

# Chemistry

**Atomic structure** – Subatomic Particles – nucleus – protons – electrons – shells - electrical charges – electron cloud model – electron density – atomic number – atomic mass – early models – Aristotle – John Dalton – Neils Bohr – ancient ideas

**Molecules** – Shells and Bonding – Chemical formulae – Models of Molecules – ball and spoke model – space filling model

**Solids, Liquids, and Gases** – Kinetic Theory – Brownian motion – Density – Hydrometer

**Changes of State** – Melting point – boiling point – sublimation – condensation – Pressure

**How Liquids Behave** – evaporation – rate of evaporation – surface tension – cohesion – adhesion

**How Gases Behave** – Diffusion – pressure – temperature

**The Elements** – grouping elements – Metal elements – Non-metals – Semi-metals

**Periodic Table** – Periods and groups - relative atomic mass

**Metals and Groups of Metals and Alloys – Corrosion – Discovery of Metals – Recycling Metals** – Flame tests – Reactivity series – Properties of metals- ductile – Malleable – Noble metals – alkali metals – Transitional metals – Poor metals – Alkaline earth metals – alloy properties – superalloys – galvanizing – sacrificial metal – oxide – rust – discovery of metals –particle accelerator

**Mixtures and compounds** – solution – solvent – solute – insoluble – suspension – miscible – immiscible – emulsifier – emulsion – bonding – covalent bonding – ionic bonding – lattices – metallic bonding – valency - allotropes

**Separation of mixtures** - decantation – filtration – chromatography – evaporation – distillation – centrifuging -

**Chemical Reactions** – endothermic reaction – exothermic reaction – activation energy – law of conservation of mass – chemical equations – Avogadro number – moles – other types of reactions – photochemical reaction – synthesis (combination) reactions – neutralization reactions decomposition reactions – thermal decomposition reactions – reversible reactions – displacement reactions – rates of reactions – reactivity – catalysts – inhibitors – enzymes – action specific

**Oxidation and Reduction** – oxidation – internal respiration – combustion – reduction (reducing agents)

## **Electrolysis**

**Acids and Bases** – electrolyte – anode – cathode – electroplating – electrorefining – anodizing – metal extraction – organic acids – caustic – ph numbers – indicators – litmus – universal indicator – dehydrating agent

**Organic Chemistry** – hydro carbons – homologous series – covalent bonds – single bonds – double bonds – triple bonds – unsaturated – addition reaction – saturated – substitution reaction – synthetic compounds – alcohols – homologous series – hydroxyl group – ethanol – detergent – soap – esters – glycerol

**Salts** - halite – brine – salt families – sulfates – chlorides – nitrates – carbonates – soluble salts – insoluble salts – making salts – fertilizers

**Crude Oil** – fossil fuels – reservoirs – fractional distillation – fractionating column – fraction - cracking

**Polymers and Plastics** – making plastics – polymerization – monomers – polythene – PVC – types of plastics – thermoplastics – thermosetting plastics – synthetic fibers – vulcanized rubber – latex – First plastics – composites – plastic production – plastics in space

## **Physics (Energy, Forces, and Motion)**

**Energy** – Chemical energy – potential energy – elastic potential energy or strain energy – kinetic energy – law of conservation of energy – energy chain – non-renewable – renewable – solar energy – solar cells – joules – kilojoules – watts

**Heat and Heat Transfer** – heat energy – Joule's experiment – thermostats – bimetallic strip – thermal capacities (specific heat) – Absolute temperatures – Fahrenheit – Celsius – absolute zero – thermometers - convection currents – conduction – conductors – insulators – radiation – vacuum – vacuum flask

**Forces** – types of forces – contact forces – newtons (N) – Hooke's Law – vector quantities – scalar quantity – resultant force – equilibrium – fulcrum – moment – elastic – elastic limit - plastic

**Dynamics** – Laws of motion – inertia – momentum – law of conservation of momentum -

**Friction** – reducing friction – lubricant – ball bearings – Drag or air resistance – streamlined

**Motion** – Speed – instantaneous speed – velocity – relative velocity – acceleration – negative acceleration (deceleration) – terminal velocity – resistance – centripetal force – gyroscopes

**Gravity** – gravity and mass – weight – stable object – unstable object -

**Pressure** – atmospheric pressure – pascals (Pa) – millibars (mb) – Hydraulic machines – Pneumatic machines – how a fire extinguisher works

**Simple Machines** – load – effort – force ratio – lever – fulcrum – 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> class levers – wheel – pulleys – screw – gears - cogs - wedge

**Work and Power** – joules – Power – watts

**Floating** – displacement – upthrust – Archimedes' principle – Density – relative density

**Flight and Aircraft design** – airfoil – Bernoulli's principle – thrust – Drag ( air resistance) streamlined – ailerons – control surfaces – elevators – rudder – rolling – yawing – pitching

## Biology (Plant and Animals)

**Stems and Roots** – shoot – bud – terminal and axillary buds - lateral or secondary buds – meristem - apical meristems – root hairs – zone of elongation – root cap – tap root or primary root – lateral roots or secondary roots – fibrous roots – adventitious roots – aerial roots – Prop roots

**Plant Tissue** – xylem – vessels – tracheids – fibers – phloem – sieve tubes – sieve plates – vascular bundles – vascular cylinder – epidermis – exodermis – dermal tissue – cortex – endodermis - parenchyma – collenchyma – cuticle – cutin – secondary tissue - annual ring – heartwood – sapwood – phellogen or cork cambium – bark – lenticels

**Leaves and structure** – Photosynthesis – foliage – simple leaf (lamina) – compound leaves (leaflets) – Leaf arrangements – specialized leaves – leaf margin - veins – midrib – epidermis – palisade layer – spongy layer – mesophyll – stomata – guard cell – leaf stalk – color in leaves - pigments – variegated leaves – xanthophylls – carotene – transpiration – guttation – turgor – wilting – plasmolysis

**Plant food** – chlorophyll – carbohydrates – starch – internal respiration – compensation points – parasites – hemiparasites – saprotrophs – epiphytes – carnivorous plants

**Plant sensitivity** – tropism – positive and negative tropism – phototropism – auxins - geotropism – hydrotropism – haptotropism – thigmotropism – photoperiodism – short-night plants – florigen – day-neutral plants

**Flowering plants** – Male parts – female parts – staminate – pistillate – monoecious – dioecious – fertilization – pollination – nectar guides -

**Seeds and Fruits** – testa – hilum – plumule – radical – types of fruits – succulent fruit – dry fruit – cones – scattering seeds – animal dispersal – water dispersal – wind dispersal – germination – dormant – cotyledons ( seed leaves ) – monocotyledons – dicotyledons – hypogeal germination – epigeal germination

**New plants from old** – Artificial propagation – runners – rhizomes - tubers

**Water plants and flowerless plants**- emergent – submergent – diatoms – Algae desmids – eutrophication – holdfasts – air bladders – liverworts – mosses – club mosses – ferns – fronds – gametophyte – alternation of generation - sori

**Fungi** – mycellum – hyphae – mycorrhizae – molds and mildew – saprotrophs – symbiotic relationships – penicillin - yeast

**Plant lifestyles** – annuals – biennials – perennials – ephemerals – deciduous - evergreen

**Natural cycles** – nitrogen cycle – carbon cycle – water cycle – greenhouse effect – global warming

**Classifying plants** – plant kingdom – divisions – vascular – nonvascular – gymnosperms – angiosperms – bryophytes

**Ecology** – habitat – community – ecosystem - succession – climax community – niche – biomes -

**Food and Energy** – food chain – trophic level – producers – consumers – decomposers – pyramid of numbers – biomass – food web – interdependence

**Conservation** – rate of extinction – endangered species – nature reserves - endemic – hotspots – slow breeders (captive breeders)

# Health and Medicine

**Skeleton** – types of bones – types of joints – inside a bone

**Muscles** – voluntary and involuntary - antagonistic pairs – skeletal muscles – visceral muscles – muscle tissue – striated – striped – myofibers – fascicles – myofibrils – myosin – actin smooth muscle tissue – cardiac muscle tissue – slow-twitch – Fast- twitch fibers

**Circulatory system** – heart – chambers – ventricles – arteries – capillaries – veins – composition of blood – blood clotting – blood groups – red blood cells – hemoglobin – white blood cells

**Food and Diet** – diet – nutrients – accessory foods – carbohydrates – Proteins – amino acids – cholesterol – vitamins – dietary fiber – roughage – minerals – starches – sugars – glucose - glycogen

**Respiratory system** – trachea – windpipe – mucus – cilia – primary bronchus – alveoli – intercostals muscles – diaphragm – voice box – vocal cords – larynx

**Energy for life** – aerobic respiration – metabolic rate – energy value – kilojoules – kilocalories – stamina – suppleness – anaerobic respiration – lactic acid – oxygen debt

**Nervous system and the brain** – neurons (sensory, association) – nerves (sensory and motor ) – nerve impulses – neurotransmitter – reflex actions – reflex arc – cerebrospinal fluid – cerebrum – cerebellum – thalamus and hypothalamus – brain stem – medulla – pons – midbrain – areas of the brain ( cerebral cortex , sensory areas, motor areas, hemispheres – brain waves – sleep – REM ( rapid eye movement ) – EEG ( electroencephalogram )

**Fighting disease** – germs – pathogens – types of bacteria – viruses – lymphatic system monocytes – phagocytosis – immunity – vaccination methods

**Medicine** – alternative treatments – complementary medicine – homeopathic remedies – acupuncture – Chi – meridians – pressure points – Osteopathy – chiropractic – Yoga – meditation – preventive medicine – vaccination – screening – drug – habit forming - addictive

