Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

SUBJECT : SCIENCE
CLASS IX

Week : 1 February 6 February 2021

CHAPTER 2 : IS MATTER AROUND US PURE

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link is given below :
https://youtu.be/HoKG5Jqthk0
https://youtu.be/98jh1RS3GuM
https://youtu.be/2SNjYYyebeU

Learning outcomes

Each student will be able to :

1. Learn about pure substance
2. Difference between true solution , colloids , suspension
3. Mixtures and compounds
4. Tyndall effect
5. Physical and chemical properties

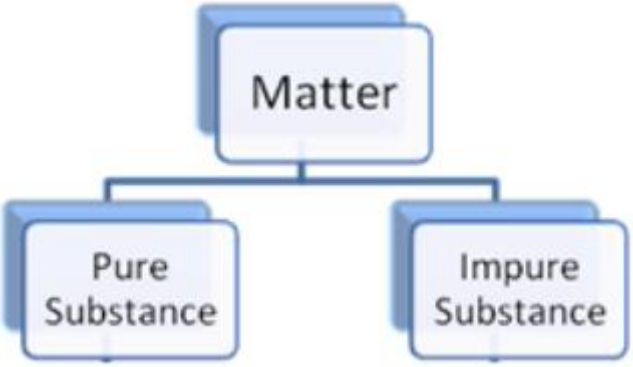
Sub topics :

- Pure substances
- Mixtures
- Difference between homogeneous and heterogeneous mixture
- True solutions , colloids and suspension
- Physical and chemical properties

LESSON DEVELOPMENT

What is a substance?

- Anything that cannot be broken into further particles by applying any physical processes is called a **Substance**.
- Matter can be classified into two types of substances – Pure substances and Mixtures



What is a pure substance?

A substance that consists of only one type of particle is called a **Pure Substance**. **For Example**, Diamond, Salt, Sulfur, Tin.

What is a mixture?

- When we combine different substances into each other a mixture is formed. **For Example**, Lemonade is a mixture of three substances, Lemon Juice, Sugar and Water.
- Which of these is a mixture or a pure substance?

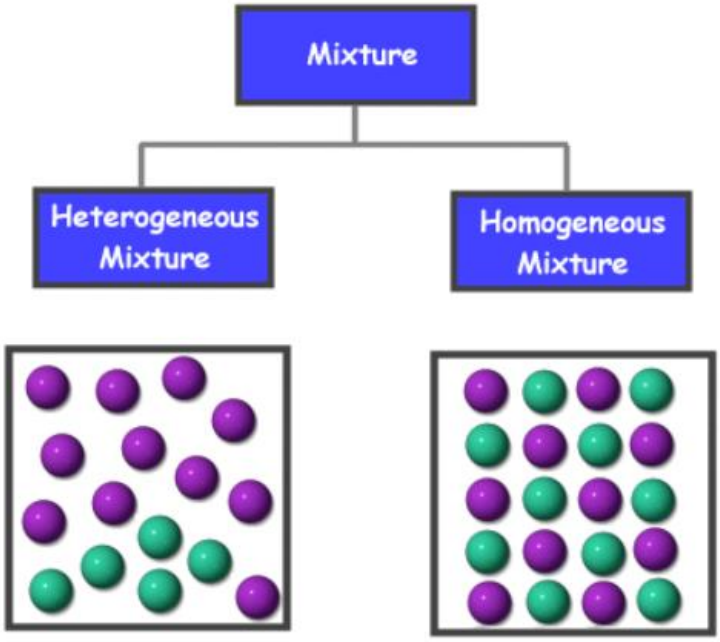
Water, Copper, Chocolate cake, Hydrogen, Soil, Air

Mixture – Chocolate cake, Soil, Air

Pure substance – Water, Copper, Hydrogen

Types of Mixtures

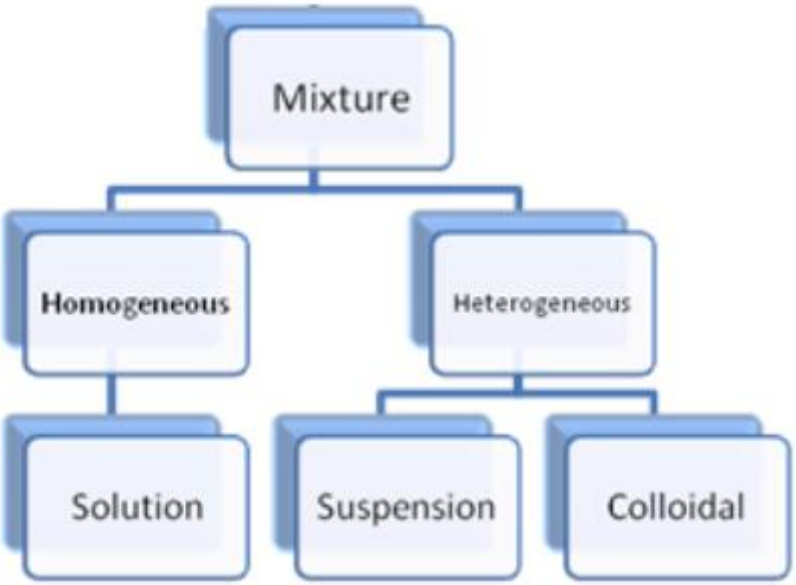
There are two categories of mixtures: Homogeneous Mixtures and Heterogeneous Mixtures



differences between homogeneous and heterogeneous mixtures –

Homogenous Mixtures	Heterogeneous Mixtures
They have a uniform composition throughout	They have a non-uniform composition
We cannot separate the components of the mixture through physical processes	We can separate the components through physical processes
Components cannot be seen through naked eyes	Components can easily be seen through naked eyes
The mixture is in single phase throughout	The substances can be of two different phases and we may see separate layers of the substances
Example: A mixture of water and milk	**Example**: A mixture of oil in water

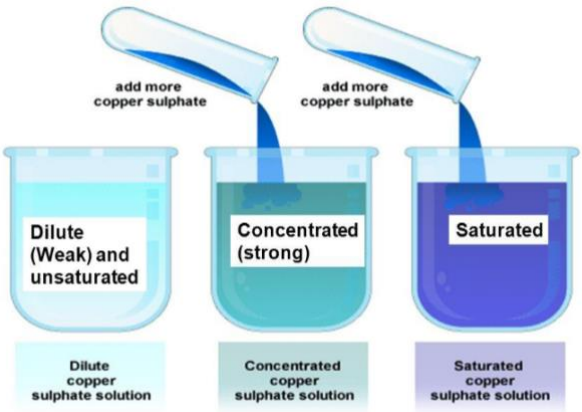
What is a solution?



A solution is nothing but a uniform mixture of two or more substances. Homogenous Mixtures are solutions.

Solution constitutes of two types of substances, a solute and a solvent.

<u>Solution = Solute + Solvent</u>



What is concentration?

C**oncentration** refers to the amount of a substance per defined space or can be defined as the ratio of solute in a solution to either solvent or total solution.

- **Percent by Mass** = (Mass of solute / Mass of solution) X 100
- **Percent by Volume** = (Volume of solute / Volume of solution) X 100

What is a suspension?

A suspension is formed when two or more substances are mix in a non-uniform manner. Heterogeneous mixtures are suspensions. The solute does not mix with the solvent and can be viewed through naked eyes.

Properties of Suspensions:

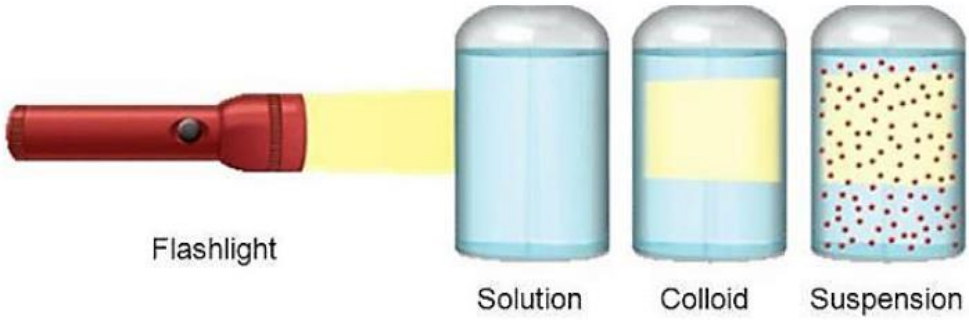
- A suspension is a heterogeneous mixture.
- We can see the particles of suspensions through naked eyes.
- We can see the path of light through the particles of a suspension.
- The particles of suspension tend to settle down when left undisturbed. Then, they can be separated using filtration.

What are colloids or colloidal solutions?

A colloidal solution or a colloid is a uniform solution of two or more substances. The particles are relatively very small that the solution appears as a homogeneous mixture but it is not.

Properties of colloids:

- Colloids are heterogeneous in nature.
- The particles of a colloid cannot be seen through naked eyes.
- The particles scatter a beam of light passed through a colloid and produce Tyndall effect.
- Colloids are stable in nature. The particles of colloids do not settle down if left uninterrupted.
- We cannot separate the particles of a colloid through filtration. We use a method called **Centrifugation** to separate the particles of a colloid.



What is the Tyndall Effect?

When a beam of light is passed through a colloid the particles of the colloid scatter the beam of light and we can see the path of light in the solution. **For Example**, when a ray of light enters a dark room it is scattered by the dust particles present in the air and we can see the path of light clearly.


Classification of Colloids

Dispersed Phase – The dispersed particles or the solute-like components in a colloid

Dispersing Medium – The substance in which these solute-like particles are added

Based on the state of the dispersing medium colloids are classified as:

How to separate components of a mixture?

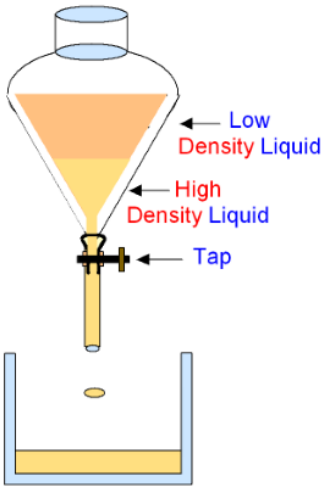
1. Evaporation – For separating a mixture of a non-volatile and a volatile substance

- **Applications:**
  - Separating coloured component from the ink
  - Salt from water
  - Sugar from Water
- **Method:**
  - Mix some ink into water and heat it. After some time the water will evaporate leaving behind the coloured substance.

2. Centrifugation – Separating dense particles from lighter particles

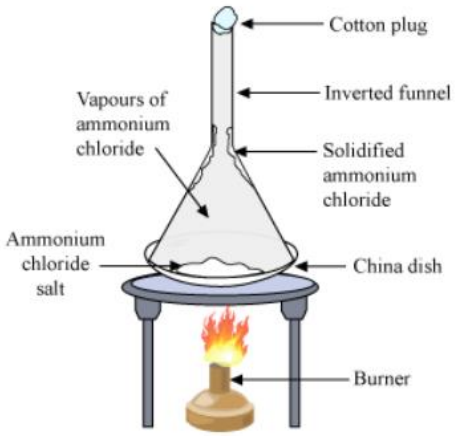
- **Applications:**
  - Separating milk from cream
  - Separating butter from cream
  - Squeezing out water from wet clothes
- **Method:**
  - Milk is put in a centrifuging machine or milk churner and the cream thus separates from milk.

3. Using a Separating funnel – To separate two immiscible liquids



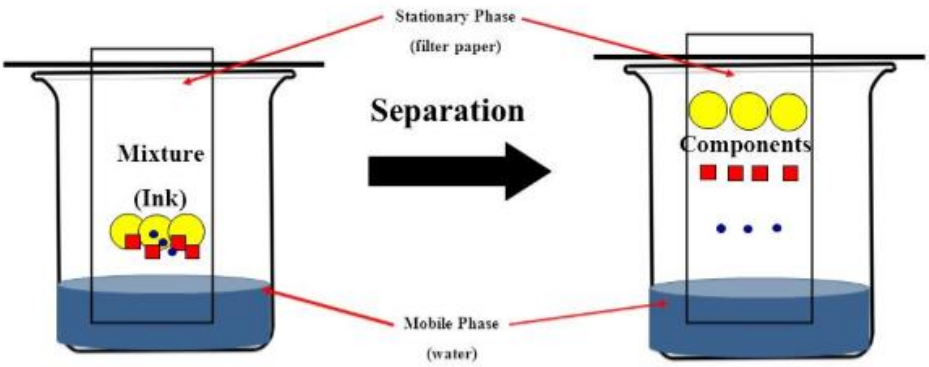
- **Applications:**
  - Oil from water
  - Iron and iron ore
- **Method:**
  - The immiscible liquids are allowed to settle in the funnel. They soon form separate layers due to varying densities. The first liquid is allowed to flow out of the funnel and as soon as it is completely poured out, the stopcock is closed thereby separating the two liquids from each other.

4. Sublimation – To separate a sublimable component from a non-sublimable component



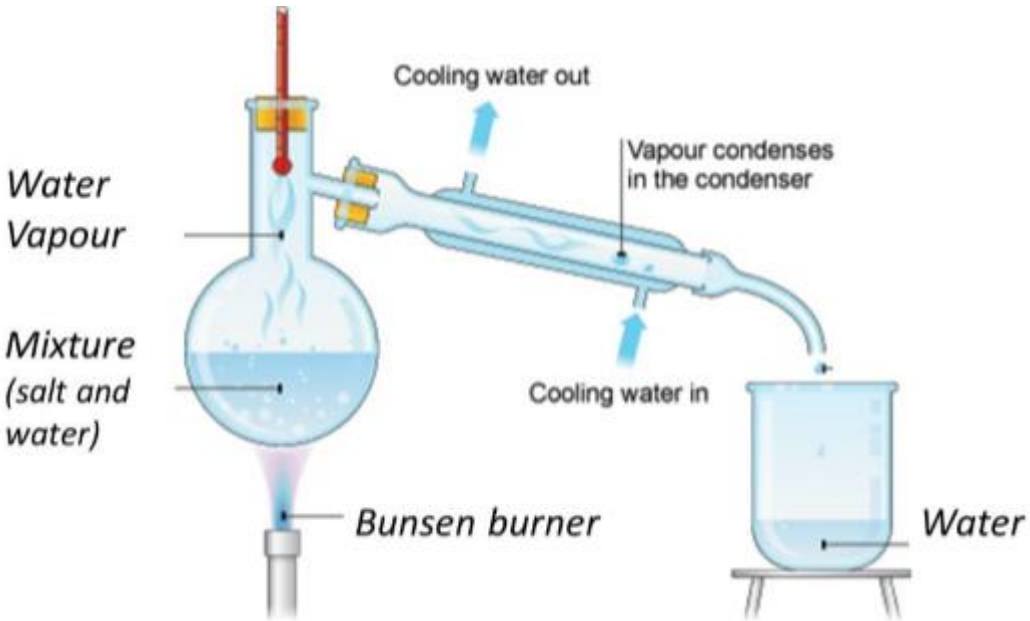
- **Applications:**
  - Ammonium chloride / camphor / naphthalene and salt
- **Method:**
  - Heat the mixture in an inverted funnel so that the sublimable component sublimes in the air and settles over the walls of the funnel and the non-sublimable component, on the other hand, is left behind.

5. Chromatography – To separate solutes that can dissolve in the same solvent



- **Applications:**
  - Separating colour components of a dye
  - Drugs from blood
- **Method:**
  - Take a filter paper or a blotting paper and place a drop of ink at the rear end. Dip the end in water. Since ink is a mixture of two or more colors, the component of ink which is soluble in water mixes into it and then separates quickly from the other components that are less soluble in water.

6. Distillation – To separate miscible liquids (the boiling points of the liquids must be sufficiently different)



- **Applications:**
  - Acetone and water
- **Method:**
  - The mixture is heated in a distillation apparatus. The one substance with lower boiling point evaporates first, condenses and gets separated from the one with a higher boiling point.
  - **Simple Distillation** – when the miscible liquids have a satisfactory difference in their boiling points
  - **Fractional Distillation** – when the difference between the boiling points of the liquids is less than 25 K

Separating different Gases from the Air

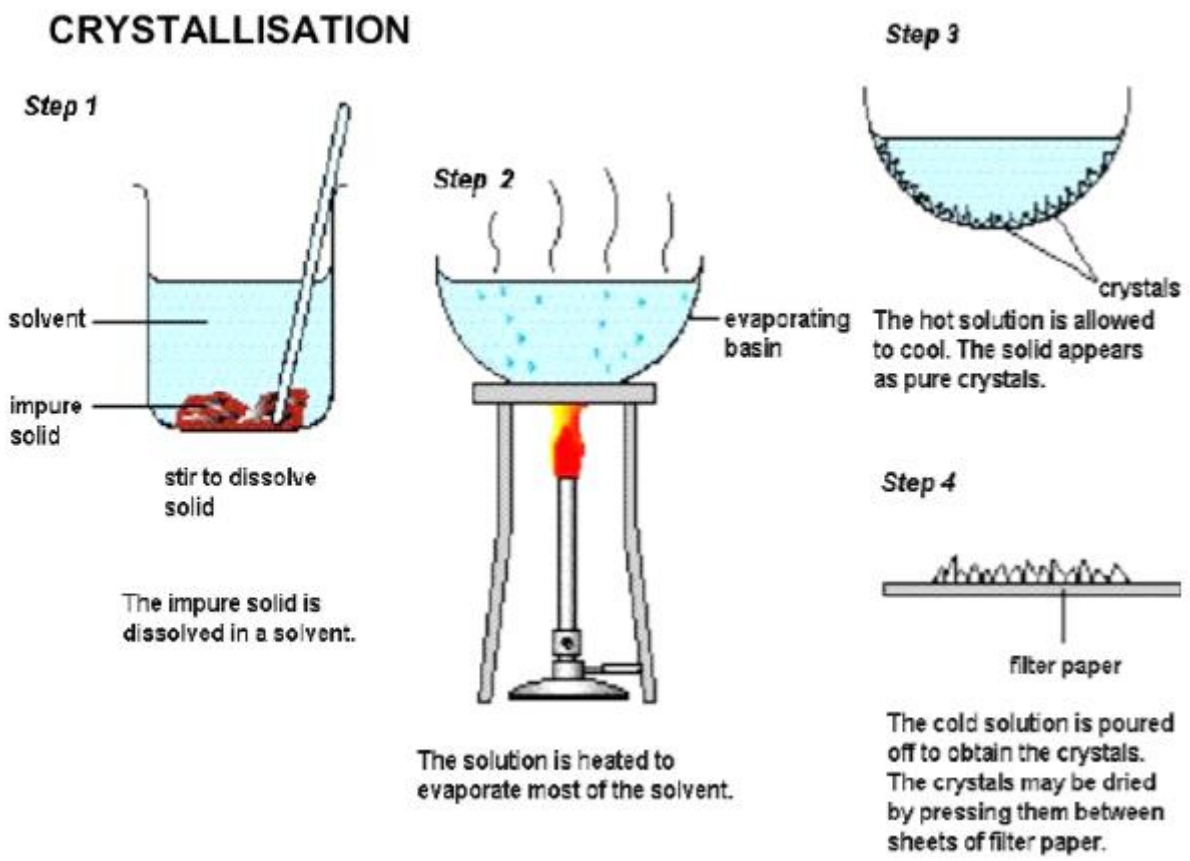
Method – Fractional Distillation

- Compress and cool the air by increasing the temperature and decreasing the pressure. The air turns to liquid air.
- Liquid air is warmed up slowly in a fractional distillation apparatus
- The several components of air get separated and are collected at various heights on the basis of their boiling points

Purifying Solids

Method used – Crystallization

In the crystallization method, we can obtain a pure solid in the form of crystals from its solution



- **Applications:**
  - Salt from sea water
  - Purification of copper sulphate
- **Method:**
  - The impurities of a substance are filtered out.
  - Water is evaporated to obtain a saturated solution.
  - The solution is covered with filter paper and left as it is.
  - After some time, the crystals of pure solid are formed.
- **Is evaporation better than crystallization?**

Simple evaporation is not better than crystallization because:

1. Some solid substances decompose because of excess heat. **For Example**, Sugar gets charred on extra heating.

2. If after filtration some impurities remain in the solution they can contaminate the solid and therefore we would not obtain a pure substance.

Physical Change and Chemical Change

Physical Property of a Substance:

Properties of a substance such as rigidity, colour, fluidity, boiling point, melting point, density and hardness which we can observe are called as **Physical Properties**.

Physical Change:

When physical properties of a substance change it is known as a **Physical Change**. When we convert a substance from one state to another, such as a solid into a liquid or vice-versa, it is also a physical change as only the physical nature of the substance changes without affecting its chemical nature.

For Example, Change of ice into water. The chemical properties of water remain the same.

Chemical Property of a Substance:

The chemical nature of a substance is known as its **Chemical Property** such as its odour or its chemical composition.

Chemical Change:

When the chemical properties or chemical composition of a substance gets altered it is called a chemical change. It is also called as a **Chemical Reaction**.

For Example, Burning of paper

Mixtures vs. Compounds

Mixtures	Compounds
Properties of a mixture Reflect the properties of the materials it contians.	Different properties from that of the elements that make up the compounds.
No uniform composition	Definite composition. Definite ratio/formula
Can be separated by physical means.	Cannot be separated by physical means.

ASSIGNEMENT

1) Which of the following statements are true for pure substances?
(i) Pure substances contain only one kind of particles
(ii) Pure substances may be compound or mixtures
(iii) Pure substances have the same composition throughout
(iv) Pure substances can be exemplified by all elements other than nickel
(a) (i) and (ii)
(b) (i) and (iii)
(c) (iii) and (iv)
(d) (ii) and (iii)

2) Tincture of iodine has antiseptic properties. This solution is made by dissolving
(a) iodine in potassium iodide
(b) iodine in vaseline
(c) iodine in water
(d) iodine in alcohol

3) Which of the following are homogeneous in nature?
(i) ice
(ii) wood
(iii) soil
(iv) air
(a) (i) and (iii)
(b) (ii) and (iv)
(c) (i) and (iv)
(d) (iii) and (iv)

4) In a water-sugar solution
(a) water is solute and sugar is solvent
(b) water is solvent and sugar is solute
(c) water is solute and water is also solvent
(d) none of these

5) Which of the following are physical changes?
(i) Melting of iron metal
(ii) Rusting of iron
(iii) Bending of an iron rod
(iv) Drawing a wire of iron metal
(a) (i), (ii) and (iii)
(b) (i), (ii) and (iv)
(c) (i), (iii) and (iv)
(d) (ii), (iii) and (iv)

6) Which of the following methods would you use to separate cream from milk?
(a) Fractional distillation
(b) Distillation
(c) Centrifugation
(d) Filtration

7) Differentiate between a true solution and a colloid.

8) You are provided with a mixture containing sand, iron filings, ammonium chloride and sodium chloride. Describe the procedures you would use to separate these constituents from the mixture

9) A solution of urea in water contains 16 grams of it in 120 grams of solution. Find out the mass percentage of the solution.

10) A solution has been prepared by mixing 5.6 mL of alcohol with 75 mL of water. Calculate the percentage (by volume) of alcohol in the solution.

11) Calculate the mass of water and glucose required to make 250 g of 40% solution of glucose.
Solution:

12) Name the process associated with the following:

(a) Dry ice is kept at room temperature and at one atmospheric pressure.

(b) A potassium permanganate crystal is in a beaker and water is poured into the beaker with stirring.

(c) An acetone bottle is left open and the bottle becomes empty.

(d) Milk is churned to separate cream from it.

(e) Settling of sand when a mixture of sand and water is left undisturbed for some time.

(f) Fine beam of light entering through a small hole in a dark room, illuminates the particles in its paths.

13) What are the two components of a colloidal solution?

14) How can you change a saturated solution to an unsaturated solution without adding any more solvent to it

15) Identify colloids and true solutions from the following:

Pond water, fog, aluminium paint, vinegar and glucose solution.

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SUBJECT : SCIENCE
CLASS IX

CHAPTER 5 : THE FUNDAMENTAL UNIT OF LIFE

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Instructional Aids / Resources

NCERT Link is given below :
https://youtu.be/ee58VOxeykM
https://youtu.be/ij3qHqY2KFw
https://youtu.be/YB9o6Jg1EuM

Learning outcomes

Students will able to learn

- About cell
- Cell organelle
- Functions of cell organelle

Sub topics :

- Cell
- Difference between plasma membrane and cell wall
- Various cell organelle
- Functions of cell organelle
- Chromosomes

LESSON DEVELOPMENT

The Fundamental Unit of Life

Discovered By	Period of time	What they discovered?
Robert Hooke	1665	noticed the presence of cells in a cork slice
Leeuwenhoek	1674	found the presence of living cells in the pond water
Robert Brown	1831	recognized the existence of a nucleus in the cell
Purkinje	1839	invented the term 'Protoplasm' which is the liquid present in a cell
Schleiden and Schwann	1838, 1839	presented the cell theory that all organisms are actually made up of cells
Virchow	1855	suggested that all cells come from cells that already exist in nature

The Cell Theory

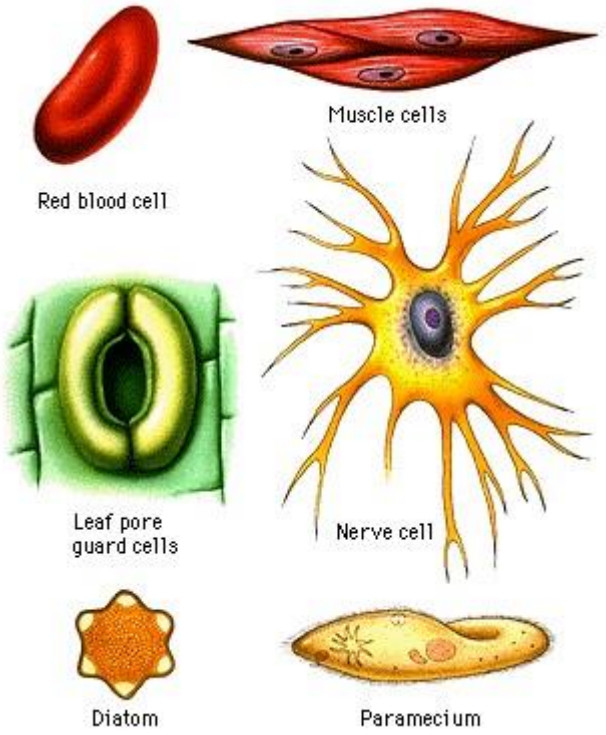
1. A cell is the structural and functional unit of all living organisms.
2. All the living organisms are made up of cells.
3. Cells are formed from pre-existing cells.

Q 1 what are unicellular and multicellular organisms

- **Unicellular Organisms** – The organisms that consist of a single cell such as***Amoeba***.
- **Multicellular Organisms** – The organisms which contain various cells that perform different functions in the organism such as plants fungi and animals

The Shape of the Cell

- The shape of the cell may vary depending upon the type of function they perform in an organism.
- Cells are capable of changing their shape. For example, the white blood cells and amoeba can change shapes on their own.



A cell contains three features –

- The Plasma Membrane
- Nucleus
- Cytoplasm

Q 2 difference between plasma membrane and cell wall

Plasma Membrane	**Cell Wall**
•Plasma membrane is the outermost covering of the cell that separate the content of the cell from its external environment	•Plant cells, in addition to the plasma membrane have another rigid outer covering called cell wall

•Plasma membrane is flexible and is made up of organic molecules called lipids and protein	Cell wall is consist of cellulose

Q3 How can substances move in and out of a cell?

OR Explain diffusion and osmosis

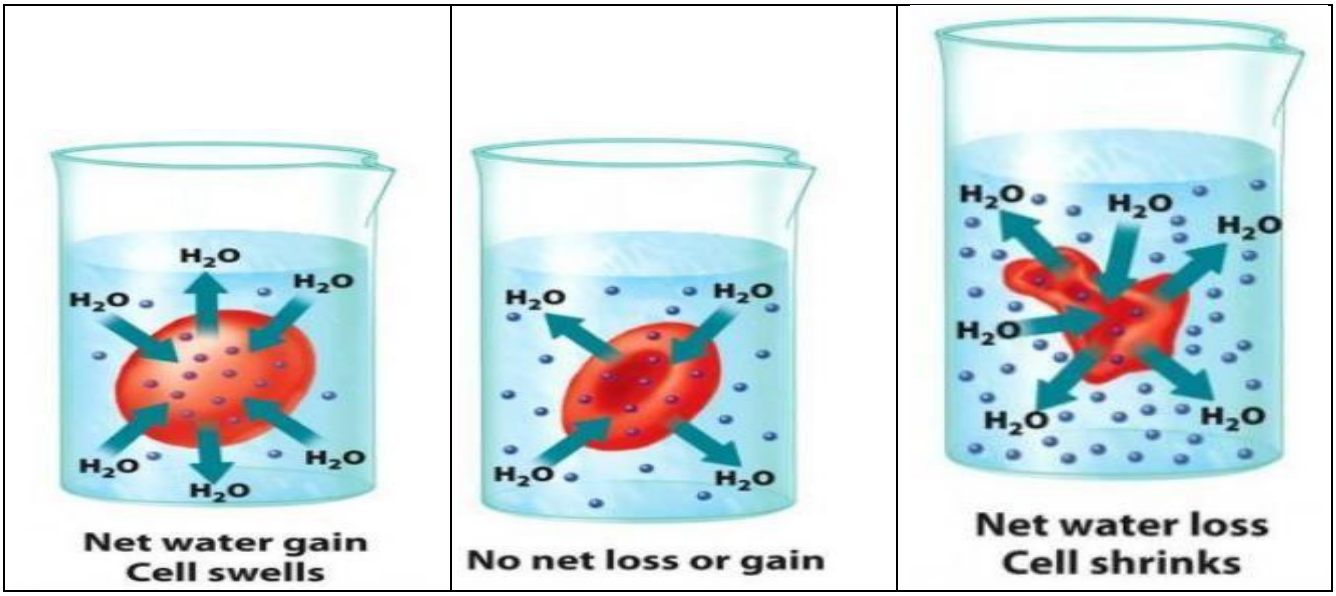
Spontaneous movement of substances like CO_2 and O_2 gas from a region of high concentration to a region where its concentration is low is called **diffusion**

Role of Diffusion
Diffusion play an important role in gaseous exchange between cell as well as cell and its external environment

. **Osmosis** is a process in which water moves from the region of high concentration to one where its concentration is low through a semi permeable membrane.

Q 4 Difference between hypertonic solution hypotonic solution, isotonic solution

Hypotonic Solutions	**Isotonic Solutions**	**Hypertonic Solutions**
•If the concentration of water outside the cell is higher than the concentration of water inside the cell , the cell gains water by the process of	•If the cells are put in an environment which has similar concentration of water as present inside. There will be no net movement	•If the cells are kept in an environment which has lower concentration of water than what is present inside the cells then due to the
osmosis , which results in swelling of the cells.	of water across the cell membrane that is amount of water going in is same as amount of water going out .	process of osmosis water moves out of the cells. •This results in a decrease in size of the cells (they shrink) as more amount of water comes out of the cell.



Q 5 What is Endocytosis?

It is a process by which the plasma membrane engulfs food and other materials inside the cell from external environment. Amoeba acquires its food through such process

Q 6 What is plasmolysis?

When are living plant cell loses water through Osmosis there is shrinkage for contraction of the contents of the cell away from the cell wall. This phenomena is known as plasmolysis **Q 7 Can dead cells absorb water**?

No, dead cells cannot absorb water through osmosis.

Q 8 How plants, fungi, and bacteria can exist in hypotonic medium? Plants, fungi, and bacteria exist in such situations because of their rigid cell membranes. Even if the cells swell up the cell membrane is able to prevent them from bursting out

Q 9 explain structure of nucleus

The Nucleus

Nucleus is a prominent, organelle present in cell which is the controlling centre of all activities of cell.

The Structure of the Nucleus

- A nucleus has a nuclear membrane which covers it all around.
- There are pores present on the nuclear membrane that allow movement of substances in and out of the nucleus.
- There are chromosomes, rod-shaped structures present in the nucleus which contain genetic information.

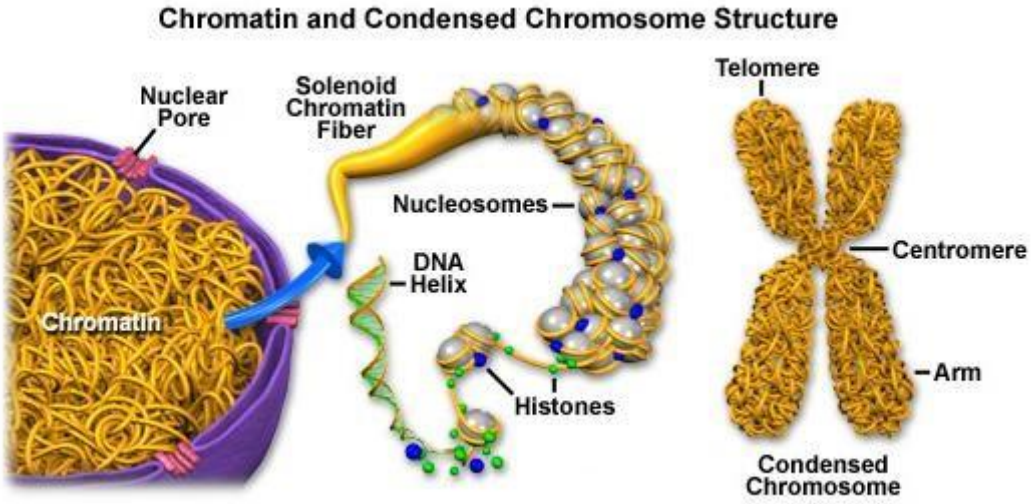
The chromosomes contain two types of things -

1. **DNA** - This is responsible for organizing and constructing new cells

2. **Proteins -** These help in packaging and condensation of DNA.

Chromatin

Chromatin is thread-like material present in a cell. The chromatin organizes itself into chromosomes whenever the cell is about to divide.



Q 10 What is a nucleoid?

Sometimes cells do not have a well-defined nucleus because they lack a nuclear membrane. Such a nucleus with no definite nuclear boundaries is called a **NucleoidQ 11 What are the prokaryotes?** Organisms whose cells do not have a definite cell membrane are called **Prokaryotes**. **Q12 What are eukaryotes?**

Organisms whose cells contain a well-defined nuclear membrane are called **Eukaryotes**.

Q13 define cytoplasm and its function Cytoplasm

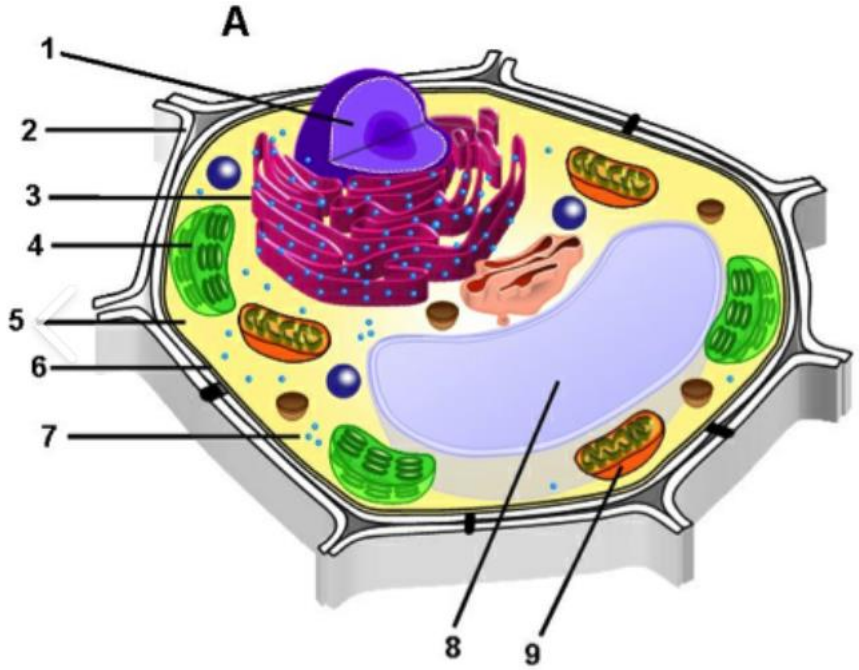
- The plasma membrane has a fluid like substance in it which is called the cytoplasm.
- The cytoplasm contains several organelles that can perform distinct functions of the cell

Functions of Cytoplasm

- It supports and suspends the cell organelles and molecules.
- The cellular processes occur in cytoplasm such as formation of proteins.
- It allows movement of substances in the cell such as hormones.
- It dissolves cellular wastes.

ASSIGNMENT

1. What are the colours absorbed by plants? The green light of the sunlight is blocked. How will the photosynthesis be affected?
2. Draw a labelled diagram of mitochondria. Write the functions of mitochondria.
3. Draw a neat labelled diagram of an animal cell.
4. Differentiate between rough and smooth endoplasmic reticulum
5. Differentiate between diffusion and osmosis.
6. If you are provided with some vegetables to cook, you generally add salt into the vegetables. After adding salt, vegetables release water. Why
7. Why is the Golgi apparatus called the secretary organelle of the cell?
8. There would be no plant life if chloroplasts did not exist. Justify.
9. Name a cell organelle which is non-membranous
10. Which organelles other than nucleus contain DNA?
11. What are chromosomes made up of?
12. Which organelle serves as a channel for transport of materials between cytoplasm and nucleus?
13. Which organelle is involved in the formation of lysosomes?
14. Cell wall is made up of which component?
15. LABEL IT



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SUBJECT : SCIENCE
CLASS IX

Week : 8 February to 13 February 2021

CHAPTER 8 : MOTION

Guidelines

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Instructional Aids / Resources

NCERT Link for chapter is given below :
https://youtu.be/ee58VOxeykM
https://youtu.be/ij3qHqY2KFw
https://youtu.be/YB9o6Jg1EuM

Learning outcomes

Students will able to learn about motion and its different type

Sub topics :

- Motion
- Types of motion
- Equation of motion
- Graphical method
- Circular motion

LESSON DEVELOPMENT

A Reference Point is used to describe the location of an object. An object can be referred through many reference points.

- Origin – The reference point that is used to describe the location of an object is called Origin.
- For Example, a new restaurant is opening shortly at a distance of 5 km north from my house. Here, the house is the reference point that is used for describing where the restaurant is located.

What is motion?

If the location of an object changes with time the object is said to be in motion.

Motion in a Straight Line

Distance – The distance covered by an object is described as the total path length covered by an object between two endpoints.

Distance is a numerical quantity. We do not mention the direction in which an object is travelling while mentioning about the distance covered by that object.

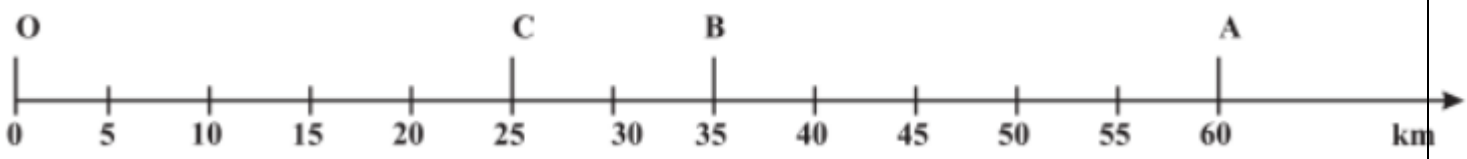


Figure 1 – Distance and Displacement

According to the figure 1 given above, if an object moves from point O to point A then total distance travelled by the object is given as 60 km.

Displacement – The shortest possible distance between the initial and final position of an object is called Displacement.

Consider the figure 1 given above, here the shortest distance between O and A is 60 km only. Hence, displacement is 60 km.

Displacement depends upon the direction in which the object is travelling.

Displacement is denoted by Δx.

$$\Delta x = x_f - x_0$$

Where,

x_f = Final position on the object

x_0 = Initial position of the object

Zero Displacement – When the first and last positions of an object are same, the displacement is zero.

For Example, consider the diagrams given below.

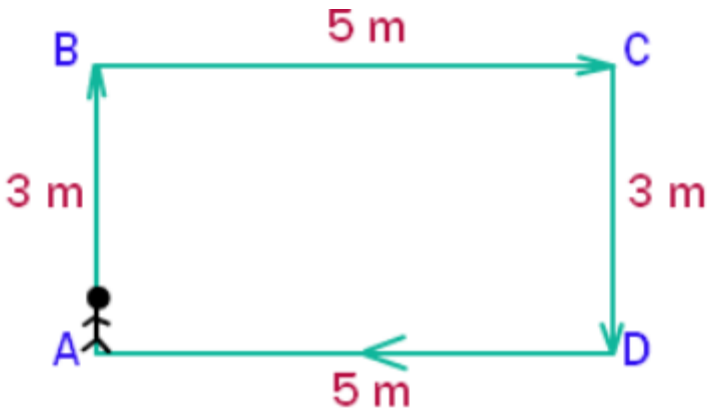


Figure 2 – Example for zero displacement

Displacement at point A = 0 because the shortest distance from A to A is zero.

Negative Displacement and Positive Displacement

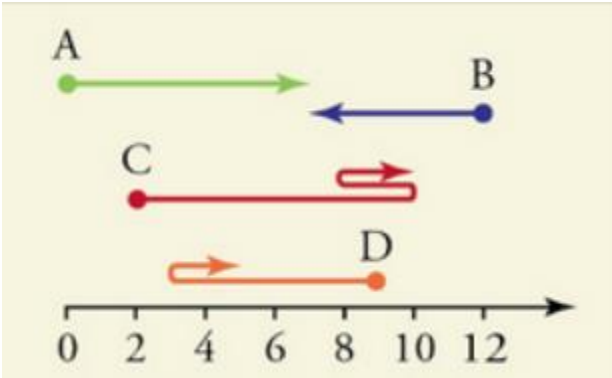


Figure 3 – Example for negative and positive displacement

Here, displacement of object B is negative

$\Delta B = B_f - B_0 = 7–12 = – 5$

A negative sign indicates opposite direction here.

Also, displacement of object A is positive

$\Delta A = A_f - A_0 = 7– 0 = 7$

What are Scalar and Vector Quantities?

- A scalar quantity describes a magnitude or a numerical value.
- A vector quantity describes the magnitude as well as the direction.
- Hence, distance is a scalar quantity while displacement is a vector quantity.

How is distance different from displacement?

Distance	Displacement
Distance provides the complete details of the path taken by the object	Displacement does not provide the complete details of the path taken by the object
Distance is always positive	Displacement can be positive, negative or zero
It is a scalar quantity	It is a vector quantity

The distance between two points may not be unique	Displacement between two points is always unique

What is uniform motion?

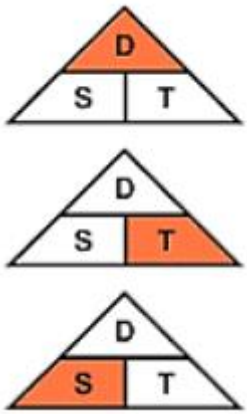
When an object travels equal distances in equal intervals of time the object is said to have a uniform motion.

What is non-uniform motion?

When an object travels unequal distances in equal intervals of time the object is said to have a non-uniform motion.

- Speed of an object is defined as the distance traveled by the object per unit time.

SI Unit: Meter (m)
Symbol of Representation: m/s or ms^{-1}
Speed = Distance/Time



Distance = Speed x Time

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

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

- Average Speed – If the motion of the object is non-uniform then we calculate the average speed to signify the rate of motion of that object.

$$\text{Average Speed} = \frac{\text{Total Distance Travelled}}{\text{Total Time taken}}$$

For Example, If an object travels 10m in 3 seconds and 12m in 7 seconds. Then its average speed would be:

Total distance travelled = 10 m + 12 m = 22m

Total Time taken = 3s + 7s = 10s

Average speed = 22/10 = 2.2 m/s

- To describe the rate of motion in a direction the term velocity is used. It is defined as the speed of an object in a particular direction.

Velocity = Displacement/Time
SI Unit: Meter (m)

Symbol of Representation: M/s or ms^{-1}

Average Velocity (in case of uniform motion)-

Average Velocity = (Initial Velocity + Final Velocity)/2

Average Velocity (in case of non-uniform motion)-

Average Velocity = Total Displacement / Total Time taken

What are instantaneous speed and instantaneous velocity?
The magnitude of speed or velocity at a particular instance of time is called Instantaneous Speed or Velocity.

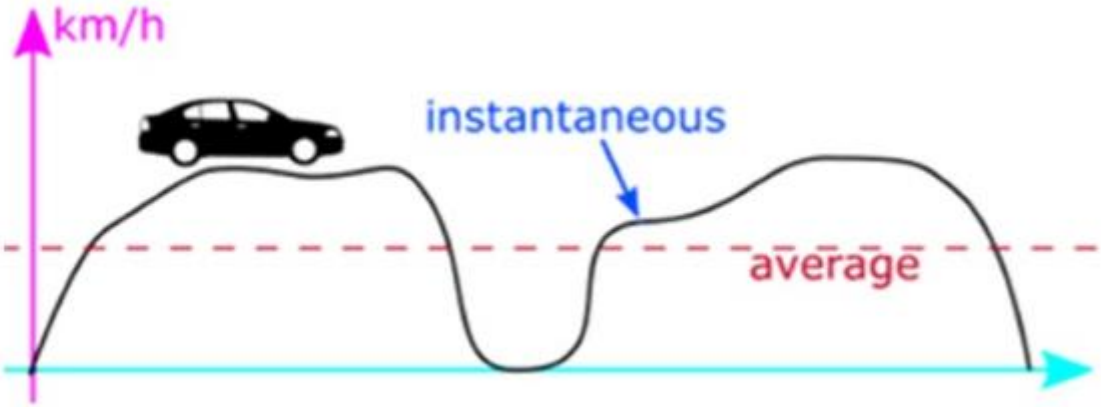


Figure 4 - Instantaneous Speed / Velocity

Uniform Motion – In case of uniform motion the velocity of an object remains constant with change in time. Hence, the rate of change of velocity is said to be zero.
Non-uniform Motion – In case of non-uniform motion the velocity of an object changes with time. This rate of change of velocity per unit time is called Acceleration.

Acceleration = Change in velocity/ Time taken
SI Unit: m/s^2

Uniform Acceleration – An object is said to have a uniform acceleration if:

- It travels along a straight path
- Its velocity changes (increases or decreases) by equal amounts in equal time intervals

Non - Uniform Acceleration – An object is said to have a non-uniform acceleration if:

- Its velocity changes (increases or decreases) by unequal amounts in unequal time intervals

Acceleration is also a vector quantity. The direction of acceleration is the same if the velocity is increasing in the same direction. Such acceleration is called Positive Acceleration.
The direction of acceleration becomes opposite as that of velocity if velocity is decreasing in a direction. Such acceleration is called Negative Acceleration.
De-acceleration or Retardation – Negative acceleration is also called De-acceleration or Retardation

Graphical Representation of Motion

1. Distance – Time Graph

It represents a change in position of the object with respect to time.

The graph in case the object is stationary (means the distance is constant at all time intervals) – Straight line graph parallel to x = axis

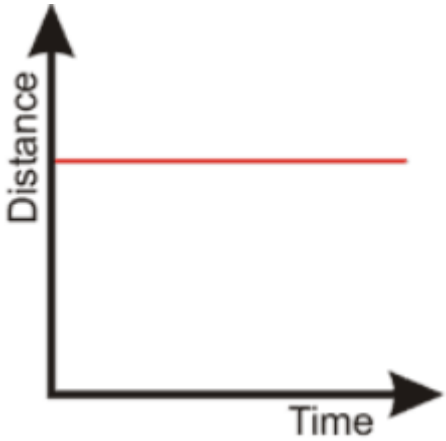


Figure 5 - Distance-time Graph in case of Stationary object

The graph in case of uniform motion – Straight line graph

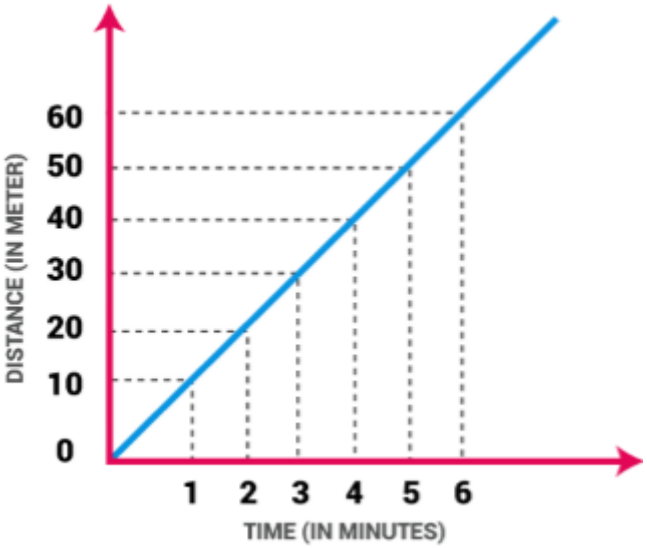


Figure 6 - Distance-time Graph in Uniform Motion

The graph in case of non-uniform motion – Graph has different shapes

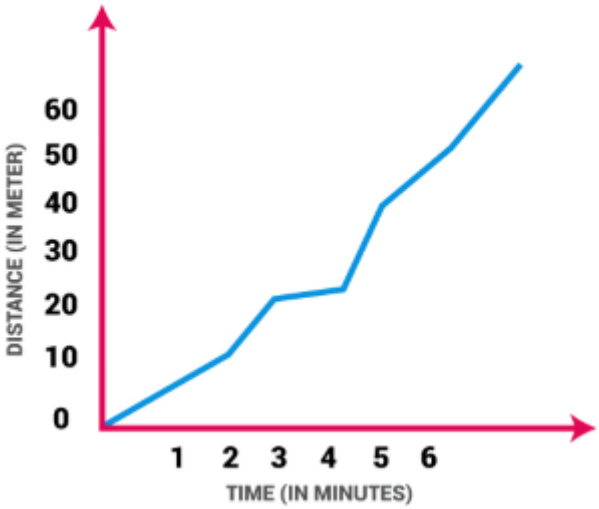
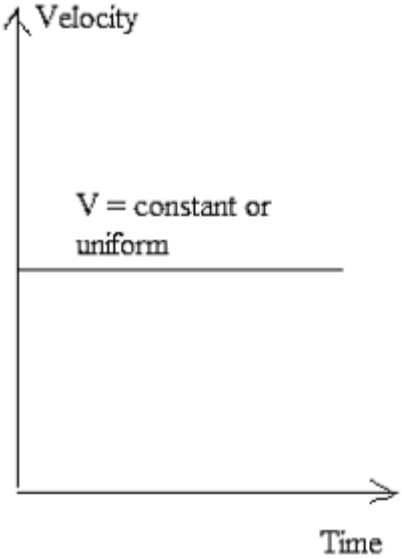


Figure 7- Distance-time Graph in Non-Uniform Motion

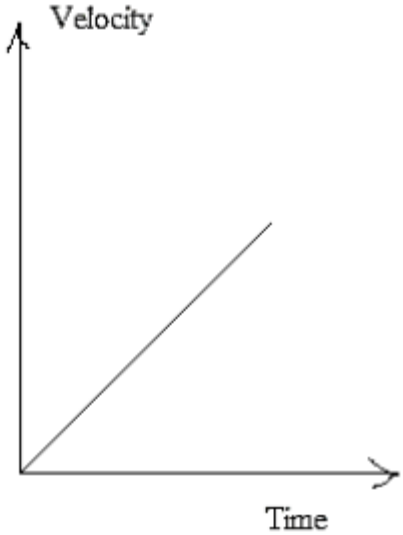
2. Velocity – Time Graphs

Constant velocity – Straight line graph, velocity is always parallel to the x-axis

Uniform Velocity / Uniform Acceleration – Straight line graph

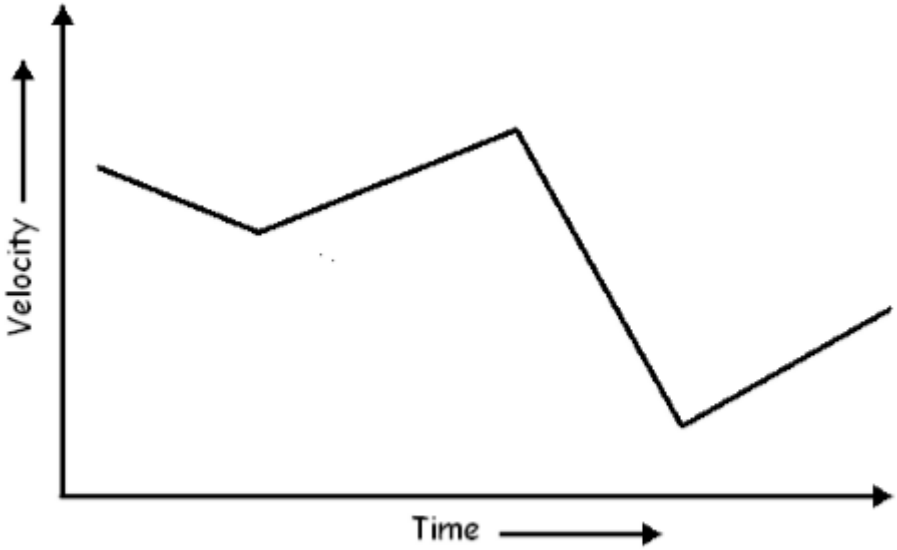


(A) v-t Ccurve for uniform velocity



(B) v-t curve for uniform acceleration

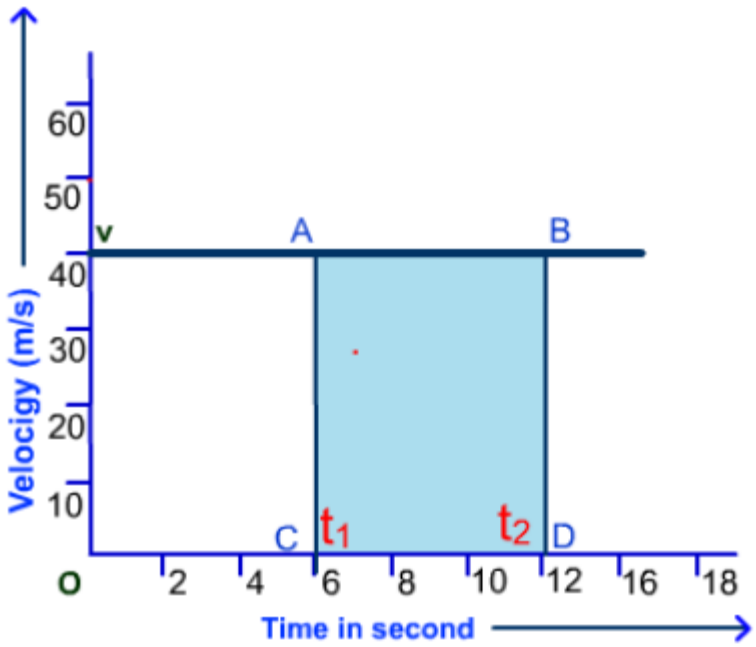
Non-Uniform Velocity / Non-Uniform Acceleration – Graph can have different shapes



Velocity - Time Graph of an object moving with Non-uniform velocity

Calculating Displacement from a Velocity-time Graph

Consider the graph given below. The area under the graph gives the distance traveled between a certain interval of time. Hence, if we want to find out the distance traveled between time interval t_1 and t_2, we need to calculate the area enclosed by the rectangle ABCD where area (ABCD) = AB * AC.

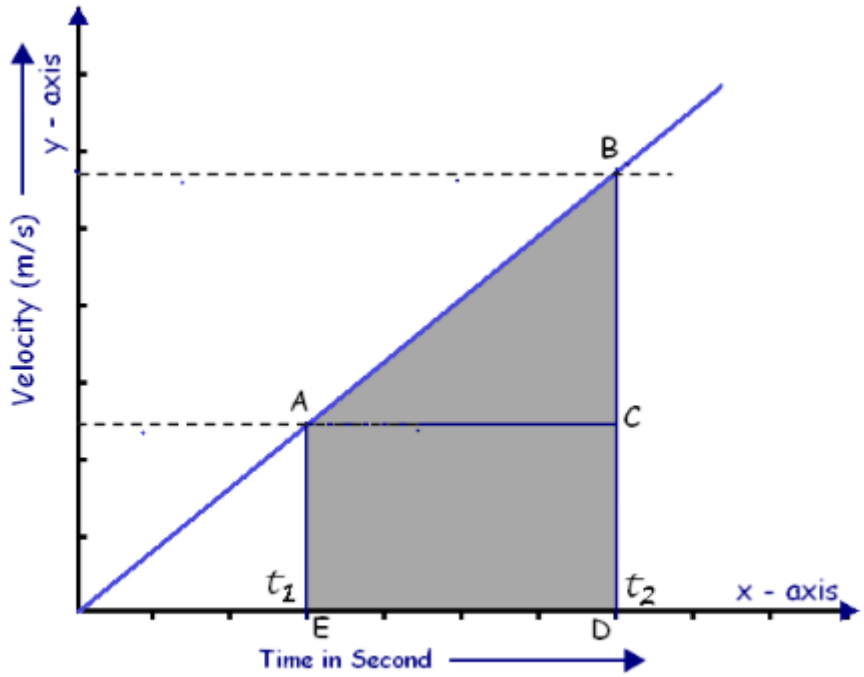


Velocity - Time Graph of an object moving with constant velocity

Similarly, to calculate distance traveled in a time interval in case of uniform acceleration, we need to find out the area under the graph, as shown in the figure below.

To calculate the distance between time intervals t_1 and t_2 we need to find out area represented by ABED.

Area of ABED = Area of the rectangle ABCD + Area of the triangle ADE = AB × BC + 1/ 2 * (AD × DE)



Velocity - time graph of an object moving with uniform acceleration

Equations of Motion

The equations of motion represent the relationship between an object's acceleration, velocity and distance covered if and only if,

- The object is moving on a straight path
- The object has a uniform acceleration

Three Equations of Motion

1. The Equation for Velocity – Time Relation

$v = u + at$

2. The Equation for Position – Time Relation

$s = ut + 1/2\ at^2$

3. The Equation for the Position – Velocity Relation

$2a\ s = v^2 – u^2$

Where,

u: initial velocity
a: uniform acceleration
t: time
v: final velocity
s: distance traveled in time t

Deriving the Equations of Motion Graphically

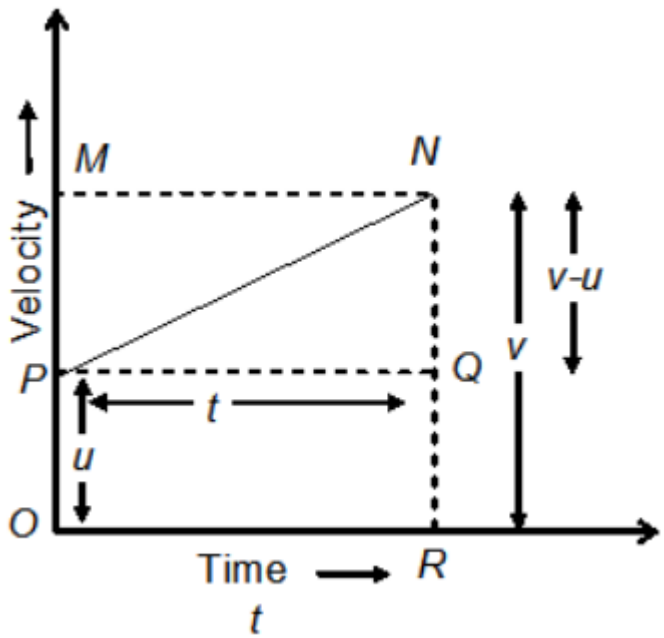


Figure 12

Study the graph above. The line segment PN shows the relation between velocity and time.

Initial velocity, u can be derived from velocity at point P or by the line segment OP

Final velocity, v can be derived from velocity at point N or by the line segment NR

Also, NQ = NR – PO = v – u

Time interval, t is represented by OR, where OR = PQ = MN

1. Deriving the Equation for Velocity – Time Relation

Acceleration = Change in velocity / time taken

Acceleration = (final velocity – initial velocity) / time

$a = (v – u)/t$

so, $at = v – u$

$v = u + at$

2. Deriving Equation for Position – Time Relation

We know that, distance travelled by an object = Area under the graph

So, Distance travelled = Area of OPNR = Area of rectangle OPQR + Area of triangle PQN

s = (OP * OR) + (PQ * QN) / 2

s = (u * t) + (t * (v – u) / 2)

s = ut + 1/2 at^2 [because at = v – u]

3. Deriving the Equation for Position – Velocity Relation

We know that, distance travelled by an object = area under the graph

So, s = Area of OPNR = (Sum of parallel sides * height) / 2

s = ((PO + NR)* PQ)/ 2 = ((v+u) * t)/ 2

2s / (v+u) = t [equation 1]

Also, we know that, (v – u)/ a = t [equation 2]

On equating equations 1 and 2, we get,

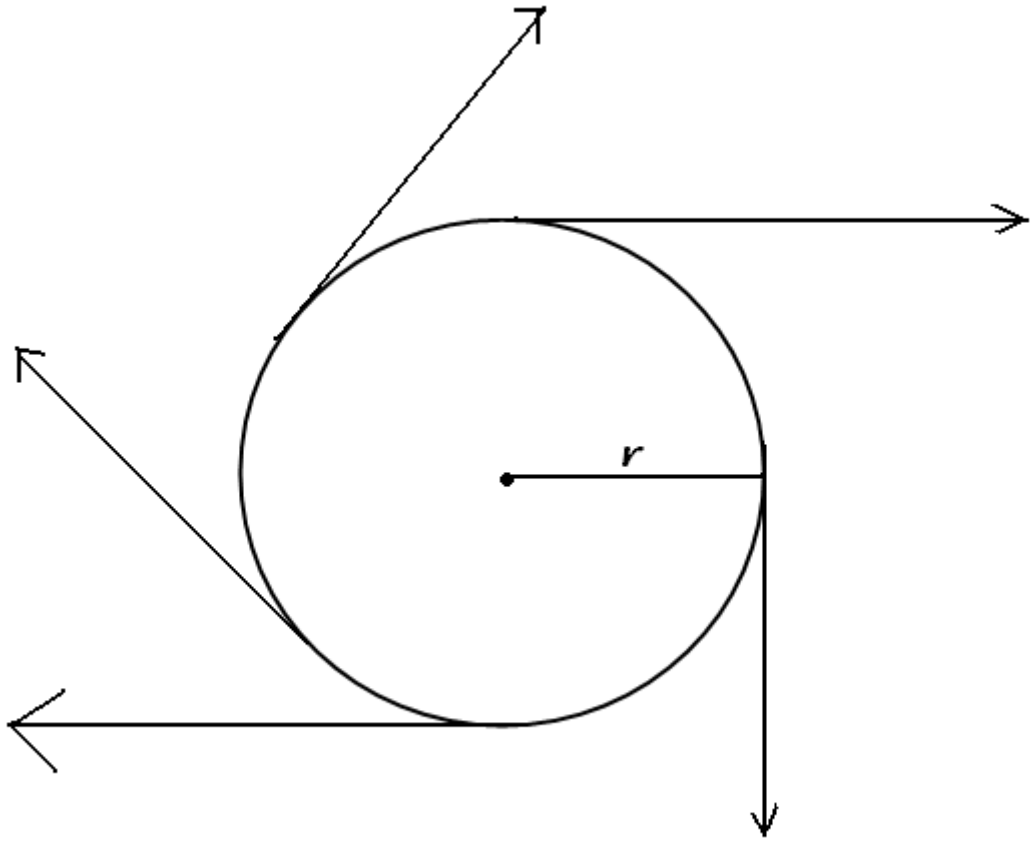
2s / (v + u) = (v – u)/ a

2as = (v + u) (v – u)

2 a s = $v^2 – u^2$

Uniform Circular Motion

If an object moves in a constant velocity along a circular path, the change in velocity occurs due to the change in direction. Therefore, this is an accelerated motion. Consider the figure given below and observe how directions of an object vary at different locations on a circular path.



Direction at different point while circular motion

Uniform Circular Motion – When an object travels in a circular path at a uniform speed the object is said to have a uniform circular motion.
Non-Uniform Circular Motion – When an object travels in a circular path at a non-uniform speed the object is said to have a non-uniform circular motion

Examples of uniform circular motion:

- The motion of a satellite in its orbit
- The motion of planets around the sun

Velocity of Uniform Circular Motion

Velocity = Distance/ Time = Circumference of circle / Time

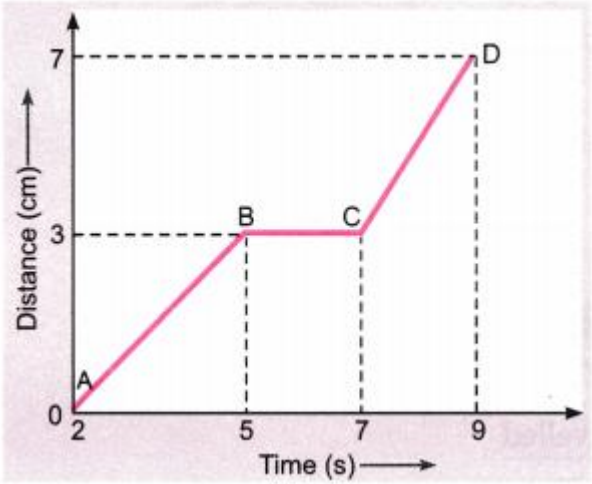
$v = 2\pi r/ t$

where,

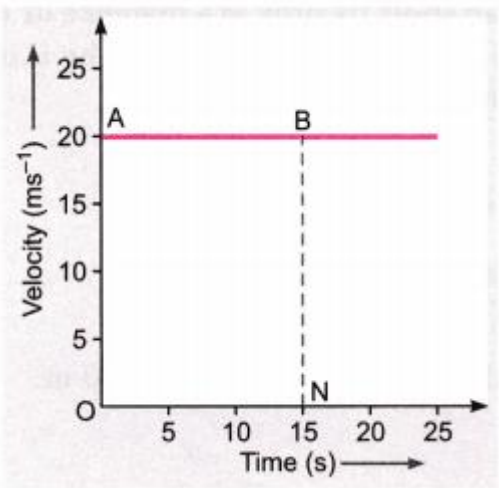
v: velocity of the object
r: radius of the circular path
t: time taken by the object

ASSIGNMENT

1. A particle is moving in a circular path of radius r. What would be the displacement after half a circle?
2. Differentiate between distance and displacement.
3. Draw a velocity versus time graph of a stone thrown vertically upwards and then coming downwards after attaining the maximum height.
4. Deduce the following equations of motion:
   (i) $s = ut + (1/2)at^2$
5. The graph given below shows the positions of a body at different times. Calculate the speed of the body as it moves from
   (i) A to B
   (ii) B to C and
   (iii) C to D.



6. The velocity-time graph shows the motion of a cyclist. Find (i) its acceleration (ii) its velocity and (iii) the distance covered by the cyclist in 15 seconds. [NCERT Exemplar]



7. A particle moves in a circle with O as centre and AO = OB = 5 cm, as radius, as shown in the figure. It starts from A. Calculate:
   (a) the distance covered, and
   (b) the displacement, when it reaches B.
8. A body travels along a circular path of radius 70 m. After travelling half a revolution in 20 s, find the

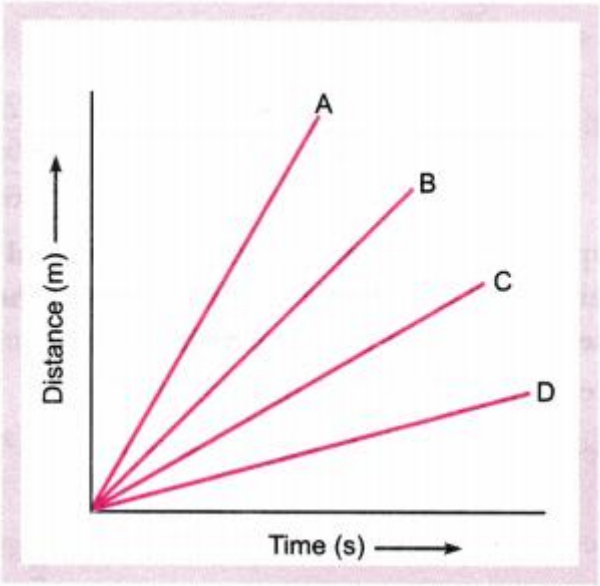
(i) average velocity,
(ii) average speed.

9. The brakes applied to a car produce an acceleration of 6 ms^{-2} in the opposite direction to the motion. If the car takes 2s to stop after the application of brakes, calculate the distance it travels during this time.

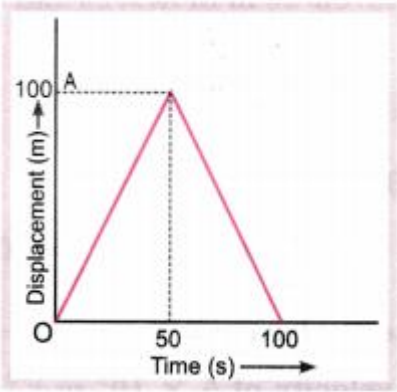
10. n object is dropped from rest at a height of 150 m and simultaneously another object is dropped from rest at a height 100 m. What is the difference in their heights after 2 s if both the objects drop with same accelerations? How does the difference in heights vary with time?

11. An object starting from rest travels 20 m in first 2s and 160 m in next 4s. What will be the velocity after 7s from the start

12. Four cars A, B, C and D are moving on a levelled road. Their distance versus time graphs are shown in figure. Which car is the slowest?



13. A girl walks along a straight path to drop a letter in the letterbox and comes back to her initial position. Her displacement-time graph is shown in figure. Plot a velocity-time graph for the same. [NCERT Exemplar]



14. Suppose a ball is thrown vertically upwards from a position P above the ground. It rises to the highest point Q and returns to the same point P. What is the net displacement and distance travelled by the ball?

15. What indicates the motion of the earth?

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SUBJECT : CHEMISTRY

CLASS IX

Week : 8 February to 13 February 2021

CHAPTER 6: TISSUES

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for chapter is given below :

https://youtu.be/CIM2Tz5VFU4

https://youtu.be/r4ZMJppIQ_8

https://youtu.be/r4ZMJppIQ_8

Learning outcomes

Students will able to learn about tissue

Sub topics :

- Tissue
- Different types of tissue
- Plant tissue
- Animal tissue
- Connective tissues
- Nerve tissues

Tissues

Quick Review

- Living organisms in this world comprise of cells.
- There are unicellular as well as multicellular organisms present in this world.
- In unicellular organisms, the only single cell is capable of performing several functions such as Respiration, Digestion and Clearing of the cell.
- In multicellular organisms, there is a division of labor. There are different types as well as groups of cells that perform different functions in a multicellular organism. **For Example**, In animals muscle cells are responsible for causing movement, nerve cells are responsible for carrying messages and signals from one part of the body to another and blood is responsible for transportation of food and oxygen to different parts of the body.
- In plants, there are vascular tissues that are responsible for carrying food and water two different parts of a plant.

The Formation of Tissues

- Cells form groups cells that need to perform a single task often group together.
- This grouping of cells together to perform a function efficiently is called a **Tissue**.
- **For Example**, Muscles and Blood.
- The tissue cells have the same structure and they perform the same function.

Tissues of Plants and Animals

Plant Tissues	Animal Tissues
Plants do not move so their tissues are predominantly the ones that provide support to them so that they can stand erect.	Animals need more energy as compared to plants because they are not stationary. Their tissues are the ones that can support movement.
These tissues are made up of dead cells because dead cells can also provide mechanical strength to the plants and do not require much maintenance.	The tissues in case of animals are made up of living cells so that they can move and perform several functions.
Only certain parts of the plant can grow. The tissues present in such regions of and divide themselves and form new tissues.	Cells in animals grow uniform early and not only in certain regions of the body.
The structure of plant tissues is not very specialized as compared to animals	The organs and organ systems in animals are highly developed.

Plant Tissues

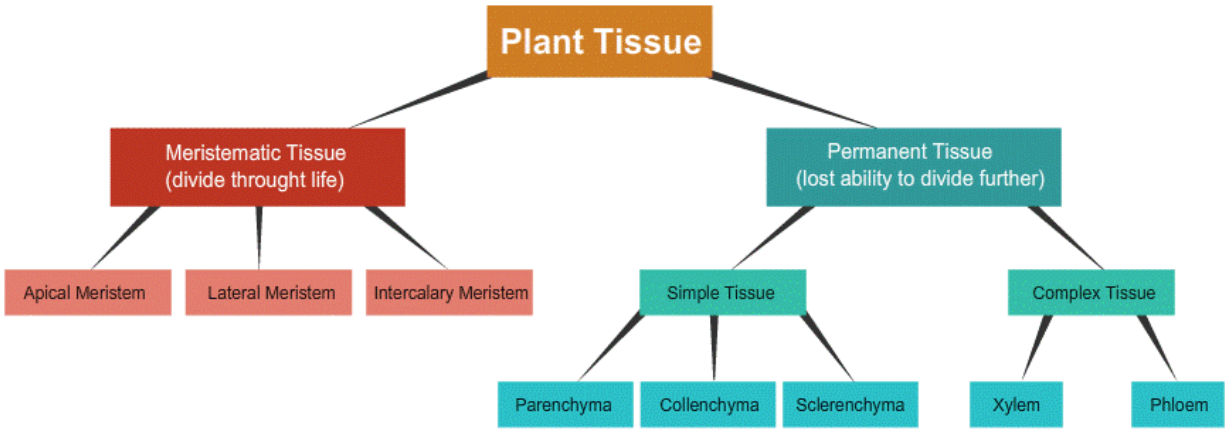


Figure 1 Types of Plant Tissues

Meristematic Tissue

- Only certain parts of a plant tend to grow. The tissues located in such parts are called meristematic tissues.
- They have the capability to divide themselves and form new tissues. They have thin cell wall made of cellulose. Also have dense nucleus and cytoplasm but lack vacuoles.
- They can further we classify differently based on the areas of the plants where they are located -
  - Apical
  - Lateral
  - Intercalary

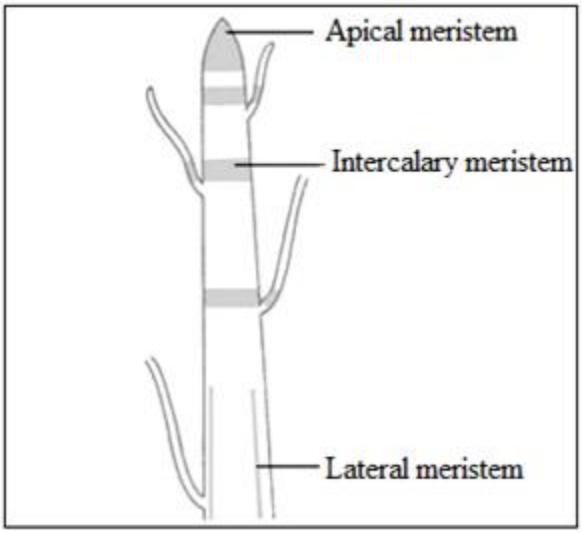


Figure 2 Location of meristematic tissue

Apical Meristem	Lateral Meristem	Intercalary Meristem

They are responsible for the growth of stems and roots in the plants They are found on the tips of the roots and stems.	They are responsible for increasing the circumference of the middle part of the stem and hence are found there.	These tissues are present at internodes or stem regions between the places at which leaves attach.

Why there are no vacuoles in the intercalary meristem?

- Vacuoles are responsible for storage of food in water. The intercalary tissues do not store them. They are rather responsible for manufacturing them.
- Moreover, vacuoles contain sap which provides rigidity to a cell. This property of vacuoles may not allow the intercalary tissues to divide and manufacture new cells. Hence vacuoles are not present in them.

Permanent Tissue

- The cells that are formed by the meristematic tissues often have to take a certain role in the plant and thus, they lose their ability to divide and form more cells. They then become the permanent tissues of the plants.
- **Differentiation** - The process by which cells of the meristematic tissues convert themselves into a permanent tissue by taking a fixed shape, size and function is called differentiation.
- **Types of Permanent Tissues:**
  - Simple Permanent Tissues
  - Complex Permanent Tissues
- **Simple Permanent Tissues are of five types:**
  - Parenchyma
  - Chlorenchyma
  - Aerenchyma
  - Collenchyma
  - Sclerenchyma

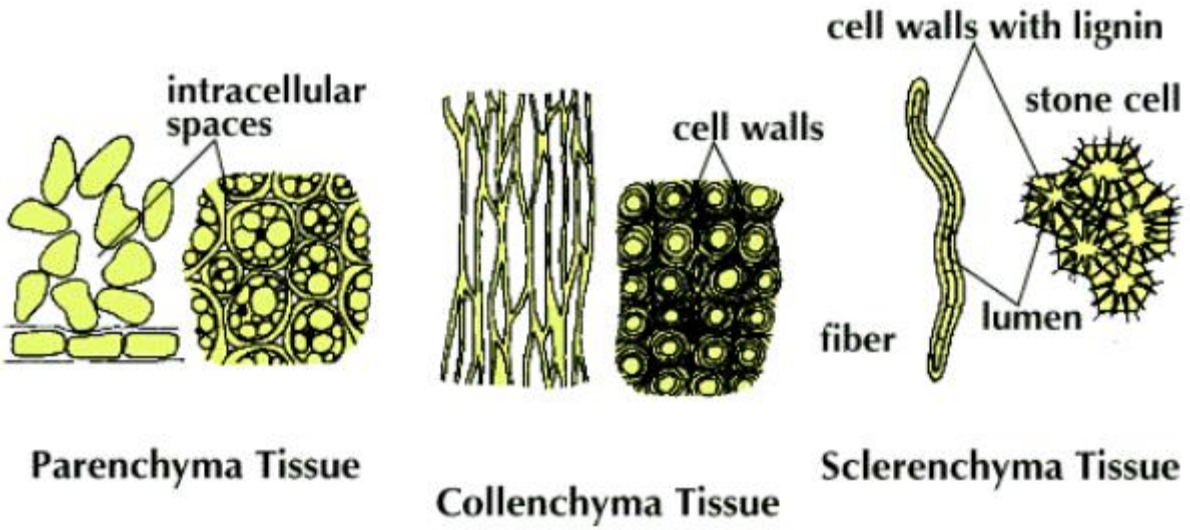


Figure 3 Simple Permanent Tissue

Parenchyma	Collenchyma	Sclerenchyma

These tissues are responsible for photosynthesis, storage of food, gaseous exchange and floating of plants.	These tissues are responsible for providing flexibility to the plants so that they can bend easily.	These tissues are responsible for making plants hard and rigid.
They are a group of living cells with cell wall made of cellulose.	They are a group of living cells with cell wall made of cellulose and pectin.	They are made up of dead cells having cell wall made of lignin.
The parenchyma cells have large intercellular spaces between them.	They have a little intercellular space in between them.	The cells do not have any intercellular spaces.
There are thin walls that surround each cell.	The cells present in these tissues are broad and irregularly thick at corners.	The cells have a long structure with thick walls.
They are found in leaves and newly formed branches.	They are present in leaves and stems of a plant.	They are found in stems, veins of the leaves and coverings of nuts and seeds.

Chlorenchyma

- These tissues are similar to that of parenchyma but they also contain chlorophyll in them.
- Due to the presence of chlorophyll, they are capable of performing the process of photosynthesis in plants.

Aerenchyma

- They are found in aquatic plants.
- They are also similar in structure to that of the parenchyma but they have large air cavities in them.
- These cavities allow the aquatic plants to float in water.

What is Lignin?

The cell walls of dead cells have a substance called lignin in them which provides rigidity to the cells. Lignin acts as the cement for the cells.

Epidermis

- The outermost layer of the cell is known as the **Epidermis**.
- It covers the entire plant.
- It is a thin layer of single cells but in places with less water, the epidermis of the plants can become thick in order to avoid frequent water loss.
- The cells are flat and they have no intercellular spaces between them.
- The outer walls of the epidermal cells are thick and the inner walls are thin.
- The epidermal cells often have long hair-like structures in roots which facilitate the absorption of water.
- The main function of the epidermis is to protect the plants from fungi, water loss and any injuries by secrets a wax-like water-resistant substance called as **Cuticle** on the surface of the plants which protects the plants.

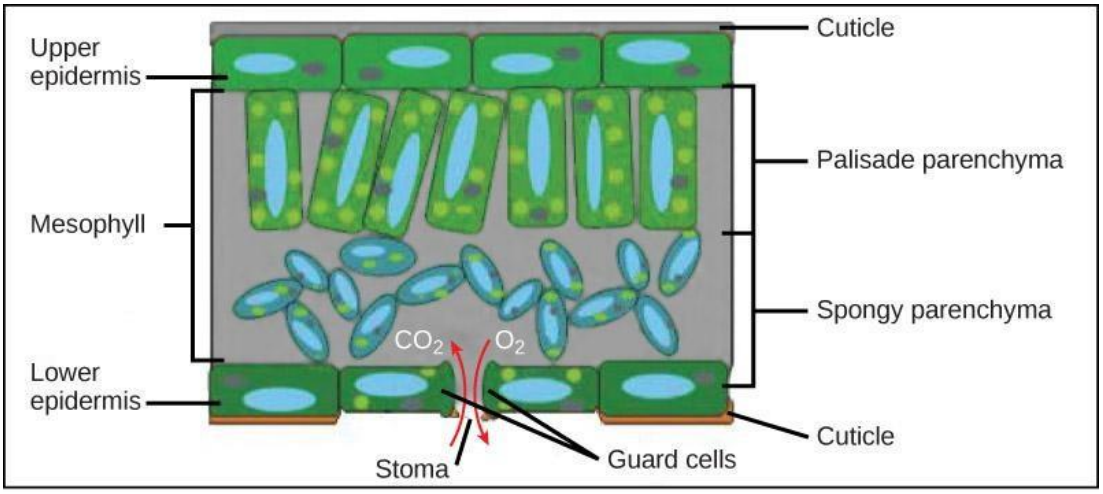


Figure 4 Epidermis

Stomata

- Stomata are pore-like structures that are present in the epidermis of the leaves.
- These pores are enclosed by two cells that have a similar shape as a kidney. These are called **Guard Cells of Stomata**. Guard cells are modified epidermal cells.
- Guard cells are responsible for the exchange of gases and transpiration.

Transpiration

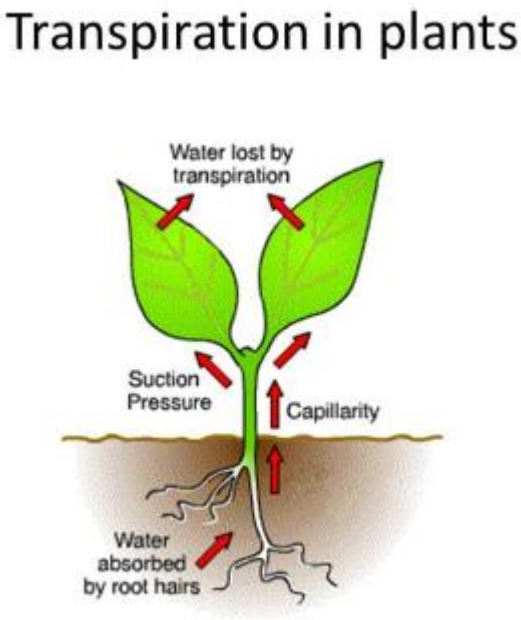


Figure 5 Transpiration

The plant cells when sometimes have extra they lose it in the form of water evaporates through stomata. This process is called **Transpiration**.

Role of Transpiration in Plants – (OLYMPIAD)

- **Exchange of Gases** - Plants absorbs carbon dioxide and release oxygen through transpiration.
- **Prevent the Plants from Overheating** - The leaves absorb sunlight during the process of photosynthesis. Some of it is used in the photosynthesis process while the rest is radiated as **Heat Energy**. We know that absorption of water causes cooling of the surrounding area. Therefore transpiration keeps the leaves cool.
- **Transportation of Food and Water in Plants** - The roots of the plants absorb minerals and water present in the soil through transpiration and they are then distributed in the plant through transpiration stream.

- **Movement of Water in Plants** – As plants lose water in the form of water vapors, the density of water in leaves becomes low. So the water from the higher density areas such as the roots move up to lower density areas through a force called **Transpirational Pull**.

Which gas is necessary for the process of photosynthesis?

The carbon dioxide gas is necessary in the process of photosynthesis. Plants use carbon dioxide along with water and sunlight to produce glucose in the process of photosynthesis. Plants take in carbon dioxide and release oxygen as a byproduct of the photosynthesis process.

Why do plants in desert areas have a waxy coating of cutin over them? (OLYMPIAD)

The epidermis cells of plants that are found in deserts have a waxy coating of cutin over them because it prevents water loss from the plants surface since water is already scarce in such areas.

Why do branches of old trees are different than the stems of a new plant?

- As a plant grows older the meristematic cells start covering the upper layer of the plants instead of the epidermis.
- These are the dead cells that have no special function in the plants but to provide them rigidity. They make the branches of the plants thick.
- This is often called the **Bark** or the thick cork of the tree.
- The bark of the trees contains a substance called **Suberin** which makes it waterproof and does not allow gaseous exchanges. **(OLYMPIAD)**

Complex Permanent Tissues

Complex Permanent Tissues comprise of different kinds of cells. These different types of cells coordinate with each other and perform a common function in these tissues. Two Complex Permanent Tissues are - **Xylem** and **Phloem**.

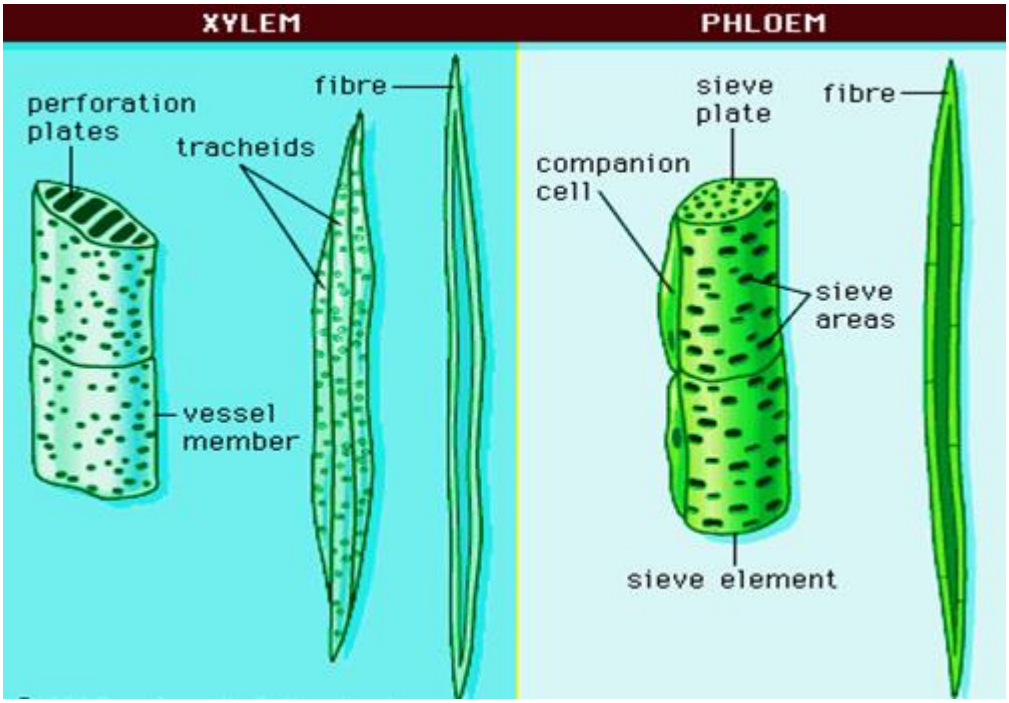


Figure 6 Xylem and Phloem

Similarities between Xylem and Phloem

- Their main function is to carry food and water in the plant.
- Both have a vascular bundle which is a conductive tissue in plants that helps them survive in different environmental conditions.

Xylem

Xylem is made up of dead cells having a thick cell lining. It consists of following elements-

- **Tracheids and Vessels** – They have broad tubular structure so that we can allow transportation of food and water in the plants vertically.
- **Xylem Parenchyma** – It stores food and helps in transportation of water horizontally in the plants.
- **Xylem Fibers** – They support transportation

Phloem

Phloem is made up of living cells and it allows the movement of food from leaves to other parts of the plant. It has the following elements –

Sieve Tubes – Broad shaped cells with porous walls

- **Companion Cells** – They facilitate the functions of the sieve tubes
- **Phloem Fibers** – Provide flexibility to the phloem
- **Phloem Parenchyma** – Stores starch and proteins

	Xylem	Phloem
Made of	Dead Cells	Living Cells
Cell wall thickness	Thick	Thin
Cell wall material	Lignin (rigid)	Celluloses
Permeability	Impermeable	Permeable
Cytoplasm	None	Cytoplasm lining
Transports…	Water & minerals	Food
Carried to….	Leaves	Growing parts & storage organs
Direction of flow	Upwards	Up & down
Tissue alos has …	Fibres	Companion cells

Animal Tissue

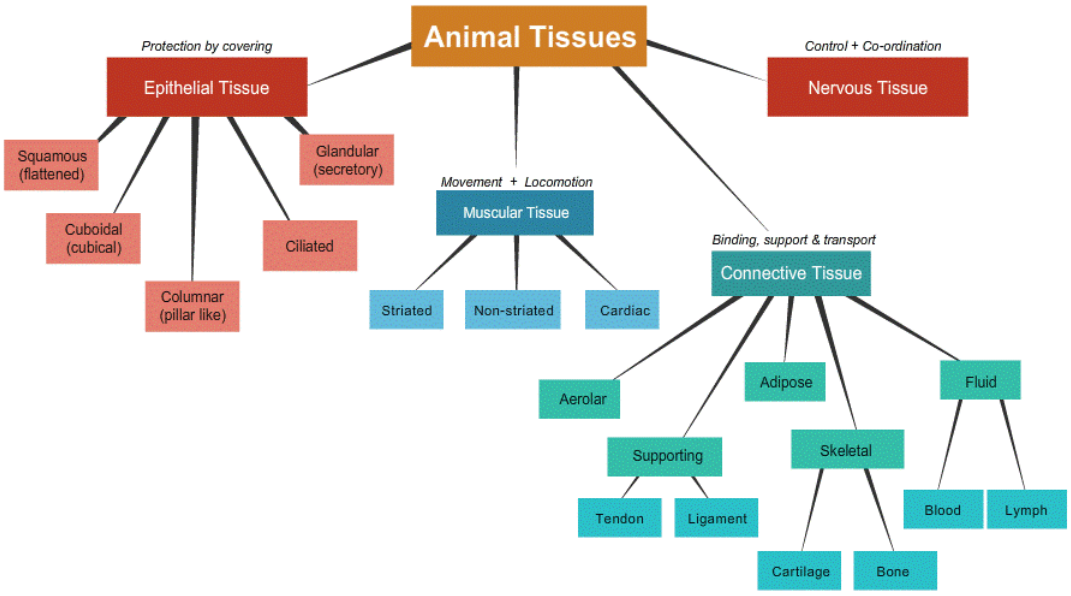


Figure 7 Types of Animal Tissues

1. Epithelial Tissue

- They are the protective tissues of the human body. They cover many organs and cavities that are present inside the body.
- **Where are the epithelial tissues found in the human body?**

- The lining of the blood vessels
- The lining of the mouth
- Kidney tubules
- Skin
- Lung alveoli

- **Structure and functions of the epithelial tissues -**
  - The main function of the epithelial tissues is to act as a barrier and separate different organs and systems from each other.
  - There is no space between the cells of epithelial tissues
  - The cells are permeable. This makes it possible for them to exchange materials between different parts of the body and also between the body and the external environment.
  - The epithelial tissues remain separated from the tissues beneath them because of a thin membrane over them.

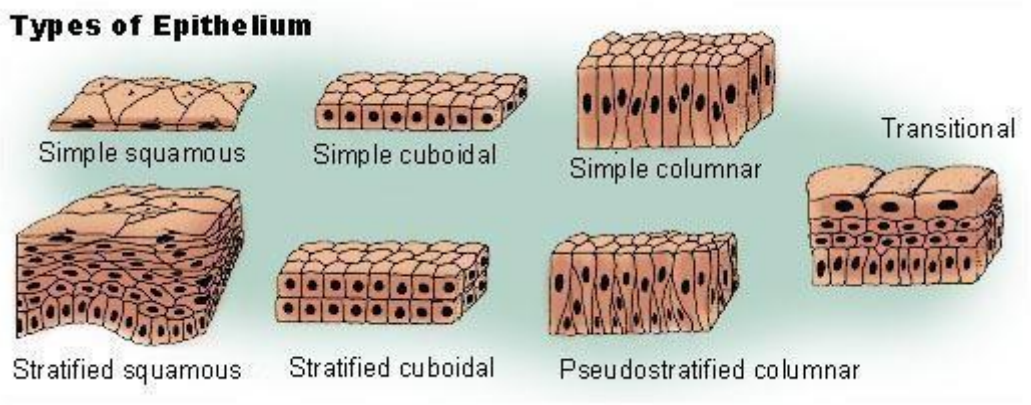


Figure 8 Types of Epithelium

Different types of epithelium tissues	Simple Squamous	Stratified Squamous	Columnar	Ciliated Columnar	Cuboidal	Glandular
Structure	They have delicate cell lining and possess a flat thin structure	The epithelium Squamous cells are arranged in several layers	They are the column-like shape tissues	Columnar epithelial tissues which have Cilia present on them	They are cube-shaped cells which are involved in absorption and secretion.	These are special gland cells that can secrete substances
Found in	Alveoli and bowman's capsule-nephron in kidney	Skin	Intestine	Respiratory system	Kidney tubules	Sweat glands in the skin

2. Connective Tissues

- **Structure and function of connective tissues**
  - They are loosely bound cells present in an intercellular Matrix.
  - This matrix can be of different types – Dense, Rigid, Fluid or Jelly-like.
  - Depending upon the functionality of the connective tissue, the nature of the matrix varies in them.
- **Examples of Connective Tissues**

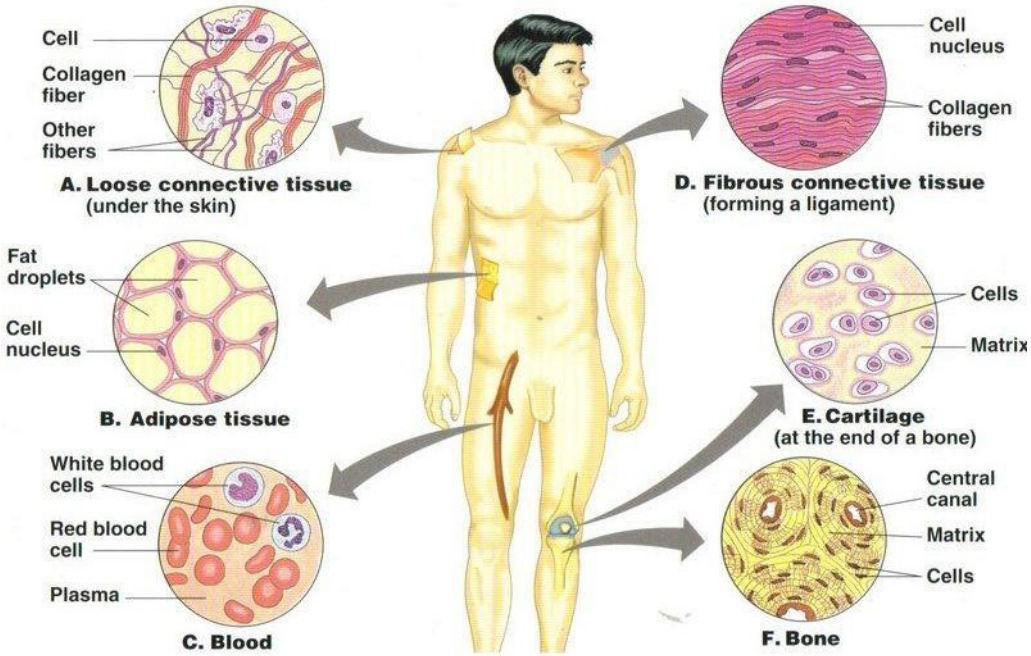


Figure 9 Connective Tissues

Blood

- The main function of blood is to transport gases, food, waste materials and hormones in the body.
- Therefore, blood has a fluid Matrix present in it which is called **Plasma**.
- The plasma contains the red blood cells, the white blood cells and blood platelets.
- The RBC have hemoglobin pigment which carries oxygen to tissues.
- White blood cells fight diseases and platelets are involved in clotting of blood when injured.
- The plasma also contains proteins and hormones in it.

Bones

- Bones form a framework of the body over which the muscles are wrapped together.
- The bone tissue is strong and inflexible in nature.
- Therefore, the bone cells are present in a rigid matrix which is formed from calcium and phosphorus.

Cartilage

- Cartilage is present over the joints of the bones and provides them with a smooth structure.
- **For Example** in the nose tip and ear pinna, trachea, larynx.
- They contain solid matrix made of protein and sugar. They have homogenous matrix.
- It provides support and flexibility to various parts of our body.

Ligaments

- A ligament connects two bones together.
- It has an elasticity which facilitates the connection.
- The cells of ligaments have a little matrix.

Tendons

- The tendons tissues are responsible for connecting bones and muscles together.
- They have limited flexibility but very great strength.

Areolar

- This tissue acts as a filter in between the spaces present inside the organs of the body.

- It helps in repairing other tissues as well.
- It is found in the skin and bone marrow.

Adipose

- Fats are stored in our body in the adipose tissues.
- They are found below the skin and between the organs of the body.
- Provides cushioning to the organs.

3. Muscular Tissue

- It is made up of muscle fibers which are long cells.
- It allows movements in our body.
- **How muscles can cause movement?**

They contain special proteins called **Contractile Proteins**. These proteins cause contraction and relaxation of the muscles.

- There are two kinds of muscles found in our body - Voluntary Muscles and Involuntary Muscles.

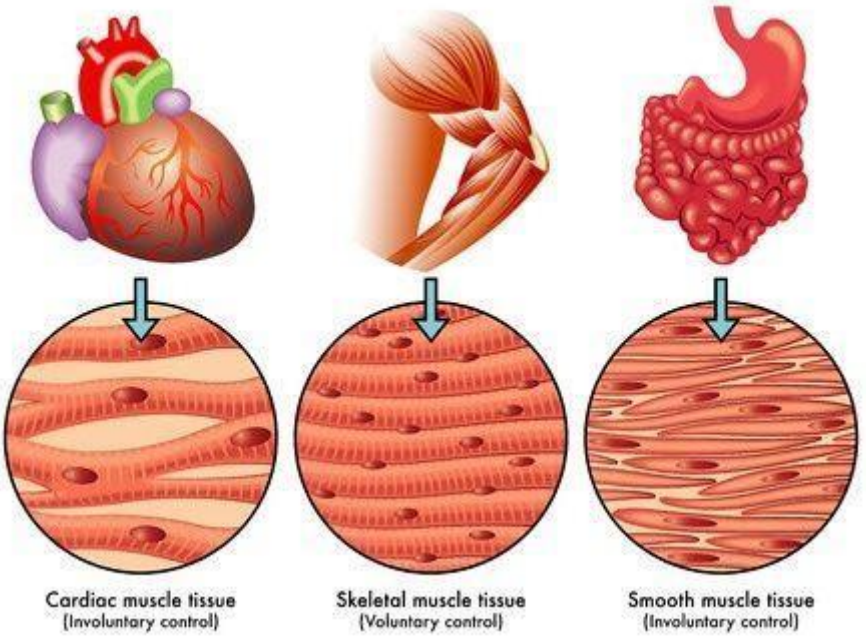


Figure 13 Muscular Tissue

Striated/ Skeletal/ Voluntary muscles	Smooth/ Unstriated/Involuntary muscles
We can move them according to our own will	We cannot start or stop the movement of involuntary muscles.
They are also called **Skeletal Muscles** as they are attached to the bones.	They also called **Smooth Muscles**.
They are also called **Striated Muscles** because of the presence of dark and light bands over them	They are also called **Unstriated Muscles** because they do not have any light or dark bands on them.
The cells of voluntary muscles have more than one nucleus, they do not have any branches, and have a long cylindrical structure.	The cells of the involuntary muscles are long and have pointed ends.
For Example, Muscles of our hands and legs.	**For Example**, The muscles in the alimentary canal and the Iris of our eyes.

- **Cardiac Muscles**
  - These are special kinds of involuntary muscles.

- The muscles of the heart are called **Cardiac Muscles** they perform rhythmic contraction and relaxation throughout our life.
- They are cylindrical in shape, they have branches and there is a single nucleus.
- Cardiac muscle consists of individual heart muscle cells connected by intercalated discs to work as a single functional organ

4. The Nervous Tissue

- **How do we react to stimuli?**
  - This is because of the nervous tissues present in our body. They are capable of transmitting information quickly from the brain to different parts of the body and vice-versa.
- Therefore nervous tissues are found in nerves, brain, and spinal cord.
- The Nervous tissue is made up of cells called the **Nerve Cells** or **Neurons**.
- These neurons connect together to form the nerves of our body.
- **Structure of a Neuron**
  - It is an elongated cell with a Cell Body that consists of some branch-like structure called Dendrites.
  - There is a Nucleus present in the center of the cell body.
  - The Nerve Endings of the cell are connected with the cell body via Axon.
  - A nerve cell can be up to 1 m long.

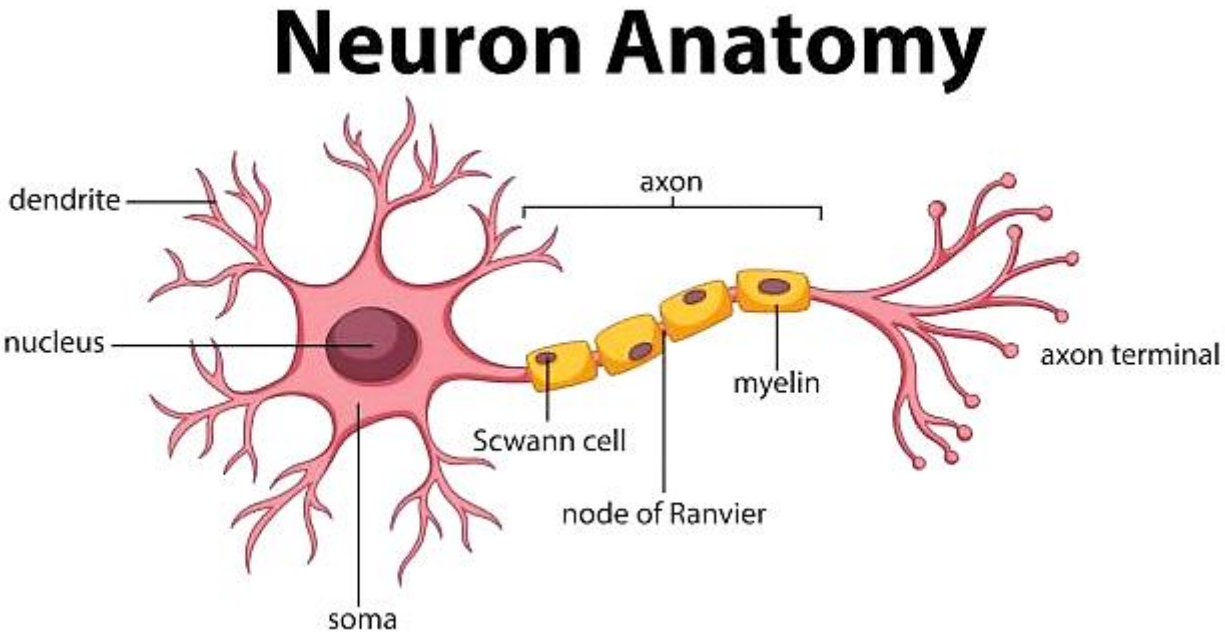
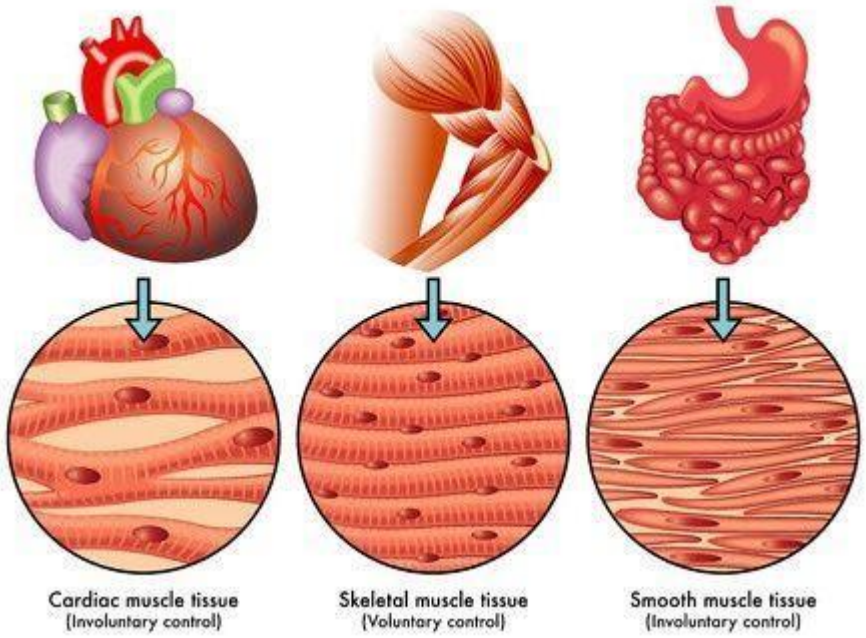


Figure 14 Structure of Neuron

ASSIGNMENT

16. Which tissue in plants provides them flexibility?
17. Name the muscular tissue that functions throughout life without fatigue.
18. Which animal tissue helps in repair of tissue and fills the space inside the organ?
19. Which blood cells deal with immune reaction?
20. Which cells are responsible for carrying messages?
21. Differentiate the following activities on the basis of voluntary (V) or involuntary (IV) muscles.
(a) Jumping of frog
(b) Pumping of the heart
(c) Writing with hand
(d) Movement of chocolate in your intestine
22. Describe the structure and function of stomata.
23. Name the different components of xylem and draw a living component.
24. Differentiate between parenchyma and collenchyma.
25. What is a neuron? Write the structure and functions of a neuron.
26. Tissue A and tissue B constitute tissue C. A carries water while B carries food for the plants. Identify A, B, C.
27. What are responsible for contraction and relaxation in muscles?
28. Describe the function of bones.
29. Briefly describe striated and smooth muscles with their functions.
30. OBSERVE THE FIGURES ,write difference between them



Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

SUBJECT : CHEMISTRY

CLASS IX

Week : 15 February to 20 February 2021

CHAPTER 9 : FORCE AND LAWS OF MOTION

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for chapter is given below :

https://youtu.be/EtyA2eG02Kw

https://youtu.be/45qzmSrLsIU

https://youtu.be/--tAOQty3fA

Learning outcomes

Students will able to learn about force and its 3 laws

Sub topics :

- Force
- Balanced and unbalanced force
- First law of motion
- Second law of motion
- Third law of motion
- Applications

LESSON DEVELOPMENT

Force and Laws of Motion

How does an object start moving?

We need to put some effort to make a stationary object move, **For Example**, a push, a hit or a pull.

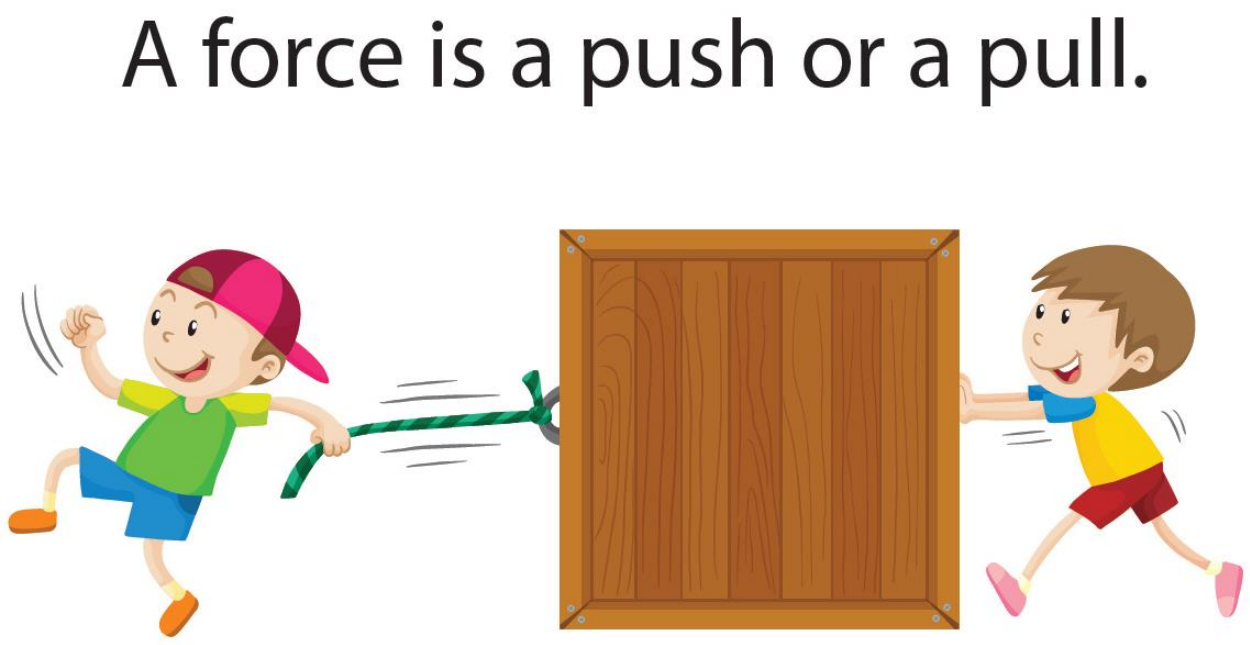


Fig.1- How does an object move

What is a force?

Whenever we push or pull an object a force acts upon them and makes them move from one place to another. Hence, force can –

- initiate motion in a motionless object
- change (increase or decrease) the velocity of the moving object
- alter the direction of a moving object
- change the shape and size of an object

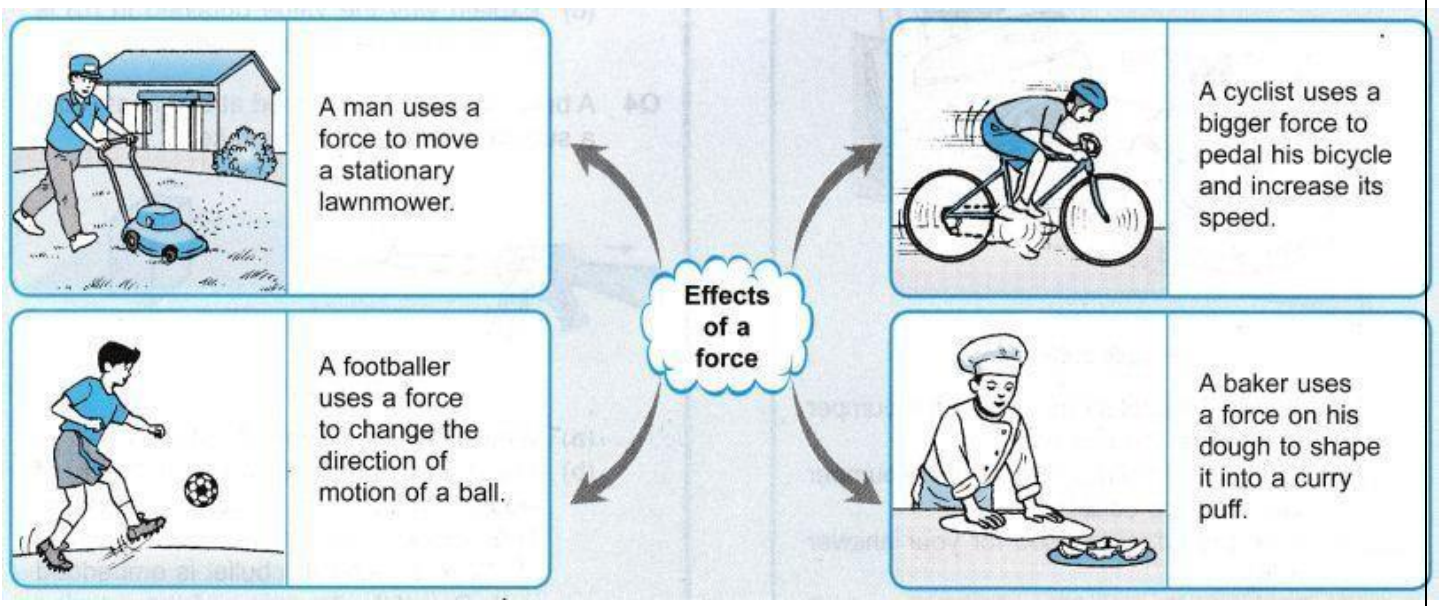


Fig.2 - Effects of Force

Balanced and Unbalanced Forces

Balanced Forces –

- When equal amount of forces are applied on an object from different directions such that they cancel out each other
- They do not change the state of rest or motion of an object
- They may change the shape and size of an object

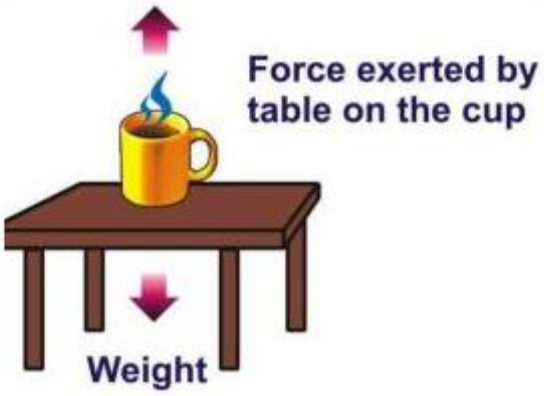


Fig.3- Balanced Forces

Unbalanced Force –

- When forces applied to an object are of different magnitude(or not in opposite directions so as to cancel)
- They can alter state of rest or motion of an object
- They can cause acceleration in an object
- They can change the shape and size of an object

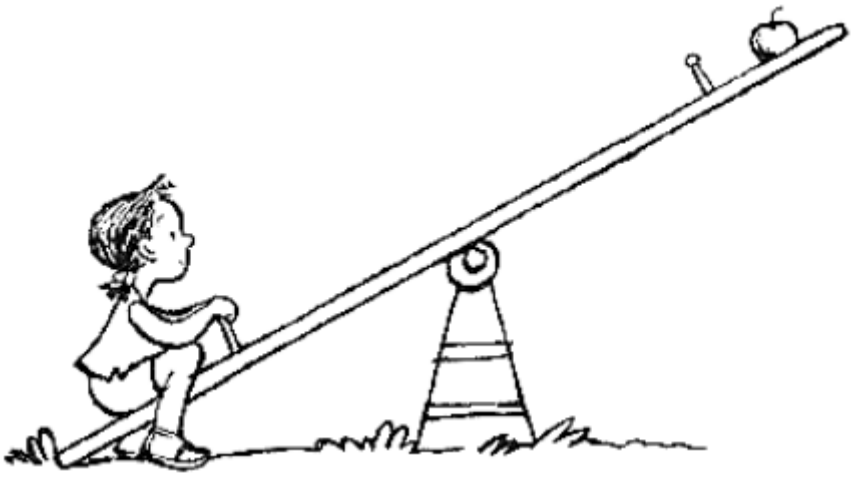


Fig.4 – Unbalanced Forces

What is the force of friction?

It is a force extended when two surfaces are in contact with each other. It always acts in a direction opposite to the direction of motion of the object.

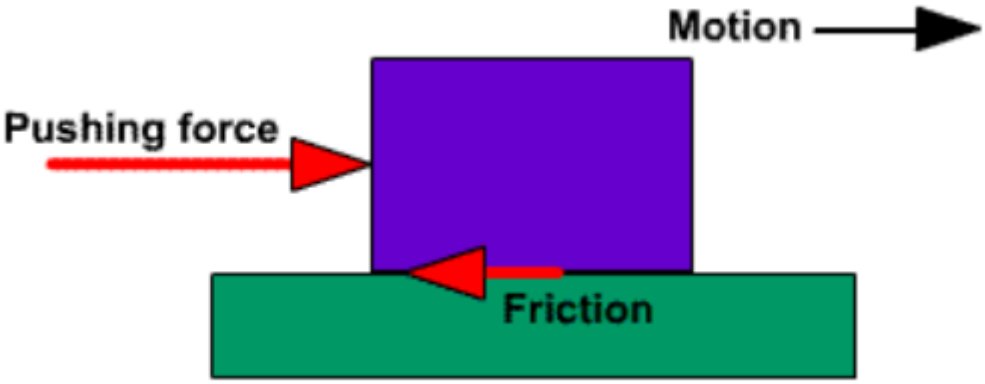


Fig. 5 – The force of Friction

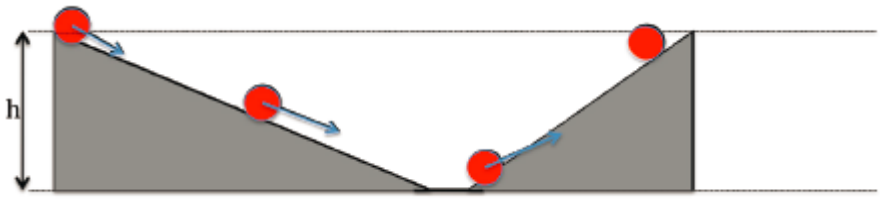
First Law of Motion

Galileo's Observation

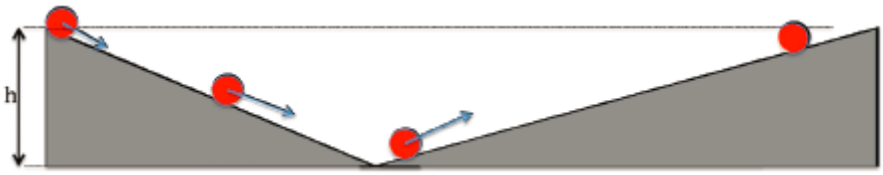
- He observed the motion of objects on an inclined plane.
- When a marble is rolled down an inclined plane its velocity increases.

Galileo's Arguments

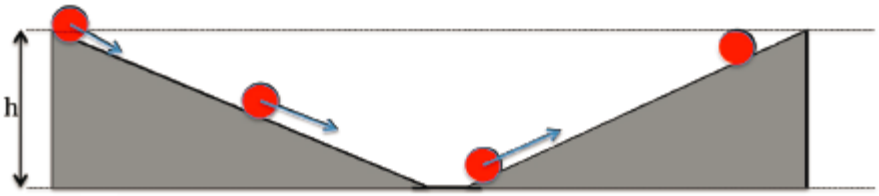
- When a marble is rolled down from the left – It will go up on the opposite side up to the same height at which it is dropped down.



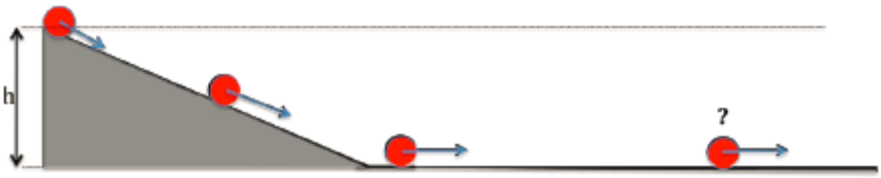
- If the inclination of planes is equal – The marble would travel equal distances while climbing up as travelled while rolling down.



- If we decrease the angle of inclination of the right plane – The marble would travel further until it reaches its original height.



- If the right side plane is made flat – Marble would travel forever to achieve the same height.

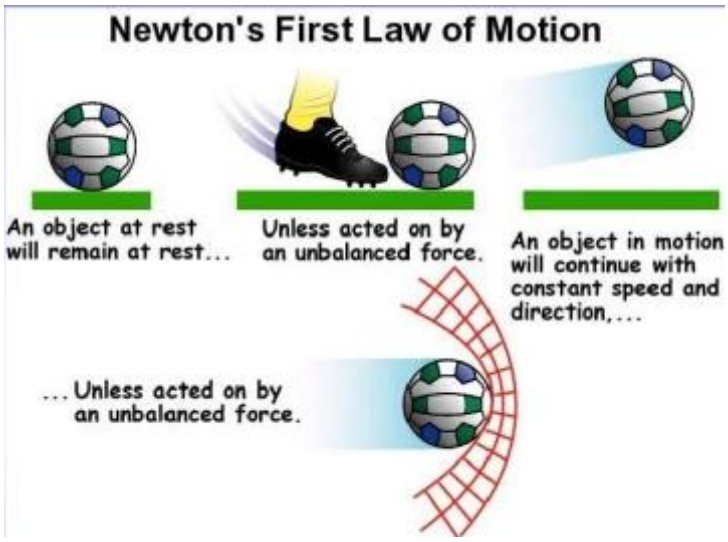


Galileo's Inference

- We need an unbalanced force to change the motion of the marble but no force is required when the marble is moving uniformly. In other words, objects move at a constant speed if no force acts upon them.

Based on Galileo's ideas Newton presented the three Laws of Motion
First law of motion or The Law of Inertia

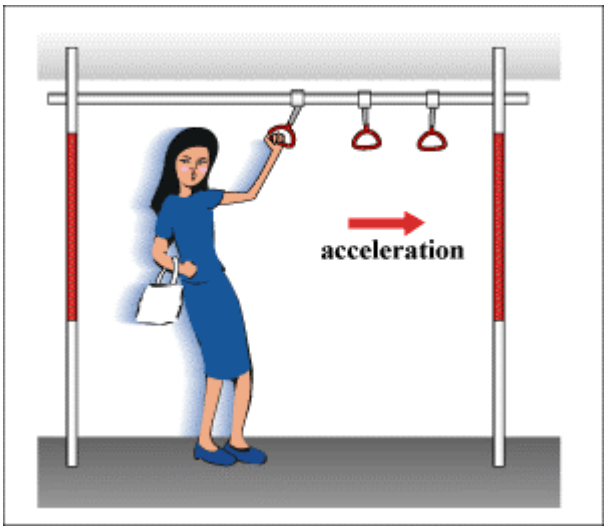
Whether an object is moving uniformly on a straight path or is at rest, its state would not change until and unless an external force is applied on to it.



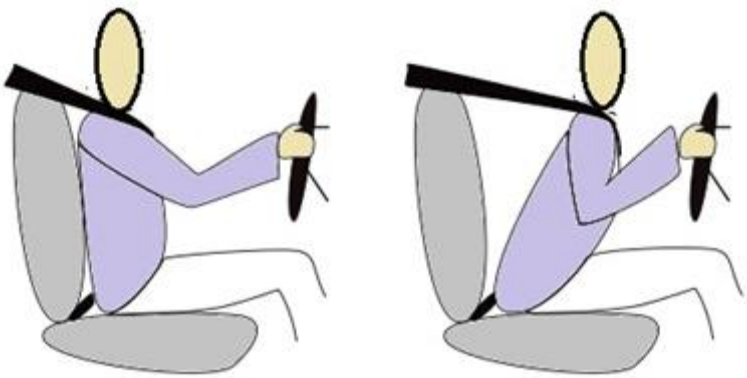
Hence, we can say that objects oppose a change in their state of motion or rest. This tendency of objects to remain in the state of rest or to keep moving uniformly is called **Inertia.**

Examples of Inertia

- We fall back when a vehicle starts moving in the forward direction because our body is in the rest state and it opposes the motion of the vehicle.



- We fall forward when brakes are applied in a car because our body opposite the change of state of motion to rest

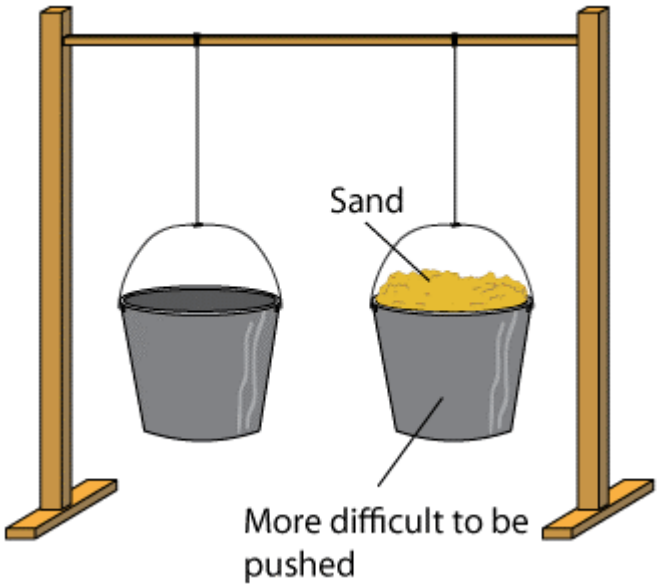


Because of inertia you feel jerk when brakes are applied

Inertia and Mass

- The inertia of an object is dependent upon its mass.
- Lighter objects have less inertia, that is, they can easily change their state of rest or motion.
- Heavier objects have large inertia and therefore they show more resistance.
- Hence 'Mass' is called a measure of the inertia of an object.

Consider the image given below; it is easier for a person to push the bucket that is empty rather than the one that is filled with sand. This is because the mass of an empty bucket is less than that of the bucket filled with sand.



The Second Law of Motion

- The impact produced by a moving object depends upon its mass and velocity.
- **For Example**, a small bullet fired at a high velocity can kill a person.
- **Momentum** – The product of mass and velocity is called Momentum.
- It is a vector quantity. Its direction is same as that of the object's velocity.
- Denoted by – p
- SI unit – kg metre per second
- p = mv,

  where m is the mass of the object,

  v is the velocity of the object

- **The momentum of a stationary object –**

  Let the mass of a stationary object be 'm',

  Let the velocity of a stationary object be 'v',

  The stationary object has no velocity, so v = 0,

  Therefore, p = m*v = m*0 = 0

  So, the **momentum of a stationary object is zero**.
- We know that the velocity of an object can be changed by applying an unbalanced force on to it. Similarly, the momentum of an object can change by applying an unbalanced force.
- **According to the second law of motion** –

  The rate of change of momentum of an object is directly proportional to the applied unbalanced force on the object in the direction of the force.

For Example –

A cricketer when catches a ball pulls his hands in the backward direction to give some time to decrease the velocity of the ball. As the acceleration of the ball decreases the force exerted on catching the moving ball also decreases. If the cricketer would try to stop a moving ball suddenly he would have to apply larger force.

Mathematical Formulation of the Second Law of Motion

Based on the definition of the second law of motion, we can infer that -

Change in momentum $\propto p2 - p1$

$\propto mv - mu$

$\propto m(v - u)$

Rate of change of momentum $\propto m(v - u)/t$

Force $\propto m(v - u)/t$

Force $= k\,m(v - u)/t$

Force $= k\,ma$

Force $= ma$

Initial velocity = u

Final velocity = v

Acceleration = $(v - u)/t$

1 unit of force = $k \times (1\ kg) \times (1\ m\ s^{-2})$

K = 1

Therefore, with help of the second law of motion we can evaluate the amount of force that is being exerted on any object. From the formula stated above, we can see that the force is directly proportional to acceleration. So the acceleration of an object can change depending upon the change in force applied.

Force = ma
SI Unit: kg-ms^{-2} or N (Newton)
The Third Law of Motion
Action and Reaction Forces
Two forces acting from opposite directions are called **Action** and **Reaction Forces**.
For Example, a ball when hits the ground (action) bounces back with a certain force reaction.

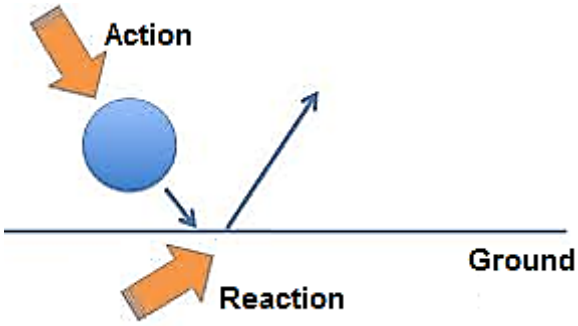


Fig. 15 - Action and Reaction Forces

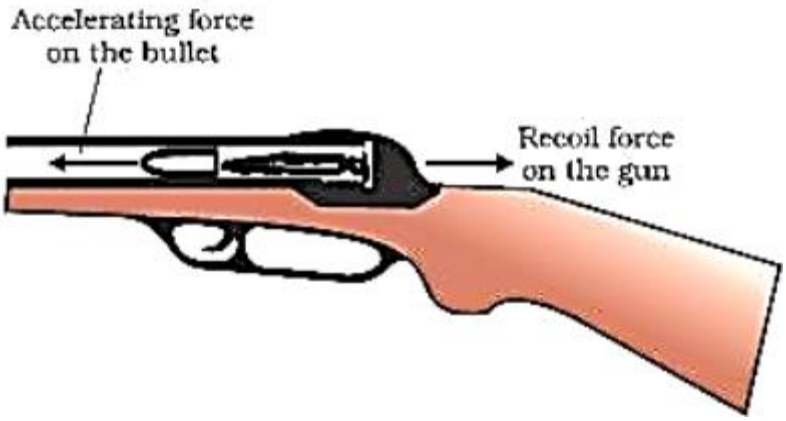
The Third Law of Motion States that –

When an object exerts a force on another object, the second object instantly exerts a force back onto the first object. These forces are always equal in magnitude but opposite in direction. These forces act on two different objects always.

Or in other words, every action has an equal and opposite reaction.

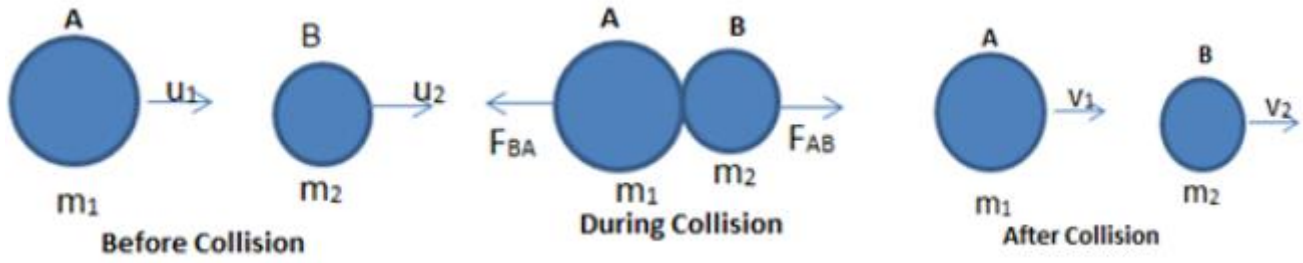
The magnitudes of forces acting upon the objects are same but the acceleration produced in them may or may not be the same because the objects can differ in masses.

For Example, when a bullet is fired from a gun, the gun only moves a little backwards (recoils) while the bullet can travel a large distance. This is because of the difference in the mass of the bullet and the gun.



Conservation of Momentum

As per the law of conservation of momentum, the sum of momenta of two objects before the collision and after collision remains the same given that no external unbalanced force acts upon them. In another way, collision conserves the total momentum of two objects.



Consider the figure given above. Two balls A and B having a certain initial velocities collide with each other. Conditions before the collision-

- There is no unbalanced force acting upon them
- The initial velocity of A is greater than initial velocity of B

The figure below explains how the momentum of the balls is conserved after the collision.

The momentum of ball A before collision = $m_A u_A$	According to third law of motion
The momentum of ball A after collision = $m_A v_A$	$F_{AB} = - F_{BA}$ [-ve sign shows opposite force]
The momentum of ball B before collision = $m_B u_B$	$m_A(v_A - u_A)/t = - m_B(v_B - u_B)/t$
The momentum of ball B after collision = $m_B u_B$	$m_A v_A - m_A u_A = - m_B v_B + m_B u_B$
Rate of change of momentum of ball A $= m_A(v_A - u_A)/t$	$m_A v_A + m_B v_B = m_A u_A + m_B u_B$
=Force of action F_{AB}	or
Rate of change of momentum of ball B $= m_B(v_B - u_B)/t$	$m_A u_A + m_B u_B = m_A v_A + m_B v_B$
= Force of reaction F_{BA}	Momentum before collision = Momentum after collision

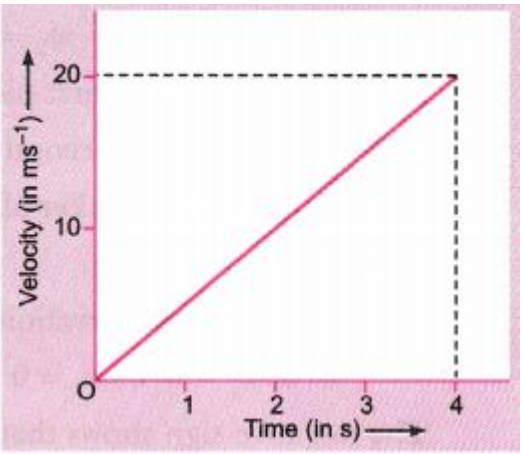
Fig.18 – Conservation of Momentum

Facts about Conservation Laws

- They are considered as the fundamental laws in physics.
- They are based on observations and experiments.
- They cannot be proved but can be verified or disproved with the help of experiments.
- A single experiment is enough to disprove a law, while a single experiment is not enough to prove the same.
- It requires a large number of experiments to prove the law.

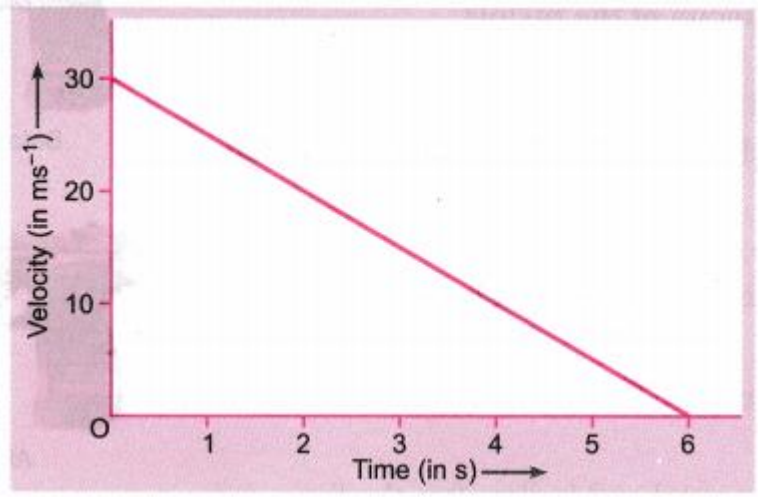
ASSIGNMENT

1. Why do bicycles begin to slow down when we stop pedalling?
2. Plot a graph between force applied on a body and the acceleration produced in the given mass, assuming that the magnitude of force is constantly changing.
3. Name the physical quantity that corresponds to the rate of change of momentum.
4. Body A is heavier than body B Which has more inertia?
5. If the body is found to be accelerated, is the force acting on it balanced or unbalanced?
6. A bullet of 10 g strikes a sand bag at a speed of 10^3 ms^{-1} and gets embedded after travelling 5 cm. Calculate
   (i) the resistive force exerted by the sand on the bullet.
   (ii) the time taken by the bullet to come to rest.
7. A body of mass 300 g kept at rest breaks into two parts due to internal forces. One part of mass 200 g is found to move at a speed of 12 m/s towards the east. What will be the velocity of the other part?
8. A force of 5 N produces an acceleration of 8 ms^{-2} on a mass m_1 and an acceleration of 24 ms^{-2} on a mass m_2. What acceleration would the same force provide if both the masses are tied together?
9. The velocity-time graph of a ball moving on the surface of floor is shown in the figure. Calculate the force acting on the ball, if mass of the ball is 100 g.



10. An iron sphere of mass 1 kg is dropped from a height of 10 m. If the acceleration of sphere is 9.8 ms^{-2}, calculate the momentum transferred to the ground by the ball.

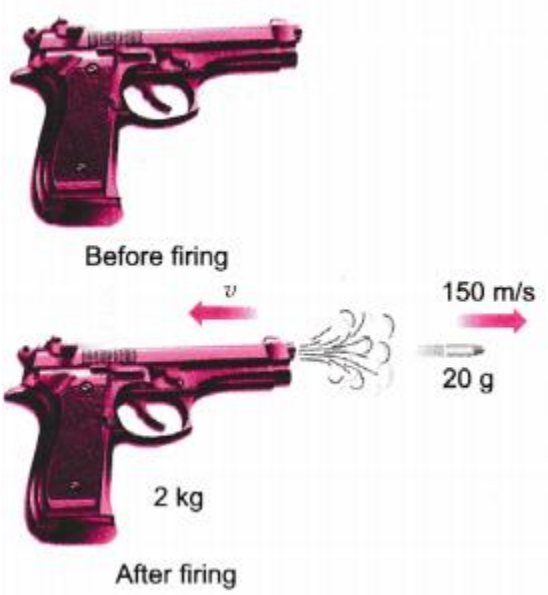
11. The velocity-time graph of a ball moving on the surface of a floor is shown in the figure. Find the force acting on the ball if the mass of the ball is 50 g.



12. A man throws a ball of mass 0.4 kg vertically upwards with a velocity of 10 m/s. What will be its initial momentum? What would be its momentum at the highest point of its reach?

13. Which would require a greater force—accelerating a 2 kg mass at 5 ms^{-2} or a 4 kg mass at 2 ms^{-2} ?

14. A bullet of mass 20 g is horizontally fired with a horizontal velocity 150 ms^{-1} from a pistol of mass 2 kg. What is the recoil velocity of the pistol?



15. If an object is not moving, does it mean that no force is acting on it?

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CHAPTER 3 : ATOMS AND MOLECULES

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for chapter is given below :
https://youtu.be/cGAlfRzxH-A
https://youtu.be/riaoGnwoISk
https://youtu.be/sHMlOvSPrUU

Learning outcomes

Students will able to learn about

1. Dalton's theory
2. Atoms and molecules
3. Compounds
4. Mole concept

Sub topics :

- law of conservation of mass
- law of constant proportion
- Dalton's atomic theory
- Atoms and molecules
- Atomicity
- Compound names
- Mole concept

LESSON DEVELOPMENT

Atoms and Molecules

The invisible and unknown form of matter

The idea of divisibility by Indian philosophers

Maharishi Kanad – He postulated that if we keep on dividing the matter (called as 'padarth') we will get smaller and smaller particles. And soon we will achieve the smallest of particles (called as 'parmanu') which may not divide further.

PakudhaKatyayama – He postulated that there are various forms of matter because the particles of matter exist together in combinations.

The idea of divisibility by Greek philosophers

Democritus and Leucippus – They suggested that when we keep on dividing the matter there comes a time when no more division of particles can take place. Such particles are called atoms which means being invisible.

But all these ideas were not backed up by many experimental pieces of evidence until Antoine L. Lavoisier provided two laws of chemical combination.

Laws of Chemical Combination

1. Law of conservation of mass – mass can neither be created nor destroyed in a chemical reaction

2. Law of constant proportion/Law of definite proportion – the elements are always present in definite proportions by mass in a chemical substance

For example, Hydrogen and oxygen are present in water in a ratio of 1:8. So if we decompose 9g of water we will obtain 1g of hydrogen and 8g of oxygen.

The Atomic Theory

John Dalton proposed an atomic theory which acted as an explanation of the above two laws. As per the theory, all matter whether it is an element, a compound or a mixture consists of tiny invisible particles called 'atoms'.

The postulates of the atomic theory by John Dalton

1. The matter is made up of tiny particles called atoms that cannot be divided.
2. Atoms are never formed or destroyed during a chemical reaction.
3. Atoms of an element exhibit same nature. They have the same size, mass, and character.
4. Atoms of different elements exhibit variant nature. They do not have same characteristics.
5. Atoms form compounds by combining in a ratio of whole numbers.
6. A compound contains a constant number and kinds of atoms

Atoms

We can call atoms as the building blocks of matter. Just like bricks are the building blocks of a building.

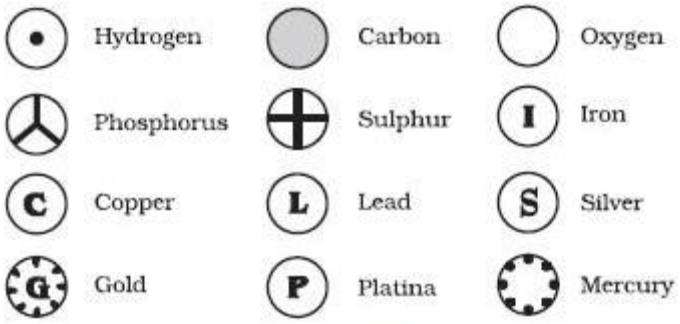
What is the size of an atom?

Atoms are extremely small. Their size is measured in nanometers where 1nm = 1/109 m.

Atomic radius is measured in nanometers 1/109 = 1nm 1m = 109 nm	
Relative Sizes	
Radii (in m)	**Example**
10^{-10}	Atom of hydrogen
10^{-9}	Molecule of water
10^{-8}	Molecule of haemoglobin
10^{-4}	Grain of Sand
10^{-2}	Ant
10^{-1}	Watermelon

Symbols for Atoms

Here are some examples of the symbols that are used to represent different atoms



Symbols for some elements as proposed by Dalton

The symbols for representing an atom are generated from the first two letters of the element's name. The first letter is always in uppercase (capital letter) while the second letter is written in lowercase. Here are some examples –

Element	Symbol	Element	Symbol	Element	Symbol
Aluminium	Al	Copper	Cu	Nitrogen	N
Argon	Ar	Fluorine	F	Oxygen	O
Barium	Ba	Gold	Au	Potassium	K
Boron	B	Hydrogen	H	Silicon	Si
Bromine	Br	Iodine	I	Silver	Ag
Calcium	Ca	Iron	Fe	Sodium	Na
Carbon	C	Lead	Pb	Sulphur	S
Chlorine	Cl	Magnesium	Mg	Uranium	U
Cobalt	Co	Neon	Ne	Zinc	Zn

The Atomic Mass

The Dalton's Atomic Theory suggested that each element has a distinguishing atomic mass. With this theory, the law of constant proportions could be explained easily.

But it is indeed difficult to evaluate the mass of an atom since the size of an atom is relatively small.

Therefore scientists started evaluating the mass of an atom by comparing it with the mass of a standard atom.

Earlier 1/16 of the mass of an oxygen atom was used as a standard for calculating the mass of other elements. Now, carbon - 12 is considered a standard atom for calculating the mass.

Its atomic mass is 12u (12 atomic mass units). Thus we can say that one atomic mass unit is the mass of 1/12 the mass of a carbon-12 atom. Here is a list of atomic masses of a few elements.

Element	Atomic Mass
Hydrogen	1 µ
Carbon	12 µ
Nitrogen	14 µ
Oxygen	16 µ
Sodium	23 µ
Magnesium	24 µ
Sulphur	32 µ
Chlorine	35.5 µ
Calcium	40 µ

Can atoms exist independently?

Atoms cannot survive independently. So, atoms join together and form molecules or ions.

Molecule

- A molecule is a collection of various atoms that combine chemically with each other.
- These atoms are bound together by certain forces of attraction.
- Atoms of the same elements or different elements can bind together to form molecules.
- Therefore, a molecule is the smallest particle of a substance that can exist independently and shows all the properties of that substance.

Molecules of Elements

- The molecules of an element are formed by combinations of similar types of atoms. For example, Helium (He) is made up of only one atom while oxygen is made up of two atoms.
- **Atomicity** – the number of atoms in a molecule of an element is called its atomicity. For example, helium is monoatomic and oxygen is diatomic.
- **Monoatomic** – when an element comprises of a single atom. Example – all metals
- **Diatomic** – when an element comprises of two atoms. Example – all gases
- **Triatomic** – when an element comprises of three atoms
- **Tetra-atomic** – when an element comprises of four atoms
- **Poly-atomic** – when an element comprises of more than two atoms

Here a few examples of atomicity of elements –

Atomicity of some Elements

Name	Atomicity	Formula
Argon	Monoatomic	Ar
Helium	Monoatomic	He
Oxygen	Diatomic	O_2
Hydrogen	Diatomic	H_2
Nitrogen	Diatomic	N_2
Chlorine	Diatomic	Cl_2
Phosphorous	Tetra – atomic	P_4
Sulphur	Poly – atomic	S_8

Molecules of Compounds

Molecules of compounds constitute atoms of different elements that combine together in a fixed proportion. For example, water comprises of two atoms of hydrogen and one atom of oxygen.

Molecules of some compounds :-

Compound	Combining elements	Number of atoms of each elements
Water – H_2O	Hydrogen, Oxygen	2 - Hydrogen, 1 - Oxygen
Ammonia – NH_3	Nitrogen, Hydrogen	1 - Nitrogen, 3 - Hydrogen
Carbon dioxide CO_2	Carbon, Oxygen	I - Carbon, 2 - Oxygen
Hydrochloric acid HCl	Hydrogen, Chlorine	1 - Hydrogen, 1 - Chlorine
Nitric acid HNO_3	Hydrogen, Nitrogen, Oxygen	1 - Hydrogen, 1 - Nitrogen, 3 - Oxygen
Sulphuric acid H_2SO_4	Hydrogen, Sulphur, Oxygen	2 - Hydrogen, 1 - Sulphur, 4 - Oxygen

Ions

- Compounds contain metals as well as non-metals. These elements include charged species which are known as ions.
- Thus, ion is a particle that has a positive or negative charge.
- **Anion** – negatively charged ion
- **Cation** – positively charged ion
- There can be a single charged atom in an ion or there may be a group of charged atoms in an ion that have a net charge on the compound.
- When a group of atoms carries a charge in a compound it is called as a **polyatomic ion.**

Chemical Formula

We use a chemical formula to represent the composition of a compound in the form of symbols. To write a chemical formula you must know two things –

1. Symbols of elements

2. Valency

Valency – it is also known as the combining capacity of an element. In other words, valency explains how atoms of one element will mix with atoms of another element. For example, the hydrogen ion is represented as H+ which means that its valency is 1. Similarly, the oxygen ion is represented as O2- which means that its valency is 2. Here is a list of valancies of various elements.

Name of the Element	Symbol	Valency	Ion.
Hydrogen	H	1	H^+
Helium	He	0	–
Lithium	Li	1	Li^+
Beryllium	Be	2	Be^{2+}
Boron	B	3	B^{3+}
Carbon	C	4 (Shares electrons)	–
Nitrogen	N	3	N^{3-}
Oxygen	O	2	O^{2-}
Fluorine	F	1	F^-
Neon	Ne	0	–
Sodium	Na	1	Na^+
Magnesium	Mg	2	Mg^{2+}
Aluminium	Al	3	Al^{3+}

Rules of writing a Chemical Formula

- Valencies of on the ions must balance.
- In a case where both metal and non-metal substances are present in a compound, the name of the metal is always written first in the chemical formula. For example, Sodium Chloride is written as NaCl
- In case of polyatomic ions, the ion is written in brackets before writing the number of ions associated to it. In case of a single ion, there is no need to mention the ion in brackets

Writing the Formulae of Simple Compounds

Binary compounds – compounds that consist of two different elements

How to write a Formula of a Compound

- Write the symbols of the corresponding elements of the compound as explained above
- Write the valencies of the elements of the compound
- Crossover the valencies of the elements

Here are a few examples of writing the chemical formula

(i) Formula of Sodium Oxide

Symbol → Na O

Charge → +1 –2

Formula → Na_2O

(ii) Formula of aluminium chloride

Symbol → Al Cl

Charge → +3 – 1

Formula → $AlCl_3$

(iii) Formula of Sodium Oxide

Symbol → Na S

Charge → +1 –2

Formula → Na_2S

(iv) Formula of magnesium hydroxide

Symbol → Mg OH

Charge → +2 1

Formula → $Mg(OH)_2$

Molecular Mass and the Mole Concept

Molecular Mass – summation of all the atomic masses in a molecule

Molecular mass is expressed in atomic mass units (amu).

For example, the molecular mass of HNO3 can be calculated as:

Atomic mass of H =1u

Atomic mass of N =14u

Atomic mass of O =16u

Molecular mass of HNO3 = 1 + 14 + (16*3) = 63u

Formula Unit Mass

The sum of atomic masses of all atoms in a formula unit of a compound is called as its formula unit mass. The formula unit mass is used in case of substances that constitute ions. For example, formula unit mass of Sodium Chloride (NaCl) can be calculated as: (1*23) + (1*35.5) = 58.5u

Formula unit mass of ZnO

= 1 × atomic mass of Zn + 1 × atomic mass of O

= 1 × 65 u + 1 × 16 u = **81 u**

Formula unit mass of Na_2O

= 2 × atomic mass of Na + 1 × atomic mass of O

= 2 × 23 u + 1 × 16 u = **62 u**

Formula unit mass of K_2CO_3

= 2 × atomic mass of K + 1 × atomic mass of C + 3 × atomic mass of O

= 2 × 39 u + 1 × 12 u + 3 × 16 u

= 78 u + 12 u + 48 u = **138 u**

Mole Concept

How do we interpret a chemical equation?

$2C + O_2 = 2CO_2$

We say that two molecules of carbon combine with one molecule of oxygen to form two molecules of carbon dioxide.

We can also say that 24u of Carbon molecules combine with 32u of oxygen molecules to form 56u of carbon dioxide molecules.

Therefore, we can characterize the quantity of a substance by its mass or by its number of molecules.

A chemical equation directly indicates the number of molecules participating in the reaction. Thus, it is convenient for us to refer to the number of substances in a chemical reaction as numbers of molecules or atoms.

Mole

Mole is a numerical quantity that has a mass equal to the atomic or molecular mass of species (atoms, molecules, ions or particles).

1 mole of any substance = 6.022 X 1023 number of particles (atoms, ions or molecules)

This is called the **Avogadro number or Avogadro Constant** which is represented as N0

The mass of 1 mole of a substance is the same as that its atomic mass or molecular mass expressed in grams.

Gram atomic mass of a substance – the atomic mass of a substance when expressed in grams is known as its gram atomic mass.
Gram molecular mass of a substance – the molecular mass of a substance when expressed in grams is known as its gram molecular mass.

For example, the atomic mass of Sulphur is 32u. Gram atomic mass of Sulphur is 32g.

Also, 32u of Sulphur has 1 atom of Sulphur. 32g of Sulphur has 1 mole atoms, that is, 6.022 X 1023 atoms of Sulphur.

Similarly, we can say that the gram molecular mass of Carbon Dioxide is 56g.

But we know that in the case of chemical equation mole is the measuring unit.

Therefore, 1 mole = 6.022 × 1023 number = Relative mass in grams

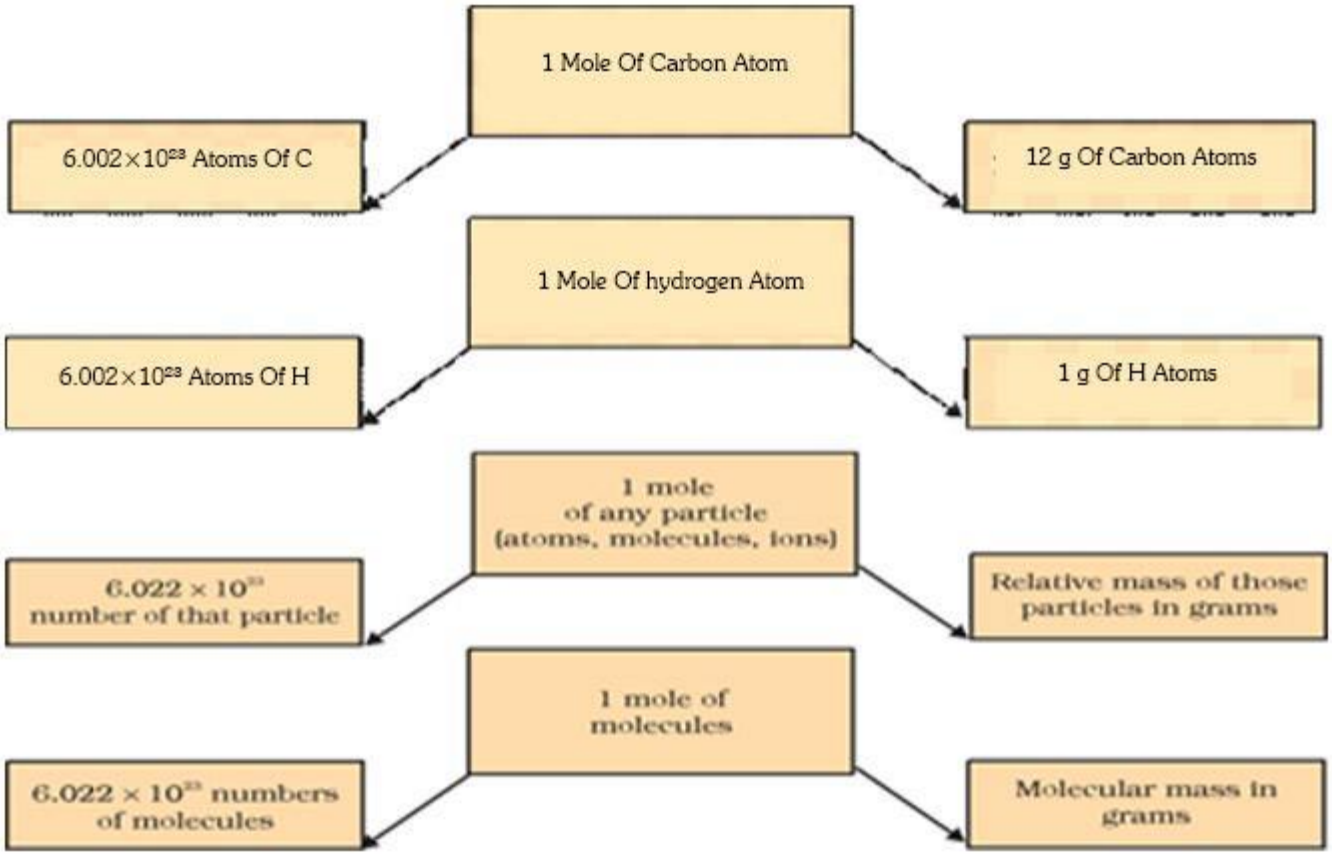
Wilhelm Ostwald introduced the word 'mole' which actually means a heap or a pile. Therefore, we consider a substance as a heap of atoms or molecules.

Consider these formulae –

$$\text{Number of moles} = \frac{\text{Mass of substance}}{\text{Molar mass}}$$

$$\text{Number of moles} = \frac{\text{Number of particles}}{\text{Avogadro number}}$$

A quick review of how mole, Avogadro number and Mass are related to each other –



ASSIGNMENT

- Atoms of most elements are not able to exist independently'. Name two atoms which exist as independent atoms.
- What is the number of electrons in Mg atom and **Mg2+** ion
- Write atomicity of the following:
  (i) Sulphur, (ii) Phosphorus
- Which postulate of Dalton's atomic theory is the result of the law of conservation of mass ?
- Give the electronic configuration of:
  (i) Al atom and its ion
  (ii) O atom and its ion
- Give the names of the elements present in the following compounds:
  (a) Quicklime (b) Hydrogen bromide
  (c) Baking powder (d) Potassium sulphate.

- State two examples in each case and write their chemical formulae:
  (a) Molecules having (me kind of atoms only.
  (b) Molecules having two different kinds of atoms.
  (c) Molecules having three different kinds of atoms.
- Classify the following compounds diatomic, triatomic and polyatomic molecules: [SAII-2014]
  $HCl, H_2, H_2O, NH_3, CH_3OH, PCl_5$
- Write the names of the following compounds:
  (a) NiS (b) $Mg(NO_3)_2$ (c) Na_2SO_4 (d) $Al(NO_3)_3$
  (e) K_3PO_4 (f) Ca_3N_2 [SA II–2014]
- In a reaction, 5.3 g of sodium carbonate reacted with 6 g of ethanoic acid. The products were 2.2 g of carbon dioxide, 0.9 g water and 8.2 g of sodium ethanoate. Show that these observations are in agreement with the law of conservation of mass, sodium carbonate + ethanoic acid —> sodium ethanoate + carbon dioxide + water.
- Calculate the formula unit masses of ZnO, **Na_2O**, **K_2CO_3**, given atomic masses of Zn = 65u, Na = 23u, K = 39 u, C = 12 u, and O = 16 u.
- Write the chemical formulae of the following: [SAII-2015]
  (a) Magnesium chloride (b) Calcium oxide
  (c) Copper nitrate (d) Aluminium chloride
- Calculate the number of molecules of sulphur (**S_8**) present in 16 g of solid sulphur.
- Calculate the number of aluminium ions present in 0.051 g of aluminium oxide.(Hint: The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al = 27 u). [SAII-2011]
- (a) Define: (i) Molecular mass, (ii) Avogadro constant.
  (b) Calculate the number of molecules in 50 g of $CaCO_3$. (Atomic mass of Ca = 40 u, C = 12 u and O = 16 u)
  (c) If one mole of sodium atom weighs 23 g, what is the mass (in g) of one atom of sodium ?
- A sample of vitamin C is known to contain 2.58 x10^{24} oxygen atoms. How many moles of oxygen atoms are present in the sample ?

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SUBJECT : SCIENCE

CLASS IX

Week : 22 February to 27 February 2021

CHAPTER 10 : GRAVITATION

Guidelines

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Instructional Aids / Resources

NCERT Link for chapter is given below :
https://youtu.be/YeqQWJ74t-M
https://youtu.be/hu7oma8ushs
https://youtu.be/QrmoMzaRuVI

Learning outcomes

Students will able to learn about tissue

Sub topics :

- Tissue
- Different types of tissue
- Plant tissue
- Animal tissue
- Connective tissues
- Nerve tissues

Gravitation

What is the Centripetal Force?

- We know that an object in circular motion keeps on changing its direction.
- Due to this, the velocity of the object also changes.
- A force called **Centripetal Force** acts upon the object that keeps it moving in a circular path.
- The centripetal force is exerted from the centre of the path.
- Without the Centripetal Force objects cannot move in circular paths, they would always travel straight.
- **For Example**, The rotation of Moon around the Earth is possible because of the centripetal force exerted by Earth.

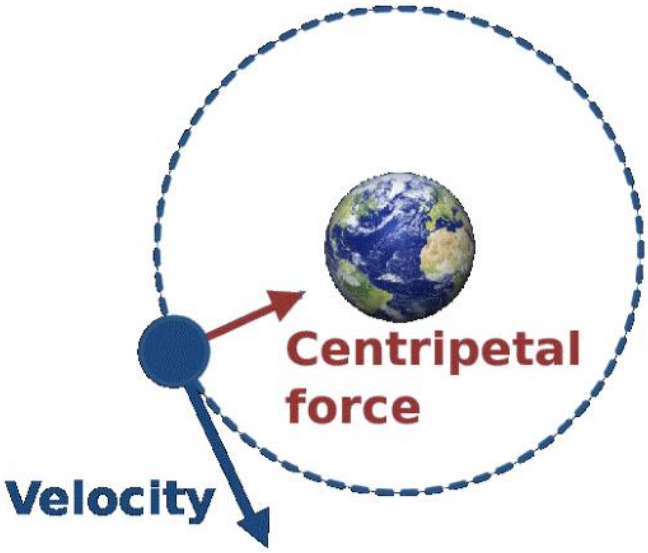


Figure 1 Centripetal Force of Earth on Moon

Newton's Observations

- Why does Apple fall on Earth from a tree? – Because the earth attracts it towards itself.
- Can Apple attract the earth? - Yes. It also attracts the earth as per Newton's third law (every action has an equal and opposite reaction). But the mass of the earth is much larger than Apple's mass thus the force applied by Apple appears negligible and Earth never moves towards it.
- Newton thus suggested that all objects in this universe attract each other. This force of attraction is called **Gravitational Force**.

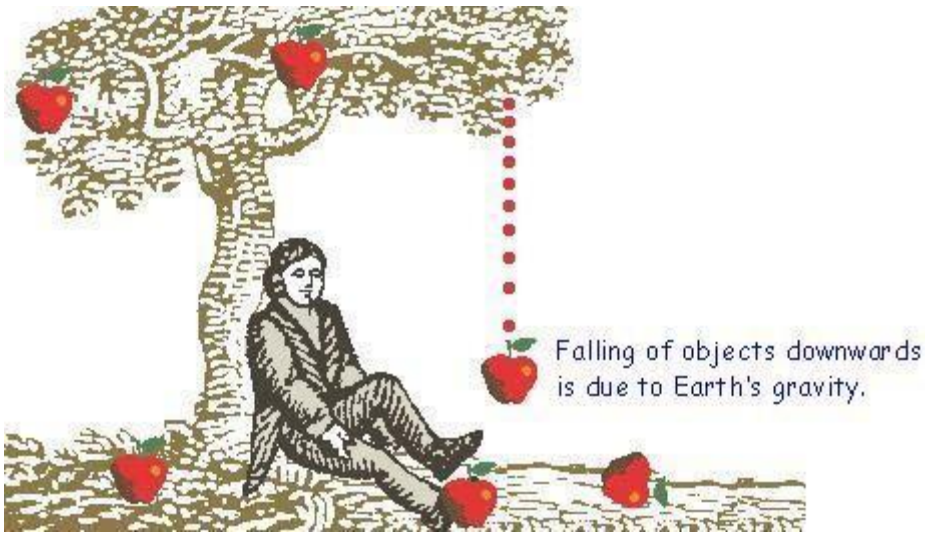
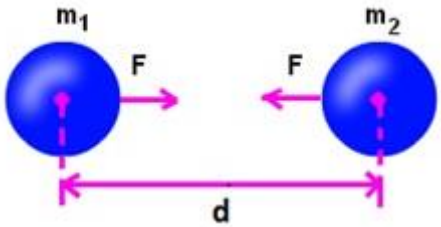


Figure 2 Gravitational Force of Earth

Universal Law of Gravitation by Newton

- According to the universal law of gravitation, every object attracts every other object with a force.
- This force is directly proportional to the product of their masses.
- This force is inversely proportional to the square of distances between them.
- Consider the figure given below. It depicts the force of attraction between two objects with masses m_1 and m_2 respectively that are 'd' distance apart.



- The figure below describes how the universal law of gravitation is derived mathematically.

$$F \alpha m_1 ------(i)$$

$$F \alpha m_2 ------(ii)$$

$$F \alpha \frac{1}{r^2} ------(iii)$$

From the above equation we can rewrite them as the following:

$$F \ \alpha \ \frac{m_1 m_2}{r^2} ------(iv)$$

If we remove the proportionality we get proportionality constant G as the following:

$$F = G\frac{m_1 m_2}{r^2}$$

The above equation is the mathematical representation of Newton's universal Law of gravitation

Hence, $G = Fr^2 / m_1 m_2$
SI Unit: $Nm^2 kg^{-2}$
Value of $G = 6.673 \times 10^{-11}$ $Nm^2 kg^{-2}$ (was found out by Henry Cavendish (1731- 1810))

- The proportionality constant G is also known as the **Universal Gravitational Constant**

Why we study the universal law of gravitation?

It explains many important phenomena of the universe –

- Earth's gravitational force
- Why the moon always moves in a circular motion around the earth and the sun
- Why all planets revolve around the sun
- How the sun and moon can cause tides

Free Fall

- **Acceleration due to gravity** – Whenever an object falls towards the Earth there is an acceleration associated with the movement of the object. This acceleration is called acceleration due to gravity.
- Denoted by: g
- SI Unit: $m\ s^{-2}$
- We know that, F= ma
- Therefore, F = mg
- The following figure demonstrates the mathematical derivation of 'g'

The force (F) of gravitational attraction on a body of mass m due to earth of mass M and radius R is given by

$$F = G\frac{mM}{R^2} \qquad \ldots (1)$$

We know from Newton's second law of motion that the force is the product of mass and acceleration.

∴ F = ma

But the acceleration due to gravity is represented by the symbol g. Therefore, we can write

$$F = mg \qquad \ldots\ldots (2)$$

From the equation (1) and (2), we get

$$mg = G\frac{mM}{R^2} \qquad \text{or} \qquad g = \frac{GM}{R^2} \qquad \ldots\ldots (3)$$

When body is at a distance 'r' from the centre of the earth then

$$g = \frac{GM}{r^2}$$

Value of 'g' may vary at different parts of the earth –

- From the equation $g = GM/ r^2$ it is clear that the value of 'g' depends upon the distance of the object from the earth's centre.
- This is because the shape of the earth is not a perfect sphere. It is rather flattened at poles and bulged out at the equator.

- Hence, the value of 'g' is greater at the poles and lesser at the equator. However, for our convenience, we take a constant value of 'g' throughout.

We can find the value of acceleration due to gravity by the following –

Calculation of g

- $F = GMm/r^2$
- $g = F/m = GM/r^2$
- Mass of Earth = 6×10^{24}kg
- Radius of Earth = 6.4×10^6m
- Calculate g on Earth
- **$g = GM/r^2$**
- **$= 6.67 \times 10^{-11} \times 6 \times 10^{24} / (6.4 \times 10^6)^2$**
- **$= 9.8$ Nkg^{-1}**

What is Free Fall?

When an object falls towards the earth due to earth's gravity and no other force is acting upon it, the object is said to be in **free fall state**. Free falling objects are not even resisted by the air.

$g = 9.8$ m/s^2 is also called the **Free-fall Acceleration**.

Value of 'g' is same on the earth, so the equations of motion for an object with uniform motion are valid where acceleration 'a' is replaced by 'g', as given under:

$v = u + gt$
$s = ut + (1/2)\, gt^2$
$2\, g\, s = v^2 - u^2$

Consider the equations of motion given in different scenarios:

When an object at rest falls towards earth – its initial velocity is zero $v = gt$ $s = t + (1/2)\, gt^2$ $2\, g\, s = v^2$
When an object with some initial velocity (u) falls towards earth – $v = u + gt$ $s = ut + (1/2)\, gt^2$ $2\, g\, s = v^2 - u^2$
When an object is thrown upwards from earth – the gravitational force acts in opposite direction, hence g is negative $v = u - gt$ $s = ut - (1/2)\, gt^2$ $-2\, g\, s = v^2 - u^2$

Difference between Universal gravitational Constant and Acceleration due to Gravity

Mass	Weight
Mass is defined as the quantity of matter in an object.	The weight of an object is the force by which the gravitational pull of earth attracts the object.
Mass is a scalar quantity	Weight is a vector quantity

The mass of an object is always constant as it depends upon the inertia of the object	The weight of an object can vary at different locations because of change in gravitational force of the earth
Mass can never be zero	Weight can be zero at places there is no gravitational force
Denoted as: m	Denoted as W
	F = mg
	where m = mass of object
	a = acceleration due to gravity
	Similarly, W is force, so
	W = mg
SI Unit: kg	SI unit: N

Weight of an object on the Moon

Just like the Earth, the Moon also exerts a force upon objects. Hence, objects on moon also have some weight. The weight will not be same as than on the earth. So, weight on the Moon can be calculated as -

$$W_M = \frac{GM_M m}{R_M^2}$$

Now,

$$\Rightarrow \frac{W_M}{W_E} = \frac{M_M R_E^2}{M_E R_M^2}$$

Where,

$M_E = 5.98 \times 10^{24}\ kg$

$M_M = 7.36 \times 10^{22}\ kg$

$R_E = 6.4 \times 10^6\ m$

$R_M = 1.74 \times 10^6\ m$

$$\Rightarrow \frac{W_M}{W_E} = \frac{7.36 \times 10^{22} \times (6.4 \times 10^6)^2}{5.98 \times 10^{24} \times (1.74 \times 10^6)^2} = 0.165 \approx \frac{1}{6}$$

Therefore, weight of an object on the moon is $\frac{1}{6}$ of its weight on the Earth.

ASSIGNMENT

1. What will happen to the gravitational force between two bodies if the masses of one body is doubled?
2. At what place on the earth's surface is the weight of a body maximum?
3. If the mass of a body is 9.8 kg on the earth, what would be its mass on the moon?
4. What keeps the moon in uniform circular motion around the earth?
5. Suppose that the radius of the earth becomes twice of its original radius without any change in its mass. Then what will happen to your weight?
6. On the earth, a stone is thrown from a height in a direction parallel to the earth's surface while another stone is simultaneously dropped from the same height. Which stone would reach the ground first and why?
7. Two objects of masses ml and m2 having the same size are dropped simultaneously from heights h_1 and h_2, respectively. Find out the ratio of time they would take in reaching the ground. Will this ratio remain the same if (i) one of the objects is hollow and the other one is solid; and (ii) both of them are hollow, size remaining the same in each case? Give reasons
8. A stone is dropped from the top of a 40 m high tower. Calculate its speed after 2 s. Also find the speed with which the stone strikes the ground.
9. Two bodies of masses 3 kg and 12 kg are placed at a distance 12 m. A third body of mass 0.5 kg is to be placed at such a point that the force acting on this body is zero. Find the position of that point.
10. A ball is thrown up with a speed of 0.5 m/s.
    (i) How high will it go before it begins to fall?
    (ii) How long will it take to reach that height?
11. Do fluids possess weight?
12. When a body is dropped from a height, what is its initial velocity?
13. When a body is thrown vertically upwards, what is its final velocity?
14. Mention any four phenomena that the universal law of gravitation was able to explain.
15. Why does a body reach the ground quicker at poles than at the equator when dropped from the same height?

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SUBJECT : CHEMISTRY

CLASS IX

Week : 22 February to 27 February 2021

CHAPTER 13 ; WHY DO WE FALL ILL

Guidelines

- Refer to the content given below and view the links
- These notes will help you to understand the concept and complete the assignment that follows
- The assignment is to be done in the chemistry notebook
- Please read the science NCERT book before you begin answering

Instructional Aids / Resources

NCERT Link for chapter is given below :

https://youtu.be/q5ORaTriWmQ

https://youtu.be/Gro5rKd5mvA

https://youtu.be/U0ya3DntNRc

Learning outcomes

Students will able to learn about different diseases

Sub topics :

- Why do we fall ill
- What is health
- What do you mean by disease
- Types of diseases
- What causes diseases
- Principle of treatment
- Principle of prevention

LESSON DEVELOPMENT

Why do we Fall Ill?

The activities performed inside our body by the internal organs are all interconnected. For instance, the heart always forms of the blood in the body, the brain always thinks, the kidney filters out waste from our body and so on. If anyone of these activities stops, this would affect the whole functionality of our body.

What is health?

It is a state of being well so that one can perform physical, social and mental functions properly. **For Example**, we say a person is healthy if they can perform their day to day tasks very well.

Figure 1: What is health?

Is health dependent on personal and social issues?

Yes, we cannot achieve health solely on our own. Every organism in this world depends upon another or the environment for their better health.

Factors that determine better health:

- We always stress upon the fact that the environment surrounding us should be healthy otherwise it may lead to harmful diseases. Therefore, we can say that **public cleanliness** is an important factor for the better health of people in society.
- Another important factor for proper health is **food**. Now, we can have food only if we have the money to buy it and for that, we need to work. Therefore we can say that good economic conditions of society and employment are needed for better health.
- Lastly, we can stay healthy if we are living a tension free life. How can we expect a healthy environment around us if everyone keeps on ill-treating each other? Therefore, we can say that a **good social environment** is required for better health.

What do you mean by a disease?

- We can say that a disease is any abnormality or disturbance caused in our body.
- A disease is not caused by any external injury but can be caused by an external factor like germs.
- Sometimes internal dysfunctionality of our body may also lead to diseases.
- A disease generally has some Symptoms and Signs associated with it, **For Example**, Pain, Swelling and Fever are some common symptoms.

How is being disease-free different from being healthy?

Healthy	Disease free
It is a state of physical, mental and social well being.	It is a state of absence from diseases.
It refers to the individual, physical and social environment.	It refers only to the individual.
The individual has good health.	The individual may have good health or poor health.

Figure 2: Healthy and Disease-Free

How can we stay disease free?

We can stay disease-free by maintaining good health that is,

- by having proper food or a balanced diet
- by keeping the environment clean
- maintaining personal hygiene

How can we identify a disease?

- A disease is associated with symptoms. In other words, our body shows certain indications with which we can assume that we may be suffering from a disease.
- We know that different parts of our body perform different functions.
- Any of these functions are disturbed, we can say that something is wrong within our body or something has changed in it. This is a symptom of getting a disease.
- Symptoms just indicate that there is a disease. They do not indicate the exact type of disease.
- The doctors often look for the signs of a disease in order to find out the exact problem. These signs, unlike the symptoms, are more definite indication of a disease. Sometimes laboratory tests are also done in order to find a disease.

Types of Diseases: Acute Diseases and Chronic Diseases

Acute Disease	Chronic Disease
Acute diseases last for only a short period of time.	Chronic diseases last for a long period of time
It is caused randomly.	It is caused in due course of time.
It does not cause major effect on general health. **Example:** Cough, dysentry.	It causes major effect on general health. **Example:** Elephantiasis, heart disease, tuberculosis.

How chronic diseases affect our health?

- Chronic diseases take relatively a long period of time hence they are likely to affect our general health as well.
- They may hinder the growth in children or increase stress in adults.
- They can make us feel tired all the time.
- They can also lead to an increase or decrease in weight.
- They can also affect our day to day activities and the ability to learn new things.
- Hence, we can say that they have long-term effects on health than acute diseases.

What causes diseases?

We know that, diseases can be caused by two factors:

Internal factors in our body such as:

- Hormonal imbalance
- Allergic Reaction
- Genetic disorder
- Malfunctioning of body organs

External factors such as:

- Unhealthy diet
- Disease causing germs (bacteria, viruses, fungi)
- Pollution in the environment
- Unhealthy lifestyle

Based on the following there are two broad categories of causes of diseases –

1. Immediate Causes and Contributory Causes

Immediate Causes	Contributory Causes
These are the actual causes that are responsible for a disease. These causes can be infectious as well as non-infectious.	These are not the direct causes but factors that contribute in causing a disease.
For Example, Bacteria, Fungi, Viruses, Germs etc.	**For Example** Poor diet, Unhealthy lifestyle, Polluted environment etc.

2. Congenital and Acquired Diseases

Congenital diseases are present since birth. For eg hole in heart of an infant. Acquired Diseases occur after birth. Based on their ability to spread from one individual to another, Acquired diseases are of two types:

Infectious and Non-infectious causes of Disease

Infectious Causes	Non-infectious Causes
These are the extrinsic or external disease causing factors.	These are the intrinsic or internal disease causing factors.
They lead to infectious disease and can affect the whole community as they are transferable from one person to another.	They lead to non-infectious diseases and do not affect the whole community as they are non-transferable from one person to another.

Difference between Infectious and Non-infectious Diseases:

Infectious or Communicable Diseases	Non-infectious or Non-Communicable Diseases
They are caused by attack of pathogens.	They are not caused by pathogens.
The diseases brought about by exitinsic or external factors.	The diseases are mostrly brought by intrinsic or internal factors.
Infectious diseases can pass from diseased person to a heathly person.	Non-infectious diseases cannot pass from one person to another.
Transmission of infection occurs through direct contact or some medium (air, water, vectors).	Transmission is absent, However hereditary diseases are transmitted from parent to offspring.
Community hygiene can reduce the incidence of infections diseases	Community hygiene is ineffective in reducing the incidence of non-infectious diseases.
Example: Cholera, Tuberculosis (TB), Pneumonia, Chickenpox.	**Example:** High blood pressure, Heart, disease, Cancer.

Infectious Agents

The pathogens or microbes that cause infectious diseases are also called as **Infectious Agents**.

Infectious agent	Disease
Virus	Common cold, influenza, dengue fever, AIDS
Bacteria	Typhoid fever, cholera, tuberculosis, anthrax
Fungi	Many common infectious disease
Protozoan	Malaria, kala azar
Worms	worm infections, elephantiasis

Figure 3: Infectious Agents

Why do we need to understand the characteristics of these infectious agents?

If we understand the characteristics we can treat the diseases caused by them in a better way. We can find out which medicine would work on which infectious agent. Some common characteristics of infectious agents are:

- Viruses live inside the host body
- Bacteria do not generally live inside the host body
- Virus, bacteria and fungi multiply quickly
- Worms do not multiply quickly

How penicillin can help fight against bacteria?

Antibiotics are generally used to block the growth of bacteria. The bacteria cells grow by creating a cell wall that protects them. Penicillin is an antibiotic that prevents the growth of the cell wall and hence bacteria die easily. Penicillin is used for fighting against different kinds of bacteria.

Several types of diseases

Based on the means of spread of a disease, we can classify it into different categories:

Type of Disease	Causing Factor	Examples
Airborne diseases	they are caused by germs, bacteria or virus in the air	Common cold, tuberculosis
Foodborne diseases	they are caused by germs (bacteria, toxins, viruses, fungi) present in the food	Food poisoning, Typhoid
Waterborne diseases	They are caused by drinking contaminated water	Cholera, Amoebiasis
Lifestyle diseases	they occur because of poor or unhealthy lifestyle	Heart disease, Diabetes
Vector-borne Diseases	they are caused due to animals that carry infectious agents from a sick person to another person These animals that act as an intermediate between disease causing germs and people are called vectors.	Malaria, Dengue Fever
Sexually transmitted diseases	they are caused due to sexual contact from one person to another	AIDS, Syphilis

Where do the disease-causing germs live in our body?

- There are a number of tissues and organs in our body where these microbes can get attached to.
- Generally, the point of entry decides where they will go. For instance, any microbe that enters through the nose is likely to settle at the lungs.
- This can also be seen through the signs and symptoms of a disease as only those organs and tissues issues seem affected where these microbes enter.
- But there are some other common diseases also that are not tissue-specific.
- **Inflammation** – Our body has an immune system in which it creates the cells that can fight against the disease-causing germs. This process of recruiting cells to kill the infectious agents present in our body is called **Inflammation**. The inflammation process shows different effects on our body such as fever or swelling.
- Hence, we can say that the likelihood we are going to be affected by the disease is determined by the immune system of our body.

Principles of treatment

Figure 4: Principles of Treatment

We may treat an infectious disease in two ways:

- By killing the infectious agents
- By reducing the effects of the disease or reducing the symptoms

We can reduce the symptoms in the following ways:

- By taking rest to conserve our energy so that our immune system can fight against the disease
- By taking medicine to reduce the common symptoms such as fever or pain and hence reducing the disease

We can kill the infectious agents in our body in the following way:

- By taking medicines that can kill them such as antibiotics or antiviral medicines

Antibiotics aren't effective against viruses?

Antibiotics commonly work by blocking the biochemical pathways that are important for bacteria. Thus these inhibit the growth of bacteria, hamper the metabolism and kill them. Antibiotics do not work on viruses because viruses do not use the biochemical path and use host cell machinery for making proteins.

However, the most effective way to treat viral infections and disease is vaccination as it can prevent a person from getting the disease in the first place.

The principles of prevention

Are there any limitations of treating infectious agents via medicines?

Yes, there are three limitations:

- Our body functions might not be able to recover easily

- This treatment takes time hence it can affect our daily activities
- An infectious disease may transfer from a person who is suffering the disease to another in the meanwhile of the treatment

Therefore, we should find out ways to prevent these diseases in the first place. There are two ways to prevent diseases:

1. **Preventing exposure to these infectious agents**

- Waterborne diseases can be prevented by always having safe and pure drinking water
- Airborne diseases can be prevented by avoiding overcrowded places in keeping the environment clean
- Vector-borne diseases can be prevented by keeping our surroundings clean and maintaining public hygiene

2. **Strengthening the immune system** so that if any infectious agents enter our body it can fight back. This can be made possible by having healthy food.

What is the Immune System?

- The immune system is a network of cells, tissues and organs that work together in order to protect our body from diseases. We may consider the immune system as a defence system of our body.
- The immune system looks out and destroys the disease-causing germs in our body with the help of special cells called white blood cells. These cells are present in the blood and hence circulate throughout the body and monitor it.
- The germs or any foreign substance that enter our body are called **Antigens**. As the immune system recognizes these antigens, it releases antibodies which lock the antigens and then destroy them with the help of other cells.
- The ability of a body to resist a disease with the help of antibodies is called **Immunity**.

ASSIGNMENT

1. Why are we advised to take blend and nourishing food when we are sick ?
2. Give two examples for each of the following :
   (a) Acute diseases
   (b) Chronic diseases
   (c) Infectious diseases
   (d) Non-infectious diseases.
3. What is an antibiotic ? Give two examples.
4. List any four essential factors that must be taken icare of by an individual for keeping good health.
5. Which amongst the two diseases : acute or chronic has adverse effect on the health of a person? Explain giving a suitable example.
6. How can we prevent water borne and vector borne infections ?
7. State any two conditions essential for good health.
8. State any two conditions essential for being free of disease.
9. Differentiate between acute diseases and chronic diseases.
10. (i) What are the various ways to prevent the diseases ?
    (ii) What is immunisation ?
11. In which of the following case do you think the long-term effects on your health are likely to be most unpleasant ?

- if you get jaundice ?
- if you get lice ?
- if you get acne. Why ?

12. What are the different means by which infectious diseases are spread ?
13. Under which of the following conditions is a person most likely to fall sick ?
    (a) When she is recovering from malaria.
    (b) When she has recovered from malaria and is taking care of someone suffering from chickenpox.
    (c) When she is on a four-day fast after recovering from malaria and is taking care of someone suffering from chickenpox. Why ?
14. Classify infectious agents into different categories and also mention the diseases caused by them.
15. Name the target organs for the following diseases :
    (a) Hepatitis targets……
    (b) Fits or unconsciousness targets……
    (c) Pneumonia targets……
    (d) Fungal disease targets……