Science-NCERT Books Summary- By Ambalika Smiti

Biology

Components of food

- Nutrients: Food component needed by our body

Type of food	Nutrient	Function	Sources
Energy giving food	Carbohydrate	Provides energy	Wheat, Rice, Bajra, Papaya, Sugarcane. Melon, Maize
Energy giving food	Fat	• Gives energy (more than carbohydrate) • Not soluble in water • To build nerves and brain. The brain is 40% fat. • To insulate the body. • To produce sex hormones and adrenal cortex hormone • To produce cholesterol (essential for cell membranes and bile salts, for example). • To absorb certain vitamins (A, D, E, and K). • To store energy.	Mustard oil, coconut oil, Milk, Ghee, Butter, Cream, Meat
Body building food	Protein	Needed for growth and repair of body	Pulses, egg, fish, paneer, peas, soyabean, milk
	Vitamins	Protects against disease	Fish, oil, Milk, carrot, lemon Body prepares Vitamin-D from sunlight
	Minerals	Proper growth and good health Needed in small quantity	Iodine: Spinach, Fish, Ginger Phosphorus: Milk, banana Iron: Radish, Apple Calcium: Milk, Egg

Proteins are used by the body to:

- enable growth, development and repair.
- build structures such as muscles, tissues and organs, including the heart, lungs, digestive organs.
- enzymes, such as those required for digestion.
- hormones, such as those for the endocrine glands.
- Proteins, therefore, are needed not only for obvious body structures, such as muscles, but also for the immune and digestive systems, etc.

- Fat-soluble vitamins are vitamins A, D, E and K. Water-soluble vitamins include vitamins C and B.
- Fibre and water

Dietary Fiber/ roughage	• Do not provide any nutrient • Add to food bulk and lubrication • Help get rid of undigested food • Nutrition for friendly bacteria in the colon.	Provided by plant products Whole grain, pulses, potatoes, fresh fruits and vegetables
water	• Absorb Nutrients • Throws out wastes from body as urine and sweat.	From liquids like water, milk and tea

- **Balance Diet:** Provides all the nutrients that our body needs, in right quantities, along with adequate amount of roughage and water.
- Cooking: Make food tastier and help digest easy
- Fat causes obesity

Trans fatty acids (TFAs) or Trans fats

- Most harmful type of fats
- Have much more adverse effects on our body than any other dietary constituent.
- Artificially(largely) , also occurs naturally (in small amount).
- Thus in our diet, these may be present as Artificial TFAs and/ or Natural TFAs.
- **Artificial TFA**s are formed when hydrogen is made to react with the oil to produce fats resembling pure ghee/butter.
- In our diet the major sources of artificial TFAs are the partially hydrogenated vegetable oils (PHVO)/Vanaspati/ margarine while the natural TFAs are present in meats and dairy products, though in small amounts.
- PHVO is rather high in TFA, all food items prepared, baked or fried by using Vanaspati/Margarine contain TFA. These include: Cakes and Pastries; Patty, Rusk; Fried Aloo Chaat , AlooTikki (prepared in 'Vanaspati'), Sweets (Mithai) (prepared in 'Vanaspati'), Cookies / biscuits, French fries, Potato chips, Bhatura, Samosa, Parantha, etc.

Harmful effects

- Higher risk of heart disease than saturated fats. While saturated fats raise total cholesterol levels, TFAs not only raise total cholesterol levels but also reduce the good cholesterol (HDL), which helps to protect us against heart disease.
- Higher risk of developing obesity, type 2 diabetes, heart disease, metabolic syndrome, insulin resistance, infertility, certain types of cancers and can also lead to compromised fetal development causing harm to the yet to be born baby.

Why they are increasingly being used?

- TFA containing oils can be preserved longer, they give the food the desired shape and texture and can easily substitute 'Pure ghee'.
- These are comparatively far lower in cost and thus add to profit/saving.

Deficiency disease

Vitamin/ Mineral	Deficiency disease/disorder	Symptoms
Vitamin A	Loss of vision	Poor vision, loss of vision in darkness (night), sometimes complete loss of vision
Vitamin B1	Beriberi	Weak muscles and very little energy to work
Vitamin C	Scurvy	Bleeding gums, wounds take longer time to heal
Vitamin D	Rickets	Bones become soft and bent
Calcium	Bone and tooth decay	Weak bones, tooth decay
Iodine	Goiter	Glands in the neck appear swollen, mental disability in children
Iron	Anaemia	Weakness

- Deficiency of protein causes stunted growth, swelling of face, discolouration of hair, skin diseases and diarrhoea.
- If food is deficient in both carbohydrates and proteins, the growth may stop completely, a person becomes very lean, thin and so weak that he/she may not even be able to move.

Testing for nutrient presence in food

Fat	• Oily patch when rubbed on paper
Carbohydrates	• Mainly in form of starch and sugar • *Iodine* solution for testing starch • Turns blue-black
Protein	• The **biuret test** used for detecting the presence of peptide bonds and hence protein. • Copper sulphate and caustic soda solution • Turns violet

Cell-Structure and Function

- Discovery of cell- Robert Hook
- Cell: Basic structural units of living organisms.
- The egg of a hen represents a single cell and is big enough to be seen by the unaided eye
- Egg of ostrich is the largest cell
- Pseudopodia in amoeba help capture food and movement, it changes shape.
- A white blood cell (WBC) in human blood is a single cell which can *change its shape.*
- The size of the cells has no relation with the size of the body of the animal or plant but related to its function.

Cell structure and function

Parts of cell

Cell membrane/Plasma membrane	• Covering around cell found in both plants and animals • Separates cells from one another and also the cell from the surrounding medium. • Is porous and allows the movement of substances or materials both inward and outward.
Cell wall	• Additional covering around cell membrane in plants only, gives shape and rigidity to cell • required by the plants for protection against variations in temperature, high wind speed, atmospheric moisture • *Bacteria cell also has cell wall*
Cytoplasm	Jelly like substance between cell membrane and nucleus
Nucleus	• spherical and located in the centre of the cell. • Separated from the cytoplasm by a membrane called the nuclear membrane. • Nuclear membrane is porous and allows movement of materials • Contains nucleolos and *chromosome (containing gene)* • Nucleus, in addition to its role in inheritance, acts as control centre of the activities of the cell.
Vacuoles	• Blank looking structure in cytoplasm • Plant cells have large central vacuole • Vacuoles in animal cells are much smaller and larger in number
Plastids	• Small colored bodies in the cytoplasm • Green pigment: Chlorophyll • Found only in plants
Cell Organelles	• Various other components called cell organelles are present in cytoplasm like mitochondria, ribosome, golgi bodies. • Mitochondria - Powerhouse of cell • Lysosome: Suicidal bag

- The entire content of a living cell is known as protoplasm. It includes the *cytoplasm and the nucleus*. Protoplasm is called the *living substance* of the cell
- The cells having nuclear material *without nuclear membrane* are termed **prokaryotic cells**.(pro : primitive; karyon: nucleus). Examples are bacteria and blue green algae.
- Cells having well *organised nucleus with a nuclear membrane* are designated as **eukaryotic** cells. All organisms other than bacteria and blue green algae are called eukaryotes.

Movement of Human Body

Joints: Places where two parts of body are joined like elbow, shoulder, neck
We can move only those parts where bones meet.

- **Ball and socket joint:** Allows movement in all direction. Eg: At arm and shoulder
- **Pivotal Joint:** Neck and head, allows forward and backward movement, cylindrical bone rotates in a ring
- **Hinge Joint:** open and closing of door, allows move back and forth, eg. At elbow
- **Fixed Joint:** Bones cannot move at these joints.

Skeleton: Framework of body made of bones, gives shape to body
Earthworm does not have bones
Birds: Their bones are hallow and light. The bones of the hind limbs are typical for walking and perching. The bony parts of the forelimbs are modified as wings. The shoulder bones are strong. The breastbones are modified to hold muscles of flight which are used to move the wings up and down
Fish: Streamlined body - body tapering at both ends, front and back are smaller than the middle portion. This shape allows water to flow easily and let fish move easily in water

Nutrients in Plants

- Carbon dioxide taken from air through pores in leaves called stomata. Pores surrounded by guard cells
- Chrolophyll : Green pigment in leaves, helps leaves capture energy from sunlight
- Pitcher plant: pitcher is modified leaf
- Population Interaction "Environment"

Nutrition in Animals

Human Digestive System

Nutrition is a complex process involving: (i) ingestion, (ii) digestion, (iii) absorption, (iv) assimilation and (v)egestion.

Alimentary Canal (Digestive tract) Compartments

(1) the buccal cavity, (2) foodpipe or oesophagus, (3) stomach, (4) small intestine, (5) large intestine ending in the rectum and (6) the anus.

- The digestive tract and the associated glands together constitute the digestive system.
- **Saliva (salivary amylase)** breaks down the starch into sugars
- The **pancreas** and salivary gland make amylase (alpha amylase) to hydrolyse dietary starch into disaccharides and trisaccharides which are converted by other enzymes to glucose to supply the body with energy. (Starch -> Disachharides/Trischharides -> Glucose)
- Food is pushed down by movement of the wall of the **foodpipe**
- The **stomach** is a thick-walled bag. Its shape is like a flattened U and it is the widest part of alimentry canal.
  - The inner lining of the stomach secretes mucous, hydrochloric acid and digestive juices.
  - The **mucous** protects the lining of the stomach.
  - The **acid** kills many bacteria that enter along with the food and makes the medium in the stomach acidic and helps the digestive juices to act.
  - The digestive juices break down the proteins into simpler substances.
- **Small Intestine:** highly coiled and is about 7.5 metres long.
  - **Villi**: Finger-like outgrowths in small intestine, help in food absorption
- **Liver:** Reddish brown, largest gland, lies in upper part of abdomen on right side.

  - Secrets bile juice that is stored in a sac called gall bladder
  - Bile help in digestion of **fat**
- **Pancreas**- below stomach, pancreatic juice acts on carbohydrates, fats and proteins and changes them in simpler form.
  - Carbohydrates get broken into simple sugars such as glucose,
  - Fats into fatty acids and glycerol,
  - Proteins into amino acids
- The digested food is absorbed in the blood vessels from the small intestine.
- The absorbed substances are transported to different parts of the body
- **Large Intestine:** wider and shorter than small intestine, absorb water and some salts from the undigested food material.
- The undigested and unabsorbed residues are expelled out of the body as faeces through the anus
- Digestion of carbohydrates, like starch, begins in the buccal cavity.
- The digestion of protein starts in the stomach.
- The bile secreted from the liver, the pancreatic juice from the pancreas and the digestive juice from the intestinal wall complete the digestion of all components of food in the small intestine.
- **Amoeba** ingests its food with the help of its false feet or **pseudopodia**. The food is digested in the food vacuole

Digestion in grass eating animals

- The grazing animals like cows, buffaloes and deer are known as ruminants.
- **Ruminants** have a large sac-like structure called rumen between the oesophagus and the small intestine. The cellulose of the food is digested here by the action of certain bacteria which are not present in humans.
  - **Cud**- Partially digested food in rumen
- Cud returns to mouth and then chewed by animal- this is called rumination.
- Humans cannot digest cellulose

Respiration

- **Cellular respiration:** Breakdown of food in the cell with the release of energy
- **Aerobic respiration:** Breakdown of glucose occurs with the use of oxygen
- **Anaerobic respiration:** Food can also be broken down, without using oxygen.
  - In the absence of oxygen, glucose breaks down into alcohol and carbon dioxide.
  - **Yeasts** respire anaerobically and yield alcohol, therefore, used to make wine and beer.
  - Our muscle cells can also respire anaerobically, but only for a short time, when there is a temporary deficiency of oxygen. During heavy exercise, fast running, cycling, walking for many hours or heavy weight lifting, the demand for energy is high. But the supply of oxygen to produce the energy is limited. Then anaerobic respiration takes places in the muscle cells to fulfil the demand of energy when muscle cells respire anaerobically. The partial breakdown of glucose produces lactic acid. The accumulation of lactic acid causes muscle cramps.
- **Inhalation**: Ribs move up and outwards and diaphragm moves down. This movement increases space in our chest cavity and air rushes into the lungs. The lungs get filled with air.
- **Exhalation: R**ibs move down and inwards, while diaphragm moves up to its former position. This reduces the size of the chest cavity and air is pushed out of the lungs
- **Breathing in Insects:** through **spiracles** (opening on the sides to take air in) and **trachea** for exchange of air. Tracheal system found only in insects and not in other animals.
- Frog and earthworm can breathe through their skins.

- Fish respires through gills.

Transportation in Plants and Animals

Circulatory system

Blood: Transports substances like digested food from the small intestine to the other parts of the body. It carries oxygen from the lungs to the cells of the body. It also transports waste for removal from the body.

Blood components

Plasma	The fluid part of the blood
Red Blood Cell (RBC)	Contain a red pigment called haemoglobin. Haemoglobin binds with oxygen and transports it to all the parts of the body
White Blood Cell (WBC)	Fight germs that may enter our body
Platelets	Helps in blood clotting

Blood vessels

Arteries (carry blood from heart)	Vein (Carry blood to heart)
Carry oxygen-rich blood from the heart to all parts of the body. Since the blood flow is rapid and at a high pressure, the arteries have thick elastic walls.	Carry carbon dioxide-rich blood from all parts of the body back to the heart. The veins have thin walls. Valves present in veins allow blood to flow only towards the heart.
Pulmonary artery carries blood from the heart, so it is called an artery and not a vein. It carries carbon dioxide-rich blood to the lungs.	**Pulmonary vein** carries oxygen-rich blood from the lungs to the heart.

Heart

Four chambers- Upper chambers are called the **atria** and the two lower chambers are called the ventricles

- Sponges and Hydra *do not possess any circulatory system.* The water in which they live brings food and oxygen as it enters their bodies. The water carries away waste materials and carbon dioxide as it moves out. Thus, these animals do not need a circulatory fluid like the blood.

Excretory system in Humans

- Kidneys, ureters, bladder and urethra form the excretory system.
- An adult human being normally passes about 1-1.8 L of urine in 24 hours. The urine consists of 95% water, 2.5% urea and 2.5% other waste products.

Transportation in Plants

- **Xylem:** Water and minerals from root to plant parts
- **Phloem:** Food from leaf to plant parts

Reproduction in Plants

Flowers are the reproductive part of plant, Flowers may have male, female or both parts.

Types:

Sexual	Asexual
From seeds	Without production of seeds.

Asexual reproduction types

- **Vegetative reproduction :** Asexual, produced from vegetative parts like stem, leaves, buds Roots of some plants can also give rise to new plants such as sweet potato and dahlia
- **Budding**: Eg yeast, buds produced and separated

3. **Fragmentation:** Eg: Algae breaks up into fragments.
4. **Spore Formation:** in Mosses, ferns

Sexual Reproduction

- Stamens are male reproductive part and Pistil female reproductive part.
- The flowers which contain either only the pistil or only the stamens are called unisexual flowers. Eg: Corn, papaya and cucumber
- The flowers which contain both stamens and pistil are called bisexual flowers. Eg: mustard, rose and petunia
- **Anther** contains pollen grains which produce male gametes.
- A *Pistil consists of stigma, style and ovary*. The ovary contains one or more ovules. The female gamete or the egg is formed in an ovule
- **Pollination**: Transfer of pollen from the anther(stamen) to the stigma (pistil) of a flower. This takes place in the **angiosperms**, the flower bearing plants.
- If the pollen lands on the stigma of the same flower it is called **self-pollination**
- **Cross-pollination**: When the pollen of a flower lands on the stigma of another flower of the same plant, or that of a different plant of the same kind.
- **Fertilization:** In sexual reproduction a male and a female gamete fuse to form a zygote. This fusion is called fertilization. From zygote embryo is formed.

Adolescence

- Secretion of *sweat glands and sebaceous glands (oil glands) increases at puberty causes acne*
- Female hormone or estrogen makes the breasts develop.
- Hormones for **pituitary** gland stimulates testes and ovaries to release **testosterone** (by testes in male) and **estrogen** (by ovary in female). These causes secondary male and female sexual characteristics .
- Pituitary gland is **endocrine** and is attached to the brain.
- All human beings have *23 pairs of chromosome*s in the nuclei of their cells. Two chromosomes out of these are the sex chromosomes, **named X and Y.**
- A female has two X chromosomes, while a male has one X and one Y chromosome
- The *gametes (egg and sperm) have only one set of chromosomes.*
- The unfertilised egg always has one X chromosome, but sperms are of two kinds X and Y
- X +X gives female child while X+Y gives male child. Thus father determine the sex of baby.

Endocrine Glands: Release hormones directly into the bloodstream, also termed ductless glands.

Some Endocrine glands

Gland	Hormone	Function
Pituitary gland	Growth hormone	Thyroid and adrenals secrete their hormones when they receive orders from the pituitary through its hormones. Pituitary also secretes growth hormone which is necessary for the normal growth of a person
Testes	Testosterone	Sex hormone in male
Ovary	Estrogen	Sex hormone in female
Thyroid	Thyroxine	Deficiency causes goiter
Pancreas	Insulin	Deficiency causes diabetes
Adrenal	Adrenalin	A hormone that maintain correct salt balance in body Adrenalin: helps body to adjust to stress

Metamorphosis (sudden change when growing up like tadpole to frog) in insects is controlled by insect hormones. In a *frog, it is controlled by* ***thyroxine,*** the hormone produced by thyroid. Thyroxine production requires the presence of *iodine in water.* If the water in which the tadpoles are growing does not contain sufficient iodine, the tadpoles cannot become adults

- Milk is balanced food in itself
- Iron builds blood and iron-rich food such as leafy vegetables, jaggery, meat, citrus, Indian gooseberry (amla)are good for adolescents

Reproduction in Animals

Mode of reproduction

Sexual	Asexual
Male and female gametes fuse to form zygote	No zygote formation

Sexual Reproduction

Male reproductive organs-

- Testes, Two sperm ducts, Penis
- Testes produce the male gametes called sperms

Female reproductive organs

- Pair of ovaries, oviducts (fallopian tubes) and the uterus
- Ovary produces female gamete called ova(egg)

Process of reproduction

- **Fertilization:** Fusion of sperm and ovum forming zygote

Fertilization which takes place inside the female body is called internal fertilization. Internal fertilization occurs in many animals including humans, cows, dogs and hens.

- IVF or in vitro fertilization(fertilization outside the body). Placed inside the uterus after 1 week. Babies born are called test tube baby.
- Fusion of a male and a female gamete takes place outside the body of the female is called external fertilization. Common in aquatic animals such as fish, starfish, etc.
- **Embryo** formation
- **Foetus** - when all part of body can be identified.

- The animals which give birth to young ones are called viviparous animals.
- Those animals which lay eggs are called oviparous animals

- The transformation of the larva into an adult through drastic changes is called **metamorphosis**.

Asexual Reproduction

- Single parent is involved
- Budding: Individual develops from buds, eg: Hydra
- Binary Fission: Breaking into two parts. Eg: amoeba

First mammal to be cloned- Dolly sheep by Ian Wilmot

Appendix

India's only double coconut tree artificially pollinated

- It bears the largest seed known to science.
- Pollinated by scientists of the Botanical Survey of India (BSI).

Double coconut tree (Lodoicea maldivica):

- It is one of the rare and globally threatened species of palm. The tree was planted at the botanical garden in 1894.
- The tree took almost a hundred years to mature.
- The Double Coconut tree not only bears the largest seed known to science — weighing around 25 kg — but this unique species is also the longest surviving palm which can live for as long as 1,000 years.
- The tree also bears the largest leaf among palms and one leaf can thatch a small hut.
- This species of palm is diecious (where male and female flowers are borne on different plants).
- The palm tree is located in the large palm house of the Botanical Garden which has the largest collection of palms in South East Asia with around 110 palm species.
- This rare tree can be found in only two of the 115 Seychelles islands and is also called Coco de Mer (coconut of the sea).

Chemistry

Fibre/Fabric

Fibres: Thin strands of thread

Fabric made of yarns, yarn made of fibres

Cotton, for example, is a *polymer called cellulose*. Cellulose is made up of a large number of glucose units

Fibre types

Natural	Man-made/artificial/synthetic
Obtained from plants and animals	Produced chemically
Animal fibre: Silk, Wool, Plants fibre: Cotton, jute	Nylon, Polyster, acrylic

Wool is obtained from the fleece of sheep or goat. It is also obtained from the hair of rabbits, yak and camels.**Silk** fibre is drawn from the cocoon of silkworm

Cotton

- Grown in black soil and warm climate
- Ginning: Separating cotton fiber from seeds by combing

Jute

- Obtained fromstem of Jute plants
- Grown in Bihar, West Bengal and Assam

- Harvested at flowering stage

Animal Fibres

Wool	• Sheep, goat, yak, camel, rabbit hair bearing animals • Hair traps of a lot of air and air being poor conductor of heat keeps warm • Yak wool is common in Tibet and Ladakh • Angora wool obtained from *Angora rabbit* • Mohair from Angora goat • Cashmere from Cashmere goat • Pashmina shawl from Pashmina goat (Kashmir) • Camelids- Llama and Alpaca found in S America also yield wool.
Silk	• Sericulture: rearing of silkworm for obtaining silk • Silk worm life history: egg ->Caterpillar/silkworm ->Pupa (with silk protein covering called cocoon) ->moth • Silk yarn is as strong as steel, obtained from cocoon • Types of silk: Tassar, Mulberry(most common), Mooga, Kosa, Eri • China leads in silk production

Steps involved in processing fibre into wool

- **Shearing:** Shaving the animals, done in summer
- **Scouring**: Washing the sheared wool to remove dirt
- **Sorting**: different textures
- Picking small flluffy fibres called **burrs**, scoured again and then drawn into fibers
- Dying in colors
- Straightened, combed, and rolled into yarn

Anthrax disease:

- Caused by Bacillus Anthracis **bacteria**
- Also called **Sorter's** disease in wool industry.
- It affects animals more than men through contact with infected animals, wool, meat, etc.
- Spread by spores.

Use in Bioterrorism:

- Used in biological warfare by agents and by terrorists to intentionally infect.
- It was spread in US through a mail. It killed 5 people and made 22 sick.

Synthetic Fibre

Rayon/Artificial Silk	• Obtained from a natural source, woodpulp. • Cheaper than silk, can be dyed, mixed with cotton to make bed sheets or mixed with wool to make carpets
Nylon	• Using coal, water and air • First fully synthetic fibre • Strong, elastic and light , lustrous and easy to wash • Used in manufacture of rope, parachute, belt, • Nylon thread is stronger than steel
Polyster	• Does not get wrinkled easily, remain crisp and easy to wash • **Terylene** is a popular polyster • PET(Polyethylene terephthalate) is also a polyster used in making bottles,

	utensils, films, wire. • Polyster- Poly+ester (repeating unit of ester) • **Ester** are chemicals which gives *fruit* their smell. • Fabrics like polycot polywool etc are made by mixing polyster with cotton and wool respectively.
Acrylic	• Artificial polymer (polyacrylonitrile) fibre, resembles wool

Disadvantage of synthetic fiber

- They melt on heating hence not suitable while working in kitchen as it catches fire easily and stick to body
- All the synthetic fibres are prepared by a number of processes using raw materials of petroleum origin, called petrochemicals.

Palstics

- Are also polymer- can be linear or cross linked
- Can be molded in all shape and sizes, recycled, reused, coloured, melted, rolled into sheets or made into wires
- Polythene(Poly+ethene) is an example of a plastic. It is used for making commonly used polythene bags.

Types

Thermoplastic	Thermosetting
• Get deformed easily on heating, bent easily Eg. Polythene, polypropylene and PVC • Used in making toys, combs, containers	• When moulded once, cannot be softened by heating • Eg: bakelite and melamine. • **Bakelite** is a poor conductor of heat and electricity, used for making electrical switches, handles of utensils, etc. • **Melamine- a** versatile material. Resists fire and can tolerate heat better than other plastics. Used for making *floor tiles, kitchenware and fabrics* which resist fire. Uniform of fireman have coating of melamine

Characteristics of plastic

- light weight, lower price, good strength and easy handling and durable
- Non-reactive: do not react with water and air, do not corrode
- Poor conductor

Teflon is a special plastic on which oil and water do not stick. It is used for nonstick coating on cookwares

Polypropylene

- High-grade plastic and a by-product in crude oil refining.
- A thermoplastic polymer
- Used in packing and labeling, textiles, stationery, furniture, vehicles.
- Would greatly help in production of lighter vehicles that would offer enhanced mileage.
- Does not get damaged by water exposure because its moisture absorption is very low.
- Mangalore Refineries and Petrochemicals Ltd. (MRPL) recently dispatched its first consignment of polypropylene pearls — Mangpol — manufactured at its recently commissioned polypropylene unit, to one of its dealers, Petrotech Products in Bengaluru.
    - MRPL is the only refinery in South India producing polypropylene. Indian Oil Corporation's Panipat refinery is the other major producer of polypropylene in the country.

Acid Bases and Salts

Acids

- has sour taste, eg: curd, lemon, juice,
- Indicators are used test the substance as acid or base.
- **Natural indicators:** Turmeric, litmus, china rose petals (Gudhal)

Bases

- bitter in taste and feel **soapy**

Name of acid	Found in
Acetic acid	Vinegar
Formic acid	Ant's sting
Citric acid	Citrus fruits such as oranges, lemons, etc.
Lactic acid	Curd
Oxalic acid	Spinach
Ascorbic acid (Vitamin C)	*Amla*, Citrus fruits
Tartaric acid	Tamarind, grapes, unripe mangoes, etc.
All the acids mentioned above occur in nature	

Name of base	Found in
Calcium hydroxide	Lime water
Ammonium hydroxide	Window cleaner
Sodium hydroxide/ Potassium hydroxide	Soap
Magnesium hydroxide	Milk of magnesia

- **Litmus-**Natural indicator obtained from **lichens**, when added acidic solution turns red, when basic solution added turns blue. Available as red and blue litmus paper
- Lime water is made from mixing lime (chuna) in water
- China rose indicator turns *acidic solutions to dark pink (magenta) and basic solutions to green*
- **Neutralisation: R**eaction between an acid and a base, Salt and water are produced with the evolution of heat

Neutralisation in everyday life:

- **Indigestion:** Too much acid causes indigestion, antacid such as milk of magnesia containing magnesium hydroxide taken to neutralise.
- **Ant Bite:** Formic acid in ant bite neutralised by rubbing moist baking soda (*sodium hydrogen carbonate*) or calamine solution, which contains zinc carbonate
- **Soil treatment**
  - Too acidic soil is treated with bases like *quick lime (calcium oxide*) or slaked lime (calcium hydroxide)
  - If the soil is basic, organic matter is added to it. Organic matter releases acids.

Metals and Non-metals

- **Metals:** hard, lustrous, malleable, ductile, sonorous and good conductors of heat and electricity

- **Non-metals:** which does not possess above quality.
- Metals like sodium and potassium are soft and can be cut with a knife.
- **Mercury** is the only **metal** which is found in **liquid** state at room temperature

Chemical properties of metals and non-metals

Properties	Metals	Non-metals
Oxidation	Metal oxide are basic in nature	Generally oxides of non-metals are acidic in nature
Reaction with water	Reacts with water	Do not react with water though they may be very reactive in air.
Reaction with acid	React with acids and produce hydrogen gas that burns with a 'pop' sound.	Generally do not react with acids
Reaction with bases	Metals react with sodium hydroxide to produce hydrogen gas.	Reactions of non-metals with bases are complex.

- **Sodium** metal is very reactive. It reacts vigorously with oxygen and water. A lot of heat is generated in the reaction. It is, therefore, stored in **kerosene**.
- **Phosphorus** is a very reactive non-metal. It catches fire if exposed to air, hence kept inside water.
- More reactive metal can replace a less reactive metal, but a less reactive one cannot replace a more reactive metal.

Mercury (Hg)

- Common names: Quicksilver, hydrargyrum.
- Only metal in liquid form at std. temperature and pressure.
- The only other element that is liquid under these conditions is bromine.
- **Occurrence**: Cinnabar (mercuric sulfide).
- **Mercury poisoning** can result from exposure to water-soluble forms of mercury (such as mercuric chloride or methylmercury), inhalation of mercury vapor, or eating seafood contaminated with mercury.
- **Usages:** In thermometers, barometers, manometers, sphygmomanometers, float valves, mercury switches, mercury relays, fluorescent lamps and other devices.
- It is also used in lighting: electricity passed through mercury vapor in a fluorescent lamp produces short-wave ultraviolet light which then causes the phosphor in the tube to fluoresce, making visible light.
- Mercury is a very rare element in the Earth's crust. It accounts for only about only 0.08 parts per million (ppm).
- It is a relatively poor conductor of heat. Most metals are excellent thermal conductors.

Effects of Mercury on Health:

- Exposure to mercury – even small amounts – may cause serious health problems, and is a threat to the development of the child in uterus and early in life.
- Toxic effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes.
- Considered by WHO as one of the top ten chemicals or groups of chemicals of major public health concern.
- People are mainly exposed to methylmercury, an organic compound, when they eat fish and shellfish that contain the compound.

- **Disease caused:** Minamata Disease
- **International Convention:** Minamata Convention on Mercury

Coal and Petroleum

Coal

- Coal is processed in industry to get some useful products such as coke, coal tar and coal gas

Coke	• Tough, porous and black, almost pure carbon • Used in manufacture of steel
Coal Tar	• Black, thick liquid, with unpleasant smell • Used as starting materials for manufacturing various substances used in everyday life and in industry, like synthetic dyes, drugs, explosives, perfumes, plastics, paints, photographic materials, roofing materials, naphthalene balls , etc.
Coal Gas	• obtained during the processing of coal to get coke • Used as fuel

Petroleum

- Petrol and diesel are obtained from a natural resource called petroleum
- Petroleum was formed from organisms living in the **sea**.
- The *world's first oil well was drilled in Pennsylvania, USA, in 1859.* Eight years later, in 1867, oil was stuck at Makum in Assam. In India, oil is found in Assam, Gujarat, Mumbai High and in the river basins of Godavari and Krishna
- Petroleum is a dark oily liquid. It has an unpleasant odour. It is a mixture of various constituents such as petroleum gas, petrol, diesel, lubricating oil, paraffin wax, etc.
- The process of separating the various constituents fractions of petroleum is known as **refining**
- 'Petrochemicals' are used in the manufacture of detergents, fibres (polyester, nylon, acrylic etc.), polythene and other man-made plastics.
- Hydrogen gas obtained from natural gas, is used in the production of fertilisers (urea).
- Due to its great commercial importance, petroleum is also called '**black gold.**

Natural Gas

- Easy to transport through pipes
- Stored under high pressure in form of CNG
- Used in fuel, less polluting, cleaner
- Used as a starting material for the manufacture of a number of chemicals and fertilisers.
- India has vast reserves of natural gas found in Tripura, Rajasthan, Maharashtra and in the Krishna Godavari delta

Changes- Physical and Chemical

Physical changes-Shape, size, colour and state of a substance are called its physical properties.

- A change in which a substance undergoes a change in its physical properties is called a physical change.
- Generally reversible.
- No new substance is formed.

- **Crystallization**: Some substances can be obtained in pure state from their solutions by crystallization

Chemical Change:A change in which one or more new substances are formed.

- **Rusting**: Presence of both water and oxygen required. Salt water makes rusting faster.

Method to prevent rusting:

- **Galvanization:** Depositing a layer of zinc on iron. It prevents iron pipes from rusting.
- **Alloy: Stainless steel** is made by mixing *iron with carbon and metals like chromium, nickel and manganese* to prevent rusting. Stainless steels are iron alloys with a **minimum of 10.5% chromium**. Other alloying elements are added to enhance their structure and properties such as formability, strength and cryogenic toughness. These include **Metals** such as:
  - Nickel
  - Molybdenum
  - Titanium
  - Copper
- **Non-metal** additions are also made, the main ones being:
  - Carbon
  - Nitrogen
- **Painting** on the metals

Combustion

- A chemical process in which a substance reacts with oxygen to give off heat
- Matchstick contains antimony trisulphide and potassium chlorate. Rubbing surface has red phosphorus

Why water control fire?

- Water cools the combustible material so that its temperature is brought below its ignition temperature.
- This prevents the fire from spreading. Water vapors also surround the combustible material, helping in cutting off the supply of air. So, the fire is extinguished.

- Three essential requirement for combustion: Fuel, Oxygen, Ignition temperature,
- **Fire extinguisher:** Contains carbon dioxide, mostly used for electrical fire. CO_2 being heavier than oxygen, covers the fire like a blanket. Since the contact between the fuel and oxygen is cut off, the fire is controlled. The added advantage of CO_2 s that in most cases it does not harm the electrical equipment. Caron dioxide is stored in compressed liquid form, so when released expands enormously providing cooling effect too.
- Dry powder of chemicals like *sodium bicarbonate (baking soda) or potassium bicarbonate also used in* extinguishing fire . Near the fire, these chemicals give off CO_2.
- **Flames**: The substances which vaporize during burning, give flame. Eg: kerosene, wax
  - **Charcoal** does not vaporize and hence does not give flame
  - Outermost part of candle flame is hottest. Blue flame is hotter than red.
- Fuels in decreasing order of calorific value: Hydrogen > LPG> CNG=Methane>Diesel=Kerosene=Petrol>Biogas>coal>wood>cow dung
- CNG - Mostly methane
- LPG - Propane + Butane

Physics

Forces and Pressure

Application of force changes state of motion or shape of object

Contact Forces: Force applied in contact with object

Muscular forces

Friction: Always acts on all the moving objects and its direction is always opposite to the direction of motion.

Non-contact Forces: Force applied without being in contact with object

Magnetic force

Electrostatic force

Gravitational force

Liquids exert pressure on the walls of the container and equal pressure at same depth.

Friction

Factors affecting friction

Surface **smoothness**: rough surface more friction. Friction is caused by interlocking of irregularities on the surfaces

Pressure increases friction

Also depends on the shape of the object and the nature of the fluid.

Substances which reduce friction are called **lubricant**

Rolling friction

Wheels reduce friction

Rolling friction is applied when two body rolls

Rolling friction < sliding friction <static friction

Rolling friction provided by ball bearing

The frictional force exerted by fluids is also called **drag**.

Motion

Rectilinear motion	Straight line
Circular	In circle
Periodic	Repeating

Uniform Motion	Non uniform motion
Speed does not vary	Varying speed

Magnet

The materials which get attracted towards magnet are **magnetic** – for example, iron, nickel or cobalt, Lodestone. The materials which are not attracted towards a magnet are non-magnetic

All magnets have two poles whatever their shape may be- North and South

Magnets lose their properties if they are heated, hammered or dropped from some height. Magnets become weak if they are not stored properly

Magnets should be kept in pairs with their unlike poles on the same side. They must be separated by a piece of wood while two pieces of soft iron should be placed across their ends

Keep magnets away from cassettes, mobiles, television, music system, compact disks (CDs) and the computer. Very strong magnet can destroy the hard drive inside a PC.

When *electric current passes through a wire, it behaves like a magnet*

Electric Current

Water is good conductor of electricity as it contains minerals, but distilled water is free of salts and hence bad conductor of electricity.

Most liquids that conduct electricity are solutions of acids, bases and salts.

Electroplating: The process of depositing a layer of any desired metal on another material by means of electricity.

Chromium has a shiny appearance. It does not corrode. It resists scratches. However, chromium is expensive and it may not be economical to make the whole object out of chromium

Zinc coating (galvanization) on iron to prevent corrosion

The electrical charges generated by rubbing are static. They do not move by themselves. When charges move, they constitute an electric current.

Electroscope: used to determine if and object is charged or not.

Similar charges repel, opposite charges attract each other

The process of transferring of charge from a charged object to the earth is called earthing. Earthing is provided in buildings to protect us from electrical shocks due to any leakage of electrical current.

The **Central Building Research Institute, Roorkee**, has developed knowhow to make quake proof houses.

When a glass rod is rubbed with a piece of silk cloth the glass rod becomes positively charged while the silk cloth has a negative charge.

Light

Law of reflection

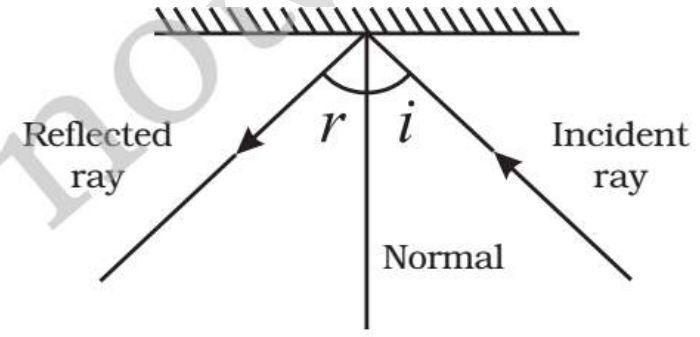

Fig. 16.3 : *Angle of incidence and angle of reflection*

Law of reflection

r=i (angle of reflection=angle of incidence) the incident ray, the normal at the point of incidence and the reflected ray all lie in the same plane.

Regular Reflection: Parallel rays reflected by smooth surface are also parallel and produce images.

Irregular or diffused reflection: All parallel rays reflected from the irregular surface are not parallel.

The objects which emit their own light are known as **luminous** objects.

The objects which shine in the light of other objects are called **illuminated** objects.

Periscopes are used in submarines, tanks and also by soldiers in bunkers to see things outside.

This idea of number of images formed by mirrors placed at an angle to one another is used in a **kaleidoscope** to make numerous beautiful patterns. Designers of wallpapers and fabrics and artists use kaleidoscopes to get ideas for new patterns.

Structure of Human eye

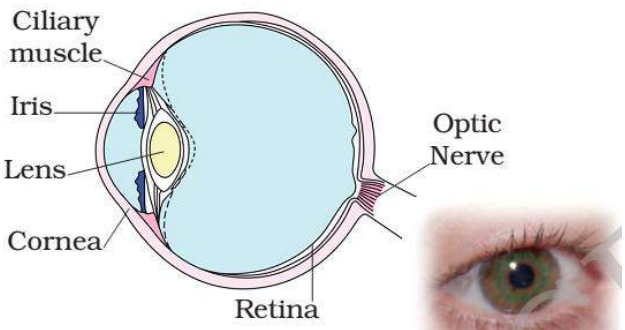

Fig. 16.14 : *Human eye*

Outer coat of the eye is white, tough so that it can protect the interior of the eye from accidents.

Cornea: Transparent front part

Iris: Behind the cornea a dark muscular structure. It gives distinctive colour to eye. It controls the amount of light entering into the eye.

Pupil: Small opening in Iris. The size of the pupil is controlled by the iris.

Lens: Behind the pupil thicker in the center.

Retina: The lens focuses light on the back of the eye, on a layer called retina. Retina contains several nerve cells. Sensations felt by the nerve cells are then transmitted to the brain through the optic nerve.

There are two kinds of cells in retina

cones, which are sensitive to **bright** light and sense **color**.

rods, which are sensitive to **dim** light.

Blind Spot: At the junction of the optic nerve and the retina, there are no sensory cells, so no vision is possible at that spot.

The impression of an image does not vanish immediately from the retina. It persists there for about 1/16th of a second. So, if still images of a moving object are flashed on the eye at a rate faster than 16 per second, then the eye perceives this object as moving. Movies are made to move across the eye usually at the rate of 24 pictures per second (faster than 16 per second).

Eyelids protect eyes from any object entering the eye. Eyelids also shut out light when not required.

The most comfortable distance at which one can read with a normal eye is about 25 cm.

Sometimes, particularly in old age, eyesight becomes foggy. It is due to the eye lens becoming cloudy. When it happens, persons are said to have cataract.

Vitamin A good for eyes: Raw carrots, broccoli and green vegetables (such as spinach) and cod liver oil are rich in vitamin A. Eggs, milk, curd, cheese, butter and fruits such as papaya and mango are also rich in vitamin A

Mirror

Plane Mirror

In a plane mirror the image is formed behind the mirror. It is virtual, erect, of the same size and is at the same distance from the mirror as the object is in front of it.

Lateral inversion takes place i.e. left appears right and vice versa

Curved Mirror

If the reflecting surface of a spherical mirror is concave, it is called a concave mirror.
If the reflecting surface is convex, then it is a convex mirror

Real/Virtual Image

If image formed on a screen is called a realimage where rays actually meet.
Image formed by a plane mirror could not be obtained on a screen. Such an image is called a virtual image.

Usage of concave mirror

Can form a real and inverted image. When the object is placed very close to the mirror, the image formed is virtual, erect and magnified
By dentists to see an enlarged image
reflectors of torches, headlights of cars and scooters, shaving mirror, magnifying glass

Usage of convex mirror

Image formed by a convex mirror is erect, virtual and smaller in size than the object.
side view mirror in vehicles
Convex mirrors can form images of objects spread over a large area. So, these help the drivers to see the traffic behind them.

Lense

Convex Lens

Convex Lenses (converging): thicker in the middle than at the edges.
Converges (bends inward) the light generally falling on it and called converging lens.
Convex lens used in magnifying glass

Concave Lens

Concave lenses (diverging): Thinner in the middle than at the edges
Diverges (bends outward) the light and is called a diverging lens
Image formed by concave lens is always virtual, erect and smaller than the object.

Prism splits sunlight in seven colors. Splitting of light in seven colors is called dispersion. Rainbow is natural dispersion by water droplets

Heat

Temperature: Measurement of hotness
Clinical thermometer contains mercury, kink present in the thermometer prevents mercury level from falling on its own
Normal Body temperature is 37^0C
Temperature of body ranges from 35-42^0C
Maximum and Minimum thermometer to measure weather temperature.
Heat flow from hotter to colder objects
Heat transfer processes

Conduction	Generally in solid
Convection	Generally in liquid

Radiation	Transfer without any medium such as from sun to earth

Note: The water and air are poor conductors of heat

Dark-colored objects absorb radiation better than the light-coloured objects. That is the reason we feel more comfortable in light-coloured clothes in the summer

Woolen clothes keep us warm during winter. It is so because wool is a poor conductor of heat and it has air trapped in between the fibres.

SOUND

In human sound is produced by the voice box or the larynx. It is at the upper end of the windpipe. Two vocal cords, are stretched across the voice box or larynx in such a way that it leaves a narrow slit between them for the passage of air. When the lungs force air through the slit, the vocal cords vibrate, producing sound.

Propagation of sound: Sound need a medium to travel. Sound cannot travel in vacuum

Speed of sound more in solid than liquid

Amplitude and frequency are two important properties of sound

Loudness of sound is proportional to the **square** of the **amplitude** of the vibration producing the sound

Above 80 db , loudness of sound is harmful

The **frequency** determines the **shrillness or pitch** of a sound.

Audible range for human ear 20 Hz- 20,000 Hz

Dogs can hear sound with frequency > 20,000 Hz

Ultrasound works at more than 20,000 Hz

Properties of Material

Appearance

Lustre: Metal, eg: iron, copper, magnesium, gold

Hardness

Soft: Compressed or scratched easily, cotton, sponge

Hard: Difficult to scratch, iron

3. **Soluble/Insoluble:**

Soluble : Completely disappear or dissolved

Insoluble: DO not mix or dissolve

Water can dissolve large number of substances, so called universal solvent.

Sink/Float: heavier sink, lighter float

4. *Transparency*:
   a. Opaque: Through which we cannot see, eg: wood, metal container
   b. Transparent: Things through which we can see, glass air, water
   c. Translucent: Through which can be seen but not very clearly

Separation of materials

1. Handpicking for slightly larger impurities
2. Threshing to separate grains from stalks
3. Winnowing for separating components from mixture. Separating heavier and lighter elements by wind or blowing air
4. Sieving for separating finer particles from bigger ones
5. Sedimentation: Heavier component settles after water is added

6. Decantation: Water along with dust is removed
7. Filtration: Using strainer to separate liquid from solid
8. Evaporation: Conversion of water into vapor. Used in common slat preparation
9. Condensation: Conversion of water vapor into liquid form

- Materials expands on heating and contracts on cooling.