Chapter – 1
MOTION
(PHYSICS NOTES)

Motion

Movement of any object from one position to another position with respect to the observer is called as **Motion**.

Position: Motion of any object is defined by its position with respect to the observer. Position is the location of the object. If object changes its position with the passage of time, it is said to be in motion.

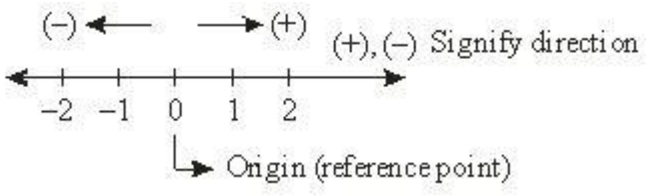
Reference point: It is the point from which the location of object is measured. It is often called as origin. Any object can be located only with the help of reference point and its direction.

Example: Suppose a person changes its position with respect to a tree (a reference point) with passage of time. In this example, person is an object and tree is a reference point. Direction is also necessary to locate an object.

Motion in straight line

When an object moves in straight line with respect to the observer then the motion is called straight line motion. For example, motion of lift.

Position in Straight line Motion:



Positive sign shows position in right (positive) direction.

Negative sign shows position in left (negative) direction.

Zero is usually considered as reference point or origin.

For example;

Position of X = +1m,

Position of Y = -3m.

Here + and – sign represent direction of object from origin. While 1m, 3m represent distance of object from origin.

Vectors & Scalar

Vector is a quantity which have both magnitude and direction.

Examples: Force, position etc.

Scalar is quantity with which direction is not associated.

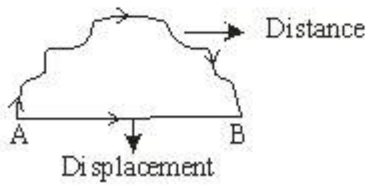
Examples: Temperature, mass etc.

Note: Magnitude of vector only represents numerical value of the vector without its direction.

Distance & Displacement

Distance is the actual path travelled by an object from its initial position to final position. It is a scalar quantity.

Displacement is the shortest straight-line path between initial and final position.



- If the initial and final points are same then displacement will be zero.
- Distance depends on path but displacement does not.
- Distance is always greater than or equal to displacement. They are equal only in straight line motion without taking U- turn.

Uniform & Non – uniform Motion

Uniform motion is a motion in which equal distance is covered in equal time intervals.

Non-Uniform motion is a motion in which unequal distance is covered in equal intervals of time.

Speed and Velocity

Speed is the distance travelled by object in unit time.

Speed = Distance Travelled / Time Taken

Average Speed: The ratio of total distance travelled to total time taken by the body gives its average speed.

Average Speed = Total Distance Travelled / Total Time Taken

It's a scalar quantity. SI unit of speed is metre/sec.

Velocity is the displacement of body in unit time.

Velocity is a vector quantity. SI unit of velocity is metre/sec.

Velocity = Displacement of Object / Time Taken

Note:

- Velocity has both magnitude and direction while speed has only magnitude and no direction.
- Velocity has same direction as displacement.

Average Velocity: The ratio of total displacement travelled to total time taken by the body gives its average velocity.

Average Velocity = Total Displacement / Total Time Taken

- Average speed is always greater than average velocity except in case of straight-line motion without u – turn when both are equal.
- If body returns to its initial position, average velocity will be zero but average speed will not be zero.
- When direction of motion changes, velocity also changes.

Instantaneous Speed and Velocity

Instantaneous speed is the speed of an object at a particular moment (instant) in time.

Instantaneous velocity is the velocity of an object in motion at a specific point in time.

Acceleration

Acceleration is measure of change of velocity with time. It is also called rate of change of velocity. SI unit is metre/sec^2. It is a vector quantity.

Acceleration = Final Velocity - Initial Velocity / Total Time Taken

If the velocity of an object changes from an initial value u to the final value v in time t, the motion is called acceleration motion. In this case, acceleration a is given by

a = v-u / t

Acceleration motion is a motion in which acceleration is not equal to zero.

- Acceleration has same direction as of velocity if velocity increases.
- Acceleration has opposite direction as of velocity if velocity decreases. In this case acceleration will be negative. Negative acceleration is also called **Retardation/ De - acceleration**.

Uniform and Non – uniform acceleration

- When velocity of body changes by equal amounts in equal time intervals, acceleration is said to be uniform.
- When velocity of body changes by unequal amounts in equal intervals if time, acceleration is said to be non - uniform.

Falling of ball is a uniform motion. Motion of car is a non – uniform motion.

Equations of Uniform Accelerated Motion

Relation among velocity, distance, time and acceleration is called equations of motion. There are three equations of motion for bodies moving with uniform acceleration.

First Equation of Motion:

$v = u + at$ ... (i)

Second Equation of Motion:

$s = ut + \frac{1}{2}at^2$... (ii)

Third Equation of Motion:

$v^2 = u^2 + 2as$... (iii)

Here,

v = final velocity of body

u = initial velocity of body

a = acceleration of body

t = time taken by body

s = distance travelled by body in time t.

Average Velocity in Uniform Accelerated Motion

If a body moves ‘s’ distance in ‘t’ time interval. Then,

Average Velocity = Displacement / Time

$= s/t$

$= (ut + \frac{1}{2}at^2) / t$ [$\therefore s = ut + \frac{1}{2}at^2$]

$= ut + \frac{1}{2}at$

$= ut + \frac{1}{2} (v-u)$

$= u + v/2 - u/2$

= u/2 + v/2 = u+v/2

Here ‘a’ is uniform acceleration of body.

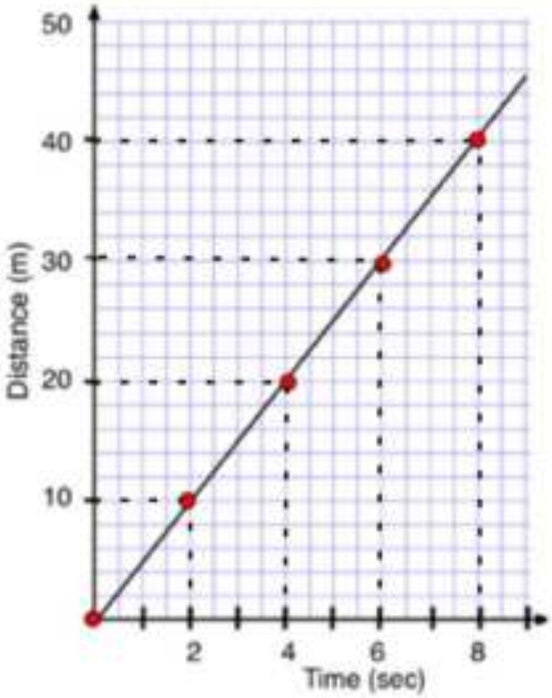
Graphical Representation of Motion

To describe the motion of an object, we can different graphs. Graphical representation of motion shows dependence of one physical quantity such as distance, velocity on other quantity such as time.

1. Distance Time Graphs:

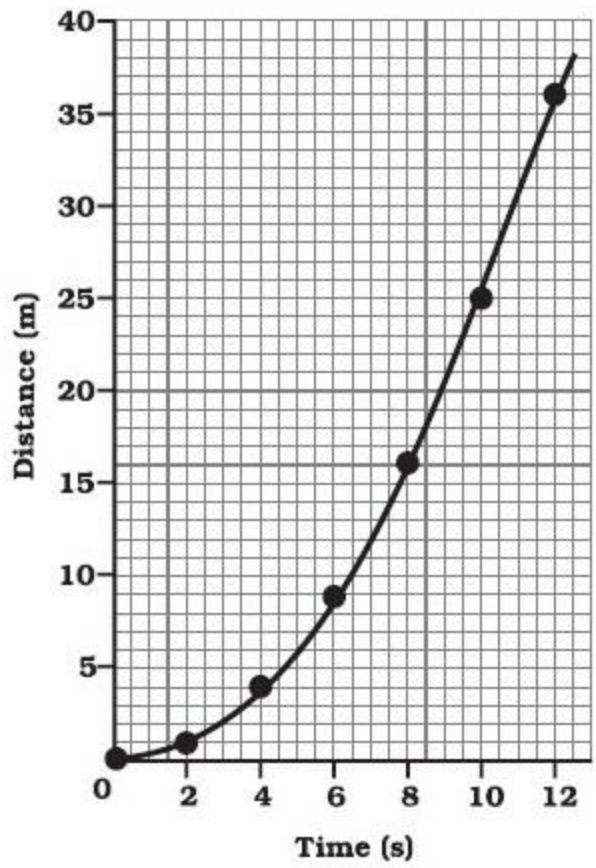
The change in the position of an object with time can be represented on the distance – time graph. The distance time graph for a moving body can be used to calculate speed of the body.

1. **Straight line graph:** The distance time graph for a body moving at uniform speed is always a straight line as body in uniform motion, body moves equal distance in equal time interval.

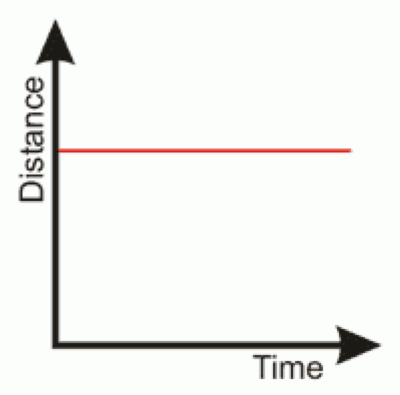


2. **Curved graph:** When graph of distance Vs time is plotted for an object moving with non uniform speed, the slope of graph will not be a straight line. The rising trend of slope shows the increasing

trend of velocity.



3. The distance-time graph is parallel to time axis when the body is at rest.



To calculate speed of body at any point say P, first draw two perpendiculars on time axis and distance axis say PA and PB respectively.

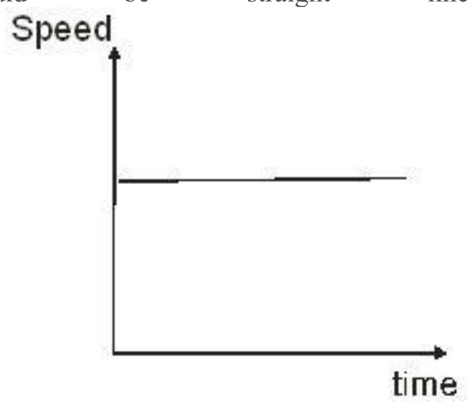
Speed of object = PA/PB

Here,

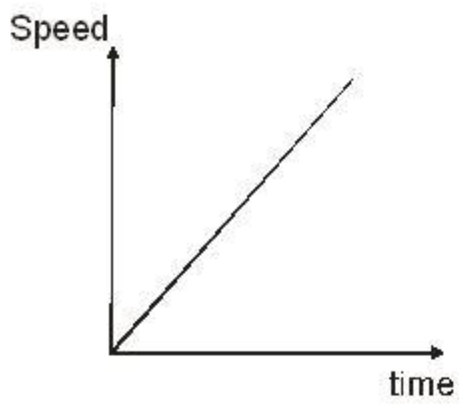
PA represents distance travelled by body and PB represents time taken by body.

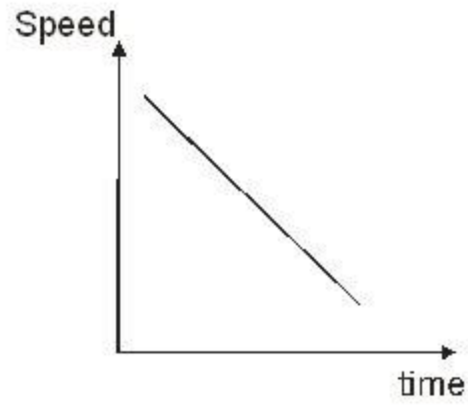
2. Velocity – time graph:

1. If a body moves with a **uniform velocity (no acceleration)** then speed time graph for this body would be straight line parallel to time axis.

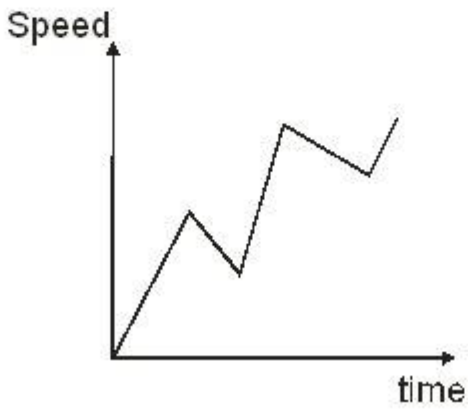


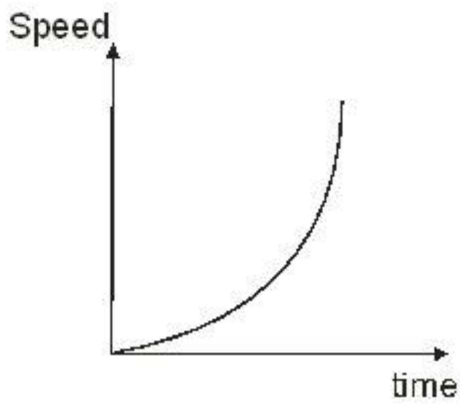
2. If body moves with a **non uniform velocity (uniform acceleration)** then speed time graph would be a straight line. The pattern of slope of the graph depends on sign of velocity.



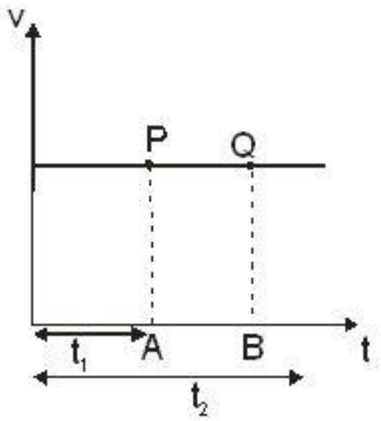


If velocity increases (positive uniform acceleration) with time, graph would be a straight upward slope. If velocity decreases (negative uniform acceleration) with time, graph would be a straight downward slope.





1. Zig – zag graph and curved graph show that the object is moving with **non-uniform velocity (with non uniform acceleration)**.



We can find out the magnitude of displacement (distance) and acceleration of body using the velocity time graph.

The distance travelled by moving body in a given time will be equal to area under speed time graph.

For above graph,

Distance travelled = area of triangle PQBA = PQ x QB

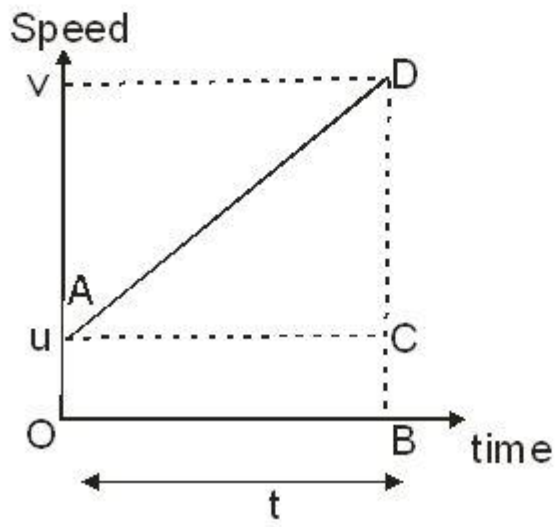
$s = v (t_2 – t_1)$

Acceleration of body = Change in velocity / time taken

As in above graph, velocity is constant, so in this case acceleration will be zero.

Derivation of Equations of Motion using graphs

Let an object moves from A to D in time interval t.

1. 

   1. Acceleration of moving object = $V_2 - V_1 / t_2 - t_1$

2. If initial velocity is u and final velocity is v then

$\Rightarrow a = v - u / t - 0$

$\Rightarrow at = v - u$

$\Rightarrow v = u + at$ Hence Proved

1. Distance travelled by object = area under graph
   = area of rectangle. ACBO + area of triangle ADC

$= (OA)(OB) + 1/2 (AC)(CD)$

$= ut + 1/2(OB)(BD - BC)$

$= ut + 1/2\, t(v-u)$

$= ut + 1/2\, t(at)$

$s = ut + 1/2\, at^2$ Hence Proved

1. Distance travelled by object = area under graph

$S = 1/2$ (Sum of || sides) x t

$S = 1/2 (u+v) \times t$

$2S / u+v = t$ … (1)

$v - u / a = t$ … (2)

Equating equations (1) and (2)

$2S / u + v = v - u / a$

$\Rightarrow 2as = (v-u)(v+u) = v^2 - u^2$

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

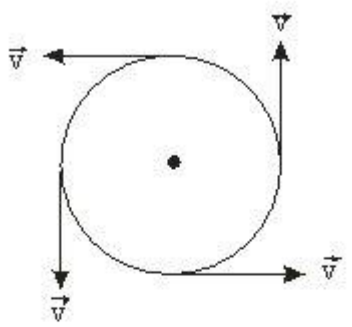
Hence Proved

Circular Motion

Uniform circular motion is the motion in which an object moves on a circular path with constant speed. For example: watch, moon revolve around earth etc.

Non uniform circular motion is the motion in which an object is moves on circular path with varying speed.

When an object is in circular motion, direction of its velocity keeps on changing.



Speed in the case of circular motion

Suppose a body is moving in a circular path of radius r.

Speed (v) = distance / time

= circumstance of circle / time

= $2\Pi r / t$

NUMERICALS

QUES.1

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

Answer 1 :
Time taken = 2 min 20 sec = 140 sec.
Radius, r = 100 m.
In 40 sec the athlete complete one round.
So, in 140 sec the athlete will complete = 140 ÷ 40 = 3.5 round.
⇒ Distance covered in 140 sec = $2\pi r \times 3.5 = 2 \times 22/7 \times 100 \times 3.5 = 2200$ m.
At the end of his motion, the athlete will be in the diametrically opposite position.
Displacement = Diameter = 200m

QUES 2. Joseph jogs from one end A to another end B of a straight 300 m road in 2 minutes
and 30 sec and then turns around and jogs 100 m back to point C in another 1 minute. What are Joseph's average speeds and velocities in jogging (a) from A to B (b) from A to C?

Answer 2:

(a) For motion from A to B:
Distance covered = 300 m
Displacement = 300 m.
Time taken = 150 sec.
We know that, Average speed = Total distance covered ÷ Total time taken

= 300 m ÷ 150 sec = 2 ms-1
Average velocity = Net displacement ÷ time taken
= 300 m ÷ 150 sec = 2 ms-1

(b) For motion from A to C:
Distance covered = 300 + 100 = 400 m.
Displacement = AB - CB = 300 - 100 = 200 m.
Time taken = 2.5 min + 1 min = 3.5 min = 210 sec.
Therefore, Average speed = Total distance covered ÷ Total time taken

= 400 ÷ 210 = 1.90 ms-1
.
Average velocity = Net displacement ÷ time taken
= 200 m ÷ 210 sec = 0.952ms-1

QUES 3:

Abdul, while driving to school, computes the average speed for his trip to be 20 kmh-1. On his return trip along the same route, there is less traffic and the average speed is 30 kmh-1. What is the average speed of Abdul's trip?

Answer 3:

Let one side distance = x km.
Time taken for forward trip at a speed of 20 km/h = Distance / Speed = x/20 h.
Time taken in return trip at a speed of 30 km/h = x/30 h.
Total time for the whole trip =x/20+x/30 = (3x+2x)/60 = 5x/60h.

Total distance covered = 2x km.
We know, Average speed = Total distance ÷ Total time

= 2x ÷ (5x/60) = 24 kmh-1

Question 4:

A motor boat starting from rest on a lake accelerates in a straight line at a constant rate of 3.0 ms-2 for 8.0 s. How far does the boat travel during this time?

Answer 4:

Here, u = 0 m/s
a = 3 ms-2
t = 8 s
Using, second equation of motion :
s = ut + 1⁄2 at2
s = 0 × 8 + 1⁄2 × 3 × 8^2 = 96 m.

Ques: 5

An artificial is moving in a circular orbit of radius 42250 km. Calculate its speed if it takes 24 hrs to revolve around the earth?

Answer 5:

Here,

$r = 42250$ km = 42250000 m

$T = 24$ h = $24 \times 60 \times 60$ s

Using Speed, $v = 2\pi r \div T$

$v = (2 \times 3.14 \times 42250000) \div (24 \times 60 \times 60)$ m/s

= 3070.9 m/s = 3.07 km/s

Chapter- 2

Physics Notes :-

Force and Newton's Laws of Motion

A push or pull on a body is called force. Forces are used in our everyday actions like pushing, lifting, pulling, stretching, twisting and pressing. A force cannot be seen. A force can be judged only by the effects which it can produce in several bodies (or objects) around us.

Force has both magnitude and direction, making it a vector quantity. It is measured in the SI unit of Newton and represented by the symbol F.

In the below shown images we can see how forces are being applied in our everyday life:

Effects of Force

- Force can make a stationary body in motion. For example a football can be set to move by kicking it, i.e. by applying a force.
- Force can stop a moving body – For example by applying brakes, a running cycle or a running vehicle can be stopped.
- Force can change the direction of a moving object. For example; by applying force, i.e. by moving handle the direction of a running bicycle can be changed. Similarly by moving steering the direction of a running vehicle is changed.
- Force can change the speed of a moving body – By accelerating, the speed of a running vehicle can be increased or by applying brakes the speed of a running vehicle can be decreased.
- Force can change the shape and size of an object. For example; by hammering, a block of metal can be turned into a thin sheet. By hammering a stone can be broken into pieces.

Balanced and Unbalanced Forces

1. **Balanced Forces**

If the resultant of applied forces is equal to zero, it is called balanced forces. Balanced forces do not cause any change of state of an object. Balanced forces are equal in magnitude and opposite in direction. Balanced forces can change the shape and size of an object. For example - When forces are applied from both sides over a balloon, the size and shape of balloon is changed.

2. **Unbalanced Forces**

If the resultant of applied forces are greater than zero the forces are called unbalanced forces. An object in rest can be moved because of applying balanced forces.

Unbalanced forces can do the following:

1. Move a stationary object.
2. Increase the speed of a moving object.
3. Decrease the speed of a moving object.
4. Stop a moving object.
5. Change the shape and size of an object.

Some Common Forces

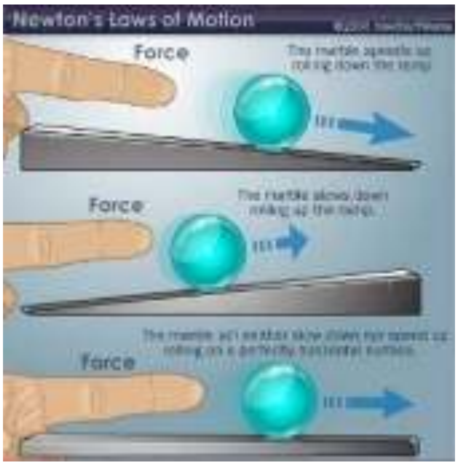
1. **Muscular Force:** The force obtained by the working of human body muscles is called muscular force. Ex: Lifting objects, doing exercise etc.
2. **Gravitational Force:** The force applied by earth on an object in downward direction is called gravitational force.
3. **Frictional Force:** The force which opposes motion is known as frictional force. It acts in the direction opposite to the velocity of body.
4. **Air Resistance:** When an object moves through air, air applies a small force in direction opposite to velocity. This force is called air resistance.

Newton's Laws of Motion

Newton has given three laws to define the motion of bodies. These laws are known as Newton's laws of motion.

Newton's 1st Law

A body at rest will remain in rest, and a body in motion will continue in motion in a straight line with uniform speed, unless it is compelled by an external force to change its state of rest or of uniform motion.



Inertia and Mass: Inertia is that property of body due to which it resists a change in its state of rest or of uniform motion.

In this above shown picture the inertia of the coin tries to maintain its state of rest even when the card flows off. The mass of an object is a measure of its inertia. Its SI unit is kilogram (kg).

Application of Newton's 1st Law

1. A passenger in bus has a tendency to keep moving in a straight line inside a bus due to inertia. When the bus takes turn, body of passenger wants to continue moving in straight line. Due to this, it appears that his body bends outwards.
2. When we hit a carpet it loses inertia of rest and moves. But the dust in it retains inertia of rest and is left behind. Thus dust and carpet are separated.
3. When a tree is shaken, it moves to and fro. But fruit remains at rest due to its inertia of rest. Due to this fruit breaks off the tree.

4. When a car is braked suddenly, the man bends forward violently due to inertia of motion. The man may collide with parts of car hurting himself. Seatbelt will not let the man bend forward. And thus save them from accident.

5. Due to inertia of motion even when the car stops, the luggage on the top of car has the tendency to move forward. Therefore luggage is tied.

Momentum:

The momentum of a body is defined as the product of its mass and velocity.
Thus, momentum = mass x velocity
Or, p = m x v
Where, p = momentum
m = mass of the body
v = velocity of the body
The SI unit of momentum is kilograms meters per second (kg.m/s)
Note: The force required to stop a moving body is directly proportional to its mass and velocity.

Change in momentum:

It is defined as the difference between final momentum and initial momentum. Suppose initial momentum is mu, and final momentum is mv, then
Change in momentum = mv – mu

Rate of change of momentum:

The rate at which momentum is changing is known as rate of change of momentum.
Rate of change of momentum = (mv – mu) / t
Or,
= m (v-u) / t

Newton's 2nd Law

The rate of change of momentum of a body is directly proportional to the applied force, and takes place in the direction in which the force acts.
Force = change in momentum / time taken
F = mv - mu / t
But we know that
F = m x a
Or Force = Mass x Acceleration

Its SI unit is Newton (N).
Thus, one unit of force is defined as the amount that produces an acceleration of 1 m s^{-2} in an object of mass 1 kg.

Application of Newton's 2nd Law:

1. When we stop the ball gradually, we need to apply less force. This is easy and safe. If we stop the ball suddenly, we need to apply larger force which is difficult and can also injure our hand.
2. In high jump if surface is hard, athlete's body changes velocity in very less time. Large force acts on his body due to which he may get injured. If the surfaces are soft, athlete's body changes velocity in more time. And less force acts on his body which is safe.

Newton's 3rd Law

Whenever one body exerts a force on another body, the second body exerts an equal and opposite force to the first body. Or, to every action there is an equal and opposite reaction.

Action and reaction forces are equal and opposite.

Application of Newton's 3rd Law:

1. Gun applies force on bullet due to which it moves ahead. By Newton's 3rd Law, bullet will also apply same force on gun in backward direction. Due to this force, gun moves back. This is called recoil of gun. Gun moves back only by small amount due to its heavy mass.
2. Hose pipe applies large force on water due to which water moves ahead. By Newton's 3rd Law water applies the same force on pipe backwards. Due to this force, pipe can move backwards. To stop it, many people need to hold it.
3. Man pushes the boat backwards and by newton's 3rd law, boat pushes man forward.
4. Man pushes water back by applying force. By Newton's 3rd Law, water applied equal and opposite force on swimmer. Due to this force man moves ahead.
5. Cheetah applies forces on ground in backward direction. By 3rd law, ground applies force equal and opposite on cheetah in forward direction. It is due to this force that cheetah moves ahead. For running faster cheetah needs to apply more force on ground in forward direction.

Conservation of Momentum

If two or more objects apply force on each other with no external force, their final momentum remains same as initial momentum.

Total momentum before collision = Total momentum after collision

Practical examples of conservation of momentum:

1. In rocket, fuel is burnt due to which gases are ejected downwards. For conservation of momentum, rocket moves up.
2. Fuel in jet plane burns and ejects gases in backward direction. Then by conservation of momentum, plane moves ahead.

State the law of conservation of momentum and derive related expression :-

Law of conservation of momentum states that when two objects collide with each other , the sum of their linear momentum always remains same or we can say conserved and is not effected by any action, reaction only in case is no external unbalanced force is applied on the bodies.

Let,

m_A = Mass of ball A

m_B= Mass of ball B

u_A= initial velocity of ball A

u_B= initial velocity of ball B

v_A= Velocity after the collision of ball A

v_B= Velocity after the collision of ball B

F_{ab}= Force exerted by A on B

F_{ba}= Force exerted by B on A

Now,

Change in the momentum of A= momentum of A after the collision - the momentum of A before the collision

= $m_A v_A - m_A u_A$

Rate of change of momentum A= Change in momentum of A/ time taken

= $(m_A v_A - m_A u_A)/t$

Force exerted by B on A (F_{ba});

F_{ba}= $(m_A v_A - m_A u_A)t$........ [i]

In the same way,

Rate of change of momentum of B= $(m_B v_B - m_B u_B)/t$

Force exerted by A on B

$F_{ab} = (m_B v_B - m_B u_B)/t$.......... [ii]

Newton's third law of motion states that every action has an equal and opposite reaction, then,
$F_{ab} = -F_{ba}$ [' -- ' sign is used to indicate that 1 object is moving in opposite direction after collision]
Using [i] and [ii] , we have
$(m_B v_B - m_B u_B)/t = -(m_A v_A - m_A u_A)/t$
$m_B v_B - m_B u_B = -m_A v_A + m_A u_A$
Finally we get,
$m_B v_B + m_A v_A = m_B u_B + m_A u_A$

This is the derivation of conservation of linear momentum.....

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Chapter - 1

Matter in Our Surroundings

Matter - Matter is anything that has mass and occupy space.

Example - Air, water, soil, wood, pen etc.

Mass - Mass is the amount of matter contained an object.

Physical Nature of Matter

1 Matter is made up of particles. Every matter is made up of certain particles which differ is shape, size and nature from other type of matter.

2. The particles of matter are very small or tiny.

Characteristics of Particles of Matter -

1) Particles of matter have space between them
2) Particles of matter are continuously moving
3) Particles of matter attract each other.
4) Particles of matter have a tendency to diffuse to intermix on their own which each other

States of Matter

Matter exists in three states which are as -

1) Solid state
2) Liquid state
3) Gaseous state

Density → Mass per unit volume of a substance is called its density

$$Density = \frac{Mass}{Volume} = \frac{m}{V}$$

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Solid State

Properties of solid

1. They have the strongest intermolecular forces.
2. They have the least intermolecular spaces as compared to liquids and gases.
3. They have definite size, shape and volume.
4. They can not flow
5. They can not be compressed.
6. Solids have higher densities as compared to their Liquid or gaseous forms.

Liquid state -

1. They have weaker intermolecular forces than solids.
2. They have more intermolecular spaces than solids.
4. They do no have definite shape and size.
5. They have definite volume.
6. They can flow.
7. They can be slightly compressed but require a great deal of pressure.
8. Density of a liquid is generally less than that of its solid form

Gaseous state -

1. They have the weakest intermolecular forces as compared to solids and liquids.
2. They have the maximum intermolecular spaces as compared to solids and liquids.

3. They do not have definite shape, size and volume.

4. They can flow and take up the entire available space

5. They can be compressed very easily.

6. The density of gases is minimum. A gas is much lighter than the same volume of a solid or a liquid.

Define the terms

1 Fluids :- Substances that can flow conform to the outline of its container.

2. Fluidity :- The tendency of a substance to flow easily and change its shape in response to outside forces, is called fluidity.
Liquids and gases are fluids.

3. Rigidity :- The tendency of a substance to maintain its shape is called rigidity.
Solids show the property of rigidness.

4. Compressibility :- The tendency of a substance to be compressed, is called compressibility.
Gases are highly compressible.

5. Intermolecular forces:- The forces of attraction between the atoms or molecules of a matter.

6. Intermolecular spaces:- The spaces present between the atoms or molecules of a matter.

7. Diffusion- Diffusion is the process in which molecules of a substance move from higher concentration to lower concentration and goes on until a uniform mixture is formed.

8. Osmosis:- In osmosis, the solvent molecules move from their higher concentration to lower concentration through a semipermeable membrane.

Change of states of matter

Matter exists in three states. Most states of matter can be changed from one form to the through different physical processes.

Interconversion of state of matter- The process in which the matter changes from one state into another and finally back to the original

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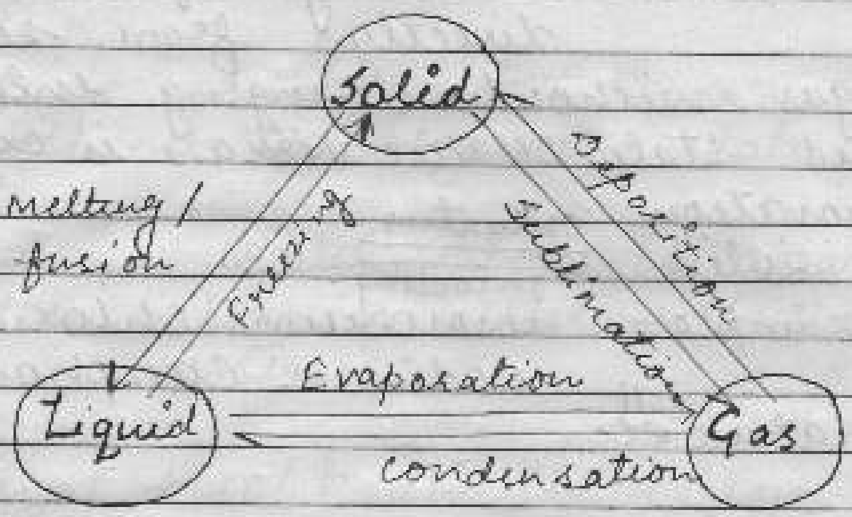
state is called interconversion



1) Fusion or Melting :- The process of conversion of matter from its solid state to its liquid state at specific condition of temperature and pressure is called fusion or melting.

Solid $\xrightarrow[\text{Melting}]{\Delta}$ Liquid

2) Boiling :- The process of conversion of matter its liquid state to vapour (gas) at specific condition of temperature and pressure, is called boiling.

3. Vapourisation :- The process in which a liquid changes to its vapour or gaseous form is called vapourisation.

4. Condensation :- On cooling, the gaseous state of water changes back to its liquid state called condensation

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5. Sublimation :- A change of state directly from solid to gas without changing into liquid state or vice versa, is called sublimation.

Solid $\underset{\text{on cooling}}{\overset{\text{on heating}}{\rightleftharpoons}}$ Gas

For example - ammonium chloride, iodine, camphor, napthalene ball etc.

Scales of Measuring Temperature :-

Q. Convert the following temperature to Celsius scale.

1> 300 K = Temperature on Kelvin scale − 273
300
300 − 273
= 27°C

2> 573 K
573 − 273
300°C

Q. Convert the following temperature to Kelvin scale.

1> 25°C
25 + 273
= 298K

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11> 373
373 + 273
646 K.

Qu- What is the physical state of water at
250°C - Water vapour or steam
100°C - Liquid water as well as vapour or Steam.

Latent Heat:- At the certain temperature the amount of heat given to change the state of substance, is called as latent heat.

Latent heat of fusion/melting:- The amount of heat required to change 1kg solid into liquid at its melting point, is called as latent heat of fusion.

Latent heat of vapourisation:- The amount of heat require to change 1 Kg liquid into vapours or gaseous state at its boiling point is called the latent heat of vapourisation.

Evaporation:- The process of conversion of liquid into its vapour state at any temperature below its boiling point is called evaporation.

Factor affecting evaporation

1) Surface Area:- The rate of evaporation increases on increasing the surface area of the liquid
Ex- While putting the clothes for drying up, we spread them out

2) Temperature :- Rate of evaporation is higher when temperature of atmosphere is higher.

3) Wind speed:- The evaporation rate increases with increase wind speed and decrease with decrease wind speed.

4) Humidity :- It is the amount of water vapour present in air the air around us cannot hold more than a definite amount of water vapours at the given temperature. If the amount of water in air is already high the rate of evaporation decrease.

* Evaporation causes cooling affect -
In an open vessel, the liquid keeps on evaporating. The particles of liquid absorb energy from the surrounding to regain the energy lost during evaporation

This absorption of energy from the surroundings makes the surrounding cold

Application of evaporation in daily life-

1. Drying of clothes after washing.
2. Keeping water in earthen pots to keep it cool.
3. Wearing of cotton clothes in summer as they easily absorb sweat and help in its easy evaporation.

Two more states of matter-

a) Plasma :- This state consists of energetic and super excited particles. These particles are in the form of ionised gases

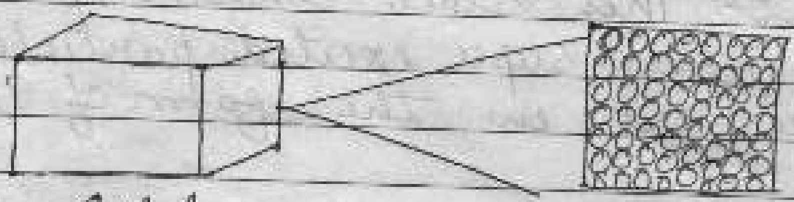
Formation of plasma :- In neon sign bulbs there is neon gas and in fluorescent tube, there is helium gas.

The gas gets ionised, when electrical energy flows through it. This charging up creates a plasma glowing inside the bulb or tube. The plasma glows with a special colour depending on the nature of the gas.

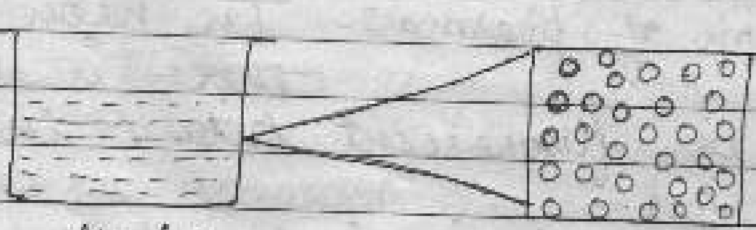
Bose- Einstein Condensate [BEC]

In 1920, Indian physicist Satyendra Nath Bose had done some calculations for a fifth state of matter.
Based on his calculation, Albert Einstein predicted a new state of Matter The Bose-Einstein Condensate
The BEC is formed by cooling a gas of extremly low density, about one hundred- thousandth the density of Normal air to super low temperature.

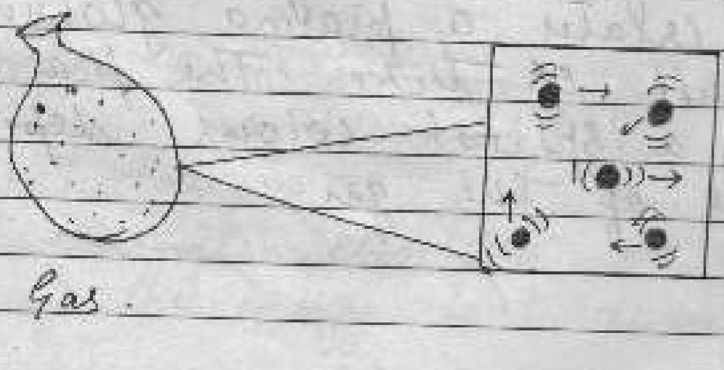
Three States of Matter



Solid



Liquid



Gas.

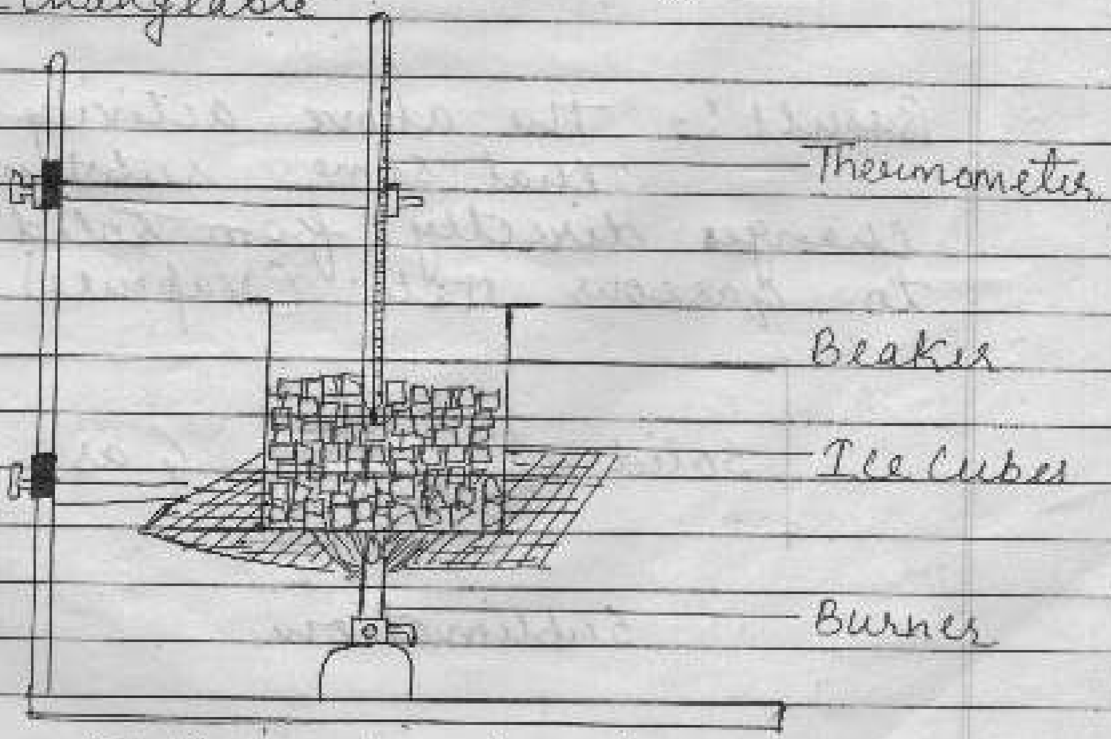
Activity :- 1

Object :- To show that three state of Matter are interchangeable.

Method:- Take some ice-crystals in a beaker and heat it. Ice crystals will change into water. Heat water formed. It will change to steam. On cooling, vapour will again change to water and water to ice.

$$\text{Solid State} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \text{Liquid state} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \text{Gaseous state}$$

Result :- The above activity shows that the three states of Matter are interchangeable.



Conversion of ice to water.

Activity - 2

Object :- To show that some substance change into gaseous state from solid state.

Method :- Take some powdered camphor or ammonium chloride in a china dish. plug a funnel with cotton on the stem and put it inverted over the china dish and heat it slowly

Observation :- Camphore or ammonium chloride changes directly into vapour state. Some part of the vapour deposits on the steam when solidify on the cooler part of steam of funnel.

Result :- The above activity shows that some substances changes directly from solid state to gaseous state (vapours)

$$\text{Solid} \underset{\text{on cooling}}{\xrightarrow{\text{on heating}}} \text{Gas}$$

Sublimation

Chapter - 1

The Fundamental Unit of Life

Introduction :-

* In 1665, Robert Hooke was examining a thin slice of cork under his self-made microscope. He observed small box like structures and named as 'cells'.

* Cell : A cell is regarded as fundamental unit of life and can be defined as "The fundamental, structural and functional unit of life" which consist of a mass of protoplasm surrounded by definite membrane called plasma membrane.

* Important Investigations :-

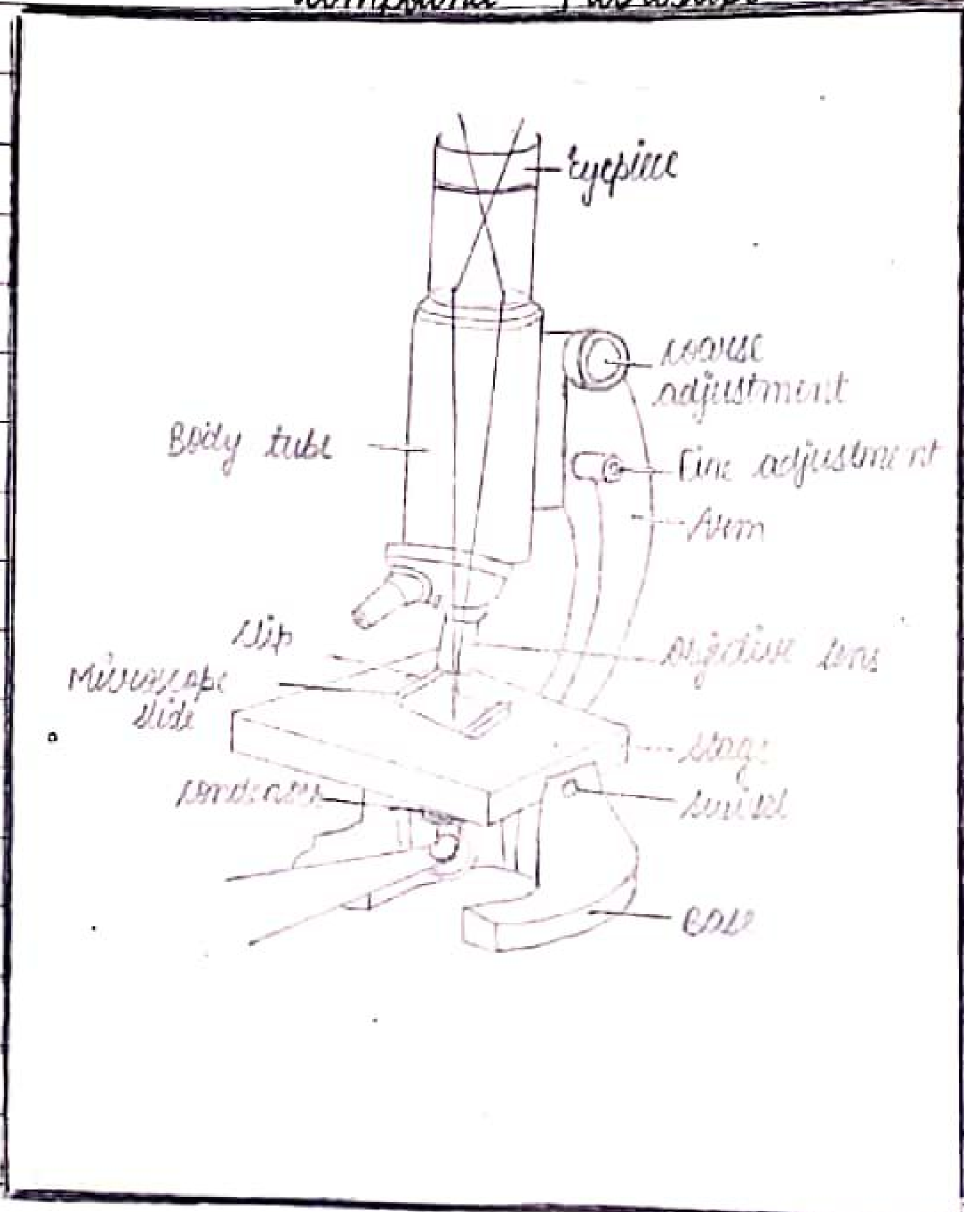
1. Cell was discovered by Robert Hooke in 1665.
2. It was Robert Brown who discovered the nucleus in 1831.
3. Purkinje in 1839 had given the term 'protoplasm' for the fluid substances present in cell.
4. M. Schleiden (1838) and T. Schwann (1839) established cell theory.

* The Important points of Cell Theory :-

1. All living things are composed of cell or cell products.
2. All living cells arise from pre-existing cells.
3. All cells basically alike in chemical composition and metabolic processes.

4. All living organisms are made up of cells and cell cannot be seen with naked eye. It requires a microscope to observe cell.

Compound Microscope



• there are some organism made up of one cell while other cells bodies are made up of many cells. so. there are two types of cells on the basis of number of cells.

1. <u>Unicellular organisms</u>: The organisms whose body is made up of a single cell are called unicellular organisms.
Examples: Amoeba, Paramoecium, Bacteria, Euglena.

2. <u>Multicellular organisms</u>: Most of the organisms are made up of many cells known as multicellular organisms.
Examples: Most of plants and animals including human beings are contain multicellular cell.

★ In these organisms number of cells group together and perform different functions to form various body parts.

Cells
↓
Tissues
↓
Organs
↓
Organ System
↓
Organism

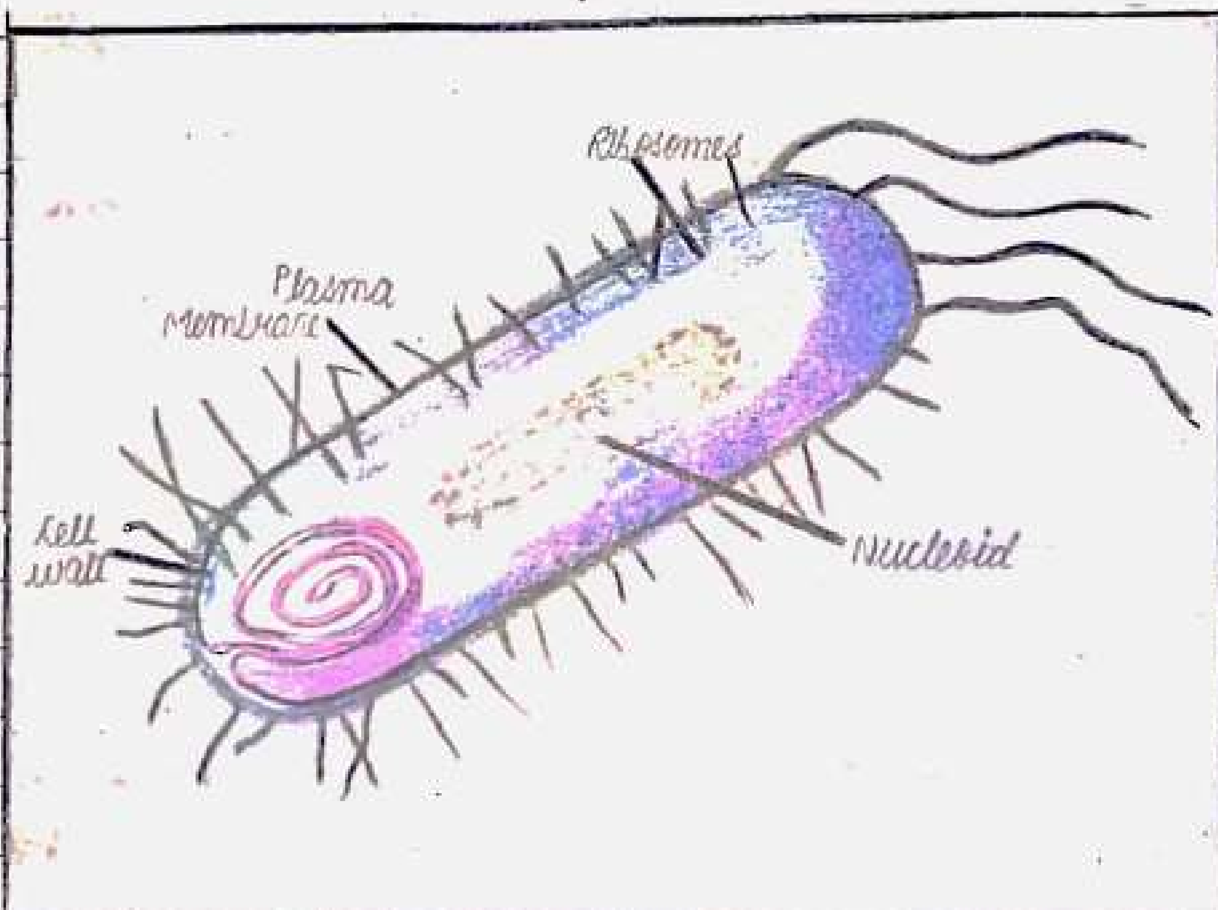
★ <u>Prokaryotic and Eukaryotic cells</u> :-

1. <u>Prokaryotic cells</u>: These include the most primitive organism such as bacteria and blue-green algae. These organisms tot lack nuclear membrane around their genetic material. These cells donot contain membrane bound

cell organelles like mitochondria, ER(endoplasmic reticulum) and golgi bodies etc.

- the nucleus without nuclear membrane is known as nucleoids.

<u>prokaryotic cell</u>



* <u>Eukaryotic cells</u>: these are the organisms which contain the nucleus and membrane - bound organelles.

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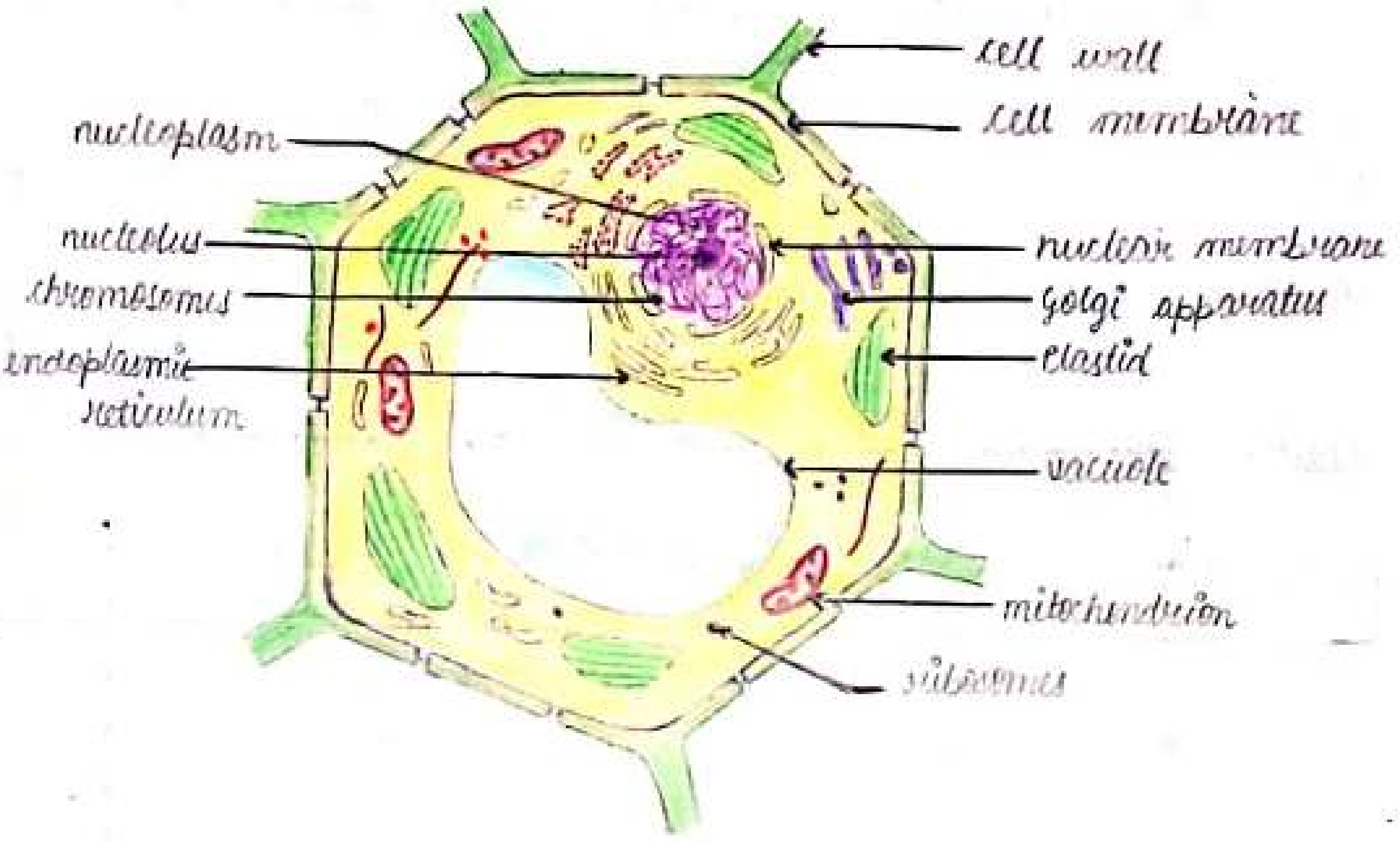
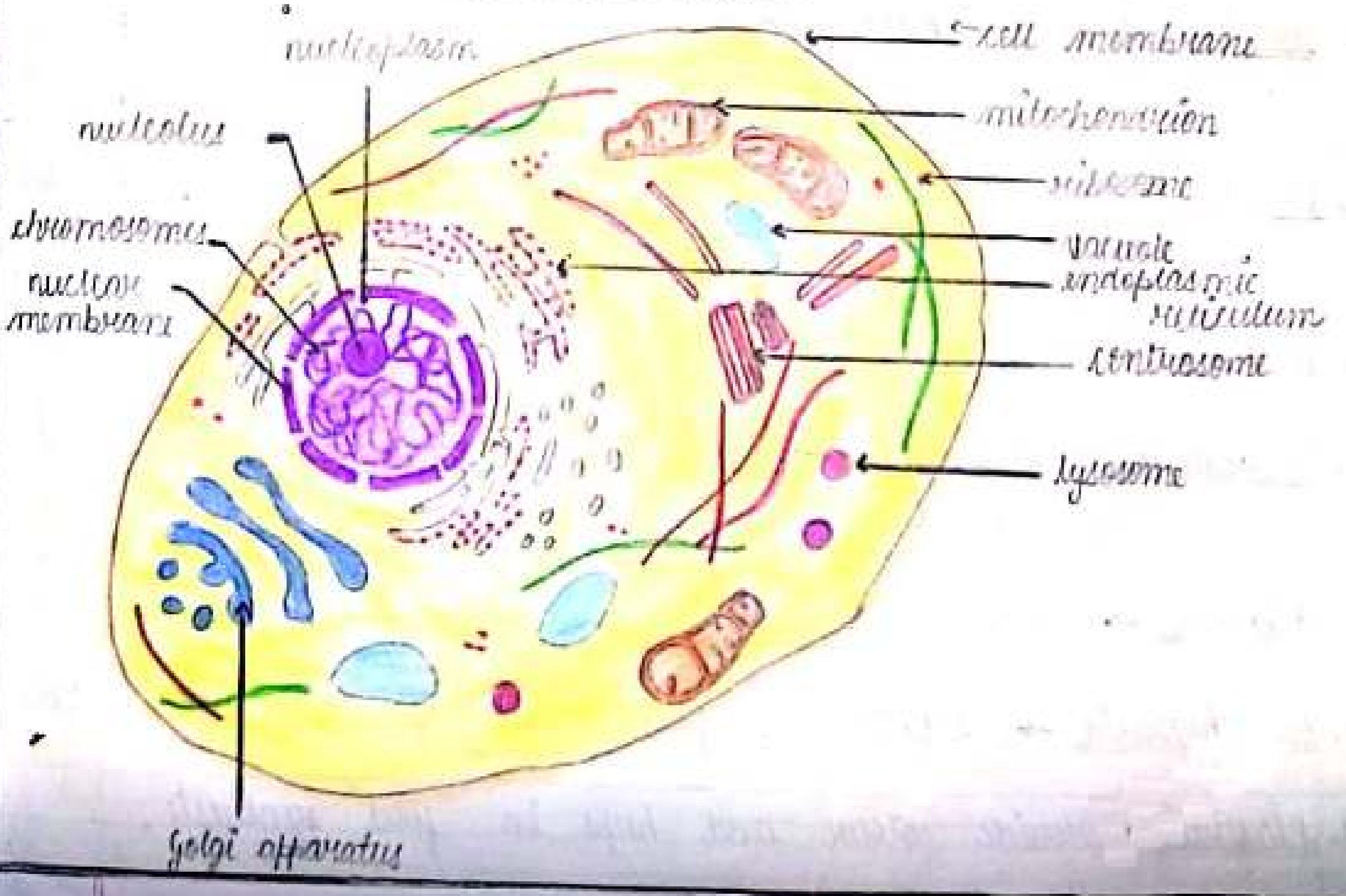
Plant Cell



Animal Cell



Prokaryotic cells	Eukaryotic cells
Size : generally small (1-10 um) 1 um = 10^{-6} m	Size : generally large (5-100 um).
Nuclear region is not well defined and known as nucleoid.	Nuclear region is well defined and surrounded by a nuclear membrane.
Chromosome: single .	More than one chromosome.
Membrane bound organelles are absent .	Membrane bound organelles are present.

Detailed structure of eukaryotic cell :-

A typical eukaryotic cell have following main components :

Non-living components	Living components
Cell wall (fungi & plants)	1. Plasma membrane
Vacuoles	2. Cytoplasm
Granules	3. Mitochondria
	4. Lysosomes
	5. Golgi bodies
	6. Endoplasmic reticulum
	7. Ribosomes

* **Plasma membrane :-** Each cell is surrounded by a covering called plasma membrane. It is ultrathin, elastic and semipermeable. It is made up of phospholipids and proteins.

Functions :-

1. It protects the cell from injury.
2. It gives proper shape to the cell.
3. It regulates the flow of selected materials in and out of the cell.

* **Cell wall :-** The plant cell have an additional thick but porous, protective coat outside the plasma membrane known as cell wall. Cell wall is made up of cellulose, pectin and some proteins.

Functions :-

1. It maintains the shape of the cell.
2. It protects the cell from mechanical injuries.
3. It provides mechanical support to the cell against gravity.

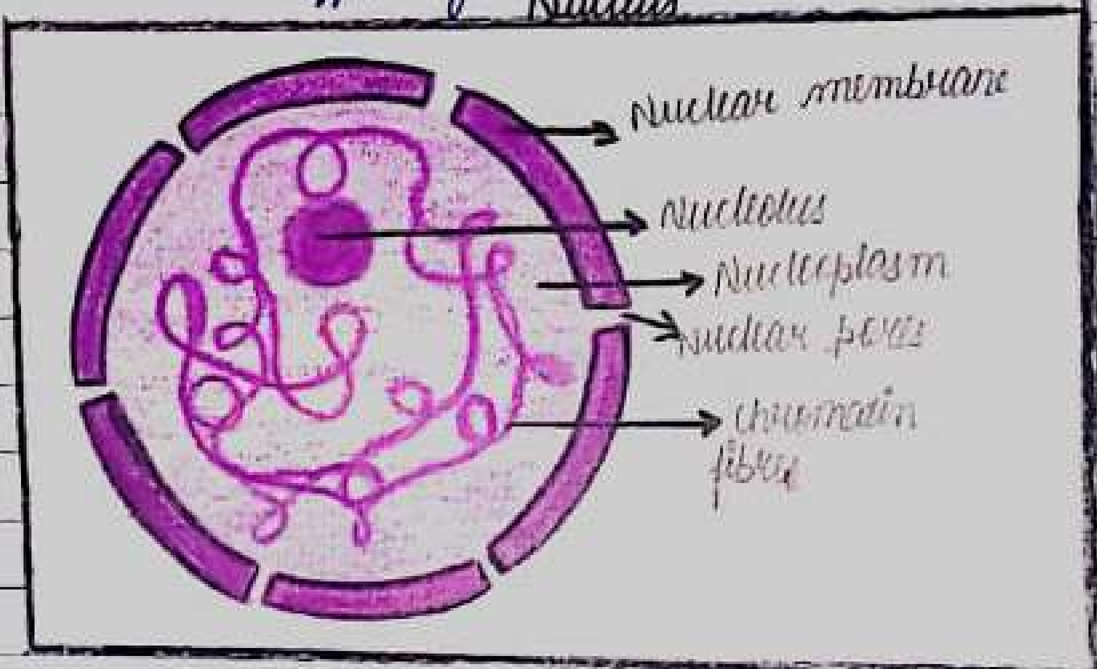
* **Nucleus :** It is the most important and largest organ of eukaryotic cell. Generally it is centrally located in animal cell ~~bu~~ while in plant cell it is pushed aside.

Nucleus is surrounded by a semipermeable nuclear membrane which contain a clear fluid material called nucleoplasm. In a nucleus one ~~or~~ or more rounded bodies are also present known as nucleolus.

Functions :-

1. It controls all the metabolic activities of the cell.
2. It helps in growth of the cell.
3. It helps in transmission of hereditary characteristics from parents to their offspring.

Nucleus



★ Cytoplasm :- The substance of a cell between the nucleus and the plasma membrane containing various cell organelles is called cytoplasm. It is a semi-fluid jelly like material.

Functions :-

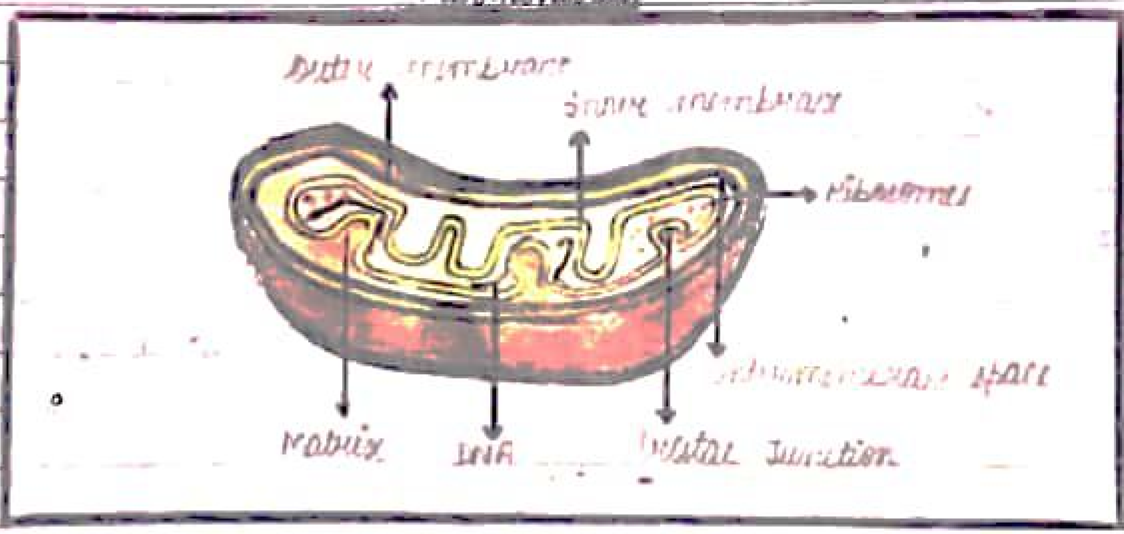
1. It act as the ~~shield~~ of sheet of metabolic activities.
2. It distributes the nutrients, enzymes and other materials in the cell.

inner membrane is present in the form of fold known as cristae. the jelly like fluid present in mitochondria is called matrix.

Functions:-

1. Mitochondria are the site of cellular respiration. here food ~~(starch)~~ (glucose) is oxidise by using oxygen to produce energy. This energy is stored in the form of ATP. because of this function mitochondria is called the power house of the cell.

Mitochondria



★ Plastids: Plastids are found only in plant cell and they are of three types:-

★ Chloroplasts: They are found in all given green plant they have green pigment called chlorophyll and involved in photosynthesis to produce / prepare food, so chloroplasts are called kitchen of the cell.

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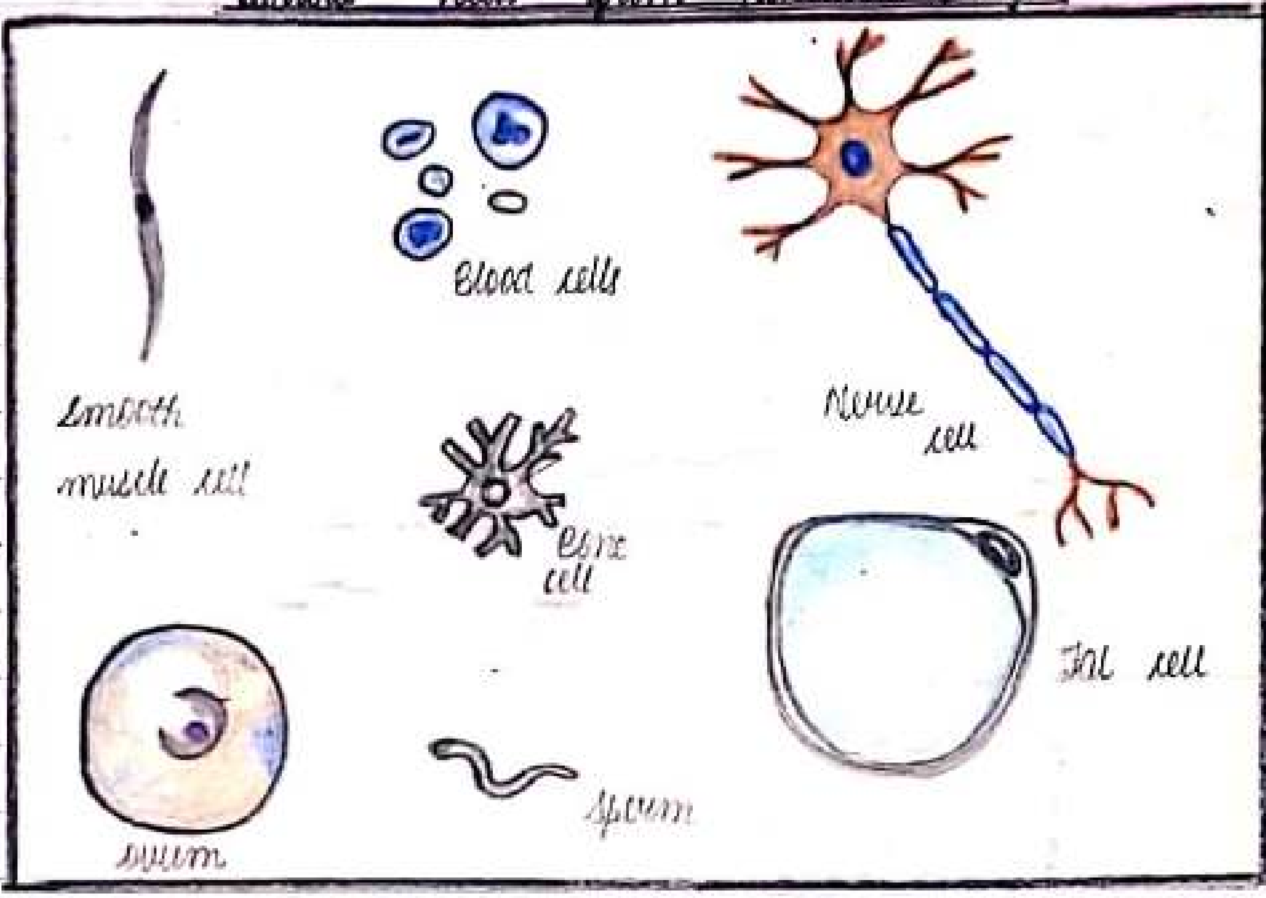
various cells from human body



★ Endoplasmic reticulum : It is an extensive network of inter-cellular membrane-bound tubes present in cytoplasm. The endoplasmic reticulum is of two types :

- Rough endoplasmic reticulum : It mainly consists of ribosomes attached on their surface. Hence, they look rough and help in protein synthesis.

- Smooth endoplasmic reticulum : It mainly consist of tubules and vesicles. It is well-developed and thin lipid formation.

Functions :-

1. Endoplasmic reticulum work as boney framework and maintains the shape of a cell.

2. The endoplasmic reticulum helps in the transportation of materials from one place to another place in the cell.

★ Golgi apparatus : It was discovered by Camillo Golgi in 1898. Golgi apparatus is present close to the nuclear membrane. The plant cell have many golgi bodies called dictyosomes.

Functions :-

1. It helps in packing of materials coming from ER.
2. Golgi apparatus also helps in synthesis of cell wall, plasma membrane and lysosomes.

★ Lysosomes : These are simple, tiny, spherical sac like structures present in cytoplasm. Lysosomes contain powerful digestive enzymes.

Functions :-

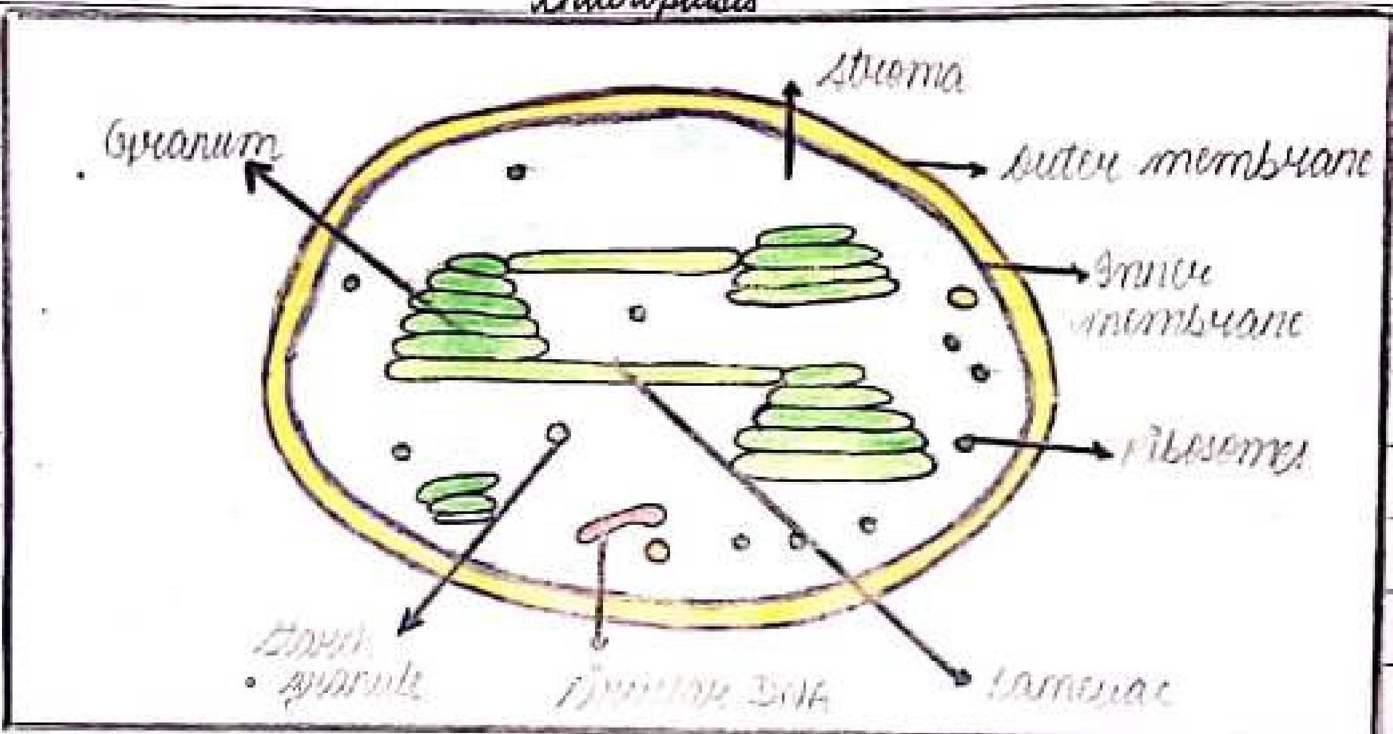
1. They destroy harmful bacteria and virus in the cell with the help of these enzymes, hence called digestive bags.
2. They also help in removing waste materials from the cell, so called cellular house keeper.
3. After collecting waste materials they come near the cell surface and burst, hence called suicidal bags.

★ Mitochondria : Each mitochondria is a double membrane bound structure present in cytoplasm. The

• **Chromoplasts:** They are coloured plastids and give various colours to fruits and flowers.

• **Leucoplasts:** They are colourless plastids and help to store food in the form of starch, fats and proteins.

Chloroplasts



★ **Vacuoles :-** They are fluid filled membrane bound storage sacs in animal cells. Vacuoles are small sized and more in number, while in plant cell only one larged sized vacuole is present.

Functions :-

1. It provides turgidity and rigidity to the cell.
2. Vacuoles store many important substances like amino acid, sugars and some proteins etc.

• **Ribosomes:** These are the dense, spherical and granular particles present in cytoplasm. They are also present on the surface of RER. Ribosomes plays an important role in the synthesis of proteins.

Transport of materials: Transport of materials across the cell membrane takes place by two processes:

1. Diffusion
2. Osmosis

• **Diffusion:** The process by which a substance uniformally spreads into another substance by the movement of particles from a region of higher concentration to the region of lower concentration is called diffusion.

Ex: when we spray perfume at one place its molecules spread nearby the area of diffusion and we can feel its smell.

* Diffusion is faster in gases in comparison to liquid state

• **Osmosis:** The movement of water or solvent molecules through a semi-permeable membrane from a region of higher water concentration to a region of lower water concentration is called osmosis.

Ex: when we put some dry raisins in water after some time they swell up because water entered in them by osmosis.

Types of solutions on the basis of concentration :-

- **Isotonic solution :** When the concentration of solution outside and inside the cell is same then is known as isotonic solution.

- **Hypotonic solution :** when the concentration of solution is more outside the cell in comparison to inside the cell then it's called hypotonic solution. or

- **Hypertonic solution :** ~~when the concentration of~~ solution that has a higher solute concentration compared to another solution is known as hypertonic solution.

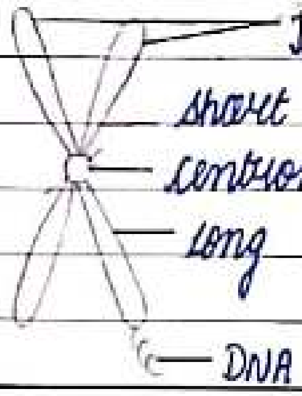
- **Hypotonic solution :** A solution that has lower solute concentration compared to another solution is known as hypotonic solution.

★ **Differentiate between :**

Plant Cell	Animal cell.
1. Cell wall is present.	1. Cell wall is absent.
2. Plastids are present.	2. Plastids are absent.
3. Centrosome is absent.	3. Centrosome is present.
4. Large Vacuoles are present.	4. Vacuoles are generally absent. If present they are small in size.
5. Cytoplasm is not as dense as in an animal cell.	5. Cytoplasm is dense.

★ **Chromosomes :-** chromosomes are thread like structures found inside the nucleus and visible at time of cell division.

Structures:-



Chromosome number :- there is a precise number of chromosomes typical for a given species, in any given asexually reproducing species the chromosome number is always the same. In sexually reproducing organisms the number of chromosome in the body cells is diploid (2n), twice the haploid number found in gametes.

Chromosomes numbers of some common organisms :-

	organisms	Body cell (2n)	Gametes (n)
1.	Human	46	23
2.	Garden pea	14	7
3.	Fruit fly	8	4
4.	Dog	78	39
5.	Cow	60	30
6.	Rabbit	44	22