IMPORTANT CHAPTERS FROM NCERT SCIENCE

CONTENTS

CLASS	PHYSICS CHAPTER	CHEMISTRY CHAPTER	BIOLOGY CHAPTER
9^{TH}	8, 9, 10, 11 & 12	1, 2, 3 & 4	5, 6, 7 & 13

CHAPTER-1-MATTER IN OUR SURROUNDINGS

- Everything in this universe is made up of material which scientists have named "matter" which occupy space and have mass.
- Early Indian philosophers classified matter in the form of five basic elements – the "Panch Tatva"– air, earth, fire, sky and water.
- Modern day scientists have evolved two types of classification of matter based on their physical properties and chemical nature.
- The particles of matter are very small – they are small beyond our imagination.
- Particles of matter have space between them.
- Particles of Matter are Continuously Moving.
- With increase in temperature the kinetic energy of the particles also increases.
- Particles of matter intermix on their own with each other by getting into the spaces between the particles.
- Intermixing of particles of two different types of matter on their own is called diffusion.
- On heating, diffusion becomes faster.
- Matter around us exists in three different states– solid, liquid and gas.
- These states of matter arise due to the variation in the characteristics of the particles of matter.

The Solid State-

- have a tendency to maintain their shape when subjected to outside force.
- break under force but it is difficult to change their shape, so they are rigid.

The Liquid State-

- liquids have no fixed shape but have a fixed volume.
- take up the shape of the container in which they are kept.
- flow and change shape, so they are not rigid but can be called fluid.
- solids, liquids and gases can diffuse into liquids.
- The rate of diffusion of liquids is higher than that of solids.
- This is due to the fact that in the liquid state, particles move freely and have greater space between each other as compared to particles in the solid state.

The Gaseous State-

- Highly compressible as compared to solids and liquids.
- Due to high speed of particles and large space between them, gases show the property of diffusing very fast into other gases.
- On increasing the temperature of solids, the kinetic energy of the particles increases.
- Due to the increase in kinetic energy, the particles start vibrating with greater speed.
- The energy supplied by heat overcomes the forces of attraction between the particles.
- The particles leave their fixed positions and start moving more freely.
- A stage is reached when the solid melts and is converted to a liquid.
- The temperature at which a solid melts to become a liquid at the atmospheric pressure is called its **melting point**.
- The melting point of a solid is an indication of the strength of the force of attraction between its particles.
- The process of melting, that is, change of solid state into liquid state is also known as fusion.

- When a solid melts, its temperature remains the same.
- The amount of heat energy that is required to change 1 kg of a solid into liquid at atmospheric pressure at its melting point is known as the latent (HIDDEN) heat of fusion.
- The temperature at which a liquid starts boiling at the atmospheric pressure is known as its boiling point. Boiling is a bulk phenomenon.
- A change of state directly from solid to gas without changing into liquid state (or vice versa) is called sublimation.
- Solid carbon dioxide (CO 2) is stored under high pressure.
- Solid CO2 gets converted directly to gaseous state on decrease of pressure to 1 atmosphere without coming into liquid state. This is the reason that solid carbon dioxide is also known as dry ice.
- Pressure and temperature determine the state of a substance, whether it will be solid, liquid or gas.
- Change of a liquid into vapours at any temperature below its boiling point is called evaporation.
- the rate of evaporation increases with an increase of surface area: evaporation is a surface phenomenon, an increase of temperature:,
- a decrease in humidity:, an increase in wind speed: Evaporation causes cooling.

CHAPTER-2-IS MATTER AROUND US PURE

- A mixture contains more than one substance (element and/or compound) mixed in any proportion.
- Mixtures can be separated into pure substances using appropriate separation techniques.
- A solution is a homogeneous mixture of two or more substances. The major component of a solution is called the solvent, and the minor, the solute.
- The concentration of a solution is the amount of solute present per unit volume or per unit mass of the solution/solvent.
- Materials that are insoluble in a solvent and have particles that are visible to naked eyes, form a suspension.
- A suspension is a heterogeneous mixture.

Colloids

- are heterogeneous mixtures in which the particle size is too small to be seen with the naked eye, but is big enough to scatter light.
- useful in industry and daily life.
- The particles are called the dispersed phase and the medium in which they are distributed is called the dispersion medium.
- Pure substances can be elements or compounds.
- An element is a form of matter that cannot be broken down by chemical reactions into simpler substances.
- A compound is a substance composed of two or more different types of elements, chemically combined in a fixed proportion.
- Properties of a compound are different from its constituent elements, whereas a mixture shows the properties of its constituting elements or compounds.
- **Mixtures** are constituted by more than one kind of pure form of matter, known as a substance.
- A substance cannot be separated into other kinds of matter by any physical process which contains more than one substance.
- Mixture which has a uniform composition throughout. Such mixtures are called homogeneous mixtures or solutions.
- Some other examples of such mixtures are: (i) salt in water and (ii) sugar in water.

- A homogeneous mixture can have a variable composition.
- Mixtures, which contain physically distinct parts and have non-uniform compositions.
- Such mixtures are called heterogeneous mixtures.
- Mixtures of sodium chloride and iron filings, salt and sulphur, and oil and water are examples of heterogeneous mixtures.

Alloys:

- Homogeneous mixtures of metals and cannot be separated into their components by physical methods.
- Considered as a mixture because it shows the properties of its constituents and can have variable composition.
- For example, brass is a mixture of approximately 30% zinc and 70% copper.
- A solution has a solvent and a solute as its components.

Properties of a solution

- A solution is a homogeneous mixture.
- The particles of a solution are smaller than 1 nm (10 -9 metre) in diameter.
- Cannot be seen by naked eyes.
- Because of very small particle size, they do not scatter a beam of light passing through the solution.
- The path of light is not visible in a solution.

The solute particles

- Cannot be separated from the mixture by the process of filtration.
- Do not settle down when left undisturbed, that is, a solution is stable.
- When no more solute can be dissolved in a solution at a given temperature, it is called a saturated solution.
- The amount of the solute present in the saturated solution at this temperature is called its solubility.
- If the amount of solute contained in a solution is less than the saturation level, it is called an unsaturated solution.
- A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium.
- Particles of a suspension are visible to the naked eye.

Properties of a Suspension

- Suspension is a heterogeneous mixture.
- The particles of a suspension can be seen by the naked eye.
- The particles of a suspension scatter a beam of light passing through it and make its path visible.
- The solute particles settle down when a suspension is left undisturbed, that is, a suspension is unstable.
- They can be separated from the mixture by the process of filtration. a colloidal solution is a heterogeneous mixture, for example, milk.

Properties of a colloid

- A colloid is a heterogeneous mixture.
- The size of particles of a colloid is too small to be individually seen by naked eyes.
- Colloids are big enough to scatter a beam of light passing through it and make its path visible.

- They do not settle down when left undisturbed, that is, a colloid is quite stable.
- They cannot be separated from the mixture by the process of filtration.
- But, a special technique of separation known as centrifugation can be used to separate the colloidal particles.
- Some examples of solids which sublime are ammonium chloride, camphor, naphthalene and anthracene. process of separation of components of a mixture is known as chromatography.
- Chromatography is the technique used for separation of those solutes that dissolve in the same solvent.

Applications

- To separate • colours in a dye • pigments from natural colours • drugs from blood. distillation.
- It is used for the separation of components of a mixture containing two miscible liquids that boil without decomposition and have sufficient difference in their boiling points.
- The crystallisation method is used to purify solids.
- Crystallisation technique is better than simple evaporation technique as –
- Some solids decompose or some, like sugar, may get charred on heating to dryness.
- Some impurities may remain dissolved in the solution even after filtration.
- On evaporation these contaminate the solid.
- The properties that can be observed and specified like colour, hardness, rigidity, fluidity, density, melting point, boiling point etc. are the physical properites.

Pure Substances Elements

- Element as a basic form of matter that cannot be broken down into simpler substances by chemical reactions.
- Divided into metals, non-metals and metalloids.
- show some or all of the following properties:
- Have a luster (shine).
- Have silvery-grey or golden-yellow colour.
- Conduct heat and electricity.
- Are ductile (can be drawn into wires).
- Are malleable (can be hammered into thin sheets).
- Are sonorous (make a ringing sound when hit).
- Mercury is the only metal that is liquid at room temperature.
- Non-metals usually show some or all of the following properties:
- They display a variety of colours. They are poor conductors of heat and electricity.
- They are not lustrous, sonorous or malleable.
- Examples of non-metals are hydrogen, oxygen, iodine, carbon (coal, coke), bromine, chlorine etc.
- A compound is a substance composed of two or more elements, chemically combined with one another in a fixed proportion.

CHAPTER-3-ATOMS AND MOLECULES

- Law of conservation of mass states that mass can be created nor destroyed in a chemical reaction.
- In a chemical substance the elements are always present in definite proportions by mass.
- All matter, whether an element, a compound or a mixture is composed of small particles called atoms.

- The postulates of this theory may be stated as follows: (i) All matter is made of very tiny particles called atoms. (ii) Atoms are indivisible particles, which cannot be created or destroyed in a chemical reaction. (iii) Atoms of a given element are identical in mass and chemical properties. (iv) Atoms of different elements have different masses and chemical properties. (v) Atoms combine in the ratio of small whole numbers to form compounds. (vi) The relative number and kinds of atoms are constant in a given compound.
- Atomic radius is measured in nanometers.
- During a chemical reaction, the sum of the masses of the reactants and products remains unchanged which is known as the **Law of Conservation of Mass**.
- In a pure chemical compound, elements are always present in a definite proportion by mass. This is known as the **Law of Definite Proportions**.
- An atom is the smallest particle of the element that can exist independently and retain all its chemical properties.
- A molecule is the smallest particle of an element or a compound capable of independent existence under ordinary conditions. It shows all the properties of the substance.
- A chemical formula of a compound shows its constituent elements and the number of atoms of each combining element.
- Clusters of atoms that act as an ion are called polyatomic ions. They carry a fixed charge on them.
- The chemical formula of a molecular compound is determined by the valency of each element.
- In ionic compounds, the charge on each ion is used to determine the chemical formula of the compound.
- Scientists use the relative atomic mass scale to compare the masses of different atoms of elements.
- Mass of 1 mole of a substance is called its molar mass.

CHAPTER-4-STRUCTURE OF THE ATOM

- An atom is divisible and consists of charged particles.

Canal rays

- Were positively charged radiations which ultimately led to the discovery of another sub-atomic particle.
- The mass of a proton is taken as one unit and its charge as plus one.
- The mass of an electron is considered to be negligible and its charge is minus one.
- **An atom was composed of protons and electrons**, mutually balancing their charges.
- Also appeared that the protons were in the interior of the atom, for whereas electrons could easily be peeled off but not protons.
- Neutrons are present in the nucleus of all atoms, except hydrogen. In general, a neutron is represented as „n“.
- The mass of an atom is therefore given by the sum of the masses of protons and neutrons present in the nucleus.
- The maximum number of electrons that can be accommodated in the outermost orbit is 8.
- The electrons present in the outermost shell of an atom are known as the valence electrons.
- An outermost-shell, which had eight electrons was said to possess an octet.
- Atoms would thus react, so as to achieve an octet in the outermost shell.
- done by sharing, gaining or losing electrons.
- The number of electrons gained, lost or shared so as to make the octet of electrons in the outermost shell, gives us directly the combining capacity of the element, that is, the valency.
- The mass number is defined as the sum of the total number of protons and neutrons present in the nucleus of an atom.

- Isotopes are defined as the atoms of the same element, having the same atomic number but different mass numbers.
- There are three isotopes of hydrogen atom, namely protium, deuterium and tritium.
- Many elements consist of a mixture of isotopes.
- Each isotope of an element is a pure substance.
- The chemical properties of isotopes are similar but their physical properties are different. (i) An isotope of uranium is used as a fuel in nuclear reactors. (ii) An isotope of cobalt is used in the treatment of cancer. (iii) An isotope of iodine is used in the treatment of goitre.
- Atoms of different elements with different atomic numbers, which have the same mass number, are known as isobars.

CHAPTER-5-THE FUNDAMENTAL UNIT OF LIFE

- Each such cell has got certain specific components within it known as cell organelles.
- Each kind of cell organelle performs a special function, such as making new material in the cell, clearing up the waste material from the cell and so on.
- A cell is able to live and perform all its functions because of these organelles.
- If we study a cell under a microscope, we would come across three features in almost every cell; plasma membrane, nucleus and cytoplasm.

Plasma Membrane or Cell Membrane

- This is the outermost covering of the cell that separates the contents of the cell from its external environment.
- The plasma membrane allows or permits the entry and exit of some materials in and out of the cell.
- It also prevents movement of some other materials.
- The cell membrane, therefore, is called a selectively permeable membrane.
- Some substances like carbon dioxide or oxygen can move across the cell membrane by a process called diffusion.
- Diffusion plays an important role in gaseous exchange between the cells as well as the cell and its external environment.
- Water also obeys the law of diffusion.
- The movement of water molecules through such a selectively permeable membrane is called osmosis.
- Osmosis is the passage of water from a region of high water concentration through a semi-permeable membrane to a region of low water concentration.
- If the medium surrounding the cell has a higher water concentration than the cell, meaning that the outside solution is very dilute, the cell will gain water by osmosis. Such a solution is known as a **hypotonic solution**.
- If the medium has exactly the same water concentration as the cell, there will be no net movement of water across the cell membrane. Such a solution is known as an **isotonic solution**.
- If the medium has a lower concentration of water than the cell, meaning that it is a very concentrated solution, the cell will lose water by osmosis. Such a solution is known as a **hypertonic solution**.
- Absorption of water by plant roots is also an example of **osmosis**.
- The **plasma membrane** is flexible and is made up of organic molecules called lipids and proteins.
- However, we can observe the structure of the plasma membrane only through an electron microscope.
- The flexibility of the cell membrane also enables the cell to engulf in food and other material from its external environment. Such processes are known as endocytosis. **Amoeba** acquires its food through such processes.

- The cell wall lies outside the plasma membrane.
- The plant cell wall is mainly composed of cellulose.
- **Cellulose** is a complex substance and provides structural strength to plants.
- When a living plant cell loses water through osmosis there is shrinkage or contraction of the contents of the cell away from the cell wall. This phenomenon is known as **plasmolysis**.
- Cell walls permit the cells of plants, fungi and bacteria to withstand very dilute (hypotonic) external media without bursting.
- The nucleus has a double layered covering called nuclear membrane.
- The nuclear membrane has pores which allow the transfer of material from inside the nucleus to its outside, that is, to the **cytoplasm**.
- The nucleus contains chromosomes, which are visible as rod-shaped structures only when the cell is about to divide.
- **Chromosome**s contain information for inheritance of features from parents to next generation in the form of DNA (Deoxyribo Nucleic Acid) molecules.
- Chromosomes are composed of DNA and protein.
- DNA molecules contain the information necessary for constructing and organising cells.
- Functional segments of DNA are called genes.
- In a cell which is not dividing, this DNA is present as part of chromatin material.
- Chromatin material is visible as entangled mass of thread like structures.
- Whenever the cell is about to divide, the chromatin material gets organized into chromosomes.
- The nucleus plays a central role in cellular reproduction, the process by which a single cell divides and forms two new cells.
- An undefined nuclear region containing only nucleic acids is called a nucleoid.
- Such organisms, whose cells lack a nuclear membrane, are called **prokaryotes** (Pro = primitive or primary; karyote ≈karyon = nucleus).
- Organisms with cells having a nuclear membrane are called eukaryotes.
- The chlorophyll in photosynthetic prokaryotic bacteria is associated with membranous vesicles (bag like structures) but not with plastids as in eukaryotic cells.
- **The cytoplasm** is the fluid content inside the plasma membrane.
- The significance of membranes can be illustrated with the example of viruses.
- Viruses lack any membranes and hence do not show characteristics of life until they enter a living body and use its cell machinery to multiply.
- Important examples of cell organelles are: endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, plastids and vacuoles.

Endoplasmic Reticulum-

- a large network of membrane-bound tubes and sheets.
- There are two types of ER– rough endoplasmic reticulum (RER) and smooth endoplasmic reticulum (SER).
- RER looks rough under a microscope because it has particles called ribosomes attached to its surface.
- The ribosomes, which are present in all active cells, are the sites of protein manufacture.
- The SER helps in the manufacture of fat molecules, or lipids, important for cell function.
- One function of the ER is to serve as channels for the transport of materials (especially proteins) between various regions of the cytoplasm or between the cytoplasm and the nucleus.
- SER plays a crucial role in detoxifying many poisons and drugs.

Golgi Apparatus-

- Its functions include the storage, modification and packaging of products in vesicles.
- In some cases, complex sugars may be made from simple sugars in the Golgi apparatus.
- Also involved in the formation of lysosomes.

Lysosomes-

- A kind of waste disposal system of the cell.
- Help to keep the cell clean by digesting any foreign material as well as worn-out cell organelles.
- Able to do this because they contain powerful digestive enzymes capable of breaking down all organic material.

Mitochondria-

- Known as the powerhouses of the cell.
- ATP (Adenosine triphopshate) molecules are known as the energy currency of the cell.
- The body uses energy stored in ATP for making new chemical compounds and for mechanical work. Mitochondria have two membrane coverings instead of just one.
- The outer membrane is very porous while the inner membrane is deeply folded.
- These folds create a large surface area for ATP-generating chemical reactions.
- Strange organelles in the sense that they have their own DNA and ribosomes.
- Able to make some of their own proteins.

Plastids-

- Present only in plant cells.
- There are two types of plastids – chromoplasts (coloured plastids) and leucoplasts (white or colourless plastids).
- Containing the pigment chlorophyll are known as chloroplasts.
- **Chloroplasts** are important for photosynthesis in plants.
- Chloroplasts also contain various yellow or orange pigments in addition to chlorophyll.
- Leucoplasts are primarily organelles in which materials such as starch, oils and protein granules are stored. Like the mitochondria, plastids also have their own DNA and ribosomes.

Vacuoles-

- Storage sacs for solid or liquid contents.
- Small sized in animal cells while plant cells have very large vacuoles.
- In plant cells vacuoles are full of cell sap and provide turgidity and rigidity to the cell.
- Many substances of importance in the life of the plant cell are stored in vacuoles.
- These include amino acids, sugars, various organic acids and some proteins.
- In single-celled organisms like **Amoeba**, the food vacuole contains the food items that the Amoeba has consumed.

CHAPTER-6 TISSUES

- Blood, phloem and muscle are all examples of tissues.
- A group of cells that are similar in structure and/or work together to achieve a particular function forms a tissue.
- Cell growth in animals is more uniform. The growth of plants occurs only in certain specific regions.
- This is because the dividing tissue, also known as meristematic tissue, is located only at these points.
- Depending on the region where they are present, meristematic tissues are classified as apical, lateral and intercalary.
- Apical meristem is present at the growing tips of stems and roots and increases the length of the stem and the root. The girth of the stem or root increases due to lateral meristem (cambium).
- Intercalary meristem is the meristem at the base of the leaves or internodes (on either side of the node) on twigs. They lack vacuoles.

Simple Permanent Tissue

- A few layers of cells form the basic packing tissue. This tissue is parenchyma, a type of permanent tissue.
- It consists of relatively unspecialised cells with thin cell walls are live cells usually loosely packed.
- provides support to plants and also stores food.
- contains chlorophyll and performs photosynthesis, and then it is called **chlorenchyma**.
- In aquatic plants, large air cavities are present in parenchyma to give buoyancy to the plants to help them float. Such a parenchyma type is called **aerenchyma**.
- The parenchyma of stems and roots also stores nutrients and water.
- The flexibility in plants is due to another permanent tissue, collenchyma.
- It allows easy bending in various parts of a plant (leaf, stem) without breaking. It also provides mechanical support to plants.
- Permanent tissue is sclerenchyma. It is the tissue which makes the plant hard and stiff.
- husk of a coconut. It is made of **sclerenchymatous** tissue. The cells of this tissue are dead.
- They are long and narrow as the walls are thickened due to lignin (achemical substance which acts as cement and hardens them). It provides strength to the plant parts.
- **Stomata** are enclosed by two kidney-shaped cells called guard cells. They are necessary for exchanging gases with the atmosphere.
- Transpiration (loss of water in the form of water vapour) also takes place through stomata.
- Epidermal cells of the roots, whose function is water absorption, commonly bear long hair-like parts that greatly increase the total absorptive surface area.

Complex Permanent Tissue-

- made of more than one type of cells.
- All these cells coordinate to perform a common function.
- **Xylem and phloem** are examples of such complex tissues.
- They are both conducting tissues and constitute a vascular bundle.
- Vascular or conductive tissue is a distinctive feature of the complex plants, one that has made possible their survival in the terrestrial environment.
- **Xylem** consists of tracheids, vessels, xylem parenchyma and xylem fibres.

- The cells have thick walls, and many of them are dead cells.
- **Tracheids and vessels are tubular structures**.
- This allows them to transport water and minerals vertically.
- The parenchyma stores food and helps in the sideways conduction of water.
- Fibres are mainly supportive in function.
- Phloem is made up of four types of elements: sieve tubes, companion cells, phloem fibres and the phloem parenchyma.
- Sieve tubes are tubular cells with perforated walls.
- Phloem is unlike xylem in that materials can move in both directions in it.
- Phloem transports food from leaves to other parts of the plant.
- Except for phloem fibres, phloem cells are living cells.

Epithelial Tissue-

- The covering or protective tissues in the animal body are epithelial tissues.
- covers most organs and cavities within the body.
- forms a barrier to keep different body systems separate.
- The skin, the lining of the mouth, the lining of blood vessels, lung alveoli and kidney tubules are all made of epithelial tissue.
- tightly packed and form a continuous sheet.
- They have only a small amount of cementing material between them and almost no intercellular spaces.
- anything entering or leaving the body must cross at least one layer of epithelium.
- the permeability of the cells of various epithelia play an important role in regulating the exchange of materials between the body and the external environment and also between different parts of the body.
- all epithelium is usually separated from the underlying tissue by an extracellular fibrous basement membrane.
- Simple squamous epithelial cells are extremely thin and flat and form a delicate lining.
- The **oesophagus** and the lining of the mouth are also covered with squamous epithelium.
- The skin, which protects the body, is also made of squamous epithelium.
- Skin epithelial cells are arranged in many layers to prevent wear and tear.
- Since they are arranged in a pattern of layers, the epithelium is called stratified squamous epithelium.
- In the respiratory tract, the columnar epithelial tissue also has cilia, which are hair-like projections on the outer surfaces of epithelial cells. These cilia can move, and their movement pushes the mucus forward to clear it. This type of epithelium is thus ciliated columnar epithelium.
- **Cuboidal epithelium** (with cube-shaped cells) forms the lining of kidney tubules and ducts of salivary glands, where it provides mechanical support.
- Epithelial cells often acquire additional specialisation as gland cells, which can secrete substances at the epithelial surface.
- Sometimes a portion of the epithelial tissue folds inward, and a multicellular gland is formed. This is glandular epithelium.
- Blood is a type of connective tissue.
- The cells of connective tissue are loosely spaced and embedded in an intercellular matrix.
- The matrix may be jelly like, fluid, dense or rigid.
- Bone cells are embedded in a hard matrix that is composed of calcium and phosphorus compounds. The plasma contains proteins, salts and hormones.

- Tendons connect bones to muscles and are another type of connective tissue.
- Tendons are fibrous tissue with great strength but limited flexibility.
- Another type of connective tissue, cartilage, has widely spaced cells.
- The solid matrix is composed of proteins and sugars.
- Cartilage smoothens bone surfaces at joints and is also present in the nose, ear, trachea and larynx.
- We can fold the cartilage of the ears, but we cannot bend the bones in our arms.
- Areolar connective tissue is found between the skin and muscles, around blood vessels and nerves and in the bone marrow.
- It fills the space inside the organs, supports internal organs and helps in repair of tissues.
- Muscles contain special proteins called contractile proteins, which contract and relax to cause movement. striated muscles.
- The cells of this tissue are long, cylindrical, unbranched and multinucleate (having many nuclei).
- involuntary muscles control such movements.
- They are also found in the iris of the eye, in ureters and in the bronchi of the lungs.
- The cells are long with pointed ends (spindle-shaped) and uninucleate (having a single nucleus). They are also called unstriated muscles.
- The muscles of the heart show rhythmic contraction and relaxation throughout life. These involuntary muscles are called cardiac muscles.
- Heart muscle cells are cylindrical, branched and uninucleate.
- A neuron consists of a cell body with a nucleus and cytoplasm, from which long thin hair-like parts arise.

CHAPTER-7-DIVERSITY IN LIVING ORGANISMS

- Organisms which have ancient body designs that have not changed very much.
- The warm and humid tropical regions of the earth, between the tropic of Cancer and the tropic of Capricorn, are rich in diversity of plant and animal life. This is called the region of megadiversity.
- Of the biodiversity of the planet, more than half is concentrated in a few countries – Brazil, Colombia, Ecuador, Peru, Mexico, Zaire, Madagascar, Australia, China, India, Indonesia and Malaysia.
- a species includes all organisms that are similar enough to breed and perpetuate.

Protista

- This group includes many kinds of unicellular eukaryotic organisms.
- Some of these organisms use appendages, such as hair-like cilia or whip-like flagella for moving around.
- Their mode of nutrition can be autotrophic or heterotrophic.
- Examples are unicellular algae, diatoms and protozoans.

Fungi

- These are heterotrophic eukaryotic organisms.
- They use decaying organic material as food and are therefore called saprophytes.
- Many of them have the capacity to become multicellular organisms at certain stages in their lives.
- They have cell-walls made of a tough complex sugar called chitin.
- Examples are yeast and mushrooms.
- Some fungal species live in permanent mutually dependent relationships with bluegreen algae (or cyanobacteria).

- Such relationships are called symbiotic. Symbiotic life forms are called lichens.
- We have all seen lichens as the slow-growing large coloured patches on the bark of trees.

Plantae

- Multicellular eukaryotes with cell walls.
- Autotrophs and use chlorophyll for photosynthesis.
- all plants are included in this group.
- Since plants and animals are most visible forms of the diversity of life around us, we will look at the subgroups in this category later.

Animalia

- These include all organisms which are multicellular eukaryotes without cell walls.
- They are heterotrophs.

Thallophyta

- Plants that do not have well-differentiated body design fall in this group.
- The plants in this group are commonly called algae.
- These plants are predominantly aquatic.
- Examples are Spirogyra, Ulothrix, Cladophora and Chara.

Bryophyta

- These are called the amphibians of the plant kingdom.
- The plant body is commonly differentiated to form stem and leaf-like structures.
- However, there is no specialized tissue for the conduction of water and other substances from one part of the plant body to another.
- Examples are moss (Funaria) and Marchantia.

Pteridophyta

- In this group, the plant body is differentiated into roots, stem and leaves and has specialised tissue for the conduction of water and other substances from one part of the plant body to another.
- Some examples are Marsilea, ferns and horse-tails. plants with well differentiated reproductive tissues that ultimately make seeds are called phanerogams.

Gymnosperms

- This term is made from two Greek words: gymno–means naked and sperma–means seed.
- The plants of this group bear naked seeds and are usually perennial, evergreen and woody.
- Examples are pines, such as deodar, pinus, cycas. angiosperms
- This word is made from two Greek words: angiomeans covered and sperma–means seed.
- The seeds develop inside an organ which is modified to become a fruit. These are also called flowering plants.
- Plant embryos in seeds have structures called cotyledons.
- **Cotyledons are called 'seed leaves'** because in many instances they emerge and become green when the seed germinates.

- Thus, cotyledons represent a bit of pre-designed plant in the seed.
- The angiosperms are divided into two groups on the basis of the number of cotyledons present in the seed.
- **Plants with seeds having a single cotyledon are called monocotyledonous or monocots.**
- **Plants with seeds having two cotyledons are called dicots**.

Animalia

- These are organisms which are eukaryotic, multicellular and heterotrophic.
- Their cells do not have cell-walls.

Porifera

- The word means organisms with holes.
- These are non-motile animals attached to some solid support.
- There are holes or „pores", all over the body.
- These lead to a canal system that helps in circulating water throughout the body to bring in food and oxygen.
- These animals are covered with a hard outside layer or skeleton.
- The body design involves very minimal differentiation and division into tissues.
- They are commonly called sponges, and are mainly found in marine habitats.
- E.G.-Euplectelia, Sycon, Spongilla.

Coelenterata

- These are animals living in water.
- They show more body design differentiation.
- There is a cavity in the body.
- The body is made of two layers of cells: one makes up cells on the outside of the body, and the other makes the inner lining of the body.
- Some of these species live in colonies (corals), while others have a solitary like–span (Hydra).
- Jellyfish and sea anemones are common examples.

Platyhelminthes

- The body of animals in this group is far more complexly designed than in the two other groups we have considered so far.
- The body is bilaterally symmetrical, meaning that the left and the right halves of the body have the same design.
- There are three layers of cells from which differentiated tissues can be made, which is why such animals are called triploblastic.
- This allows outside and inside body linings as well as some organs to be made.
- There is thus some degree of tissue formation.
- However, there is no true internal body cavity or coelom, in which well-developed organs can be accommodated.
- The body is flattened dorsiventrally, meaning from top to bottom, which is why these animals are called flatworms.
- They are either freeliving or parasitic.
- Some examples are freeliving animals like planarians, or parasitic animals like liverflukes.

Nematoda

- The nematode body is also bilaterally symmetrical and triploblastic.
- However, the body is cylindrical rather than flattened.
- There are tissues, but no real organs, although a sort of body cavity or a pseudocoelom, is present.
- These are very familiar as parasitic worms causing diseases, such as the worms causing elephantiasis (filarial worms) or the worms in the intestines (roundworm or pinworms).
- E.g.-Ascaris, Wuchereria.

Annelida

- Annelid animals are also bilaterally symmetrical and triploblastic, but in additionthey have a true body cavity.
- This allows true organs to be packaged in the body structure.
- There is, thus, extensive organ differentiation.
- This differentiation occurs in a segmental fashion, with the segments lined up one after the other from head to tail.
- These animals are found in a variety of habitats– fresh water, marine water as well as land. Earthworms, Nereis and leeches are familiar examples.

Arthropoda

- This is probably the largest group of animals.
- These animals are bilaterally symmetrical and segmented.
- There is an open circulatory system, and so the blood does not flow in well-defined blood vessels.
- The coelomic cavity is blood-filled.
- They have jointed legs (the word „arthropod" means „jointed legs").
- Some familiar examples are prawns, butterflies, houseflies, spiders, scorpions and crabs.

Mollusca

- In the animals of this group, there is bilateral symmetry.
- The coelomic cavity is reduced.
- There is little segmentation.
- They have an open circulatory system and kidney-like organs for excretion.
- There is a foot that is used for moving around.
- Examples are snails and mussels. Chiton, Octopus, Pila & Unio.

Echinodermata

- In Greek, echinos means hedgehog, and derma means skin.
- Thus, these are spiny skinned organisms.
- These are exclusively free-living marine animals.
- They are triploblastic and have a coelomic cavity.
- They also have a peculiar water-driven tube system that they use for moving around.
- They have hard calcium carbonate structures that they use as a skeleton.
- Examples are Asterias (starfish) and sea urchins.

Protochordata

- These animals are bilaterally symmetrical, triploblastic and have a coelom.
- In addition, they show a new feature of body design, namely a notochord, at least at some stages during their lives.
- The notochord is a long rod-like support structure (chord=string) that runs along the back of the animal separating the nervous tissue from the gut.
- It provides a place for muscles to attach for ease of movement.
- Protochordates may not have a proper notochord present at all stages in their lives or for the entire length of the animal.
- Protochordates are marine animals.
- Examples are Balanoglossus, Herdemania And Amphioxus.

Vertebrata

- These animals have a true vertebral column and internal skeleton, allowing a completely different distribution of muscle attachment points to be used for movement.
- Vertebrates are bilaterally symmetrical, triploblastic, coelomic and segmented, with complex differentiation of body tissues and organs.
- All chordates possess the following features: (i) have a notochord (ii) have a dorsal nerve cord (iii) are triploblastic (iv) have paired gill pouches (v) are coelomate.

Pisces

- These are fish.
- They are exclusively waterliving animals.
- Their skin is covered with scales/plates.
- They obtain oxygen dissolved in water by using gills.
- The body is streamlined, and a muscular tail is used for movement.
- They are cold-blooded and their hearts have only two chambers, unlike the four that humans have.
- They lay eggs.
- We can think of many kinds of fish, some with skeletons made entirely of cartilage, such as sharks, and some with a skeleton made of both bone and cartilage, such as tuna or rohu.

Amphibia

- These animals differ from the fish in the lack of scales, in having mucus glands in the skin, and a three-chambered heart.
- Respiration is through either gills or lungs.
- They lay eggs.
- These animals are found both in water and on land.
- Frogs, toads and salamanders are some examples.

Reptilia

- These animals are cold-blooded, have scales and breathe through lungs.
- While most of them have a three-chambered heart, crocodiles have four heart chambers.

- They lay eggs with tough coverings and do not need to lay their eggs in water, unlike amphibians.
- Snakes, turtles, lizards and crocodiles fall in this category.

Aves

- These are warm-blooded animals and have a four-chambered heart.
- They lay eggs.
- There is an outside covering of feathers, and two forelimbs are modified for flight. They breathe through lungs.
- All birds fall in this category.

Mammalia

- Mammals are warm-blooded animals with four-chambered hearts.
- They have mammary glands for the production of milk to nourish their young.
- Their skin has hairs as well as sweat and oil glands.
- Most mammals familiar to us produce live young ones.
- However, a few of them, like the platypus and the echidna lay eggs, and some, like kangaroos give birth to very poorly developed young ones.

CHAPTER-8 MOTION

- The shortest distance measured from the initial to the final position of an object is known as the displacement.
- Automobiles are fitted with a device that shows the distance travelled. Such a device is known as an odometer.
- As the object covers equal distances in equal intervals of time, it is said to be in uniform motion.
- If the athlete moves with a velocity of constant magnitude along the circular path, the only change in his velocity is due to the change in the direction of motion.
- The motion of the athlete moving along a circular path is, therefore, an example of an accelerated motion.

CHAPTER-9-FORCE AND LAWS OF MOTION

- An object moves with a uniform velocity when the forces (pushing force and frictional force) acting on the object are balanced and there is no net external force on it.
- If an unbalanced force is applied on the object, there will be a change either in its speed or in the direction of its motion.
- Thus, to accelerate the motion of an object, an unbalanced force is required.
- And the change in its speed (or in the direction of motion) would continue as long as this unbalanced force is applied.
- An object remains in a state of rest or of uniform motion in a straight line unless compelled to change that state by an applied force.
- The tendency of undisturbed objects to stay at rest or to keep moving with the same velocity is called inertia.
- The first law of motion is also known as the law of inertia.
- Inertia is the natural tendency of an object to resist a change in its state of motion or of rest.
- The mass of an object is a measure of its inertia.
- The train has more inertia than the cart.

- Clearly, heavier or more massive objects offer larger inertia.
- Quantitatively, the inertia of an object is measured by its mass.
- the impact produced by the objects depends on their mass and velocity.
- The second law of motion states that the rate of change of momentum of an object is proportional to the applied unbalanced force in the direction of force.
- The third law of motion states that when one object exerts a force on another object, the second object instantaneously exerts a force back on the first.
- These two forces are always equal in magnitude but opposite in direction.
- These forces act on different objects and never on the same object.
- It is important to note that even though the action and reaction forces are always equal in magnitude, these forces may not produce accelerations of equal magnitudes.
- This is because each force acts on a different object that may have a different mass.
- To every action there is an equal and opposite reaction.
- the sum of momenta of the two objects before collision is equal to the sum of momenta after the collision provided there is no external unbalanced force acting on them. This is known as the law of conservation of momentum.

CHAPTER-10-GRAVITATION

- The change in direction involves change in velocity or acceleration.
- The force that causes this acceleration and keeps the body moving along the circular path is acting towards the centre.
- This force is called the centripetal (meaning „centre-seeking‟) force.
- The motion of the moon around the earth is due to the centripetal force.
- The centripetal force is provided by the force of attraction of the earth.
- If there were no such force, the moon would pursue a uniform straight line motion.
- Newton concluded that not only does the earth attract an apple and the moon, but all objects in the universe attract each other. This force of attraction between objects is called the gravitational force.
- The universal law of gravitation successfully explained several phenomena which were believed to be unconnected:

(i) the force that binds us to the earth;
(ii) the motion of the moon around the earth;
(iii) the motion of planets around the Sun; and
(iv) the tides due to the moon and the Sun.

- Whenever objects fall towards the earth under this force alone, we say that the objects are in free fall.
- This acceleration is due to the earth‟s gravitational force.
- Acceleration is called the acceleration due to the gravitational force of the earth (or acceleration due to gravity).
- Mass remains the same whether the object is on the earth, the moon or even in outer space.
- The force acting on an object perpendicular to the surface is called thrust.
- All liquids and gases are fluids.
- The upward force exerted by the water on the bottle is known as upthrust or buoyant force.
- The force due to the gravitational attraction of the earth acts on the bottle in the downward direction.
- So the bottle is pulled downwards.

- But the water exerts an upward force on the bottle.
- Thus, the bottle is pushed upwards. objects of density less than that of a liquid float on the liquid.
- The objects of density greater than that of a liquid sink in the liquid.
- When a body is immersed fully or partially in a fluid, it experiences an upward force that is equal to the weight of the fluid displaced by it.

CHAPTER-11-WORK AND ENERGY

- Two conditions need to be satisfied for work to be done: (i) a force should act on an object, and (ii) the object must be displaced.
- Work done by a force acting on an object is equal to the magnitude of the force multiplied by the distance moved in the direction of the force.
- Work has only magnitude and no direction.
- Unit of work is newton metre (N m) or joule (J).
- Work done is negative when the force acts opposite to the direction of displacement.
- Work done is positive when the force is in the direction of displacement.
- An object having a capability to do work is said to possess energy.
- The object which does the work loses energy and the object on which the work is done gains energy.
- Objects in motion possess energy which is known as kinetic energy.
- The kinetic energy of an object increases with its speed.
- the kinetic energy of a body moving with a certain velocity is equal to the work done on it to make it acquire that velocity.
- kinetic energy of an object in the form of an equation.
- The potential energy possessed by the object is the energy present in it by virtue of its position or configuration.
- The potential energy of an object at a height depends on the ground level or the zero level you choose.
- An object in a given position can have a certain potential energy with respect to one level and a different value of potential energy with respect to another level.
- the sum of the potential energy and kinetic energy of the object would be the same at all points.
- The sum of kinetic energy and potential energy of an object is its total mechanical energy.

CHAPTER-12-SOUND

- Sound waves are characterised by the motion of particles in the medium and are called mechanical waves.
- When a vibrating object moves forward, it pushes and compresses the air in front of it creating a region of high pressure. This region is called a compression
- When the vibrating object moves backwards, it creates a region of low pressure called rarefaction (R), It cannot travel through vacuum, a transverse wave is the one in which the individual particles of the medium move about their mean positions in a direction perpendicular to the direction of wave propagation.
- Light is a transverse wave but for light, the oscillations are not of the medium particles or their pressure or density – it is not a mechanical wave.
- compressions are regions where density as well as pressure is high.
- Rarefactions are the regions of low pressure where particles are spread apart and are represented by the valley, that is, the lower portion of the curve.
- A peak is called the crest and a valley is called the trough of a wave.
- The loudness or softness of a sound is determined basically by its amplitude.

- The brain interprets the frequency of an emitted sound is called the pitch.
- The speed of sound remains almost the same for all frequencies in a given medium under the same physical conditions.
- The amount of sound energy passing each second through unit area is called the intensity of sound.
- The speed of sound depends on the properties of the medium through which it travels.
- The speed of sound decreases when we go from solid to gaseous state.
- In any medium as we increase the temperature the speed of sound increases.
- A sound created in a big hall will persist by repeated reflection from the walls until it is reduced to a value where it is no longer audible.
- The repeated reflection that results in this persistence of sound is called reverberation.
- To reduce reverberation, the roof and walls of the auditorium are generally covered with sound-absorbent materials like compressed fibreboard, rough plaster or draperies.
- Sounds of frequencies below 20 Hz are called infrasonic sound or infrasound.
- Rhinoceroses communicate using infrasound of frequency as low as 5 Hz.
- Whales and elephants produce sound in the infrasound range.
- Earthquakes produce low-frequency infrasound before the main shock waves begin which possibly alert the animals.
- Frequencies higher than 20 kHz are called ultrasonic sound or ultrasound.
- Ultrasound is produced by dolphins, bats and porpoises.
- Ultrasounds are high frequency waves.
- Ultrasounds are able to travel along well defined paths even in the presence of obstacles.
- Ultrasounds are used extensively in industries and for medical purposes.
- Ultrasound is generally used to clean parts located in hard-to-reach places.
- Ultrasounds can be used to detect cracks and flaws in metal blocks.
- Ultrasonic waves are made to reflect from various parts of the heart and form the image of the heart. This technique is called „echocardiography".
- Ultrasound scanner is an instrument which uses ultrasonic waves for getting images of internal organs of the human body.
- The acronym SONAR stands for Sound Navigation and Ranging.
- Sonar is a device that uses ultrasonic waves to measure the distance, direction and speed of underwater objects.

CHAPTER-13-WHY DO WE FALL ILL

- When there is a disease, either the functioning or the appearance of one or more systems of the body will change for the worse.
- These changes give rise to symptoms and signs of disease.
- Diseases last for only very short periods of time, and these are called acute diseases.
- For a long time, even as much as a lifetime, and are called chronic diseases.
- An example is the infection causing elephantiasis, which is very common in some parts of India.
- All diseases will have immediate causes and contributory causes.
- Also, most diseases will have many causes, rather than one single cause.
- One group of causes is the infectious agents, mostly microbes or micro-organisms.
- Peptic ulcer disease is no longer a chronic, frequently disabling condition, but a disease that can be cured by a short period of treatment with antibiotics.

- Staphylococci, the bacteria which can cause acne.
- Trypanosoma, the protozoan organism responsible for sleeping sickness.
- The organism is lying next to a saucer-shaped red blood cell to give an idea of the scale.
- Leishmania, the protozoan organism that causes kala-azar.
- The organisms are oval-shaped, and each has one long whip-like structure.
- One organism (arrow) is dividing, while a cell of the immune system (lower right) has gripped on the two whips of the dividing organism and is sending cell processes up to eat up the organism.
- The immune cell is about ten micrometres in diameter.
- Common examples of diseases caused by viruses are the common cold, influenza, dengue fever and AIDS.
- Diseases like typhoid fever, cholera, tuberculosis and anthrax are caused by bacteria.
- Many common skin infections are caused by different kinds of fungi.
- Protozoan microbes cause many familiar diseases, such as malaria and kalaazar.

Antibiotics.

- They commonly block biochemical pathways important for bacteria.
- Many bacteria, for example, make a cell-wall to protect themselves.
- The antibiotic penicillin blocks the bacterial processes that build the cell wall.
- As a result, the growing bacteria become unable to make cell-walls, and die easily.
- But viruses do not use these pathways at all, and that is the reason why antibiotics do not work against viral infections.
- Many microbial agents can commonly move from an affected person to someone else in a variety of ways.
- In other words, they can be „communicated", and so are also called communicable diseases.
- Examples of such diseases spread through the air are the common cold, pneumonia and tuberculosis.
- The bacteria cause tuberculosis.
- If they enter through the mouth, they can stay in the gut lining like typhoid causing bacteria or if they go to the liver, like the viruses that cause jaundice.
- An active immune system recruits many cells to the affected tissue to kill off the disease-causing microbes. This recruitment process is called inflammation.
- In HIV infection, the virus goes to the immune system and damages its function.
- Thus, many of the effects of HIV-AIDS are because the body can no longer fight off the many minor infections that we face every day.
- Making anti-viral medicines is harder than making antibacterial medicines is that viruses have few biochemical mechanisms of their own.
- They enter our cells and use our machinery for their life processes.
- There are vaccines against tetanus, diphtheria, whooping cough, measles, polio and many others.