, Long, Luminous.

#### Illustration : 1.2

Arrange the given words in alphabetical order and find the one that comes last.

partition, passion, parlor, participate, particle, prayer, practies, practical

**Sol.** The given words can be arranged in the alphabetical order as  
parlor, participate, particle, partition, passion, practical, practies, prayer  
Clearly, prayer comes last.

#### Illustration : 1.3

Arrange the given words in the order they occur in dictionary.

1. science    2. scrutiny    3. scripture    4. scramble    5. script

(A) 3, 1, 2, 4, 5    (B) 1, 4, 5, 3, 2    (C) 3, 4, 1, 2, 5    (D) 3, 4, 2, 5, 1

**Sol.** (B) The correct alphabetical order of the given words is science, scramble, script, scripture, scrutiny. Thus, the correct sequence is 1, 4, 5, 3, 2

## 1.3 WORD FORMATION BY VARIOUS METHODS

### (a) By using the letters of other word

#### Illustration : 1.4

If it is possible to make a meaningful word from 2nd, 5th, 6th, and 7th letters of the word GENEROSITY, then which will be the first letter of that word? Mark X if no such word can be formed ,M if more than 1 such word can be formed.

- (A) R                    (B) S                    (C) M                    (D) X

**Sol.** (C) The second, the fifth, the sixth and seventh letters of the word GENEROSITY are E, R, O and S respectively. The meaningful words will be ROSE, SORE and ORES . We can see more than 1 words or 3 words can be formed so answer will be 'M'.

#### Illustration : 1.5

Find which one word can not be made from the letters of the given word.

ENVIRONMENT

- (A) EMINENT            (B) ENTER            (C) ENTRANCE            (D) MOVEMENT

**Sol.** (C) Entrance, The word contains all the letters of the word except C and A. So, the word ENTRANCE cannot be formed.

### (b) By scrambling the letters

Arrange the following group of letters such that when arranged in a specific order, meaningful word is formed.

#### Illustration : 1.6

R T A N U E

1 2 3 4 5 6

- (A) 1,3,2,6,4,5            (B) 3,2,4,6,1,5            (C) 4,3,2,5,1,6            (D) 4,6,5,2,3,1

**Sol.** (C) The given letter, when arranged in the order 4,3,2,5,1,6. Form the word NATURE.

#### Illustration : 1.7

I N E T O C

1 2 3 4 5 6

- (A) 2,5,4,1,6,3            (B) 3,6,4,1,2,5            (C) 4,3,6,5,2,1            (D) 6,5,2,3,4,1

**Sol.** (A) The given letter, when arranged in the order 2,5,4,1,6,3. Form the word NOTICE.

## 1.4 ALPHABETICAL QUIBBLE

In this type of questions, generally a letter-series is given, which can be a Word or the English alphabets from A to Z or Z to A. The candidate is then required to trace the letters satisfying certain given conditions as regards their position in the given sequence or the sequence obtained by performing certain given operations on the given sequence.

#### Illustration : 1.8

Which letter will be the sixth to the right of the nineteenth letter from the right end of the following alphabets ?

ABCDEFGHIJKLMNPQRSTUVWXYZ

- (A) N                    (B) M                    (C) Y                    (D) F

**Sol.** (A) In the given alphabet series the nineteenth letter from the right end is H. The sixth letter to the right of H is N.

### **Illustration : 1.9**

If the first four letters of the word **ANTHROPOMORPHISM** are rewritten in the reverse order followed by the next four rewritten in the reverse order followed by the next four letters in the reverse order and so on, which letter will be twelfth from the left end in the rewritten order?



**Sol.** (C) The new arrangement is as follows: HTNAOPORPROMMSIH.

# **EXERCISE**

01

**Directions : (1 to 2)** Arrange the given words in alphabetical order and tick the one that comes first.

1. (A) Grammar      (B) Granary      (C) Gradient      (D) Grand

2. (A) Mahender      (B) Mahendra      (C) Maninder      (D) Mahindra

3. If the following words are arranged in an alphabetical order, which word will appear in the second ?  
(A) Principal      (B) Principle      (C) Principia      (D) Principled

4. Which of the following is in the seventh position to the right of the eighteenth position from the right end in the letter number sequence given below :?  
B3KG5PD79ERK1MT6ZHQ8W2A  
(A) J      (B) 1      (C) M      (D) K

5. If the positions of the first and sixth letters of the word **BENEFICIAL** are interchanged; similarly the positions of the second and seventh letters are interchanged and so on, which letter will be third from the right end after rearrangement ?  
(A) C      (B) E      (C) F      (D) N

6. If it is possible to make a meaningful word with the first, the fourth, the seventh and the eleventh letters of the word **INTERPRETATION**, which of the following will be the third letter of that word ? If more than one such word can be made, give **M** as the answer and if no such word can be formed, give **X** as the answer.  
(A) T      (B) E      (C) X      (D) M

7. If it is possible to make a meaningful word with the third, the fourth and the eleventh letters of the word **CONTROVERSIAL**, which of the following will be the last letter of that word ? If more than one such words can be made, give **M** as the answer and if no such word is there, give **X** as the answer.  
(A) S      (B) I      (C) X      (D) M

8. If it is possible to make a meaningful word with the second, the sixth, the ninth and the twelfth letters of the word **CONTRIBUTION**, which of the following will be the last letter of that word ? If more than one such words can be made, give **M** as the answer and if no such word is there, give **X** as the answer.  
(A) N      (B) O      (C) X      (D) M

9. From the word **INACTIVE**, how many independent words can be made without changing the order of the letters and using each letter only once ?  
(A) One                    (B) Two                    (C) Three                    (D) More than three

**Directions : (10 to 13)** In each of the following questions, find which one word can not be made from the letters of the given word.

- 10.** KALEIDOSCOPE  
(A) SCALE                    (B) PADLOCK                    (C) PACKET                    (D) DIESEL

**11.** EDUCATED  
(A) DUCK                    (B) CUTE                            (C) TADE                            (D) ACTE

**12.** TEACHERS  
(A) REACH                    (B) CHAIR                            (C) CHEER                            (D) SEARCH

**13.** REASONABLE  
(A) ARSON                    (B) BONES                            (C) NOBLE                            (D) BRAIN

**Directions : (14 to 17)** Arrange the given words in alphabetical order and choose the one that comes first



**Directions : (18 to 20) Arrange the following group such that when arranged in a specific order, meaningful word is formed.**

18. T R I F U  
1 2 3 4 5  
(A) 3,1,2,4,5      (B) 4,2,5,3,1      (C) 4,3,2,1,5      (D) 5,3,2,1,4

19. T L E M N A  
1 2 3 4 5 6  
(A) 2,6,4,5,3,1      (B) 3,2,4,6,5,1      (C) 4,3,5,1,6,2      (D) 5,3,2,4,6,1

20. R M N B U E  
1 2 3 4 5 6  
(A) 1,5,4,2,6,3      (B) 2,6,3,4,1,5      (C) 3,5,2,4,6,1      (D) 4,6,3,2,1,5



#### Add to Your Knowledge

- Can you tell us, how many pairs of letter in the word **DABBLE** have as many letters between them as in the Alphabet Series ?

Such type of problems are called letter word problem, so here we have to find the number of pairs of letters who have same number of letters (irrespective of the letters) between them as they have in the alphabet series according to their place value for example 'DAB' is a pair because D and B has one letter 'C' between them and here D and B has one letter 'A' between them, so the same number of letters. So now can you find the answer?



# EXERCISE > 02

1. If the days of the week are replaced by every alternate letter of the English alphabet with Wednesday replaced by E, thursday by G and so on, then fifth day beginning from Friday will be shown by which of the following? [NSO\_SET-B\_2014]  
(A) E (B) I (C) O (D) Q

2. If the alphabets are written in reverse order after interchanging alphabets from 'C to M' with those from 'P to Z' respectively. Which letter would be midway between E and S in the new order ? [NSO\_SET-B\_2014]  
(A) Z (B) Y (C) N (D) X

3. If the letters of the word IMPORTANCE are arranged from left to right in alphabetical order, then which letter will be fifth from the left? [IMO-2011]  
(A) O (B) N (C) M (D) K

4. In the question, some letters are given which are numbered 1, 2, 3, 4 and 5. Below are given four options containing combinations of these numbers. Find that combination of numbers so that letters arranged accordingly form a meaningful word. [IMO\_SET-A\_2012]  
A R E G R  
1 2 3 4 5  
(A) 5,4,3,1,2 (B) 5,1,4,3,2 (C) 4,5,1,3,2 (D) 2,4,3,5,1

5. How many such pairs of letters are there in the word 'DISTURBANCE' which have as many letters between them as there are in English alphabets? [IMO\_SET-A\_2013]  
(A) 6 (B) 5 (C) 8 (D) 7

6. Arrange the following words in the alphabetical order as arranged in dictionary and choose the word that comes last. [IMO\_SET-A\_2013]  
(A) Prominent (B) Prohibition (C) Programme (D) Prolong

7. Study the following arrangement of letters, digits and symbols to answer the question given below:

**A B 7 C D 9 Z 4 ★ P 2 M © K S 3 ↑ 5 N T @**

Which of the following letters/ symbols is exactly midway between the 4<sup>th</sup> letter from left end and 6<sup>th</sup> letter from right end?

[IMO\_SET-B\_2013]

- (A) K                    (B) M                    (C) P                    (D) Y

8. Arrange the given below words in the order as in a dictionary. [IMO\_SET-A\_2014]

- (i) Mercury                (ii) Showroom                (iii) Rice                (iv) Petrol                (v) Oranges  
 (A) (i), (v), (iv), (ii), (iii) (B) (i), (iv), (v), (iii), (ii) (C) (i), (v), (iv), (iii), (ii) (D) (ii), (Hi), (iv), (v), (i)

9. Select the combination of numbers so that the letters are arranged accordingly to form a meaningful word. [IMO\_SET-B\_2014]

H B M R S U O

1 2 3 4 5 6 7

- (A) 3, 4, 2, 7, 6, 1, 5    (B) 5, 2, 7, 1, 4, 6, 3    (C) 4, 1, 7, 3, 2, 6, 5    (D) 4, 1, 7, 3, 2, 5, 6

10. If the first and sixth letters in the word 'COMPROMISE' are interchanged, also the second and seventh letters are interchanged and so on, which letter will be seventh letter from the right?

[IMO\_Level-II\_2011-12]

- (A) I                    (B) S                    (C) E                    (D) R

11. How many pairs of letters are there in the word INSENSITIVE which have same number of letters between them as in english alphabet? [IMO\_Level-II\_2012-13]

- (A) Three                (B) Four                (C) Five                (D) Six

12. Which of the following letters will be fourth if they are arranged alphabetically as found in the dictionary? [IMO\_Level-II\_2012-13]

- (A) Clever                (B) Calm                (C) Cloth                (D) Custom

## ANSWER KEY ➤

### EXERCISE # 1

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

### EXERCISE # 2

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|
| Ans.  | D | B | C | B | A | A | C | C | C | B  | C  | D  |