CURRENT MUDDE

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Concised
Relevant
Organized

A Self Help Science Book

1.Biology

2.Chemistry

3.Physics

Chandan Maity

Preface

This book is compiled especially for the Govt. exams.

All the important topic are covered in this exam.

Book is fully NCERT based.

Advantages of this book:

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2. *Organized make learning brain friendly for you*
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BIOLOGY

Biology

Bio – life, Logy - study means Study of life.

Father of Biology - Aristotle

Divided into two parts

Botany - study of plants

Father of Botany - Theophrastus

Zoology - study of animals

Father of Zoology - Aristotle

Cell

Cytology - study of cell

Father of cytology - Robert hook.

Discovered in 1665 by Robert Hook

Cell membranes - outermost covering of the cell also known as selectively permeable membrane.

Cell wall - It lies outside the cell membranes present in plants, fungi, Bacteria not in animals. Made of cellulose.

Nucleus - contains chromosomes which are made up of DNA (Deoxyribonucleic acid) and Protein.

Functional segments of DNA is called genes.

Cell having lack of nuclear membrane called prokaryotes (pro- primitive/immature, karyon - Nucleus)

Cell having well developed nuclear membrane called Eukaryotes (Eu - developed / mature, karyon - nucleus)

Cytoplasm - Fluid contents inside the cell membrane. It enclosed many cell organelles

Cell organelles - little structures present in cell.

1. Endoplasmic Reticulum - a. Rough endoplasmic reticulum (RER) - presence of ribosomes on its surface.

b. Smooth endoplasmic reticulum (SER) - lack of ribosomes.

2. Golgi Apparatus - Discovered by Camillo Golgi.

3. Lysosomes - Suicidal bag of the cell contains digestive enzymes.

4. Mitochondria - Powerhouse of the cell.

Energy store in the form of ATP (Adenosine Triphosphate) . ATP is also known as energy currency of the cell.

Tissue

A particular functions is carried out by a group of cells called Tissue

Two types

1. Plant Tissue
2. Animal Tissue

Plant Tissue

1. Meristematic Tissue - consists of undifferentiated cells capable of cell division.

   Types

   (a) Apical Meristem – Present in growing tips of stems & roots.

   (b) Intercalary Meristem – Present near the node.

   (c) Lateral Meristem – Girth of stem or root.

2. Permanent Tissue - plant tissues that have lost the ability to grow and divide.

(a) Simple Permanent Tissue – Parenchyma, Collenchyma, Sclerenchyma

(b) Complex Permanent Tissue – Xylem & Phloem

Xylem – Transports water & minerals in plants.

Phloem - Transports foods from leaves to the other part of the plant.

Animal Tissue

1. Epithelial Tissue – Covering & protective tissue in animal body.
   Ex. Skin, lining of mouth, Blood vessels, alveoli, kidney tubules.
2. Connective Tissue – Connects, separates & supports all types of tissue in the body.
   Ex. Blood, Bone.
3. Muscular Tissue – Consists of muscle fibres that help in movement of our body also known as skeletal muscles / Striated muscles.
   Movements
   1. Involuntary Movements – working without our willingness.
      Ex. Movement of food in alimentary canal (Peristaltic movement)
   2. Voluntary Movements – Working according to our willingness.
      Ex. Movement of our body.

4. Nervous Tissue - controls the body's movements, sends and carries signals to and from the different parts of the body, and has a role in controlling bodily functions.

Neurons – Longest cell of the body.

Classifications

Five kingdom classification: This classification is based on their cell structure, mode and source of nutrition and body organisation.

Types: 1. Monera – Not defined nucleus & body organisms.
Ex. Blue green algae, Cynobacteria.

2. Protista – Unicellular eukaryotic organisms
Ex. Unicellular algae, protozoans.

3. Fungi - use decaying organic material as food and are therefore called saprotrophs.

4. PLANTAE - multicellular eukaryotes with cell walls.
Ex. Plants.

5. Animalia - multicellular eukaryotes without cell walls.
Ex. Animals.

Plantae

1. THALLOPHYTA - do not have well-differentiated body.
Ex. Algae, Spirogyra.

2. BRYOPHYTA – also known as amphibian of the plants. Commonly differentiated stem & leaf like structures.
Ex. Moss.

3. PTERIDOPHYTA - plant body is differentiated into roots, stem and leaves and has specialised tissue for the conduction of water and other substances.
Ex. Ferns.

4. GYMNOSPERMS - gymno– means naked and sperma– means seed. plants of this group bear naked seeds.
Ex. pines and deodar

5. ANGIOSPERMS - angio means covered and sperma– means seed. These are also called flowering plants. The seeds develop inside an ovary which is modified to become a fruit.
Ex. Beans, Wheat, Rice, Corn.

Cotyledons

Cotyledons also known as seed leaves.

1. Monocotyledons - seeds having a single cotyledon

   Ex. onions, garlic, wheat, corn, rice, bamboo, banana.

2. Dicotyledons - seeds having two cotyledons.

   Ex. pea, beans

Animalia

1. ARTHROPODA – means jointed legs and the largest group of animals. Open circulatory system.

   Ex. prawns, butterflies, houseflies, spiders, scorpions and crabs.

2. MOLLUSCA - They have an open circulatory system and kidney-like organs for excretion.

   Ex. Snails, Mussels, Octopus .

3. VERTEBRATA - a true vertebral column and internal skeleton, allowing a completely different distribution of muscle attachment points to be used for movement.

   (a) Pisces (fish) - Their skin is covered with scales/ plates. They obtain oxygen dissolved in water by using gills. They have two chamber heart.

   Ex. Dog fish, Lion fish, Mandarin fish.

   (b) AMPHIBIA - found both in water and on land. Mucus glands in the skin, and a three-chambered heart. Respiration is through either gills or lungs. They lay eggs.

   Ex. Frogs, toads and salamanders.

   (c) REPTILIA - Have scales and breathe through lungs. While most of them have a three-chambered heart (Exception – Crocodile having four chambered heart).

Ex. Snakes, turtles, lizards and crocodiles.

(d) AVES – 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.

Ex. Ostrich, Sparrow, Pigeon, Crow.

(e) MAMMALIA - 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.

Ex. Human, Rat, Bat, Cat.

Disease

1. Acute Disease – Disease lasts for very short period of time

   Ex. Cold, Fever.

2. Chronic Disease – Lasts for long time or even lifetime

   Ex. Elephantiasis.

3. Infectious Disease – Spread / Infect from one person to other .

   Ex. Cold, Tuberculosis.

4. Non Infectious Disease – Not spread from one to other person.

   Ex. Cancer, High Blood Pressure.

Infectious agents and Diseases

1. Viruses
    1. Common cold
    2. Influenza
    3. Dengue
    4. Polio
    5. Hepatitis – B

6. AIDS (Acquired Immuno Deficiency Syndrome)
7. Chicken Pox
8. Measles
9. Mumps
10. Small Pox
11. Swine Flu
12. Encephalitis

2. Bacteria
    1. Typhoid
    2. Cholera
    3. Tuberculosis
    4. Tetanus
3. Fungi
    1. Ringworm
4. Protozoa
    1. Malaria
    2. Kala – Azar
5. Worm
    1. Elephantiasis

Diseases caused by Protozoa

1. Malaria

Parasite	Plasmodium
Vector	Female Anopheles Mosquito
Symptoms	High fever, Headache, Nausea, Muscular Pain
Drug	Quinine

Diseases caused by Viruses

1. Influenza

Virus	Myxovirus (Influenza Virus)
Symptoms	sudden chills, sneezing, coughing.

2. Hepatitis (Jaundice)

Virus	Hepatitis A,B,C,D,E,G
Infected	Liver
Symptoms	Headache, Yellow Urine, Fever, Loss of Appetite.

3. Rabies (Hydrophobia)

Virus	Rabies / Lyssa Virus
Treatment	Pasteur's Treatment (discovered by Louis Pasteur)

4. AIDS (Acquired Immuno Deficiency Syndrome)

Virus	Human Immunodeficiency Syndrome (HIV)
Infected	White Blood Cells or Lymphocytes(T4 helper cells)
Transmission	Unprotected sex, transfusion of blood, infected needles.
Symptoms	Swollen Lymph nodes, regular fever, weight loss.

5. Polio

Virus	Polio Virus
Infected	Central Nervous System
Symptoms	Paralysis, deformity.
Vaccine	Oral Polio Vaccine

Diseased Caused by Bacteria

1. Tuberculosis (T.B.)

Discovered by	Robert Koch
Bacteria	Tuberculin
Affected	can affects all parts of the body
Symptoms	Loss of appetite & weight, fever, sweating.
Vaccine	BCG (Bacillus Calmette Guerin)

2. Cholera

Bacteria	Vibrio Cholera
Symptoms	Diarrhoea, weight loss, Shrunken Eyes.
Control	ORS (Oral Rehydration Solution)

Vaccination

Father of Vaccination	Edward Jenner
Resistant to	Smallpox virus
Obtain from	cowpox virus

	Vaccine	Disease
1.	DPT – Hib	Diphtheria, Tetanus, Pertusis
2.	Hepatitis B	Hepatitis (Serum Hepatitis)
3.	Polio	Poliomyelitis
4.	BCG(Bacillus Calmette Guerin)	Tuberculosis

Control and Coordination

Nervous System

Nervous System is the part of an animal's body that coordinates its behaviour and transmits signals between different body areas.

It is made of Nerve cells or Neurons (Longest cell of the body).

Neurons

1. Cell Body – Main part of the cell in which nucleus & Cytoplasm are present.
2. Dendrites –They are short fibres stretching out from Cell Body.It allow electrical impulse to cell body.
3. Axon –Longest stretched fibre in neuron & carry electric impulse to the Nerve ending.

Types

1. Sensory Neurons – Transmit impulse from sensory cells to CNS.
2. Motor Neurons – Transmit impulse from CNS to muscle cells.
3. Relay Neurons – Link Sensory & Motor Neurons.

Parts of Nervous System

1. Central Nervous System (CNS) – Consists of Spinal cord & Brain.
2. Peripheral Nervous System (PNS) – All other nervous system like Visceral nerves, Cranial nerves.

Reflex Action

Simple, Fast & Automatic response, which is not controlled by our brain.

Ex. Blinking of eyes, coughing, sneezing, moving away your hand on touching a hot plate.

Reflex Arc

A Pathway by which Reflex Action is done.

Brain

It is main control coordinating centre of our body.
Protected by a bony box called Cranium.
Surrounded by three membranes called Meninges.
Space between is filled by a fluid called Cerebro Spinal Fluid.

Divided in three Parts

1. Forebrain
2. Midbrain
3. Hindbrain

Forebrain

Mainly consists of Cerebrum
Cerebrum is responsible for thinking, learning, reasoning,intelligence, personality, ideas.

Midbrain

Control reflex movements of eyes, neck, trunk, head in response to visual and auditory stimulation.

Hindbrain

Consists of three parts

1. Pons – regulating respiration
2. Cerebellum – maintain posture & balance of the body.
3. Medulla – control many involuntary actions like breathing, B.P, Heart Beat, saliva, vomiting and connected to spinal

cord.

Hormones

Hormone in animals

Chemical substances, which help in coordination and growth of the body.

Glands

It is a small structure, which secretes some specific substances into our body.

Types

1. Endocrine Glands – It is a Ductless glands which secretes its chemicals into direct our blood.
   Ex. Thymus, Thyroid, Pituitary, Hypothalamus etc.
2. Exocrine Glands – Gland having duct also called Duct gland which secretes its chemicals into a duct.
   Ex. Salivary Gland, mammary gland, sweat gland etc.
3. Heterocrine Glands – also known as Dual glands, mixed glands. Glands having both types of function endocrine & exocrine glands.
   Ex. Pancreas, Liver.

Endocrine Glands

1. Hypothalamus – produce "Releasing hormones & Inhibitory hormones" and regulate Pituitary gland secretions.
2. Pituitary Glands (Master Gland)
   Secrets many hormones, Growth hormone is one of them.

   ### Growth Hormone

   Responsible for the growth of the body.
   Deficiency of this hormone – Dwarfism
   Excess of this hormone - Gigantism

3. Thyroid Gland – produce Thyroxine hormone, which helps the rate of metabolism of the body. Iodine is necessary for the production of Thyroxine hormone.

   Deficiency of Iodine – Goitre disease.

4. Parathyroid Gland – produce Parathyroid hormone, which helps in regulate the calcium & phosphate level in the blood.
5. Thymus Gland – produce Thymus hormone & Responsible for Immunity. It starts shrink after puberty.
6. Pancreas – Release Insulin.

   It lowers the glucose (sugar) level in blood.

   Deficiency – Diabetes.

7. Adrenal Glands (Emergency Glands)

   It secretes Adrenaline hormone which regulates heartbeats, breathing, B.P. It gives lots of emergency to fight & flight.

8. Testes – Present in pairs in males.

   It releases Testosterone hormone, which is responsible for the male feature such as moustache, beard, and male puberty.

9. Ovaries – Present in pairs in females.

   It releases Oestrogen & Progesterone hormone. Oestrogen controls the development of female feature like voice, soft skin, and mammary glands. Progesterone is responsible for maintaining of Pregnancy.

Hormone in plants

Auxin – Promote cell enlargement. It moves away from light. It increase the growth of stem but slow down the growth of roots.

Gibberellins – Helps in breaking the dormancy of seeds & buds and also stimulate the growth of fruit.

Cytokinins – Promote cell division, delaying the age of leaves, opening of stomata.

Abscisic Acid – It works as a growth inhibitor. Promotes dormancy of seed & buds, closing of stomata, falling of leaves.

Ethylene – Responsible for ripening of fruit & present in gaseous form.

Reproduction

Production of new young ones from existing organisms is knows as reproduction.

Types

1. Asexual Reproduction
2. Sexual Reproduction

Asexual Reproduction

Producing new organisms from single parent without involvement of sex cells.

1. Fission
   (a) Binary Fission – When unicellular organism divides into two new organisms.
   Ex. Amoeba, Paramecium, Leshmania.
   (b) Multiple Fission - When unicellular organism divides into many new organisms.
   Ex. Plasmodium.
2. Budding –When small part of a body grows & form a bud and detached and becomes a new organisms.
   Ex. Hrdra, Yeast.
3. Fragmentation – When body breaks up into many small pieces on maturation.
   Ex. Spirogyra.
4. Regeneration – Many organisms accidentally cut or breaks into pieces and grows into new organisms.
   Ex. Planaria, Hydra.
5. Spore Formation – Many organisms produce hundreds of spores that burst into air and under favourable condition they produce new organisms.
   Ex. Rhizopus Fungus, Penicillium fungus)

6. Vegetative Propogation- many plants in which parts like the root, stem and leavesdevelop into new plants under appropriate conditions.

   Ex. Bryophyllum, Potato, money plant, banana.

Tissue Culture – Production of new plants from tissue removed from growing tip of the plants.

Sexual Reproduction

Producing new organisms from both parents with involvement of sex cells.

Gametes / Sex cells

Cells participate in Sexual reproduction called Gametes / Sex cells.

Male gametes – Present in males.

Female gametes – Present in females.

When both gametes male & female fuses with each other formed a new cell called Zygote (Single cell body).

Sexual reproduction in plants

Carpel / Pistil – Female reproductive part of a flower
It consists of Stigma, Style, and Ovary.

Stigma – Top part of carpel and it receives the pollen grain from anther.

Style – A tube that connects stigma to ovary.

Ovary – It contains ovules & ovule contains female gametes.

Stamen – Male Reproductive part of a flower
It consists of Anther & filament,

Anther – It makes pollen grains & store them. Pollen grains contains male gametes.

Filament – stalk of anther. It support anther.

Unisexual flower – Contains either stamen or carpels.

Ex. Papaya & Watermelon.

Bisexual flower – Contains both stamen & carpels.

Ex. Hibiscus, mustard.

Pollination – Transfer of pollen grains from anther of flower to the stigma of a carpel.

Fertilisation – When male & female gametes in flowers fuse in ovule called fertilisation.

Sexual Reproduction in Animals

Male reproductive system

It consists of Testes, Penis, Scrotum, Epididymis, Vas Deference, Seminal Vesicles, and Prostate Gland.

Testes – Main reproductive part.

It makes male gametes called Sperm.

Releases male sex hormone called Testosterone.

Scrotum - Testes lies inside a pouch called Scrotum.

It lies outside of the body and 3˚ lower from body temperature.

Epididymis - sperms come from testes and stored some time in a coiled tube called Epididymis.

Vas Deference – It is tube connects from Epididymis to Urethra.

Seminal Vesicle & Prostate Gland – Secretion from these parts provide nutrition to sperm and make their transport easier.

Female Reproductive system

It consists of Ovaries, Oviducts (Fallopian Tubes), Uterus & Vagina.

Ovaries – Oval shaped structure present inside the body.

It is a main sex organ in female.

It makes female sex gametes called Ova / Ovum / eggs.

Releases female sex hormones Oestrogen & progesterone.

Oviducts / Fallopian Tubes – Ovum release from ovary and captured by tube called fallopian tubes. Sperm fuse with ovum here.

Uterus – A bag like structure in which fertilise ovum / Zygote mature into Baby.

Fertilization – The fusion of sperm with ovum into oviduct is called fertilization.

Placenta – A special tissuethat exchange nutrients, oxygen & waste products between embryo & mother body.

Gestation – The time-period of fertilization to the delivery of the baby.

Ovulation – Release of an ovum from an ovary.

Mensuration – It is the removal & breakdown of inner thick lining of uterus along with blood if fertilization not happened in the form of bleeding. (28 days cycle).

Genetics

Father of Genetics – Gregor Mendel.

Experiment on - Pea plant.

Heredity – Transmission of characters from parents to their offspring is called Heredity.

DNA – Deoxyribonucleic acid.

Gene – Unit of DNA that controls the character of an organism.

Chromosome – it is a thread like structure in nucleus which is made up of DNA.

Total no. of chromosomes in humans – 23 pairs
46 chromosomes.

Phenotype – Characteristic which is visible in an organism, is called phenotype like tall, short.

Genotype – shows genes which is responsible for visible appearance .
Ex. TT, Tt, tt.

Sex Determination

XY Chromosomes – Male

XX Chromosomes – Female

Blood Group

Discovery of Blood Group – Karl Landsteiner.

Experiment on – Rhesus Monkey

Four blood group – A, B, AB, O.

Universal Donor – O (negative)

Universal Receiver – AB (Positive)

Homologous organs

Organs having same basic structure but different functions.
Ex. Forelimb of humans, Lizards, Frog.

Analogous Organs

Organs having different basic structure but similar functions.
Ex. Wing of Bird & Insect.

Theory of Evolution

Given by Charles Darwin.

Nutrition

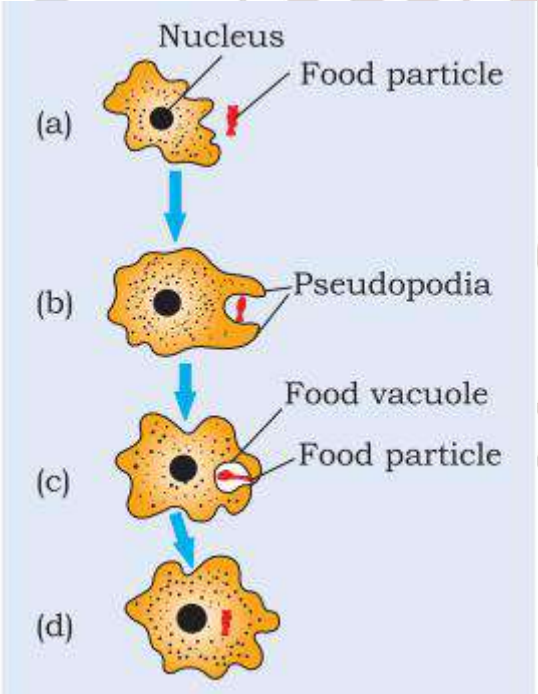
1. Autotrophic Nutrition

Autotrophic nutrition is a process in which the organism produces their food from the simple inorganic materials such as water, carbon dioxide and mineral salts in the presence of sunlight.

$$6CO_2 + 6H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \underset{\text{(Glucose)}}{C_6H_{12}O_6} + 6O_2$$

2. Heterotrophic Nutrition

Heterotrophic nutrition is a type of nutrition in which organisms depend upon other organisms for food to survive.



Nutrition in Amoeba

Pseudopodia are a false leg like structure in Amoeba for capturing food.

Digestion in Human

Digestion in human completes in five steps

1. Ingestion

2. Digestion

3. Absorption

4. Assimilation

5. Excretion

1. Ingestion – taking in food into mouth.

2. Digestion

    1. Saliva secrets from salivary glands present in our mouth helps in breakdown of starch present in our food with.

        Enzyme – Salivary Amylase.

    2. Food is broken down into small Pieces by teeths and smoothen by saliva and mixed with the help of tongue.

    3. After mastication food is swallowing into our food pipe known as Oesophagus pipe , where food slowly move form food pipe to stomach by rhythmically relaxation and contraction movement of muscles known as Peristaltic movement.

    4. Food is again break down into small parts in stomach.

        Gastric gland is present in Stomach

        Secretion of Gastric gland

        1. Pepsin — A protein digestive enzyme which breakdown protein parts in food into smaller molecules.
        2. HCL — creates acidic medium in which pepsin enzymeswork.

3. Mucus Provide protection of inner lining of stomach from HCL.

5. Now food enters from stomach to Intestine.

Small Intestine

Length – approx. 6.5 meter

Parts – 1. Duodenum– First part connects from stomach. Foods enter into it from stomach.

2. Jejunum – Middle part.

3. Ileum – Last part that connects large Intestine.

Small Intestine received two glands secretion

1. Liver – It release Bile Juice that helps in emulsifying fat or Lipids part in the food.
   It stores Bile juice in Gall bladder.
   It makes acidic food coming from stomach into alkaline.
2. Pancreas – It releases pancreatic juice which contains digestive enzyme.
   Amylase – Helps in breakdown of starch into carbohydrates.
   Trypsin – Helps in breakdown of protein into simple form.
   Lipase – Helps in breakdown of emulsifying fats.

Small Intestine itself releases Intestinal juice that contains many enzymes which digest

Carbohydrates – Glucose

Simple Proteins – Amino Acids

Fats – Glycerol

Digestion of food completes here.

3. Absorption

Small Intestine have small finger like structure on its surface called Villi. Very small villi creates a very large surface for the absorption of food molecules.

4. Assimilation

After the absorption food enters blood and carry to body cells where cells oxidised it and release energy.

Food which is not used by our body, store in the liver in the form of Glycogen.

5. Egestion – Undigested food comes out of our body through Anus.

Breathing & Respiration

Process of taking in oxygen & out Carbon dioxide is known as Breathing.

Respiration

It is a process of releasing of energy from taken food and eliminate waste product.

Food + Oxygen = Co2 + water + Energy (ATP)

It is an oxidation process.

ATP – Adenosine Tri Phosphate

Energy produced during respiration is stored in the form of ATP.

ADP + P + Energy = ATP (Stored Energy)

Types

1. Aerobic Respiration – Respiration in the presence of oxygen.

   Glucose ($C_6H_{12}O_6$) $\xrightarrow[Mitochondra]{Oxygen}$ $6CO_2 + 6H_2O + 38ATP$

   Mitochondria is the site of Aerobic Respiration.

   38ATP is produced in this reaction.

2. Anaerobic Respiration – Respiration in the absence of Oxygen.
   Glucose ($C_6H_{12}O_6$) $\xrightarrow[cytoplasm]{in\ the\ absence\ of\ Oxygen}$ $2C_2H_5OH$ (Ethanol) + $2CO_2$ + 2ATP
   Glucose convert into ethanol & carbon Dioxide and release energy.
   This process is also called fermentation by which we obtain wine etc.

   During excessive exercise our muscles produced energy by aerobic respiration due to insufficient oxygen. This produce lactic acid in muscles and results muscle cramps.

Respiration in Plants

Plants mainly take respiration through stomata. It is a small opening present on leaves by which exchange of gases occur.
loss of water also takes place through it called Transpiration.

Respiration in Animals

1. Earthworm – Skin
2. Fish, Prawn & aquatic animals – Gills
3. Insects Grasshopper, Cockroach, Housefly, - Spiracles
4. Human, Bird, dog, Lizards – Lungs

Breathing in Humans

It is a process in which oxygen is taken in and carbon Dioxide is expelled from the body.

(a) Breathing In: In this process, Rib Cage moves upward and Diaphragm moves downward.
(b) Breathing Out: In this process, Rib Cage moves downward and Diaphragm moves upward.

Respiratory system in Humans

It consists of Nose, Nasal passage, Trachea, Bronchi, Lungs, Diaphragm.

Exchange of gases occurs in Alveoli.

When we burn coal it produce carbon monoxide it strongly binds with haemoglobin in the blood and prevents it from carrying oxygen into the brain & other parts of the body. Due to this a person can die.

Excretion

It is a process in which body removes its waste toxic products.

Excretion in plants

Waste products of plants are Co_2, Water vapour, oxygen.

These gaseous wastes are removed from the stomata present in leaves & lenticels present in stem.

Some waste collect in leaves, fruits and barks, plants removed these wastes by falling of leaves, peeling of bark and falling of fruits.

Some waster products of plants are useful like gums & resins.

Excretion in animals

Main waste products in animals are Co_2, Urea, uric acid, ammonia.

In humans kidney is our excretory organ.

Excretion system in Humans

System consists of two kidneys, two ureters, bladder & urethra.

Kidney

It is a bean shaped organ present backside of above waist in our body.

It present in a pair.

If remove waste & excess water from our body in the form of a yellow liquid called Urine.

Kidney is made of millions of Nephrons. Therefore, Nephron is the functional unit of kidney.

Nephrons consists of “bowman’s capsule” and “tubule”.

Bowman’s capsule contains a bundle of very small blood capillaries called “Glomerulus”.

Glomerulus filters the blood and allow passing small substances like glucose, amino acids, urea, salt water etc. & after passing, they collected in Bowman’s capsule. After it, they passed in tubule where some substances are again selectively reabsorbed by the blood capillaries. Urea and excess water does not reabsorb and through ureters, it collected in Bladder.

After some time when Bladder is full urine is excrete out from our body by Urethra.

Dialysis

After the failure of kidneys for blood filtration, we used a technique called Dialysis or Haemodialysis.

Chemistry

Matter

Matter is any substance that has mass and takes up space by having volume.

States of Matter

1. Solid State – It have fixed shape, fixed volume, do not flow, incompressible, high density, molecules are tightly packed,
2. Liquid State – No fixed shape, fixed volume, less compressible, low density, flow easily.
3. Gaseous State – No fixed shape, no fixed volume, easily compressible, very low density, flow easily.

Comparison

1. Space between particles – Solids< Liquids <Gases
2. Force of attraction – Gases < Liquids < Solids
3. Movement of particles –Solids< Liquids <Gases

Diffusion

It is a mixing of a substance with another substance due to the motion of their particles.

Ex. Smell of food reaches a short distance.
Fragrance of agarbatti spreads into air.

Temperature $0°C$= 273 K (Here $°C$ is degree Celsius & K is kelvin)

SI unit of temperature is Kelvin (K).

Q. Convert the temperature of $28°C$ to the kelvin scale.

= 28 + 273

= 301 K

Melting / Fusion

When a solid substance converts into a liquid on heating is known as Melting / Fusion.

Boiling / Vaporisation

When a liquid substance converts into a gas on heating called Boiling / Vaporisation.

Condensation

Changing of a gas into liquid is called condensation.

Latent Heat

The heat, which is required to change the state of any substance,is called Latent Heat.
Remember in this process there is no raise in temperature.

Latent Heat of Fusion

It is the heat, which is required to change form solid to liquid state.

Latent Heat of Vaporisation

It is the heat, which is required to change from liquid to gaseous state.

Sublimation

When a substance directly change its state from solid to vapour on heating & vapour to solid on cooling is called Sublimation.

Ex. Naphthalene, Iodine, Ammonium Chloride, Camphor.

Solid carbon dioxide – Dry Ice.

Evaporation

When a liquid changing into its vapour state without reaching its boiling point.

Appearing of water vapour outside the glass containing cold water, ice shows the presence of water vapour in air.

There are two more states

1. Plasma – occurs naturally in stars.
2. Bose Einstein

Metals

It has following properties.

1. Malleable – Metal can be changed into thin sheet by beaten.

   Ex. Aluminium foil.

2. Ductile – It can be drawn into thin wire

   Ex. Gold, Silver wire.

3. Lustrous / Shiny& Good conductor of electricity & heat.

4. Hard - Except Sodium & Potassium (soft metals)

5. Solid at room temperature – Except Mercury (Liquid at room temp.)

6. High Boiling& melting point – Except Potassium & Sodium.

Non – Metals

It has following properties.

1. Non malleable
2. Non Ductile
3. Bad conductor of heat & electricity
4. Not shiny & Lustrous except Iodine (having shiny surface)
5. Soft except diamond (hardest natural substance & allotropic of Carbon)
6. Exist in three states (Bromine is liquid in room temp. &non metal)
7. Low melting point (Except graphite having very high melting point).

Metalloids

These elements having properties of both metal & non-metal.

Ex. Silicon (Si), Boron(B).

Mixture - A mixture contains two or more type of elements but not mixed chemically.

All solutions are the example of mixture.

Ex. Salt solution, milk, air.

Types

1. Homogeneous mixture (also called solution)

Those mixture in which substances are completely mixed & you cannot see the partition/separation/clear visible boundary.

Ex. Sugar solution, Salt solution, Air.

2. Heterogeneous mixture

In this type of mixture substances are separate from each other and you can see a clear partition/separation.

Ex. Milk, Paint, Blood.

Compound

A substance which is a combination of two or more than elements.

Ex. NaCl, HCL.

Alloys

It is a homogeneous mixture of metals.

Ex.	Brass	Copper (Cu) + Zinc (Zn)
	Bronze	Copper (Cu) + Tin (Sn)
	Solder	Lead (Pb) + Tin (Sn)

Amalgam Mercury + other metals

Benefits of alloys

1. Stronger than metal.
2. Harder than metal.
3. More resistive, lower melting point & lower electrical conductivity.

Solutions

It is a homogeneous mixture of two or more substances.

Ex. Salt solution, Alloy, Sugar Solution.

Suspension

It is a heterogeneous mixture in which small particles are in suspended state.

Ex. Milk of Magnesia, Sand particle in water.

Colloids

It is an intermediate state between solutions & suspensions.

Ex. Starch solution, Soap Solution.

Tyndall effect

In colloidal solution If you pass the torch light it scatters the light by colloidal particles this effect is known as Tyndall effect.

Types in colloids

1. Sol – Ex. Ink, Soap solution.
2. Aerosol – Solid or liquid is dispersed in gas

   Ex. Hairspray, Fog, Mist.
3. Solid sol – Ex. Coloured gemstone.
4. Emulsion – Liquid in Liquid

Ex. Milk, Butter.

Physical change

Changes in which new substances are not formed.

Ex. Glowing of electric bulb, Freezing, Boiling& melting of water.

Chemical change

Changes in which new substances are formed.

Ex. Burning of paper, Rusting of iron, ripening of fruit, Baking of roti.

Separartion of liquids form different process

1. Mixture of chalk & water can be separated by Filtration process.

2. Separation of cream from milk by Centrifugation process.

Chromatography

It is technique by which we separate two or more solids form liquid.

Crystallisation

Cooling of a hot concentrated solution for obtaining crystals is called crystallisation.

Distillation

It is a process in which we heating a liquid to form vapour

Fractional Distillation

It is the process in which we separate two or more miscible liquid by distillation by the help of their different boiling points.

Ex. Separate mix of alcohol water, acetone water.

Atoms & Molecules

Law of conservation of mass

In a chemical reaction, total mass of products is equal to the total mass of reactants.

Dalton's Atomic Theory

Postulates of Dalton's Atomic theory

1. Matter is made up of small particles called atoms.
2. It cannot be divided, neither created nor be destroyed.

Drawbacks

1. Atoms can be divided into small parts like electrons, protons.
2. Same atoms can have different masses & different atoms can have same masses.

Atom

It is the smallest particle of any element that can take part in chemical reaction.

Atomic radius is measured in nanometre (1nm = 10^{-9} m)

Hydrogen H	Helium He	Carbon C	Lithium Li
Nitrogen N	Oxygen O	Chlorine Cl	Magnesium Mg
Aluminium Al	Silicon Si	Phosphorus P	Sulphur S
Argon Ar	Calcium Ca	Nickel Ni	Zinc Zn
Bromine Br	Iodine I	Barium Ba	Cobalt Ba
Uranium U	Sodium Na	Potassium K	Iron Fe
Copper Cu	Silver Ag	Gold Au	Mercury Hg
Lead Pb	Tin Sn	Manganese Mn	Neon Ne

Molecules

It is a chemical bond of two or more atoms & electrically neutral.

Ex. H_2, S_8

Atomicity

Total no. of atoms present in one molecule of an element.

Ex. Ozone = 3

Noble Gases = 1

Hydrogen, Chlorine, Nitrogen = 2

Ions

When an atom or group of atoms is positively & negatively charged is called Ions.

Cation – It formed when an atom losses it's one or more electron. It is positively charged.

Ex. Na^+, H^+

Anion –It formed when an atom gains one or more electron. It is negatively charged.

Ex. Cl^-,

Ionic Compounds

Compound which are formed by combining of Ionic compounds.

Ex. NaCl, $CaCl_2$.

Properties of Ionic compounds

1. High melting & boiling points.
2. Generally crystalline solid.
3. Soluble in water but insoluble in organic solvents.
4. Conduct electricity due to dissolve in metals & formed ions.

Covalent Bond

It is a bond formed when two atoms share their electrons between them.

Types

1. Single covalent bond
   Bond is formed by sharing of 2 electrons.
   Ex. Cl_2 ,HCl, CH_4 (Methane) , CCl_4,
2. Double covalent bond
   Bond is formed by sharing of two pair of electrons (four electrons).
   Ex. O_2, CO_2, C_2H_4.

3. Triple covalent bond
   Bond is formed by sharing of three pair of electrons (six electrons).
   Ex. N_2, C_2H_2,

Properties of covalent compounds

1. Generally low melting & boiling points.
2. Insoluble in water but soluble in organic solvents.
3. Do not conduct electricity.

Minerals

It is the state in which the metals or their compounds are found in earth.

Ores

Those minerals from which metals are extracted are known as ores.

All ores are minerals but not all minerals are ores.

Metals	Ores
Aluminium	Bauxite
Zinc	Calamine, Zinc Blend
Sodium	Rock Salt
Iron	Haematite
Mercury	Cinnabar
Copper	Cuprite, Copper Glance
Manganese	Pyrolusite

Calcination

When a carbonate ore is heated in absence of air this process is known as Calcination.

Ex. Calamine ore ($ZnCO_3$) is converted into Zinc Oxide (ZnO).

Roasting

When a sulphide ore is heated in the presence of air this process is known as Roasting.

Ex. Zinc blend ore (ZnS) is converted into Zinc oxide (ZnO).

Thermite Reaction

It is a reaction in which a metal oxide is reduced & covert in metal by using aluminium powder as a reducing agent.

Refining of Metals

Process of purify the impure metals.

Ex. Electrolytic refining.

Atoms

It consists of three subatomic particles.

1. Electron – It has negative charge & present outside the nucleus.
2. Proton – It has positive charge& present in nucleus.
3. Neutron – It is neutral & present in nucleus.

Electron

Discovery – J.J Thomson
Experiment on – Cathode Rays.
Mass – 9×10^{-28} gm.

Charge – 1.6×10^{-19} coulomb (negative charge)

Proton

Discovery – Ernest Rutherford
Experiment – Anode Rays
Mass - 1.6×10^{-24} gm
Charge - 1.6×10^{-19} coulomb (Positive charge)

Neutron

Discovery – James Chadwick
Mass - 1.6×10^{-24} gm
Charge – Neutral

Christmas pudding / Watermelon model of atom - Given by J.J Thomson

Atomic Number

Total no. of proton in an atom or total no. of electron in a neutral atom.

Ex. Sodium (Na)– It have total 11 protons so its atomic no. is 11.

Mass Number / Atomic Mass

Total no. of Protons & Neutrons present in an atom.

Mass number = No. of protons + No. of Neutrons

Ex. Mass no. of Sodium = 11 Protons + 12 Neutrons = 23

Electronic configuration of an atom

Electrons are present in outer shells or energy level.

Energy shells are K, L, M, N, O and P.

The innermost shell have the lowest energy level.

The outermost shell have the highest energy level.

Electron Shell	Maximum electrons ($2n^2$)
K (first shell)	$2 \times 1^2 = 2$
L (second shell)	$2 \times 2^2 = 8$
M (third shell)	$2 \times 3^2 = 18$
N (fourth shell)	$2 \times 4^2 = 32$

Distribution of electrons in some atoms

1. Carbon – Atomic no. 6
   K = 2 (full)
   L = 4 (remaining electron 6 – 4)
2. Sodium – Atomic no. 11
   K = 2 (full)
   L = 8 (full)
   M = 1 (remaining 1 electron)

Valence electrons (Valency)

Total no. of electrons those are take part in chemical reactions.

They are electrons present in the outer shell.

Ex. Find the valence electron & valence shell of Chlorine
Chlorine (Atomic no. 17) –
Electronic configuration – K(2) L(8) M (7)
Valence shell – M
Valence electron – 7

Noble gases

They are chemically unreactive because their outer most shell is completely filled.

Noble gases	Atomic No.
Helium (He)	2
Neon (Ne)	10
Argon (Ar)	18
Krypton (kr)	36
Xenon (xe)	54
Radon (Rn)	86

Isotopes

Same atomic no. but different mass no.

Ex. $^{12}_{6}C$, $^{13}_{6}C$, $^{14}_{6}C$ all carbon have 6 atomic no. but different mass no.

Chlorine having 17 atomic no. but different mass no. 35, 37

Oxygen having 8 atomic no. but different mass no. 16 , 17, 18

Hydrogen having 1 atomic no. but different mass no. 1, 2, 3

Radioactive Isotpoes

Uranium – 235 used as a fuel in nuclear reactor.

Arsenic – 74 used for detecting tumor.

Cobalt – 60 used for cancer treatment.

Iodine – 131 used for treatment of goitre.

Isobars

Different atomic no. & same mass no.

Ex. ^{40}S, ^{40}Cl, ^{40}Ar, ^{40}K, and ^{40}Ca all have different atomic no. but same mass no.

Some Important Chemical reactions for exam

Reactants Products

Zn (Zinc) + H_2SO_4 (Sulphuric acid)= $ZnSo_4$(Zinc Products) + H_2

H_2(Hydrogen) + O_2(Oxygen) = $2H_2O$(water)

$Ca(OH)_2$(calcium hydroxide) + CO_2(carbon dioxide) = $CaCO_3$(Calcium Carbonate) + H_2O

CH_4 (methane) + $2O_2$(oxygen)= CO_2(carbon dioxide) + $2H_2O$ (water) + Heat Energy

$C_6H_{12}O_6$ (glucose) + $6O_2$(oxygen) = $6CO_2$ (carbon dioxide) + $6H_2O$(water)

$CaCO_3$(Calcium Carbonate /Lime Stone) + Heat = CaO (Calcium Oxide) + CO_2(carbon dioxide)

Types of reactions

1. Combination Reactions

When two or more reactants combine to form a single product.

2Mg (Magnesium) + O_2 (oxygen) = 2MgO (Magnesium Oxide)

2. Decomposition Reactions

In a reaction when one reactant is break into two or more products .

$CaCO_3$(Calcium Carbonate /Lime Stone) + Heat = CaO(Calcium Oxide) + CO_2(carbon dioxide)

3. Displacement Reactions

When one element exchange with other element of a compound.

Zn (Zinc) + H_2SO_4 (Sulphuric acid)= $ZnSo_4$ (Zinc Products) + H_2

4. Double Displacement Reactions

When elements of different compound exchange their ions with each other.

$AgNO_3$ (Silver Nitrate) + NaCl (Sodium Chloride) = AgCl (Silver Chloride) + NaNO3 (Silver Nitrate)

Oxidation Reaction

It is a reaction in which

1. Addition of oxygen takes place.
2. Removal of Hydrogen takes place.

Oxidising Agent

1. Substance which gives oxygen for oxidation.
2. Substance which removes hydrogen for Oxidation.

Reduction Reaction

It is a reaction in which

1. Addition of hydrogen takes place.
2. Removal of oxygen takes place.

Reducing Agent

1. Substance which gives hydrogen for reduction.
2. Substance which removes oxygen for reduction.

Ex. CuO (Copper Oxide) + H_2 (Hydrogen) = Cu (Copper) + H_2O (water)

Here CuO is changed into Cu , Oxygen is removed from CuO that means it is a Reduction reactions. CuO is Oxidising Agent.

H_2 is changed into H_2O , Oxygen is added with H_2, it means it is a Oxidation reaction. H_2 is Reducing Agent.

Corrosion of metals

A process in which metals continuously deteriorate by air, moisture, chemicals.

$4Fe$ (Iron) + $3O_2$ (Oxygen) + $2xH_20$ = $2Fe_2O_3xH_2O$(Hydrated iron III oxide)

It weakens gates, buildings, railings, bridges.

Rusting

Corrosion of iron is called rusting.

It is a process in which iron left in damp environment for a long time due to this it gets covered with a red brownish flaky substance called rust.

Formula $Fe_2O_3xH_2O$ (Hydrated iron III oxide)

Preventions

1. Painting.

2. Galvanisation – a process in we deposit a thin layer of zinc on iron.

3. Coating with grease & oil.

4. Tin plating & chromium plating.

Corrosion of Aluminium

When aluminium is left in moist air a layer of aluminium oxide is formed due to which it loses its shine is known as corrosion of Aluminium.

This thin layer of aluminium oxide also protect from further corrosion.

Anodising

It is a formation of thick layer of aluminium oxide on aluminium surface by electrolysis.

Corrosion of Copper

Due to corrosion a green coating is formed.
Formula $CuCO_3.Cu(OH)_2$

Corrosion of silver

Due to corrosion a black coating is formed.
Formula Ag_2S

Rancidity

Due to oxidation of fats & oils present in the food, food produces bad & unpleasant smell is known as Rancidity.

Prevention from Rancidity

1. Using Anti-oxidant like BHA (ButylatedHydroxy –Anisole)

2. Packed with nitrogen gas.

3. Store in refrigerator

4. keep away from light

Acids

Acid is a chemical substance, which releases Hydrogen ions (H^+) when dissolving in water.

Acids are those chemical substances which has following properties

1. Sour Taste
2. Turns blue litmus to Red
3. React with metals and form hydrogen gas
   Ex. $Zn + H_2SO_4 = ZnSO_4 + H_2$ (gas)
   Hydrogen gas burns with a pop sound explosion when burning candle bring near it.
4. Reacts with metal carbonates & form Carbon Dioxide gas
   Ex. $Na_2CO_3 + 2HCL = 2NaCl + CO_2$ (gas) + H_2O
5. When acid reacts with base it form salt & water.

   Ex. NaOH(Base) + HCl (acid) = NaCl(salt)+ H_2O

Strong Acids

Those acids which are completely ionised and release a large quantity of hydrogen ions are known as Strong Acids.

Ex. HCl (Hydrochloric Acid), H_2SO_4 (Sulphuric Acid), HNO_3 (Nitric Acid)

Weak Acids

Those acids which are partially ionised and release less quantity of hydrogen ions are known as weak acids.

Ex. CH_3COOH(Acetic Acid) $\leftrightharpoons CH_3COO^- + H^+$

Bases

Base is a chemical substance when we dissolved in water it produce hydroxide ions (OH^-).

Bases have following properties:

1. Bitter taste.
2. Soapy touch.
3. Turns red litmus to blue.
4. Conduct electricity in solution.
5. Reacts with metals & form hydrogen gas.

   EX. $2NaOH$ (sodium hydroxide) + Zn (Zinc) = Na_2ZnO_2(sodium Zincate)+ H_2O
6. Reacts with acids & form salt & water

   Ex. $2NaOH$ (sodium hydroxide) + H_2SO_4 (sulphuric acid) = Na_2SO_4 (sodium sulphate) + $2H_2O$

Strong Bases

Base that can completely ionised in water & produce a large quantity of hydroxide ions (OH^-) .

Ex. NaOH (sodium hydroxide), KOH (Potassium hydroxide).

Weak Bases

Base that partially ionised in water & produce a small quantity of hydroxide ions (OH^-).

Ex. NH_4OH (Ammonium Hydroxide), $Ca(OH)_2$ (calcium Hydroxide)

Indicators to check Acids & Base

It is a dye that change its colour when we contact with it to acids & Bases.

Ex. Litmus, Methyl orange & Phenolphthalein.

Litmus : It is a natural indicator obtain from Lichen.
Lichen is a symbiotic association of Fungi &Algi.
Lichen is also a pollution indicator.
Acids – turns blue to red.
Bases – turns red to blue.

Methyl orange: Acids – Red colour in acid solution.
Bases – yellow colour in basic solution.

Phenolphthalein Acids –colourless in acid.
Bases – pink colour in basic solution.

Natural indicators

1. Litmus

2. Turmeric (yellow dye) – turns red in basic .
3. Red cabbage – turns green in basic & red in acidic.

pH Scale

It is a scale by check the strength of H^+ (hydrogen ions) & determine whether it is acid, base or neutral.
Inversely proportional to the concentration of hydrogen ions.
It has scale from 1 to 14.

1. Acids – pH less than 7.
2. Neutral – pH equal to 7.
3. Base – pH greater than 7.

Some important pH values for exam

HCL	0	Milk	6.5
Blood	7.4	Pure water	7
Saliva (before eating)	7.4	Saliva (after eating)	5.8
NaOH	14	Gastric Guice	1.4

Acids & Bases used in our daily life

Antacid used in indigestion due to acidity

1. Milk of Magnesia ($Mg(OH)_2$)

2. Baking Soda ($NaHCO_3$)

When PH of acid formed in mouth from a long time our teeth start decaying. To prevent this decaying we use tooth paste which is a basic and mainly made up of fluoride.

Honey bee sting (acidic sting) treated with mild base like baking soda.

Ant sting (methanoic acid) treated with mid base like baking soda.

Wasp Sting (alkaline liquid) treated with mid acid like vinegar.

Salts

It is mainly formed when a acid reacts with base.

Few common salt for exam

Salt	Formula
Sodium Sulphate	Na_2SO_4
Potassium Sulphate	$K_2 SO_4$
Calcium Sulphate	$CaSO_4$
Copper Sulphate	$CuSO_4$
Sodium Chloride	NaCl
Sodium Nitrate	$NaNO_3$
Sodium Carbonate	Na_2CO_3
Ammonium Chloride	NH_4Cl

Few properties of salts

1. Strong Acid + Strong Base = Neutral Solution
2. Strong Acid + Weak Base = Acidic Solution
   Ex. $NH_4Cl + H_2O = NH_4OH + HCL$
3. Strong Base + Weak Acid = Basic Solution
   Ex. $Na_2CO_3 + 2H_2O = 2NaOH + H_2CO_3$

Sodium Chloride (Common Salt)

Formula NaCl

Can be obtained from sea- water by Evaporation method.

Artificial method

$$NaOH + HCl = NaCl + H_2O$$

Sodium Hydroxide (Caustic Soda) / NaOH

$$2NaCl + 2H_2O \xrightarrow[Electricity]{Electrolysis} 2NaOH + Cl_2 + H_2$$

In this process we used aqueous sodium chloride (also known as Brine).

Elctrolysis of NaCl solution is calledchlor – alkali process.

Uses

1. Making soaps & detergents.

Washing Soda (Sodium carbonate. Decahydrate)

Formula $Na_2CO_3.10H_2O$

It is used in cleansing action.

Soda ash – Na_2CO_3 (Anhydrous Sodium Carbonate)

Baking Soda (Sodium Hydrogen Carbonate)

Formula $NaHCO_3$

$NaCl + NH_3 + H_2O + CO_2 = NaHCO_3 + NH_4Cl$

Uses

1. Used in baking powder.
2. Used as antacid medicine.
3. Used in fire extinguisher (sulphuric acid also used in fire extinguisher)

Bleaching powder (Calcium oxychloride)

Formula $CaOCl_2$

$Ca(OH)_2$ (Slaked Lime) $+Cl_2 = CaOCl_2$ (Bleaching Powder)$+ H_2O$

Bleaching Agent

A substance which removes colour is known as Bleaching Powder.

Uses

1. used in textile industry for bleaching.
2. It disinfecting drinking water.
3. used for manufacturing Chloroform ($CHCl_3$)

Gypsum

Formula $CaSO_4.2H_2O$

Plaster of Paris

Formula $CaSO_4.1\frac{1}{2}H_2O$

$CaSO_4.2H_2O$ (Gypsum) $\xrightarrow{100^{\circ}C\ heat\ /\ 373K}$ $CaSO_4.1\frac{1}{2}H_2O$ (Plaster Of paris) + H_2O

Uses

1. Making toys, Pop work in buildings.
2. Used in hospital for healing fractured bone.
3. Used in ceiling designs.

Aqua – Regia

It is the mixture in which concentrated nitric acid &concentrated Hydrochloricacid are mixed in the ratio 1:3.

It dissolves gold &platinum .

Carbon & its Compounds

Carbon (C)

Atomic no. 6

Electronic configuration K (2) , L(4)

Valency of carbon 4

It forms covalent bonds.

Carbon is a tetravalent.

Allotropes of Carbon

1. Diamond
2. Graphite
3. Buckminsterfullerene

Diamond

Structure Regular Tetrahedron

Hardest natural substance.

Very shining surface (Brilliance)due to total internal reflection.

It does not electricity due to no free electrons.

Uses

1. Cutting glasses, marbles, rock drilling.
2. Jewellery

Graphite

Structure Flat Hexagonal rings.

Greyish – black soft slippery substance.

Good conductor of electricity due to the presence of free electrons.

Uses

1. Used in dry cells as an electrode.
2. Pencil leads & black paints.
3. Used as a lubricants in machine.

Buckminsterfullerene

It is a cluster of 60 carbon atoms.

Structure Interlocking Hexagonal & Pentagonal rings like football.

Organic compounds of Carbon

1. Hydrocarbons - Compounds that made up of carbon and hydrogen only.

(a) Saturated Hydrocarbons – Hydrocarbons in which carbons are connected with each other only with single bond.

Ex. Alkanes - Methane (CH_4), Ethane (C_2H_4).

(b) Unsaturated Hydrocarbons-Hydrocarbons in which carbons are connected with each other by double or triple bons.

Ex. Alkenes (Ethene), Alkynes (Ethyne).

Naming of Hydrocarbons

Meth	One carbon atom
Eth	Two
Prop	Three
But	Four
Pent	Five
Hex	Six
Hept	Seven
Oct	Eight
Non	Nine
Dec	Ten

Alkanes

Hydrocarbons in which carbons are connected with each other only with single bond.

Formula C_nH_{2n+2} (N = no. of carbon atoms)

Ex. Methane = CH_4 (Carbon = 1 atom, n = 1 then formula $C_1H_{2\times1+2}$)

Ethane = C_2H_6 (Carbon = 2 atom, n = 2 then formula $C_2H_{2\times2+2}$)

Propane= C_3H_8 (Carbon = 3 atom, n = 3 then formula $C_3H_{2\times3+2}$)

Butane = C_4H_{10} (Carbon = 4 atom, n = 4 then formula $C_4H_{2\times4+2}$)

Alkenes

Hydrocarbons in which carbons are connected with each other only with double bonds.

Formula C_nH_{2n} (N = no. of carbon atoms)

Ex. Ethene = C_2H_4 (Carbon = 2 atoms, N= 2 then formula $C_2H_{2\times2}$)

Propene = C_3H_6 (Carbon = 3 atoms, N= 3 then formula $C_2H_{2\times3}$)

Butene = C_4H_8 (Carbon = 4 atoms, N= 4 then formula $C_2H_{2\times4}$)

Alkynes

Hydrocarbons in which carbons are connected with each other only with triple bonds.

Formula C_nH_{2n-2} (N = no. of carbon atoms)

Ex. Ethyne = C_2H_2 (Carbon = 2 atoms, N= 2 then formula $C_2H_{2\times2-2}$)

Propyne = C_3H_4 (Carbon = 3 atoms, N= 3 then formula $C_2H_{2\times3-2}$)

Butyne = C_4H_6 (Carbon = 4 atoms, N= 4 then formula $C_2H_{2\times4-2}$)

Alkyl groups

When one hydrogen atom removed from an alkane molecule is called alkyl group.

Ex. Methyl group $CH_3 -$

Ethyl group $C_2H_5 -$

Isomers

Those organic compounds having same molecular formula but different structure.

Ex. n-Butane & iso-Butane.

Functional Groups

1. Halo Group (Cl, Br, I)

   Group of atoms which can combined with a carbon atom of organic compound.

   Ex. $CH_3 - Cl$ Chloromethane

   $CH_3 - Br$ Bromomethane

2. Alcohol group (-OH) / hydroxyl group

   Ex. $CH_3 - OH$ Methanol

   $C_2H_5 - OH$ Ethanol

3. Aldehyde group (-CHO)

   Ex. HCHO Methanal

   CH_3CHO Ethanal

4. Ketone group (-CO-)

Ex.	CH_3-CO-CH_3	Propanone
	CH_3-CO-CH_2CH_3	Butanone

5. Carboxylic Acid (-COOH)

Ex.	H-COOH	Methanoic acid
	CH_3COOH	Ethanoic acid

Properties of chemical compounds

1. Combustion – Burning these compounds produce a lot of heat, carbon dioxide, water light.
   Saturated hydrocarbons generally burn with a blue flame, but if air supply is not sufficient then it burn with black smoke.
2. Unsaturated hydrocarbons burn with a yellow flame, if pure oxygen is provided then it will also produce a blue flame.

Oxy – acetylene

It is a mixture of acetylene & oxygen gas which is burn & produce very high temperature used for welding metals. (temp. 3200^0C)

Hydrogenation of Oils

Addition of hydrogen to an unsaturated hydrocarbon (vegetable oils) leads to formation of saturated hydrocarbon (Vegetable ghee or Vanasphati ghee) called hydrogenation.

Vegetable oil (unsaturated fatty acids) is good for health.

Vegetable ghee (saturated fats) is bad for health.

Ethanol

Formula C_2H_5OH

If ethanol contains 5% water it is called “rectified spirit”.

If it contains 100% pure ethanol it is called “absolute alcohol”.
Use as an additive in Petrol.

Molasses – It is left part after the crystallisation of sugar from sugar cane juice & thick, dark brown in colour.

Ethanol is produced by fermentation process of can sugar present in molasses.

Ethanoic Acid (Acetic Acid)

Formula CH_3COOH

Dilute solution of ethanoic acid is called Vinegar which is used in pickles.

Esters

Formula	$CH_3COOC_2H_5$
Smell	Fruity / Sweet smell
Uses	perfumes, Soap

Alkaline hydrolysis of esters is used for soap making / saponification.

Soap

It is a sodium salt of a long chain carboxylic acid.

Ex. Sodium Stearate $C_{17}H_{35}COO^-Na^+$

Sodium Palmitate $C_{15}H_{31}COO^-Na^+$

In this long chain hydrocarbons are hydrophobic.

Ionic ends are hydrophilic.

It is prepared by heating of vegetable oils & animal fat with Sodium Hydroxide.

Micelle

It is a spherical aggregation of soap molecules in water.

When we wash our cloths in water hydrocarbon ends in the micelle trapped oil, grease & dirt particles. Ionic ends (Sodium ends) remains attached with water molecules. When we agitate cloth in water dirt particles dispersed in water and remove from cloths.

Limitation – Shop is not useful in hard water washing.

For overcome this limitation we used Detergents.

Detergents

It is a soldium salt of Long chain Benzene sulphonic acid.

Formula $CH_3(CH_2)_{11}C_6H_4SO_3^-Na^+$

Periodic Classification of Elements

Dobereiner's Triads

When element are in increasing order in atomic masses, group of three elements having similar properties. The atomic mass of middle element of this triad has equal to the arithmetic mean of the rest of the two elements

	Elements	Atomic masses
Ex. 1.	Lithium (Li)	7
	Sodium (Na)	23
	Potassium (K)	39
2.	Calcium (ca)	40
	Strontium (Sr)	88
	Barium (Ba)	137
3.	Chlorine (Cl)	35.5
	Bromine (Br)	80
	Iodine (I)	127

Newland's Octaves law

When elements were arranged in increasing order of atomic masses the properties of first elements is similar to the property of the eight elements.

Periodic Table

It is a chart in which elements were arranged in a manner that properties in a column or in a row are similar to each other.

Horizontal rows in this table called periods.

Vertical rows in this table called groups.

Mendeleev's periodic table

In this table, Mendeleev arranged elements in increasing atomic masses, and found that after regular interval properties were matched.

Seven periods and eight groups were arranged in this table.

Merits

1. Table predicted the existence of some elements.
   Ex. Germanium (Ge), Gallium (Ga),
2. It could predict properties of many elements according to their position.
3. It could accommodate noble gases.

Limitations

1. It could not explain the position of Isotopes.

   Ex. Cl – 35, Cl – 37

2. Some elements have wrong atomic masses order.

   Ex. Cobalt (atomic masses 58.9) positioned first than

   Nickel (atomic masses 58.7) later.

3. Hydrogen did not get a correct position.

Modern Periodic Table

Modern periodic table is based on atomic numbers. When we arranged elements according to increasing atomic numbers. There is a similarity in electronic configuration due to which their chemical properties also similar.

Characteristics of Periods (row)

1. No. of valence electrons in elements increases when we move from left to right in a period (row).
2. Valency of electrons increases from 1 to 4 then 4 to 0 when moving from left to right in a period (row).
3. Size of atoms decreases moving from left to right.
4. Metallic character found in left side, metalloid character in middle, non – metals character found in right side of the period.
5. Chemical reactivity of atoms first decrease & then increases when we move from left to right.

Characteristics of groups (columns)

1. In a group all elements have the same no. of valence electron& same valency due to this their chemical properties also similar to each other.
2. Size of atom increases when we move from top to bottom in a group.
3. Metallic character of atoms increases from moving top to bottom.
4. Chemical reactivity of metals increases from moving top to bottom, but decreases for non – metals.

PHYSICS

Motion

Motion

If a body continuously change its position with respect to a reference point is known as Motion.

Distance

It is the actual length travelled by a body.

Displacement

Shortest distance between the initial & final point along-with direction.

Vector quantity

A physical quantity has magnitude as well as direction.

Ex. Displacement, Velocity,

Scalar quantity

A physical quantity having only magnitude.

Ex. Speed, distance,

Distance cannot be zero but displacement can be zero.

Ex. If a person travelled in a circle of 10 km periphery

Then total distance = 10km

Displacement = 0 km.

Uniform motion

If a body, travels equal distances in equal intervals of time.

Ex. 5m in 1 sec

10m in 2sec

15m in 3sec.

Non – uniform motion

If a body travels unequal distances in equal intervals of time.

Ex. Free falling body.

Speed

It is the distance travelled by a body with respect to time.

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

S.I Unit = metre per second (m/s)

It is a scalar quantity

Speedometer = A instrument by which we measure speed.

Odometer = A instrument by which we measure the distance.

Average Speed

Total Distance travelled by a body by total time.

$$\text{Avg.Speed} = \frac{\text{Total distance travelled}}{\text{Total time}}$$

Uniform Speed

If a body, travels equal distances in equal intervals of time.

Velocity

It is the distance travelled by a body with respect to time in a given direction.

$$\text{Velocity} = \frac{\text{Distance travelled in a given direction}}{\text{Total time}}$$

Or

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Total time}}$$

It is a Vector Quantity.

S.I Unit = meter per second (m/s)

Ex. 50 m/s in west direction.

Uniform Velocity

If a body moves in a specific direction in straight line and travelled equal distance in equal interval of time.

Average speed of the body can never be zero, but average elocity can be zero.

Acceleration

It is the rate of change of velocity with respect to time.

$$\text{Acceleration} = \frac{Change\ in\ Velocity}{Total\ time}$$

Change in velocity = Final velocity – initial Velocity

S.I Unit metre per second square (m/s^2)

It is a vector quantity.

If a body moves with a uniform velocity, its acceleration will be zero.

Uniform Acceleration

If a body travels in a straight line and velocity increases by equal amounts in equal time intervals.

Ex. Free falling body.

Non-uniform Acceleration

If a body travels in a straight line and velocity increases by unequal amounts in equal time intervals.

Retardation / Deceleration

If a body travels & velocity of the body decreases then it is called retardation or Negative Acceleration.

S.I Unit metre per second square (m/s^2)

Equation of Motions

1. First equation of motion $V = U + at$

V = final velocity

U = Initial Velocity

a = acceleration

t = time taken

2. Second equation of motion $s = ut + \frac{1}{2} at^2$

s = distance

u = Initial velocity

a = acceleration

t = time taken

3. Third equation of motion $v^2 = u^2 + 2as$

v = final velocity

u = initial velocity

a = acceleration

s = distance travelled

If a body
1. starts from rest , u = 0
2. moves with uniform velocity , acceleration a = 0
3. stops, v = 0

Uniform circular motion

If a body moves in a circular path with uniform speed its direction continuously changes then is called uniform circular motion.

It is an accelerated motion.

Ex.
1. Artificial satellites moves around earth.
2. Moon movement around the earth.
3. Earth moves around the sun.

Centripetal force – It is a force that acts on an object to travel along a circular path.

Centrifugal force – It is a fictitious force, appeared as an outward force on a mass when it is rotated.

Force and Laws of Motion

Force

It is a push or pull on an object resulting from the interaction with another object.

S.I Unit = Newton (N)

It is a vector quantity.

Balanced force

If the net resultant force on a body is zero called balanced force.

It cannot move a stationary body or cannot stop any moving body but it can change shape of the body.

Unbalanced force

If the net resultant force on a body is not zero it is called unbalanced force.

It can move a stationary body or stop any moving body.

Newton's laws of motion

Newton's first law of motion / Galileo's law of Inertia

If a body is at rest it will remains at rest and if a body is in motion it will continue in motion unless an external force compels it to change.

Inertia of a body depends on mass of that body. If a body has more mass it has more inertia.

Ex. 1. Stone has more inertia than football.

2. If we placed a coin on a card which is placed on a glass tumbler and flick the card hard with fingers then card will move away & coin drops down. Because card & coin were in rest initially but sudden strike on card, card moves away & coin remains in rest condition & drop down in glass tumbler.

3. When a tree shaken its fruits, leaves fall down due to inertia.

4. When a bus starts suddenly passengers fall backward & stops suddenly passengers jerked forward.

5. When we beat a carpet with stick, dust particles start coming out from it.

Momentum

Momentum of a body is the product of mass & velocity

Momentum = mass × velocity

$$P = m \times v$$

S.I Unit = kilogram metre per second (kg.m/s)

It is a vector quantity

More the mass and the velocity more will be the momentum.

Ex. 1. Due to high speed of cricket ball it has high momentum.

2. Heavy truck has high momentum.

3. Karate player can break many slabs by a single hit due to high momentum.

Newton's second law of motion

Force is directly proportional to the rate of change of momentum in a given time.

Force = mass × acceleration

$$F = m \times a$$

Note: 1. If mass is doubled then force is also doubled.

2. If mass is doubled & acceleration halved then force remains same or vice versa.

Applications

1. Uses of seat belts to prevent injury, it slowly reduce large momentum of a car.
2. A player while catching a ball slowly moves his hand in backward.
3. During high jump a heap of sands or cushion is provided for prevent injury.

Newton's third law of motion

Every action has equal & opposite reaction.

Application

1. Walking on road, swimming.

2. Gun recoils (after firing gun move little backward called recoiling)
3. Flying of jet aeroplane & rockets.
4. When we jump out from a boat it goes away due to pushing away by feet.
5. Backword movement of horse pipe.
6. In a cart horse pulls cart in forward and pushed the road in backward.

Conservation of momentum

Momentum can never be created nor be destroyed it changes from one body to another.

Total momentum before collision = Total momentum after collision

Rocket & jet also work on conservation of momentum.

Gravitation

Every body in the universe attracts every other body with a force called Gravitational force.

1. Gravitational force is directly proportional to the product of their masses.
2. Gravitational force is inversely proportional to the square of the distance between them.

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

F = Gravitational force

G = Gravitational constant = $6.67 \times 10^{-11} Nm^2 / kg^2$

m1 & m2 are the mass of the body.

Note: 1. If we halve the distance between them then force becomes 4^{th} times.

2. If we double the distance between them then force becomes $1/4^{th}$ times.

Gravitational force in earth = 9.8 N (newton)

Applications

1. All the planets rotate around the sun due to gravitational force.
2. Tides formed by rising & falling water level in sea are the results of gravitational force of sun & moon towards water surface of sea.

Kepler's law of planetary motion

1. First law

   Planets move in elliptical orbit around the sun & sun is at one of the foci of the orbit.

2. Second law

   Each planet covers equal area in equal interval of time.

   When planet is near to the sun its speed increases & when planet far from the sun its speed decreases.

3. Third law

   Cube of the distance between the planet & the sun is directly proportional to the square of the time to move around the sun.

   $r^3 = \text{constant} \times T^2$

Note :

1. When we throw a ball in upward direction its velocity decreases to zero then it stops moving in upward direction and then it falls towards earth in downward direction and its velocity increases.
2. When a body is freely falling in downward its acceleration = 9.8 m/s^2
3. When it goes upward it undergoes in retardation = 9.8 m/s^2
4. Acceleration of free falling body does not depend upon the mass of the body. It is same for all bodies.
5. If a small stone & a big stone are dropped from same height they both will earth surface at the same time.

Mass

It is a quantity of matter.

It is a scalar quantity.

S.I Unit = Kilogram.

It does not change.

Weight

It is the force acting on the object due to gravity.

$$W = m \times a$$

W = Weight

m = mass

a = acceleration

S.I Unit of weight = Newton

It is a vector quantity.

Weight is a force; Value of weight is 9.8 N.

Weight on the moon is 1/6 of the weight on the earth.

Weight of the body changes place to place due to change in acceleration.

Weight of any body is zero at the centre of the earth (because g = 0)

Pressure

It is a force applied on perpendicularly to the unit surface area.

$$\text{Pressure} = \frac{Force}{Area}$$

S.I Unit of pressure is Pascal (P) or N / m^2

It is a scalar quantity.

Application of pressure

1. School bag has wide straps because force is distributed on a large area due to this less pressure produced on shoulders.
2. Sharp knife cuts better because it produce large pressure due to less surface area.
3. Point tip of needle.
4. When man is moving pressure is greater than when it standing.
5. Large tractor tyre & Concrete sleepers below railway track.

Fluids

Any substance that can flow easily is a fluid.

Ex. Liquids, gases.

Buoyancy / Upthrust

Every liquid exerts an upward force to an immersed object in it. This upward force is known as Buoyancy force.

Liquid exerts pressure in perpendicular direction on wall of immersed object.

Affecting factors for Buoyant force

1. Volume inside the liquid increases buoyant force also increases or vice versa.
2. If density of the liquid increases, buoyant force also increases on object or vice versa.

Archimedes Principle

Buoyant force on an immersed object in a liquid is equal to the weight of liquid displaced by the object.

Buoyant force = Weight of displaced liquid

Applications

1. Hydrometer works on this principle and measure density of liquids.
2. Lactometer works on this principle and measure the purity of the milk.
3. Used for find relative density of a substance.

Floatation principle

An object will float in a liquid if the weight of the object is equal to the weight of the liquid displaced by it.

Weight of the object = weight of displaced liquid

1. Object will float when its density is less than or equal to the liquid.
2. Object will sink if its density is greater than the liquid.
3. Ship will float on this mechanism the avg. density of ship is less than that of water.

Density

It is the ratio of mass & volume of a substance.

$$\text{Density} = \frac{Mass}{Volume}$$

S.I Unit of Density = Kilograms per cubic metre (kg / m^3)

Density of water = 1000 kg / m^3

Density of Iron = 7800 kg / m^3

Relative Density

$$\text{Relative Density of any substance} = \frac{Density\ of\ the\ substance}{Density\ of\ the\ water}$$

$$= \frac{Mass\ of\ the\ substance}{Mass\ of\ an\ equal\ Volume\ of\ water}$$

Relative density has no S.I Unit because of same ratio they cancel each other.

Relative density of water is 1.

Work and Energy

Work

When a force moves an object, then work is said to be done.

Work = Force × displacement

$$W = F \times s$$

S.I Unit of work = Joule (J) (also Nm is the derived unit)

It is a scalar quantity.

A man try to push wall with hands but wall does not move that means work is not to be done.

A cooli stands with heavy suitcase but not move than work is not to be done.

Work done in lifting a body or against gravity

$$W = m \times g \times h$$

W = work done

m = mass of body

g = gravity (9.8 N)

h = height

Work done against pulling a body at an angle θ

$$\text{Work} = \text{Force} \times s \times \cos\theta$$

Θ = angle between the direction of motion &direction of force

Note: 1. Work done on circular path is zero due to ($\text{Cos } 90^0 = 0$)

2. Work done of Satellite & earth moving around planet & sun is 0.
3. Work done on man carrying suitcase is zero.
4. Work done on pushing a wall is zero.

Positive work - When force is in the direction of force.

Negative work – when force is in the opposite direction of force.

Zero work – When angle between direction of force & motion is 90^0.

Energy

It is the ability to do work.

It is a scalar quantity.

S.I Unit = Joule (J)

Kinetic Energy

It is the energy of an object due to its motion.

$$\text{Kinetic Energy (K.E)} = \tfrac{1}{2}\, mv^2$$

So, Kinetic Energy of a body depends upon its mass & the velocity.

If mass is double then K.E also doubled.

If mass is halved then K.E also halved.

If velocity is doubled then K.E is fourth times.

If velocity is halved then K.E is one-fourth times and so on.

Potential Energy

It is the stored energy in the body due to its position, arrangement or state.

Potential Energy = m × g × h

m = mass of the body

g = acceleration due to gravity

h = height from a reference point

Ex. 1. Energy in wound up spring.

2. Energy in stretched rubber.

3. Energy in sitting bird.

Mechanical energy = Kinetic energy + Potential energy

Power

It is the rate of doing work or energy is consumed.

$$\text{Power} = \frac{Work\ done}{Time}$$

Or

$$\text{Power} = \frac{Energy\ comsumed}{Time}$$

S.I Unit = watt (W)

It is a scalar quantity.

1 H.P (horse power) = 746 watt

Commercial unit of energy = Kilowatt-hour (kWh).

1 kilowatt – hour = 3600000 joules (3.6×10^6 J)

Energy conservations

1. Electric bulb – Electric energy →Heat energy →Light energy
2. Radio – Electric energy → Kinetic energy → sound energy
3. Electric motor –Electric energy → Mechanical energy

4. Hydropower plant – Potential energy → Kinetic energy → Electrical energy
5. Solar cell – Light energy → Electrical energy

Law of conservation of energy

Energy can neither be created nor be destroyed it transfer from one form to another form.

1. Free fall of the body

From upward to downward initially body at rest there is only potential energy & kinetic energy is zero. Then ball move in downward direction due to gravity potential energy changes into kinetic energy now ball have both energy potential as well as kinetic energy at the end when ball just before hitting the ground its potential energy zero & it has only kinetic enrgy. At any point during this free fall total energy is always equal.

2. Swinging of Pendulum

When we swing a pendulum at the end there is only potential energy & kinetic energy is zero then after moving towards centre potential energy changes into kinetic energy. At the centre there is only kinetic energy & potential energy is zero.

Sound

It is a form of energy which is transfer from one point to another point and which can be heard.

Sound is produced when an object vibrates to & fro.

1. Longitudinal waves

A wave that vibrates in the direction that it is moving.

Ex. 1. A spring when stretched or pushed from one end.
2. Sound wave in air.

Compression – a state in which particles of the medium are very close to each other.

Rarefaction – a state in which particles of the medium are far away to each other.

2. Traverse waves

A wave that vibrates perpendicular to the direction of the wave.

Ex. 1. A spring whose one end is fixed & other end is move up down rapidly.

2. When we throw a stone in water traverse waves is formed.

Crest – Maximum elevation of a wave is called crest.

Trough – maximum depression of a wave is called Trough.

Characteristics of a sound wave

1. Wavelength (λ)

   It is a minimum distance when a sound wave repeats its cycle.

   S.I Unit = metre (m).

   Symbol = λ

2. Amplitude

   It is the maximum distance that a wave moves up & down.

   S. I unit = metre (m).

   Symbol = A

3. Time – Period

   It is time required in which a wave completes its cycle.

   S.I unit = second (s).

   Symbol = T

4. Frequency

   It is the no. of cycles of waves complete in one second.

   S.I unit = hertz (Hz).

   Symbol = v or f .

$$\text{Frequency} = \frac{1}{Time\ period}$$

5. Velocity

   It is the distance travelled by a wave in one second.

$$V = f \times \lambda$$

V = velocity

f = frequency

λ = wavelength

Medium for sound

Sound cannot travel in vacuum, sound needs a medium to travel through it.

It can travel through Solid, Liquid and Gas.

Speed of sound in Gas < Liquid < Solid.

Sound cannot travel through vacuum that's why astronaut cannot hear their voice in space or moon.

Speed of sound depends on

1. Nature of material.
2. Temperature

   Temperature of air increases, speed of the sound also increases.
3. Humidity

   Humidity increases, speed of sound also increases.

Notes:

1. Flash of thunder lightening seen first than the sound of lightening because speed of light is many times more than sound.
2. In cricket when batsman hit the ball first, we seen the hitting later we hear the hit sound.
3. When a gun is fired we see the flash first later we hear the firing sound.

Reflection of sound

When sound wave strikes the surface it reflected.

Applications

1. Megaphone & Bulb horn
2. Stethoscope
3. Soundboard in auditorium.

Echo

It is a repetition of sound waves caused by reflection of sound waves.

For echo, there is a time gap of minimum 0.1 sec between original sound & reflected sound.

Minimum distance for echo is 17.2m.

Reverberation

It is persistence of sound waves due to repeated reflections from the objects like walls, ceiling & floor of the hall.

Frequency range

A human can listen a sound in range of 20 Hz to 20,000 Hz.

Infrasonic sound

Sound frequency less than 20Hz is called Infrasonic.

Ex. Rhinoceros, whales, elephants.

Ultrasonic sound

Sound frequency greater than 20,000 Hz is called Ultrasonic.

Ex. Dogs, Bats.

Applications of ultrasound waves

1. For detect cracks or defects in metals.
2. For cleaning purpose which hard to clean by hands.
3. For investigating the internal body parts like kidneys, pancreas etc.
4. For monitoring the development of the foetus.
5. For Kidney stones breaking.
6. Used in SONAR.
7. Bats capture their prey by ultrasound waves.

SONAR

SONAR = Sound Navigation and Ranging.

It is a device which is used to find depth of the sea, treasures, sub marine etc.

Characteristics of sound

1. Loudness

   It depend on the amplitude of the sound wave that how much amplitude is large or small.

If amplitude is large louder the sound & vice versa.

Loudness of sound measured in “decibel” denoted by “DB”.

2. Pitch

We can distinguish between two different sounds with same loudness by their pitch.

It depends on the frequency of the sound wave.

If frequency is more than pitch is high & if frequency is less than pitch is low.

Ex. Male & Female voice with same loudness.

3. Quality (Timbre)

We can distinguish between two different sounds with same pitch by their Quality of sound.

It depends on the shape of the sound wave.

Ex. Flute & Violin.

Electricity

It is the presence & flow of electric charges.

Charge

1. Positive charge When a glass rod rubbed with a silk cloth.
2. Negative charge When ebonite rod rubbed with a woollen cloth.

S.I Unit = Coulomb (C) = 6.25×10^{18} electrons.

Conductors

Any substance through which electrons are flow called conductors.

Ex. Silver, Aluminium, iron.

Insulators

Any substance through which electrons do not flow called insulators.

Ex. Glass, wood, rubber, plastic.

Electric potential

It is the work done of moving a unit positive charge from infinity to the particular on which electric potential has to be found.

Potential Difference

$$V = \frac{W}{Q}$$

V = potential difference

W = work done

Q = Quantity of charge moved

S.I Unit of potential difference = Volt (V)

Potential difference is measured by voltmeter.

Voltmeter has “High Resistance”.

Current

$$I = \frac{Q}{t}$$

I = Current

Q = Charges t = time

S.I unit = ampere (A)

Current is measured by Ammeter.

Ammeter has very low resistance.

Ohm’s law

Current flow in conductor is directly proportional to the potential difference at a constant temperature.

$$I = \frac{V}{R}$$

I = current

V = potential difference

R = Resistance

Note: 1. Current is directly proportional to the potential difference.

2. Current is inversely proportional to the resistance.
3. If potential difference is doubled current is also doubled, and if halved current is also halved.
4. If Resistance is doubled then current is halved, and if resistance is halved current is doubled.

Resistance

It is the property of a conductor which opposes the flow of electrons.

S.I unit of resistance is ohm (Ω).

Factors on which resistance depend

1. Length → Resistance is directly proportional to the length of conductor.
   If length doubled resistance doubled, if length halved then resistance will be halved.
2. Cross section area → Resistance is inversely proportional to the area of cross section.
   If diameter doubled then resistance is $1/4^{th}$times, if diameter is halved then resistance will be 4^{th} times.
3. Nature of material
4. Temperature → Resistance increasing on increasing temperature in metals and vice versa.

Resistivity

$$\rho = \frac{R \times A}{l}$$

ρ = Resistivity

A = Area of cross – section

R = Resistance

l = Length

S.I unit = ohm – metre (Ω m)

Resistivity does not depend on length & area. It depends on the nature of material & temperature.

Combination of resistance

1. Series

   $R_T = R_1 + R_2 + \ldots\ldots R_n$

   R_T = Equivalent resistance

   R_1 = Resistance of the first body

   R_2 = Resistance of the second body

R_n = Resistance of the last body

Note : 1. If you want the resistance high then connect it in series.

2. Each resistance has different potential difference & potential difference of all the resistance is equal to the sum of voltage of battery.

3. Same current flows through all resistances.

2. Parallel

$$R_{n\ (parallel)} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots + \frac{1}{R_n}.$$

R_n = Equivalent resistance

R_1 = Resistance of the first body

R_2 = Resistance of the second body

R_n = Resistance of the last body

Note: 1. If you want the resistance low then connect it in parallel.

2. Current flow through each resistance is different, but sum of all is equal to the current flow of the circuit.

3. Potential of each resistance is same & equal to the battery.

Electric power

1. $P = V \times I$
2. $P = I^2 \times R$
3. $P = V^2 / R$

Heat produced

$$H = I^2 \times R \times t$$

Application of Heating effect of current

1. Used in heating appliances like kettle, heater, iron.
2. Electric bulb – Tungsten is used in bulb because of its high melting point 3800^0C & low evaporation rate. Bulb is filled with un reactive gases argon, nitrogen.

3. Used in fuse – fuse has low melting point & high resistance.
   Material – Thin tin plated copper.

Magnetic field

1. Magnets has two pole South pole & North pole.
2. Magnetic field lines leave the north pole of a magnet and enter its south pole.
3. Closer the magnetic field lines greater the strength of the magnetic field.
4. Two magnetic field lines never cross each other.
5. Same pole of different magnet repel each other & different pole of different magnet attract each other.

Solenoid

It is a long coil containing large no. of insulted copper wire turns.
If no. of turns increases, strength of the magnetic field produced in the solenoid also increases.
If current pass more than strength of the magnetic field also more.

Colour of different wire

Live wire = Red colour wire
Black wire = neutral wire
Green wire = Earth wire

Sources of energy

Source of energy which can give us an amount of energy over a large period of time.

Types

1. Non – Renewable / conventional source
2. Renewable / non – conventional source

Non – Renewable / Conventional source of energy

Sources of energy that is not replenished quickly when exhausted.

Ex. Coal, Natural gas, LPG, petroleum.

Renewable / Non – Conventional source of energy

Sources of energy that is not exhausted and continuously produced.

Ex. Wind energy, solar energy, water energy.

Fuel

Sources of energy which are burnt produce heat is called fuels.

Ex. L.P.G, Kerosene, Coal, Diesel, Petrol.

Calorific value

It is the amount of heat produced when 1 gm of fuel is completely burnt.

Common unit = Kilojule per gram (kJ /gm)

Highest calorific value = Hydrogen gas

Ignition Temperature

It is the minimum temperature on which a fuel can catch fire.

Property of a good fuel

1. Easily available, cheap, easily transport, safe to handle.
2. High calorific value.
3. Should not produce smoke on burning & not leave as behind after burning.

Fossil fuels

Fossil fuels are hydrocarbons, primarily coal, fuel oil or natural gas, formed from the remains of dead plants and animals.

It is a non – renewable sources of energy.

Coal

It is a mixture of many compounds mainly carbon, hydrocarbon, oxygen and few nitrogen & sulphur compounds.

Petroleum

It means rock oil which is dark, viscous & foul smelling mixture of several solid, liquid and gaseous hydrocarbons.

Distillation of petroleum gives Petrol, Diesel, Kerosene.

Liquefied Petroleum Gas (LPG)

It consists mainly Butane with some propane & ethane.

Ethyl mercaptan (C_2H_5SH) is mixed in LPG cylinders to detect leakages in cylinder because LPG has no smell.

Natural Gas / Compressed natural gas (CNG)

It consists mainly 95% methane + small amount of ethane & propane.

It is formed by the decomposition of vegetable matter deep under the water by anaerobic bacteria.

Pollution causes by fossil fuels

1. Burning of fossil fuels releases acidic gases like So_2 & No_x(nitrous oxide).
   Acid rain = So_2 & No_x (nitrous oxide). Acid rain damages crops, monuments famous example is Taj mahal corroded by acid rains.
2. Burning of fossile fuels releases Co_2 gas which is mainly responsible for global warming because it trap the heat releases from the earth surface and increase the avg. temperature of the earth.

   Green house gases – Co_2 , Methane (CH_4) , Nitrous oxide, Fluorinated gases.

3. Produce ash & smoke.

Renewable / Non – Conventional source

1. Hydroelectric energy
   Energy is produced from the flowing of water
   Ex. Hydro-power plant.

2. Wind energy

   Energy is produced from the kinetic energy of wind.

   Ex. Wind generator.

3. Solar energy

   Energy is produced from the sunlight.

   Ex. Solar cooker, Solar cell, Solar street light.

Solar cell

It is a device converts the solar energy into electricity & store it.

It has two layers one is silicon – arsenic & other is silicon – Boron.

4. Biomass gas

   Energy produced form wastes, crops, leaves, cow dung, fruits.

   Biomass gas constitutes – Methane (CH_4), Co_2, H_2, H_2S.

   Main Bio gas component is methane (upto 75%).

   It is prepared by anaerobic respiration by anaerobic bacteria.

5. Sea Energy
   a. Tidal energy

      Due to gravitation force of moon level of sea water level rises (high tide) & fall (low tide) this movement produces a large amount of energy called Tidal energy.

   b. Ocean Thermal energy

      It is the energy produced from the difference in the temperature between the surface of the ocean & depth of the ocean.

6. Geo thermal energy

   Energy produced from the heat of the hot rocks present inside the earth.

Nuclear Energy

It is the energy produced from the nuclear reactions.

Types

1. Nuclear fission
2. Nuclear fusion

Nuclear Fission

It is a splitting process in which radioactive atoms like uranium, plutonium etc. bombarded with low energy neutrons & splits into smaller nuclei & produce a huge amount of energy.

Ex. Nuclear power plant, Nuclear bomb.

Material used Uranium -235, Plutonium – 239.

This energy is used for electricity.

Notes:

1. Boron rod is used as a control rods because it absorbs extra neutrons produced in this reaction & control the reaction.
2. Graphite core is used as a moderator it slow down the speed of neutrons.
3. Co_2 or liquid sodium is used as a coolant to transfer heat.

Nuclear Fusion

It is a combining process in which two nuclei of light atoms combine and produce a huge amount of energy.

Ex. Hydrogen bombs, Sun's reaction.

Reflection of Light

Light

It is a form of energy by which we see objects by our eyes.

Dual Nature of light

1. Wave theory – Light is made up of electromagnetic waves, it does not need any medium to travel.
2. Particle theory – Light is made up of particles which travel in a straight line.

Luminous object

Those objects which can emit their own light are called luminous object.

Ex. Sun, Candle, Tube light.

Non – Luminous object

Those objects which cannot emit their own light are called non – luminous object.

Ex. Moon, Earth, Sofa, Table.

Incidence ray

Ray which is fall on the surface of mirror.

Normal

It is a perpendicular line on the surface of mirror at the point of incidence ray.

Reflected Ray

Ray which is reflected after the fall of incidence ray.

Incidence angle

Angle between the incidence ray & the normal.

Angle of Reflection

Angle between the reflected ray & the normal.

Laws of Reflection of light

1. Incident ray, reflected ray & the point of incidence (normal) all lie in same plane.
2. Angle of incidence is equal to the angle of reflection.

Image

It is an appearance produced when light rays coming from an object reflected from a mirror or lens.

Real Images

Image of Object which can be obtained on a screen.

Ex. Cinema Hall.

Virtual Images

Image of object which cannot be obtained on a screen.

Ex. Image in mirror.

Image in Plane Mirror

Images form in a plane mirror is same as the object in every aspect like height, distance.

Ex. If a object is 2m in height & 4m distance away from mirror then image formed also of 2m in height & 4m distance away from mirror.

Lateral Inversion

Image of the object in mirror just opposite like right side becomes left side in image & left side becomes right side in image.

On an Ambulance AMBULANCE is written in lateral form

Because when we print on a van in lateral form then its correct image form in mirror.

Uses of plane mirror

1. Dressing table, walls in washroom, in roads.

Mirror

1. Concave Mirror

Concave mirror has a reflecting surface that is recessed inward (away from the incident light).

Ex. Inside surface of spoon.

2. Convex Mirror

Convex mirror has a reflecting surface bulges towards the light source.

Ex. Outside bulge surface of spoon.

Concave mirror

Pole = Centre of any spherical mirror is called pole.

Focus = real focus and in front of the mirror.

Focal length = Distance between the focus & the pole.

Convex mirror

Focus = virtual focus and behind the mirror.

Focal length = Distance between the focus & the pole.

Radius of Curvature

It is radius of the hollow mirror from which the mirror has been cut out.

Relation between Focal length & Radius of curvature

$$F = \frac{R}{2}$$

F = Focal length

R = Radius of curvature

Concave mirror

Image and their position in concave mirror

Position of object	Size of image	Image formed on	Nature of Image
Between focus and pole	Enlarged	Behind the mirror	Virtual & erect (correct & straight)
Focus (F)	Very enlarged	Infinity	Real & Inverted

Between focus (F) and centre (C)	Enlarged	Beyond C	Real & Inverted
At C	Equal to object	At C	Real & Inverted
Beyond C	Diminished (small)	Between focus (F) & Centre (C)	Real & Inverted
Infinity	Highly Diminished	At focus (F)	Real & Inverted

Uses of concave mirror

1. Shaving mirror
2. Torches, head lights, search light.
3. Dentists, Doctor's head mirror.
4. TV dish antenna.

Mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

f = focal length of mirror

u = Object distance from mirror

v = image distance from mirror

Magnification

$$m = \frac{h1}{h2} \quad \text{or} \quad m = -\frac{v}{u}$$

m = magnification

h_1 = height of object

h_2 = height of image

If magnification (m) has +ve sign then image is virtual & erect.

If magnification (m) has -ve sign then image is real & inverted.

Convex Mirror

Image and their position in convex mirror

Position of obect	Size of Image	Position of Image	Nature of Image
Between pole (P) & Infinity	Diminished	Between p & f behind the mirror	Virtual & erect
At Infinity	At focus (f) behind the mirror	Highly diminished	Virtual & erect

Uses

1. Rear view mirror in cars, trucks.
2. In shop for security.

Refraction of Light

When light passes through one medium to another medium its direction changes it is called Refraction of light.

Optically rarer medium

A medium in which speed of light is high.

Optically denser medium

A medium in which speed of light is low.

Notes:

1. When a ray of light goes from a rarer medium to denser, it bends towards the normal axis.
   Ex. Air to glass.
2. When a ray of light goes from a denser medium to rarer, it bends away from the normal axis.
   Ex. Glass to air.

Daily effects of refraction of light

1. An object inside water appears to be above or raised to its original position.
2. Pool of water appears less deep than its original depth.
3. Partly immersed stick in water appears to be bent.

Laws of Refraction of light

1. Incidence ray , refracted ray & normal axis all lie in the same point & plane.

Snell's law

$$\text{Constant} = \frac{\sin i}{\sin r}$$

.

Sin i = sine angle of incidence ray

Sin r = sine angle of refracted ray

Refractive Index

When light passes through air to any medium that time constant is called refractive index.

Refractive index has no unit.

Those substance has high refractive index is optically denser & those has low refractive index is optically rarer.

Lens

1. Convex lens / Converging lens

   Lens which is thinner at edge & thick at centre.

2. Concave lens / Diverging lens

Lens which is thicker at edge & thin at centre.
It has virtual focus.

Optical centre (C)

It is centre of the lens through which if any ray pass it does not deviate.

Principal axis

It is a line which is normal to the surface of the lens & passing through the optical centre.

Focus

It is a point on which parallel rays meet or converge after passing through the lens.

Focal length (f)

Distance between the optical centre & focus of the lens.

Convex lens

Image and their position in convex lens

Position of object	Size of image	Position of image	Nature of image
Between focus (f) & centre (C)	Enlarged	Same side where object has.	Virtual & erect
At focus (f)	Highly enlarged	At infinity	Real & Inverted
Between f & 2f	enlarged	Beyond 2f	Real & Inverted
At 2f	Same size as object	At 2f	Real & Inverted
Beyond 2f	Diminished (small)	Between f & 2f	Real & Inverted
At infinity	Highly Diminished (very small)	At focus (f)	Real & Inverted

Uses

1. Used in spectacles of Hyper-metropia (long-sightedness).
2. In camera, telescopes, microscopes, magnifying glass, projectors.

Concave lens

Images & their position in concave lens

Position of object	Size of image	Position of Image	Nature of image
Between centre (C) & infinity	Diminished	Between centre (C) & focus (f)	Virtual & erect
At infinity	Highly Diminished	At focus (f)	Virtual & erect

Uses

1. Used in spectacles for correcting myopia (short – sightedness)
2. Eye lens of Galilean telescope, wide angle spyhole in doors.

Power of a lens

$$\text{Power} = \frac{1}{focal\ length\ of\ the\ lens}$$

Unit of power of the lens = dioptre (D)

Power of a convex lens = positive (like +3.0 D)

Power of a concave lens = negative (like – 0.5 D)

Power of combination of lenses is equal to the sum of their powers.

Human Eye and the colourful world

Eye

It is a sensory organ by which we see the objects near us.

Nature of image is real & inverted on retina.

Parts in eye

1. Cornea

It is a transparent, front part of the eye & bulging outside. Light enters through it into eyes.

2. Iris

   Behind the cornea, a colourful pigmented membrane is present called Iris.

   It control the light enters in eye. If a large amount of light enter in eyes it contracts the pupil and reduce the amount. If less amount of light enters in eyes it enlarge the pupil & increase the amount.

   Adjustment of eyes take some time that's why if we suddenly enter in a dark room from bright light we cannot see immediately but after some time we see properly.

3. Pupil

   In the middle of this iris there is a black hole called Pupil, through which the entered light controlled. Iris control the pupil size.

4. Ciliary muscles

   A part of an eye which holds the lens of the eye & control the thickness of the lens of eyes while focusing.

5. Lens

   Human eye lens is a convex lens. Its thickness changes according to distance on focusing.

6. Retina

   It a surface layer inside the eye on which image is formed. In Retina has light sensitive cells Rods & Cones which are help to see the object.

   1. Cone cells — Cells help to see a clear, colourful, sharp vision in day light. They can detect colours.
   2. Rod cells — Cells help to see in dark, deem light, they cannot detect colours.

   Blind spot — A small in a retina on which no image is formed through it optic nerves leaves the eye & leads to the brain.

7. Aqueous Humour

It is a space between cornea & eye lens which is filled with watery liquid.

8. Vitreous Humour

   It is a space between eye lens & retina filled with a transparent liquid.

Accommodation

For focusing on far object as well as near objects on retina focal length (converging power) of lens is changing this ability is called accommodation.

Minimum distance to see an object without any strain is 25 cm.

Range is Infinity to 25 cm.

Defects in eyes

1. Myopia (Short – Sightedness)
2. Hypermetropia (Long – Sightedness)
3. Presbyopia

1. Myopia (Short / Near Sightedness)

It is a defect in which a person cannot see distant object clearly.

Caused due to

1. Because of short focal length (high converging power)
2. Eye ball is too long.

Image of distant object is formed not on retina but before retina.

It is corrected by Concave lens.

2. Hypermetropia (Long / Far Sightedness)

It is a defect in which a person cannot see nearby object clearly.

Caused due to

1. Because of large focal length (low converging power)
2. Eye ball is too short.

Image of nearby object is formed behind the retina.

It is corrected by Convex lens.

3. Presbyopia

It is defect due to which an old person cannot see nearby objects clearly because of loss of accommodation power.

It is corrected by Convex lens.

Bifocal lenses

Spectacles have both lenses Concave & Convex lens for far & distant objects.

Cataract

It is a dense cloudy area that forms in the lens of the eye.

With single eye angle of view is 150^0 & with both eye 180^0.

Dispersion of light

Dispersion

It is splitting of light into seven colours when white light is passing through a transparent prism.

Seven colours are

Red, orange, yellow, green, blue, indigo & violet.

Short formula VIBGYOR

Red light

Deviates least due to its high wave length & it has maximum speed among the seven colours. That's why it is used in red light and back light of vehicles so it cannot deviate from a great distance and seen clearly.

Rainbow

It is an arc of seven colours appears on sky due to the dispersion of sun light by raindrops.

It is formed opposite of sun.

In actual rainbow formation is a combination of refraction, dispersion, refraction. But mainly it is formed by the dispersion of light.

Atmospheric Refraction

Earth having many layers of atmosphere & having different densities that's why when light passes through earth's atmosphere it refracted many times this is called atmospheric refraction.

Ex.

1. Twinkling of stars.
2. Stars appears higher than the actual height.
3. Sun appears 2min before than sunrise & 2min after the sunset.

Scattering of light

When light scattered in various direction randomly is called scattering of light.

Tyndall effect

Scattering of light by a medium containing small-suspended particles called Tyndall effect.

Red light scattered less & blue light mores.

Ex. Beam of light visible when light through a dust room.

Beam of lights in forest.

Effects of scattering of lights

1. Blue colour of sky – Because in sunlight blue colour scatters more by air molecules in atmosphere due to this we see blue colour of sky.
2. In outer space we see black colour due to no atmosphere no scattering of light.
3. Sun appears red at sunrise & sunset because blue colour scatters out but red colour does not scatter and reaches our eye.