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 UPKAR'S

General Science

Dr. H. P. Sharma & Dr. A. P. Singh



UPKAR'S
GENERAL
SCIENCE

[It includes recent advances in Space Science, Biotechnology, Biochemistry, Environment Pollution, Ecology, Ecosystem, India's National Programmes, Awards in Science and Science News]

By

Dr. H.P. Sharma

&

Dr. A.P. Singh

Revised & Enlarged Edition

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Preface to the Sixth Edition

It is most gratifying to note that our insistence on highest standards has been fully rewarded as evident by the most cordial and warmest reception extended to the very First Edition of the book by its kind and generous readers, thus resulting in this revised, greatly improved and enlarged Sixth Edition within a short period.

In the preparation of this edition, authors have sincerely borne in mind the continuously widening horizon of science and new scientific researches. Much has been rewritten, or expanded in order to keep pace with the magnitude of the advances in the fields of science. Special attempt has been made to make the book useful to students preparing for various competitive examinations. Our main aim is to give an up-to-date account of the relevant topics while trying to avoid unnecessary details.

This volume contains all new discoveries and inventions which are relevant and important for all competitive examinations. Chapters have been added on recent advancement of Science in various fields e.g., human genome, DNA finger printing, cloning, environmental pollution, advancement of biochemistry, ecology and ecosystem. National programmes of India have also been dealt with in detail. Current advancing frontiers of Science and technology have been added in a new chapter on Science News.

—Authors

Preface to the First Edition

The horizon of Science is continuously widening. The pace of scientific research has been quite fast. New discoveries and inventions are the order of the day. Certain branches are under greater focus of the scientists. Obviously, there is no sphere of man's activity where scientific enquiry has not revealed certain new facts. Thus the accumulation of knowledge in the domain of Science has been rapid and vast.

Today almost in all competitive examinations objective questions are being asked. General Science has a definite place in the syllabus of the majority of these examinations. Under General Science various types of questions, such as objective, very short answer, short answer and long answer type are usually put. But it is quite difficult for the candidates to collect requisite information related to such type of questions. Keeping in view all these, this book 'UPKAR GENERAL SCIENCE' has been written.

This volume contains all those facts which are relevant and important for all competitive examinations. The language of the book has been simple and the coverage of the subject matter has been wide.

—Authors

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General Science

1

VOCABULARY OF SCIENCE

[A]

Abampere—The unit of current in the CGS electromagnetic system of units. Other ab-units include the abcoulomb, abohm and abvolt. They derive from equations in which the permeability of free space is set dimensionless and equal to unity.

Abscisic acid—It was formerly known as dormin. It is a plant hormone that inhibits plant growth.

Absolute zero temperature—The temperature at which all substances have zero thermal energy and thus it is believed to be the lowest possible temperature. Theoretically it is -273°C , *i.e.*, 273°C below the freezing point of water. Absolute zero is of great significance in Thermodynamics.

Abyssal Fauna—The animals inhabiting the oceans at depths greater than 1 km. Here, temperatures range between 5°C and 1°C , the pressure approaches about 600 atm and daylight is absent. Abyssal animals are all highly specialized. Some of these animals are blind; some sport bioluminescent lures and body panels.

Acupuncture—An ancient Chinese medical practice in which fine needles are inserted into the body at specific points, used for relieving pain and treating a variety of conditions including Malaria and Rheumatism. Although it is not yet understood how acupuncture works, it is still widely practised in China and increasingly in the west, mainly as a form of Anaesthesia.

Actinides—The 15 elements with atomic numbers 89–103. The elements through uranium occur in nature; except actinium, they show higher valencies than + 3.

Acetaldehyde—It is also known as ethanal (CH_3CHO), a colourless, flammable liquid. An important reagent, it is used in the manufacture of dyes, plastics and many other organic chemicals.

Acetic acid—It is also known as ethanoic acid (CH_3COOH), most important of the carboxylic acids, and is a pungent, colourless liquid used to make acetates. It is important in biosynthesis. Acetic acid is produced by bacterial action on alcohol in air (yielding vinegar). Pure acetic acid is known as glacial acetic acid.

Acetylene—It is a colourless, flammable gas prepared by the reaction of water and calcium carbide. It is a very weak acid. Acetylene may explode when under pressure, so is stored dissolved in acetone.

Acetylsalicylic acid (Aspirin)—An effective analgesic, which also reduces fever and inflammation and also affects blood platelets. It is useful in headache, minor feverish illness, menstruation pain, rheumatic fever, inflammatory arthritis and may also be used to prevent thrombosis. Acetylsalicylic acid or aspirin may cause gastrointestinal irritation and haemorrhage and should be avoided in case of peptic ulcer.

Acid—It is a chemical substance that produces free hydrogen ions in solution. Reacts with base to form salt.

Acid rain—Rain that has become polluted by sulphuric acid and nitric acid as a result of absorption of sulphur dioxide and nitrogen oxides in the atmosphere. The effects can include the destruction of crops, trees and fish, as well as damage to the buildings.

Acidosis—It is a medical condition in which the acid-base balance in the blood plasma is disturbed in the direction of excess acidity, the pH falling below 7.35. It may cause deep sighing, breathing and drowsiness or coma.

Acne—It is a common pustular skin disease of the face and upper trunk, most prominent in adolescence.

Acoustics—The study of sound or science of sound.

Acrobatics—The art of performing gymnastics.

Acrophobia—A morbid fear of heights, sometimes associated with physical symptoms; often an isolated phobia in otherwise normal people.

Acquired Characteristics—Modifications in an organism resulting from interaction with its environment. In 1801, Lamarck proposed an evolutionary theory in which the assumption that acquired characteristics could be inherited provided the mechanism for species divergence. In later editions of 'The Origin of Species' Darwin moved towards accepting this explanation in parallel to that of Natural Selection, but eventually the Lamarckian mechanism was entirely discounted. It is now thought, however, that organisms which reproduce asexually can pass on acquired characteristics.

Actinic radiation—Electromagnetic radiation that can cause photochemical reactions, especially radiation that can be used as a source of illumination in photography. It includes X-rays and infrared and ultraviolet radiation, as well as light.

Adiabatic process—This is a physical or chemical process that takes place with no gain or loss in heat to or from the environment. An example of an adiabatic process is the vertical flow of air in the atmosphere.

Adipose tissue—These are specialized fat-containing connective tissues, mainly lying under the skin and within the abdomen, whose functions include fat storage, energy release and insulation. In individuals its distribution varies with age, sex and obesity.

Aerology—The branch of science dealing with activities of air and other gases.

AIDS (Acquired Immune Deficiency Syndrome)—This disease is caused by a virus which kills some T-cells in the immune system responsible for producing antibodies against invading organisms. The virus has been isolated from semen and saliva, and most cases occur in homosexuals and haemophiliacs.

Air—The air or the gaseous envelope which surrounds the earth is a mixture of several mixtures. It is neither an element nor a compound. The composition of air slightly differs at different places, but its average composition is—Oxygen 20.95%, Nitrogen 78.09%, Carbon dioxide 0.04%, other gases 0.92%, water vapour variable.

Air-Cushion Vehicle (ACV) or Hovercraft—A versatile marine, land or amphibious vehicle which supports its weight on a high-pressure air cushion maintained by a system of fans. Because this minimizes the friction between the craft and the ground, the auxiliary propulsion equipment can maintain speeds up to 100 Knots, even over difficult surfaces. The air-cushion principle was discovered by the U.K. engineer Christopher Cockerell in the early 1950s.

Air pollution—Means fouling up of the atmosphere as a result of discharge into it of obnoxious gases and even poisonous fumes produced by automobiles, industries, nuclear explosions etc. The problem has recently assumed alarming proportions and is engaging worldwide attention.

Albedo—It is the ratio between the amount of light reflected from a surface and the amount of light incident upon it. The term is usually applied to celestial objects within solar system; the moon reflects about 7% of the sun light falling upon it, and hence has an albedo of 0.07.

Albino—An organism lacking the pigmentation normal to its kind. The skin and hair of albino animals (including man) are uncoloured while the irises of their eyes appear pink. Albinism, which may be total or partial, is generally inherited.

Albumen—A group of proteins soluble in water, present in animals and plants. Ovalbumen is the chief protein in egg white; serum albumen occurs in blood plasma, where it controls osmotic pressure.

Alchemy—It is chemical technology dealing with the conversion of base metals into gold.

Alcohols—Alcohols are class of aliphatic compounds of general formula ROH, containing a hydroxyl group bonded to a carbon atom. They

are classified as monohydric, dihydric etc., according to the number of hydroxyl groups; and as primary, secondary or tertiary according to the number of hydrogen atoms adjacent to the hydroxyl group. Alcohols occur widely in nature and are used as solvents, antifreezes and in chemical manufacture. Alcohols that contain more than one hydroxyl group ($-OH$) are called **Polyhydric alcohols**.

Aldehydes—These are organic compounds of general formula $RCHO$, containing a carbonyl group. They are highly reactive and find many uses in industry in the preparation of solvents, dyes, resins and other compounds. Many aldehydes occur in nature and are often responsible for the flavour and scent of animals and plants.

Algae—Lower plants in which there is no differentiation of stem, root and leaf. They differ from Fungi in that they have chlorophyll and are habitually aquatic. Algae in both marine and fresh water plankton are important as the basis of food chains. Many of the larger algae are important to man; for example, the red algae **Porphyra** and **Chondrus crispus** are used as foodstuffs. Another red algae, **Gelidium** is a source of Agar and the kelps (Macrocystis) produce alginates, one use of which is in the manufacture of ice cream. Other uses of algae are in medicine and as manure.

Algin—Polysaccharide extracted from brown sea-weeds. A derivative, sodium alginate, is a thickening agent and an emulsion stabilizer used in the food industry, especially ice cream manufacture and as sisal in paper and textiles.

Alkali—A water-soluble compound of the alkali metals for ammonia, which acts as a strong base producing a high concentration of hydroxyl ions in aqueous solution. Alkalies neutralize acids to form salts and have important industrial applications. Alkalies are corrosive and can cause severe burns.

Alkaline Soil—Precisely any soil that has a pH value more than 7.0.

Alkalosis—This is a medical condition in which the blood plasma becomes excessively alkaline, *i.e.*, the pH rises above 7.45 with resulting nausea, anorexia or tetany. Respiratory alkalosis is due to over ventilation with loss of plasma carbon dioxide.

Alkaloids—These are narcotic poisons found in certain plants and fungi. They are usually heterocyclic nitrogen containing bases. They are usually contained in the seeds, seed-capsules, bark or roots.

Alkanes or Paraffins—They are homologous series of saturated hydrocarbons. The lowest members, which are gases, are methane, ethane, propane and butane. Alkanes are obtained from petroleum and natural gas.

Allele (Allelomorph)—They are one of the two or more genes that can and do occupy particular loci on homologous chromosomes. Different alleles are responsible for the different though similar effects of genetic variation and are interconvertible by mutation.

Allelopathy—The production of harmful allelochemic substances, which inhibit germination of seeds or roots of other plants *e.g.*, til crop and pipal dry leaves control motha weed.

Allergy—A state of abnormal sensitivity to foreign material (Allergen) in susceptible individuals. Allergic diseases are also often due to fear, anxiety and grief, as these are related to emotional aspects. In man exposure to allergen induces formation of antibodies, at a later time if the allergen is again encountered, it reacts with the antibodies causing release of histamine from most cells in the tissues. Inflammation follows with local irritation, redness and swelling, which in skin appears as eczema or urticaria. In the nose and eyes Hay fever results, and in the gastrointestinal tract diarrhoea may occur. In the lungs a specific effect leads to spasm of bronchi, which gives rise to the wheeze and breathlessness of Asthma.

Allochrony—Species or species populations that are either sympatric at different times of the year or otherwise have non-overlapping breeding seasons. (*e.g.*, different flowering seasons in anthophytes).

Allograft (Homograft)—Graft between individuals of the same species but different genotypes (allogenic).

Allometry—Study of relationships between size and shape.

Allopatric—Geographical distribution of different species, or sub-species or populations within species, in which they do not occur together but have mutually exclusive distributions. Populations occupying different vertical zones in the same geographical area may still be fully allopatric.

Allotropy—Occurrence of some elements in two or more forms (known as allotropes) which differ in their crystalline or molecular structure. Allotropes may have strikingly different physical or chemical properties. Carbon has 2 allotropes, graphite and diamond.

Alpha (α) Particle—A fast-moving helium nucleus that is emitted during the radioactive disintegration of a heavy atomic nucleus. The helium nucleus consists of two protons and two neutrons. Alpha particles carry a double positive charge and are strongly absorbed by air, thin paper and metal foils.

Amalgam—Alloy of mercury with another metal. Most metals except iron will form amalgams; those with high mercury contents are liquid, but most are solid. Amalgams of some noble metals occur naturally; Silver & Gold are extracted from their ores by forming amalgams. Dental amalgam containing silver, copper, zinc and tin is used to fill teeth.

Amoeba—It is a unicellular animal consisting of an ectoplasm, endoplasm in which lie one or more nuclei. Amoebae are found wherever there is moisture, some parasitic forms, *e.g.*, Entamoebahistoltyca causes dysentery in man.

Amino Acids—Amino acids are important class of carboxylic acids containing one or more amino ($-\text{NH}_2$) groups. Twenty or so α -amino acids ($\text{RCH}[\text{NH}_2]\text{COOH}$) are the building blocks of the proteins found in all liv-

ing matter. They are also found and synthesized in cells. Amino acids are white, crystalline solids, soluble in water; they can act as acids or bases depending on the chemical environment. Humans synthesize most of the amino acids in their body except eight essential amino-acids, which they can not produce. Each amino acid contains both an acid and an amino group, they can form a long chain of amino acids bridged by amide links and called peptides. Some amino acids are converted into hormones, enzymes and nucleic acids.

Amniocentesis—It is a diagnostic technique for genetic abnormalities in unborn babies. The test involves taking a sample of the amniotic fluid which surrounds the growing baby inside the womb. It is usually done about the 16th week of pregnancy. This fluid contains cells from the developing baby. Chemical and microscopic examinations of these cells can provide valuable information, revealing the presence or absence of genetic disorders. The chromosome analysis of the cells in the amniotic fluid can also reveal the sex of the baby.

Ammonia (NH₃)—It is a colourless acrid gas. Liquid ammonia is good solvent and is a base. Its aqueous solution contains ammonium hydroxide and is used as a household cleaning fluid. Ammonia is used as a fertilizer, refrigerant and in making many drugs, dyes and plastics.

Ammonification—The biochemical process whereby ammonical nitrogen is released from nitrogen containing organic compounds.

Anabiosis—Is a state of living organisms in which, as a result of freezing, the biological activity level of tissues and organs is reduced to a minimum—a state somewhere on the boundary between life and death. Hibernation (winter sleep) among poikilothermic animals are examples of anabiosis in nature.

Analgesics—Drugs used for relief of pain. They mainly impair perception of or emotional response to pain by action on the higher Brain Centres.

Angiosperm—Flowering and seed-bearing plants; their seeds are contained in ovary.

Angiotensins—Angiotensin I is a decapeptide produced by action of kidney enzyme (Renin) on the plasma protein angiotensinogen when blood pressure drops. It is in turn converted by a plasma enzyme in the lung to the octapeptide angiotensin II, and extremely powerful vasoconstrictor which raises blood pressure and also results in sodium retention and potassium excretion by kidney.

Angstrom unit (Å)—The C.G.S. unit used to express optical wavelengths and is equal to 0.1 nm (or 10⁻⁸ cm).

Anatomy—A branch of Biology dealing with the internal structure of the organisms.

Antacids—Mild alkalis or bases taken by mouth to neutralise excess stomach acidity for relief of dyspepsia, including peptic ulcer and heart-

burn. Milk of Magnesia, Aluminium hydroxide and Sodium bicarbonate are common antacids.

Anthesis—The full-bloom stage of flowers.

Anthropology—The study of man from biological, cultural and social viewpoints. Herodotus may perhaps be called the father of anthropology.

Antibiotics—Substances produced by micro-organisms; that kill or prevent growth of other micro-organisms. Their properties are made use of in the treatment of bacterial and fungal infections. Most common antibiotic is Penicillium produced by the mould *Penicillium notatum*.

Antibodies and antigens—As one of the body's defence mechanisms, proteins called antibodies, are made by specialized white cells to counter foreign proteins known as antigens. Common antigens are viruses, bacterial toxins and allergens. A specific antibody is made for each antigen. Antibody reacts with antigen in the body.

Antiknock additives—These are substances added to gasoline to slow the burning of the fuel and thus prevent 'knocking' the premature ignition of the combustion mixture in the cylinder head. Most widely used is lead tetraethyl $[\text{Pb}(\text{C}_2\text{H}_5)_4]$. This is usually mixed with 1, 2-dibromo and 1, 2-dichloroethane which prevents the formation of lead deposits in the engine. Antiknock additives are being phased out due to anti-lead campaign. Replacements are higher octane fuels and upper cylinder lubricants.

Antifungal—A drug used in the treatment of a disease caused by a fungus.

Anti-matter—Matter composed of antiparticles. These are atomic particles and are 'mirror images' of particles, in that they have an opposite electrical charge. For instance, the positron is an electron with a positive charge.

Antiemetics—Drugs administered to reduce vomiting.

Anti-oxidants are the enzymes inside the cell to provide protection against oxidative damage. They are superoxide dismutase, glutathio-peroxides, glutathiotransferase, etc. Beta carotene is an antioxidant present in carrot and leafy vegetable. Selenium is another anti-oxidant present in our diet. Vitamin E may protect the macula from oxidative damage. Ascorbic acid (Vitamin C) is a proved antioxidant. Uric acid is one more powerful anti-oxidant present in the human body. Anti-oxidant may prevent cancer formation by entrapping the free radicals and enhancing the immune surveillance system.

Antisense gene—A gene that produces an *m-RNA*. Complementary to the transcript of a normal gene (usually constructed by inverting the coding region relative to the promoter).

Antiseptics or germicides—Substances that kill or prevent the growth of micro-organisms (particularly bacteria and fungi); they are used to avoid sepsis from contamination of body surfaces and surgical instruments.

Archaeology—The study of the past through identification and interpretation of the material remains of human cultures.

Astrology—The ancient art of predicting the course of human destiny with the help of indication deduced from the position and movement of the heavenly bodies.

Astronomy—The study of the heavenly bodies.

Astronautics—The science of space travel.

Arteriosclerosis—A disease of arteries in which the wall becomes thickened and rigid, and blood flow is hindered. Arteriosclerosis is the formation of fatty deposits (containing cholesterol) in the inner lining of an artery, followed by scarring and calcification. Excess saturated fats in the blood may play a role in its formation.

Asphalt—It is a tough black material used in road paving, roofing and canal and reservoir lining. Now obtained mainly from petroleum refinery residues. It consists mainly of heavy hydrocarbons.

Astatine—It is a radioactive halogen, occurring naturally in minute quantities and prepared by bombarding bismuth with alpha particles. Tracer studies show that astatine closely resembles iodine.

Atmosphere—It is a unit of pressure. The pressure that will support a column of mercury 760 mm. high.

Atom Bomb—The principle of atom bomb is based on the artificial disintegration of uranium (235) when bombarded by neutrons, the uranium atoms are split up and untold energy is released in the form of X-rays, γ -rays, heat-rays etc. Energy liberated in these forms plays havoc with biological life and property. Therefore, atom bomb is a weapon of mass destruction deriving its energy from nuclear fission.

Atomic energy—It can be produced by the disintegration of atoms of certain radio-active elements. The energy which is produced in this way can be utilized for useful purposes rather than destructive purposes.

Atomic fusion, New Technique—Scientists in the west and in the Soviet Union are reported to be using new techniques for heating hydrogen gas to millions of degrees at which the atoms will fuse together, releasing nuclear energy. In this way the energy in the electrons, can be transferred to the hydrogen gas (called plasmas) which in turn will become ignited to fusion temperature.

Atomic Clock—A very accurate form of clock in which the basis of time scale is derived from the vibrations of atoms or molecules. Examples, the caesium clock, and the ammonia clock.

Atropine—It is an alkaloid derived from hyoscyamine obtained from Belladonna. It decreases the effects of the parasympathetic nervous system and is used to dilate the pupils of the eyes, to increase heart rate, to reduce the secretion of mucus and saliva, and to relax spasm.

Aurora (Polar lights)—Striking display of light seen in sun in night skies near the earth's geomagnetic poles. The **aurora borealis** (Northern lights) is seen in Canada, Alaska and N. Scandinavia; the **aurora australis** (Southern lights) is seen in Antarctic regions. The auroras are caused by the collision of air molecules in the upper atmosphere with charged particles from the sun that have been accelerated and funneled by the earth's magnetic field. Particularly intense auroras are associated with high solar activity. Night time airglow is termed permanent aurora.

Auxins—These are hormones which promote lengthwise plant growth and control abscission and the plant's responses to light and gravity. Natural auxins are derivatives of indole. Synthetic auxins are used for crop control and as weed killers.

Azo compounds—A class of organic compounds. The most important azo compounds have aromatic groups and are made by coupling of Diazonium compounds with nucleophiles such as phenols or aromatic amines. They comprise more than half the dyes commercially available.

[B]

Backcross—Crossing an individual with one of its parents or with the genetically equivalent organism. The offspring of such a cross are referred to as the backcross generation or back cross progeny.

Barometer—An instrument for measuring air pressure, used in weather forecasting and for determining altitude.

Biometry—The application of mathematics and statistics to Biology and Agriculture.

Bionics—The study of functions, characteristics and phenomena observed in the living world and the application of this knowledge to the world of machines.

Bionomics—The study of the relationship of an organism to its environment. Less common name for ecology.

Biophysics—The physics of vital processes of living beings.

Botany—The study of plants.

Bacteria—Unicellular micro-organism. They differ from plant and animal cells in that their nucleus is not a distinct organelle surrounded by a membrane. They are usually placed in a separate kingdom, the Protista. Bacteria are like plant cells in that they are surrounded by a rigid cell wall. Bacteria are important to man in many ways.

Blood Bank—Storing place of reserve human blood kept for emergency blood transfusion in the cases of accidents etc. Persons donating blood are generally between 18 and 50 years, with negative history of venereal diseases, chronic alcoholism and recent illness.

Blue ice or natural ice being exported by Greenland. The ice is virtually germ-free and is said to be 2000 to 3000 years old. It is mostly used by manufacturers of whisky.

Burette—It is graduated glass tube with a tap used for measuring the volume of liquid run out from it. It is used in volumetric analysis.

Bacteriology—The science that deals with bacteria, their characteristics and their activities as related to medicine, industry and agriculture.

Barium meal is barium sulphate, highly insoluble and opaque to X-Rays, can be easily ingested for X-rays examination of the gastrointestinal tract.

B.C.G. Vaccine is Bacillus Calmette-Guerin, antituberculosis vaccine developed by Calmette and Guerin.

Beta Ray—A stream of beta particles (*i.e.*, electrons or positrons) emitted from radioactive nuclei undergoing beta disintegration. Beta particles are emitted with velocities approaching that of light.

Blood Group—Blood group ABO system was discovered by Karl Landsteiner in 1900. In this system, blood is classified by whether the red cells have antigen A (blood group A), B (B group), A and B (group AB), or neither A nor B antigens (group O).

Blood Transfusion—The process of transfusing the blood of one person into the vascular system of another person.

Binocular vision—The use of two eyes, set at a small distance apart in the head and aligned approximately, parallel, to view a single object. Owing to parallax, the images in the two eyes are slightly different which enables the observer to perceive what is seen in three dimensions and so to judge the distance, size and shape. Only man and some higher animals possess binocular vision.

Biogenesis—Theory that all living organisms are derived from other living organisms.

Biological clocks—The mechanisms which control the rhythm of various activities of plants and animals. Some activities, such as mating, migration and hibernation, have a yearly cycle, other chiefly reproductive functions (including human menstruation) follow the lunar month.

Biological control—The control of pests with the help of natural predators, parasites or diseases.

Biochemical (or Biological) Oxygen Demand (BOD) is a measure of the content of organic matter in water and wastes. It is the amount of oxygen when a sample containing a known mass of oxygen in solution is kept at 20°C for five days. The oxygen is consumed by micro-organisms that feed on the organic matter in the sample. A high BOD implies a high organic matter, suggesting a high degree of pollution.

Bioluminescence—The production of non-thermal light by certain organisms such as fireflies, many marine animals, bacteria and fungi.

Buffer—A solution in which pH is maintained at a nearly constant value. It consists of a relatively concentrated solution of a weak acid and its conjugate base and works best if their concentrations are roughly equal, in which case the hydrogen ion concentration equals the dissociation constant of the acid. Biochemical processes in the body are controlled by natural buffer systems.

Babbit metal—It is an alloy containing 89% tin, 9% antimony and 2% copper. Today the term babbit metal is also applied to other high-tin and high-lead bearing alloys.

Bacteriophage (Phage)—It is a virus which attacks bacteria. They have a thin protein coat surrounding a central core of DNA (or occasionally RNA) and a small protein tail. The phage attaches itself to the bacterium and infects the nucleic acid into the cell. This genetic material alters the metabolism of the bacterium and several hundred phages develop inside it. Eventually the cell bursts, releasing the new mature phages. Study of the phages (bacteriophages) has revealed much about protein synthesis and nucleic acids.

Bakelite—It is a synthetic resin and made by chemical reaction of formal-dehyde and phenol. It is a thermosetting plastic. A hard, strong material and is used as an electrical insulator, an adhesive and a paint binder.

Baking powder—It is white yeast substitute which causes dough to rise by giving off carbon dioxide bubbles when moistened. It gives off carbon dioxide when reacted with acids and is used as baking powder, in fire extinguishers and as an antacid. It usually contains sodium hydrogen carbonate (NaHCO_3) and tartaric acid or Cream of tartar.

Baleen—It is found as fibrous plates hanging in rows from the roof of the mouth in whalebone whales (Baleen whales). Its function is to strain plankton, on which these whales feed from the water.

Barbiturates—It is a class of drugs acting on the central nervous system which may be sedatives, anesthetics or anticonvulsants. They depress nerve cell activity, the degree of depression and thus clinical effect varying in different members of the class. Although widely used in the past for insomnia, their use is now discouraged in view of high rates of addiction and their danger in over-dosage; safer alternatives are now available. Short-acting barbiturates are useful in anaesthesia; phenobarbitone is used in treatment of convulsions, often in combination with other drugs.

Basal Metabolic Rate (BMR)—This is a measurement of the rate at which an animal at rest uses energy. Human BMR is a measure of the heat output per unit time from a given area of body surface, the subject being at rest under certain standard conditions. It is usually estimated from the amount of oxygen and carbon dioxide exchanged in a certain time.

Base—Bases may be defined as substances which react with acids to form salts or as substances which give rise to hydroxylions in aqueous solution. Some such inorganic strong bases are known as Alkalis. In modern terms, bases are species which can accept a hydrogen ion from an acid or which can donate an electron-pair to a Lewis acid.

Beeswax—Substances secreted by worker bees and used to build the cell walls of the honeycomb. It contains cerotic acid, myricin and long chain alkanes. The purified wax is used for candles and in furniture waxes, cosmetics and some printing inks.

Benthos—Plants and animals living on the sea bottom, as distinct from Nekton (creatures which swim freely) and Plankton (creatures which drift with the current). Benthos include sea-anemones and sea-cucumbers.

Biodiversity—The sum total of all living plants, animals and microbes is called biodiversity. The term has come to the forefront because largescale habitat destruction alteration has led to the extinction of a large number of species. The highest levels of biodiversity is found in the warm tropical regions. Tropical rain forests and coral reefs are two areas that are extremely rich species composition.

Biochips—Living cells rely on tiny electrical signals to work. Scientists believe that by redesigning cell structures they can use living material to process data in the way that a chip does. That is one form of biochip. The other is the tiny conventional microchip that can be linked to organic material to control its growth and operation. Another name for this new and fast developing science is **molecular electronics**.

Biodegradation—This is the process by which living organisms break down matter into its simpler constituents and thus recycle nutrients. All natural decay processes such as rotting of wood are examples of biodegradation.

Biomass—Biomass is the name given to biological material, normally plants, that can be processed to extract usable energy. Oil and coal are the ultimate forms of biomass—they result from the decay of biological substances over millions of years, concentrating the available energy.

Biome—Biome is the ecological region characterized by the predominant vegetation type, such as savanna. The biome is the largest biogeographical unit.

Biomedical engineering—Biomedical engineering is the development and application of mechanical, electrical, electronic and nuclear devices in medicine. The many recent advances in biomedical engineering have occurred in four main areas : Artificial organs; new surgical techniques involving the use of lasers; Cryosurgery and ultrasonics; diagnosis and monitoring using thermography and computers and prosthetics.

Bionics—Bionics is the science of designing artificial systems which have the desirable characteristics of living organisms. There may be simply

imitation of nature, such as military vehicles with jointed legs or more profitably systems which embody a principle learned from nature. Examples of the latter include radar, inspired by the echolocation system of bats, or the development of associative memories in computers as in the human brain.

Biophysics—A branch of biology in which the methods and principles of physics are applied to the study of living things. It has grown up in the 20th century alongside the development of electronics. Its tools include the Electroencephalograph and the Electron microscope, its techniques those of spectroscopy and X-Ray diffraction and its problems the study of nerve transmission, Bioluminescence and materials transfer in respiration and secretion.

Biopsy—It is a simplified procedure of obtaining tissues from affected part/parts, usually some unusual growth or lining of an organ for microscopic examination.

Biosphere—Biosphere is the region inhabited by living things. It forms a thin layer around the earth, including the surface of the Lithosphere, Hydrosphere and the lower atmosphere.

Biosynthesis or anabolism—The biochemical reasons by which living cells build up simple molecules into complex ones. These reactions require energy, which is obtained from light or from ATP which is produced in degradation reactions.

Biotechnology—Using biological organisms, systems or processes to make or modify products. Biotechnology dates from the first fermented drinks and for thousands of years man has used microorganisms (yeasts and moulds) to make food, drugs, dyes, fertilisers etc. As their understanding to microbes and molecular biology has grown, biotechnologists can increase the output of traditional micro-organisms by creating an environment in which they multiply quickly and can be used for large scale production. Sometimes, rather than the whole microbe, they use a part of it, particularly enzymes which will perform some subsequent chemical conversion. Where there is no known enzyme or microbe that manufactures a substance naturally, the techniques of Genetic engineering can be applied to create new strains. For example, foreign genes can be inserted into bacteria to endow them with novel characteristics and to induce them to synthesise particular materials.

Biotite—Biotite is a range of iron-rich varieties of Mica, grading into Phlogopite. It is a constituent of most igneous and many metamorphic rocks.

Black hole—Black hole is the final stage of evolution for very massive stars, following total gravitational collapse. At the centre of the black hole are the infinitely densely packed remains of the star, perhaps only a few kilometer across, if not crushed entirely out of existence. The gravitational field of a black hole is so intense that nothing, not even electromagnetic radiation (including light) can escape through it. For this reason black holes

can only be detected through their gravitational effects on other bodies and through the emission of 'X' and 'γ' rays by matter falling into them. It has been suggested that the end of the universe will be its becoming a single black hole.

Bleaching powder—It is a white powder consisting of calcium hypochlorite and basic calcium chloride, made by reacting calcium hydroxide with chlorine. It is used for bleaching and as a disinfectant, but in time loses its strength.

Blind spot—This is the area of the retina of each eye, where the optic nerve and blood vessels enter. It has no light-sensitive receptors. In binocular vision the two spots do not receive corresponding images and so are not noticeable.

Blubber—It is the layer of fat below the skin of whale and some other marine mammals and is several inches thick. It provides buoyancy, insulation and functions as energy reserve. It yields oil which was once used for lighting and more recently for making soap and margarine. A blue whale can yield more than 20 tonnes of oil.

Blue baby—Blue baby is the infant born with a heart defect (a hole between the right and left sides or malformation of the arteries) that permits much of the blood to bypass the lungs. The resulting lack of oxygen causes cyanosis. These conditions used to be fatal but can now often be corrected by surgery.

Blue Whale—*Balaenoptera musculus*, a member of the cetacea, (aquatic mammals) the largest living animal, attaining a length of 30 metre and weighing up to 130 tonnes. A baleen whale lives mainly in the Antarctic ocean.

Bole—The main stem of a tree & sometimes only the lower part of the stem upto a point where the main branches are given off.

Bonsai—The ancient oriental art of growing trees in dwarf form. The modern enthusiast may spend three years cultivating the 'miniature' trees mainly by root pruning and shoot trimming. Plants that can be 'dwarfed' include the cedars, myrtles, junipers, oaks, cypresses, pyracanthas and pines. Bonsai has spread worldwide and is a fastgrowing hobby in North America, where there are many 'bonsai' clubs.

Bordeaux mixture—It is a fungicide made from copper sulphate, calcium hydroxide and water. It was once widely used on crops, but has generally been replaced by fungicides less harmful to fruit and foliage.

Boric acid—(H_3BO_3) or Boracic acid is colourless crystalline solid, and a weak inorganic acid. It gives boric oxide (B_2O_3) when strongly heated. Boric acid is used as an external antiseptic, in the production of glass and as a welding flux.

Botulism—Botulism is usually fatal type of food poisoning caused by a toxin produced by the anaerobic bacteria—*Clostridium botulinum* and *clostridium parabolium*, which normally live in soil but may infect badly canned food. The toxin paralyzes the nervous system. Thorough cooking destroys both bacteria and toxin.

Breeder Reactor, also called fast reactor, is a kind of nuclear reactor that can produce more fuel than it consumes. It has no moderator and its fuel is highly enriched uranium or plutonium. The core is small and the chain reaction proceeds rapidly, producing greater amount of heat than with the other thermal reactors. Large number of neutrons are produced, but absorbed in a blanket of U-238 placed around the core. This does not cause fission in the uranium, but converts it into plutonium-239. This plutonium can later be separated and then used as a fuel for the fast reactor. In this way, the fast reactor produces fuel as it consumes it.

Bromelin—A protein digestive enzyme present in the mature pineapple fruit.

Budding—A graft operation where the scion part is only a small piece of bark or wood containing a single bud.

Bursa—It is fibrous sac containing synovial fluid which reduces friction where tendons move over bones. Extra bursae may develop where there is an abnormal pressure or friction.

Brownian motion—It is a frequent, random fluctuation, illustrated by the motion of particles of the dispersed phase of a fluid colloid. It is a result of the bombardment of the colloidal particles by the molecules of the continuous phase; a chance greater number of impacts in one direction changes the direction of motion of the particle. It is believed that all molecules of fluids undergo Brownian motion. Observation of Brownian motion in colloids is of value in studies of diffusion.

[C]

Caffeine or trimethylxanthine (C₈H₁₀N₄O₂)—It is an alkaloid extracted from coffee and also found in tea, cocoa and cola. Caffeine stimulates the central nervous system and heart, and is a diuretic. It increases alertness, in excess causing insomnia and is mildly addictive.

Calcium (Ca)—It is a fairly soft, silvery-white alkaline-earth metal, the fifth most abundant element. It occurs naturally as Calcite, Gypsum and Fluorite. Calcium is very reactive, reacting with water to give a surface layer of calcium hydroxide, and burning in air to give the nitride and oxide. Calcium metal is used as a reducing agent to prepare other metals, as a getter in vacuum tubes, and in alloys. Calcium compounds are important constituents of animal skeleton; Calcium phosphate forms the bones and teeth of vertebrates and many sea-shells are made of the carbonate. **Calcium carbonate** (CaCO₃) is an insoluble base. **Calcium chloride** (CaCl₂) is very

deliquescent and is used as an industrial drying agent. **Calcium fluoride** (CaF_2) is phosphorescent and is used as windows in ultraviolet and infrared spectroscopy. **Calcium hydroxide** [$\text{Ca}(\text{OH})_2$] or **Slaked lime** is soluble in water and is used in industry and agriculture as an alkali, in mortar and in glass manufacture. **Calcium oxide** (CaO) or **Quick lime** reacts violently with water to give calcium hydroxide and is used in arc lights and as an industrial dehydrating agent. **Calcium sulphate** (CaSO_4) occurs naturally as gypsum and anhydrite. When the dihydrate is heated to 128°C , it loses water forming the hemihydrate, plaster of paris.

Calculi—Calculi are stones, solid concretions of calcium salts or organic compounds, formed in the kidney, bladder or gall bladder. They are often associated with infections.

Calendering—It is a process used in the manufacture of textiles, rubber, some plastics and especially high quality paper. The substance concerned is passed between a series of pairs of heated rollers, which squeeze it to form a smooth or textured sheet.

Callus—It is a connective tissue initially formed around a fracture and slowly ossified as repair proceeds.

Calorie—It is the unit of heat. The calorie or gram calorie, originally defined as the quantity of heat required to raise 1 g of water through 1°C at 1 atm. pressure, is still widely used in chemical thermodynamics.

Camphor—It is a white crystalline compound distilled from the wood and young shoots of the camphor tree (*cinnamomum camphora*). Camphor has a strong characteristic odour which repels insects. It is also used medicinally-internally as an anodyne and antispasmodic and externally in liniments. In large doses it is a narcotic poison.

Canada balsam or Canada turpentine is a sticky exudate from the Balsam fir (*Abies balsamea*). It is a pale yellow oleoresin that has a refractive index similar to glass and is primarily used as a cement for glass in optics.

Cancer—Cancer is a group of diseases in which some body cells change their nature, start to divide uncontrollably and may revert to an undifferentiated type. They form a malignant tumor which enlarges and may spread to adjacent tissues. In many cases cancer cells enter the blood or lymph systems and are carried to distant parts of the body. There they form secondary colonies, called metastases. Such advanced cancer is often rapidly fatal, causing gross emaciation. Less often tumors produce substances mimicking hormone action or producing remote effects such as neuritis. Cancers are classified according to the type of tissue in which they originate. The commonest type, **Carcinoma** occurs in glandular tissue, skin or visceral linings. **Sarcoma** occurs in connective tissue, muscle, bone and cartilage. **Glioma** is a sarcoma of brain neuroglia, usual in that it does not spread elsewhere. **Lymphoma**, including Hodgkin's disease is a tumor of the

lymphatic system. **Leukaemia** can be regarded as a cancer of white blood cells or their precursors. Certain agents are known to predispose to cancer including radioactivity, high doses of X-rays and ultraviolet radiations and certain chemicals, known as carcinogens. A number of cancers are suspected of being caused by a virus and these appear to be hereditary factors in some cases. **Oncogenes** are thought to provide a vital clue to the formation of cancer.

Caoutchouc or pure rubber—It is a vegetable gum which is the main constituent of natural rubber.

Capacitance—It is the ratio of the electrical charge on a conductor to its potential; or for a capacitor, the ratio of charge to the potential difference between its plates. Capacitance is measured in farads (F).

Capacitor or condenser—It is an arrangement of conductors separated by an insulator (dielectric) used to store charge or introduce reactance into an alternating current circuit.

Capillarity—The name given to various surface tension phenomena in which the surface of a liquid confined in a narrow-bore tube rises above or is depressed from the level it would have if it were unconfined. When the attraction between the molecules of the liquid and those of the tube exceeds the combined effects of gravity and the attractive forces within the liquid, the liquid rises in the tube until equilibrium is restored. Capillarity is of immense importance in nature, particularly in the transport of fluids in plants through the soil.

Caramel ($[\text{C}_{12}\text{H}_{18}\text{O}_9]_x$)—It is a brown syrupy substance made by heating sugar to 180°C with a little water and sometimes sodium carbonate and is used as a colouring and flavouring agent in foodstuffs, including a soft candy of the same name.

Carat—It is a unit of mass used for weighing precious stones. Since 1913 the internationally accepted carat has been the metric carat (CM) of 200 mg. The purity of gold is also expressed in carats. Here one carat is a 24th part; thus pure gold is 24-carat. 18-carat gold contains 75% gold and 25% other noble metals, and so on.

Carbohydrates—They are a large and important class of aliphatic compounds, widespread and abundant in nature, where they serve as an immediate energy source; cellulose is the chief structural material for plants. They are generally divided into four groups, the simplest being the **monosaccharides** or simple sugars and the **disaccharides** or double sugars. The **Oligosaccharides** (uncommon in nature) consist of three to six monosaccharide molecules linked together. The **polysaccharides** are polymers, usually homogeneous, of monosaccharide units, into which they are broken down again when used for energy. The main plant polysaccharides are cellulose and starch; in animals a compound resembling starch, **glycogen** is formed in the muscles and liver. Carbohydrates play an important role in

food chains; they are formed in plants by photosynthesis and are converted by ruminant animals into protein.

Carbolic acid—It is the old name of **phenol**, particularly when used as an antiseptic. The hydroxyl hydrogen atom of phenol is relatively acidic.

Carbon (C)—It is unique among elements in that a whole branch of chemistry (organic chemistry) is devoted to it, because of the vast number of compounds it forms. Carbon occurs in nature as both uncombined (coal) and combined form as carbonates, carbon dioxide in the atmosphere and petroleum. It exhibits allo-tropy, occurring in three contrasting forms : Diamond, Graphite and White Carbon. So called amorphous carbon is actually microcrystalline graphite; it occurs naturally and is found as coke, charcoal and carbon black (obtained from incomplete burning of petroleum). Amorphous carbon is widely used for adsorption, because of its large surface area. A new synthetic form is carbon fibre, which is very strong and is used to reinforce plastics and to make electrically conducting fabrics.

Carbon has several isotopes : C^{12} (used as a standard for Atomic weight) is most common but C^{13} makes up 1.11% of natural carbon. C^{10} , C^{11} , C^{14} , C^{15} and C^{16} are all radioactive. C^{14} has the relatively long half-life of 5730 years and is continuously formed in the atmosphere by cosmic ray bombardment; it is used in **Radiocarbon dating**.

The element (especially as diamond) is rather inert, but all forms will burn in air at a high temperature to give carbon monoxide in a poor supply of oxygen and carbon dioxide in excess oxygen. Carbon will combine with many metals at high temperatures, forming carbides. Carbon shows a covalency of four, the bond pointing towards the vertices of a tetrahedron, unless multiple bonding occurs.

C₃ Plants—A plant having low **WUE** & photosynthetic rate (both) but high photo respiration rate *e.g.*, pulses, cereals & oil seeds (wheat, rice, gram, mustard).

C₄ Plants—The plants, having higher **WUE** (Water Use Efficiency) and photosynthetic rate (both) and low photo respiration rate *e.g.*, maize, sugarcane, millets, jowar, Amaranthus etc.

CAM Plants—Those plants, having Cruciliation Acid Metabolism reaction & also remain succulent in desert areas *e.g.*, Pineapple, Opuntia etc.

Carbides are binary compounds of carbon with a metal. Ionic carbides are mainly acetylides which react with water to give acetylene or methanides which give methane. **Carbon dioxide** (CO_2) is colourless and odourless gas. It is non-toxic but can cause suffocation. The air contains 0.03% carbon dioxide which is exhaled by animals and absorbed by plants for photosynthesis. At atmospheric pressure, it solidifies at $-78.5^\circ C$ to form dry ice. Liquid carbon dioxide formed under pressure is used in **Fire-extinguishers**. Carbon dioxide is also used to make carbonated drinks. When dissolved in

water an equilibrium is set up. With carbonate, bicarbonate and hydrogen ions are formed and a low concentration of **Carbonic acid** (H_2CO_3). **Carbon bisulphide** (CS_2) is a colourless liquid of nauseous odour due to impurities and is highly toxic and flammable. It is used as a solvent and in manufacture of rayon and cellophane. **Carbon monoxide** (CO) is colourless, odourless gas. It is produced by burning carbon or organic compounds in a restricted supply of oxygen, for example, in poorly ventilated stoves or the incomplete combustion of gasoline in automobile engines. It is manufactured as a component of **water gas**. Carbon monoxide is toxic because it combines with haemoglobin of RBC to form pink carboxyhaemoglobin, which is stable and will not perform the function of transporting oxygen to tissues. **Carbon tetrachloride** (CCl_4) is a colourless liquid, non inflammable but toxic made by chlorinating carbon disulphide and is used as a solvent for drycleaning and in the manufacture of Freon.

Carborundum—It is silicon carbide (SiC) and is almost as hard as diamond. It is used as an abrasive and is inert, refractory and a good heat conductor. Used in making high-temperature bricks. At high temperatures it is a semi-conductor.

Carotenoids—These are a group of yellow, orange, red and brown pigments found in almost all animals and plants and are responsible for the colour of carrots, lobsters and many flowers and fruits. In leaf chloroplasts the carotenoid colours are masked by chlorophyll until this is lost in the fall. The colour is due to a long conjugated double-bond system formed by condensation of isoprene units. There are two main types of carotenoids, the oxygen-containing xanthophylls and the hydrocarbon carotenes. Vitamin A is formed from certain carotenes.

Cartilage—Tough, flexible connective tissue found in all vertebrates, consisting of cartilage cells (chondrocytes) in a matrix of collagen fibres and a firm protein gel. The skeleton of vertebrate embryo is formed wholly of cartilage, but in most species much of this is replaced by bone during growth. There are three main types of cartilage : **Hyaline cartilage** is translucent and glossy and found in the joints, nose, trachea, bronchi; **Elastic cartilage** is found in the external ear, Eustachian tube, larynx; and fibrocartilage attaches tendons to bone and forms the discs between the vertebrae.

Casein—The chief milk protein, found there as its calcium salt.

Catalyst—Any substance which when added to a reaction, alters the rate of the reaction but remains chemically unchanged at the end of the process. Catalysts are widely used in industry, in the hydrogenation of oils and the cracking of petroleum. All living organisms are dependent on the complex catalysts called enzymes which regulate biochemical reactions.

Cataract—Disease of the eye lens, regardless of cause. Normally the clear lens becomes opaque and light transmission and perception are reduced.

CAT Scan—CAT Scan (Computerised Axial Tomography), sometimes also referred as CT scan, is a technique of obtaining X-Ray pictures of thin slices of body without any operation. The technique comes to help in locating or identifying tumours or blocked blood vessels in such soft tissues as the brain or in large organs such as the liver which cannot be photographed by the usual X-Ray techniques. A computer connected to the detector processes all the inputs into a flat picture of few micron thick cross section.

Catalytic Converter—It is a device, fitted on to the exhaust pipes of petrol-driven automobiles which helps reduce the emission of environmentally damaging gases from the automobiles. The exhaust fumes of automobiles using unleaded petrol, contain gases like the nitrogen oxides, carbon monoxide and benzene which are harmful to health when inhaled. The catalytic converter helps convert these gases into harmless gases. The converter cannot be used in automobiles using leaded petrol because the lead (antiknocking agent) present in petrol can inactivate the catalyst and render the device useless.

Catgut—A strong thin cord used to string musical instruments and rackets and to sew up wounds in surgery, made from the intestines of herbivorous animals. In surgery, it has the advantage of being eventually absorbed by the body.

Cellulose—The main constituent of the cell-walls of higher plants. Cotton is 90% cellulose. Cellulose is carbohydrate with a similar structure to starch.

Cell—It is the basic unit of living matter from which all plants and animals are built. A living cell can carry out all the functions necessary for life. Bacteria and protozoans are examples of single-cell organisms. In multicellular organisms cells become differentiated to perform specific functions. All cells have certain basic similarities. Animal cells are surrounded by a plasma membrane (note cell wall). This is living, thin and flexible. Plant cells are surrounded by a thick, rigid, non-living cellulose cell wall. Cells differentiate in a multi-cellular organism to produce cells as different as a nerve cell and a muscle cell. Cells of similar types are grouped into tissues. There are two broad types of cells. *Firstly*, **Prokaryotic cells**, which have the genetic material in the form of loose filaments of DNA and not separated from the cytoplasm by a membrane. *Secondly*, **Eukaryotic cells**, which have the genetic material borne on chromosomes made up of DNA and protein and are separated from cytoplasm by a nuclear membrane. Eukaryotic cells are the unit of basic structure in all structure in all organisms except bacteria and blue green algae, which comprise single prokaryotic cells.

Centripetal force—The force applied to a body to maintain it moving in a circular path is known as centripetal force. If a body is resting in a rotating frame, it experiences a **Centrifugal force**, apparently acting away

from the centre of rotation, numerically equal to the internal centripetal force.

Cerebral palsy—It is a diverse group of conditions caused by brain damage around the time of birth and resulting in a variable degree of non-progressive physical and mental handicap.

Cerenkov radiation—Electromagnetic radiations emitted when a high-energy particle passes through a dense medium at a velocity greater than the velocity of light in that medium. Cerenkov radiation may be seen when radioactive materials are stored under water.

Ceramics—Materials produced by treating non-metallic inorganic materials (originally clay) at high temperature. Modern ceramics include such diverse products as porcelain and china clay.

C.G.S. Units—A metric system of units based on the centimetre (length), gram (mass) and second (time), generally used among scientists until superseded by SI units.

Chemistry—The science of the nature, composition and properties of material substances, and their transformations and interconversion. In modern terms, Chemistry deals with elements and compounds, with the atoms and molecules of which they are composed, and with the reactions between them.

Chemotherapy—The use of chemical substances to treat various diseases.

Chlorophyll—Various green pigments found in plant chloroplasts. They absorb light and convert it into chemical energy, thus playing a basic role in photosynthesis. Chlorophylls are chelate compounds in which magnesium ion is surrounded by a porphyrin system.

Cholesterol—($C_{27}H_{46}O$) Sterol found in nearly all animal tissues, especially in the nervous system, where it is a component of Myelin. Cholesterol is a precursor of bile salts and of adrenal and sex hormones. Large amounts of cholesterol are synthesized in liver, intestines and skin.

Chromosomes—Thread like bodies in cell nucleus, composed of genes, linearly arranged, which carry genetic information responsible for the inherited characteristics of the organism. Chromosomes consist the Nucleic Acid DNA (and sometimes RNA) attached to a protein core. All normal cells contain a certain number of chromosomes characteristic of the species (46 in man) in homologous pairs (diploid). Gametes, however, are haploid, having only half this number, one of each pairs, so that they unite to form a zygote with the correct number of chromosomes. Defective or supernumerary chromosomes cause various abnormalities.

Chronology—The science of dating, involving the accurate placing of events in time and the definition of suitable timescales.

Chandrasekhar limit—A limiting mass of about 1.44 solar masses above which a white dwarf cannot exist in a stable configuration.

Chemical and biological warfare—It is the use of poisons and diseases against an enemy, either to kill or disable personnel or to diminish food supply, natural ground cover etc.

Chemiluminescence—It is luminescence caused by a chemical reaction, usually oxidation as of phosphorus in air. The molecules are excited to a high energy level and emit light as they return to the ground state. This process in living organisms is called bioluminescence.

Chip—It is tiny integrated circuit on a chip of silicon. A chip can accommodate more than 1,00,000 transistors. When memory and logic components are built in, it is known as a microprocessor.

Chorea—It is abnormal, non-repetitive involuntary movement of the limbs, body and face. It may start with clumsiness, but later uncontrollable and bizarre movements occur. It is a disease of basal ganglia. **Sydenham's chorea** or Saint Vitus' dance is a childhood illness associated with progressive dementia.

Cleistogamy—A built in breeding mechanism where flowers remain closed at the time of pollination. It favours self-pollination.

Cider—It is alcoholic beverage made from fermented sour apples. In America, this is known as 'Hard cider', whereas 'Sweet cider' is a commercially prepared non-alcoholic apple juice.

Clone—It is a population of cells derived from a single ancestor. All cells in a clone have the same genetic make-up; cloning is a vital tool for genetic engineering particularly in producing large quantities of specific cells. Using recombinant DNA techniques, scientists insert plasmids containing the DNA of the required cell into a bacterium. As the bacterium multiplies, each new one will contain the same member of plasmids as the original one. Each plasmid will contain a clone of the original DNA. In this way, the bacterium is used as a factory to mass produce a desired type of cell.

Climacteric Fruit—Fruit, having minimum respiration rate and remains constant even after harvest, followed by a sharp rise to a peak and then slowly decline *e.g.*, apple.

Cloning—In simple terms cloning means making an identical copy. A clone is an organism or a group of organisms created from a single parent. With advances in genetic engineering, it is now possible to produce an entire organism from just a single somatic cell taken from a plant or animal. Cloning is now a standard biotechnological tool for growing superior plants of uniform quality in large numbers from parental cells taken from one good-quality plant. The first experimental cloning of animals was done in 1952 by American scientist Robert Briggs and Thomas J. King.

Clotting of blood—Clotting of blood is a complex process set in motion when it comes into contact with tissues outside its ruptured vessel. These contain a factor, **thromboplastin**, which activates a sequence of changes in the clotting factors of plasma (12 enzymes). Further the factor II (prothrombin, formed in the liver) with calcium ions and a platelet factor, is converted to thrombin. This converts factor I (fibrinogen) to fibrin, a tough, insoluble polymerized protein which forms a network of fibres around the platelets, that have stuck to the edge of the wound and to each other. The network entangles the blood cells and contracts, squeezing out the serum and leaving a solid clot.

Coal tar—It is a dense black viscous liquid produced by the destructive distillation of coal. Fractional distillation of coal tar produces a wide variety of industrially important substances. These include Asphalt (pitch) and creosote, a wood preservative; also various oils used as fuels, solvents, preservatives, lubricants and disinfectants. Specific chemicals that can be isolated include, benzene, toluene, xylene, phenol, pyridine, naphthalene and anthracene the main source or the pharmaceutical and other chemical industries.

Cobalt bomb—It is a device used in cancer treatment as a source of gamma rays. It uses Co^{60} (cobalt 60), a radioisotope of cobalt. Because of its long half-life, Co^{60} is used widely as a radioactive tracer.

Codon—It is the basic unit in the genetic code which controls protein synthesis. Each molecule of messenger-RNA consists of an ordered sequence of nucleotides. There are only four different nucleotides in RNA, not enough to code individually for the 20 amino acids which make up proteins. So the nucleotides are grouped into three, giving 64 different combinations called codons. Of these, 61 code for amino acids. Several codons usually code for the same amino acids and 3 signal for termination of the protein chain. The code appears to be the same for all organisms.

Coelacanth—It is a group of fossil fishes. *Latimeria cholumnae* is a member of coelacanth and was thought to be extinct until discovered off the East coast of Africa in 1938. *Latimeria cholumnac* is known as 'Living fossil fish'.

Cohesion—It is the tendency of different parts of a substance to hold together. This is due to the forces acting between molecules; a molecule will repel one close to it but attract one that is farther away; somewhere between these there is a position where work must be done to either separate the molecules or push them together. This situation results both in cohesion and in adhesion. Cohesion is strongest in a solid, less strong in a liquid, and least strong in a gas.

Collagen—It is tough fibrous protein occurring as a major component of the connective tissue of many animals. Animal hide is chiefly collagen

converted by tanning into leather. When collagen is boiled it yields gelatin and glue.

Colloid or colloidal solution—It is a system in which two (or more) substances are uniformly mixed so that one is extremely finely dispersed throughout the other. A colloid may be viewed intuitively as a halfway stage between a suspension and a solution the size of the dispersed particles being larger than simple molecules. Typical examples of colloids include ‘Fog’ and ‘Butter’. Colloids may be classified in two ways; one by the nature of the particles (dispersed phase) and medium (continuous phase); the other by, as it were, the degree of permanency of the colloid. In the latter case, one may define a **Lyophilic colloid** as one that forms spontaneously when the two phases are placed in contact; and a **Lyophobic colloid** as one that can be formed only with some difficulty and maintained for a moderate elapse of time only under special conditions. Colloids have interesting properties, perhaps the most notable of which is light **‘Dispersion’**; it is due to colloidal particles in the atmosphere that sky is blue in the day time and red during sunset. However, the interface between particles and continuous phase plays a major part in water purification.

Computer—A machine that accepts, processes and stores data according to the user’s set of instructions. These instructions are known as program, which are stored in the computer. They are calculating machines. They carry out arithmetic at great speed.

Contact lens—It is a small lens worn directly on the cornea of the eye under the eyelid to correct defects of vision. Generally made of transparent plastic, they sometimes give better results than glasses and are certainly less noticeable.

Coriolis force—A fictitious force used to describe the motion of an object in a rotating system. As the air moving from north to south over the surface of the earth would to an observer outside the earth, be moving in a straight line. To an observer on the earth, the path would appear to be curved, as the earth rotates.

Coulure—Failure of grape blossoms to set, resulting in premature drop.

Critical mass—The minimum mass of material that can sustain a nuclear chain reaction. An explosive chain reaction results when subcritical masses are brought together to form a mass greater than the critical mass.

Cultigen—Plant or group of plants known only in cultivation which presumed to have originated under domestication.

Cyanides—These are compounds containing the CN group. Organic cyanides are called ‘Nitriles’. Inorganic cyanides are salts of hydrocyanic acid (HCN), a volatile weak acid and both are highly toxic. The cyanide ion (CN⁻) is a **Pseudohalogen** and forms many complexes. Cyanides are used in the extraction of gold and silver, electroplating and case hardening.

[D]

Damp—Various noxious gases found in mines. **Firedamp** is methane, a colourless gas forming a highly explosive mixture with air. Sir 'Humphry Davy's safety lamp reduced the danger of such explosions. **Afterdamp** is a mixture of carbon dioxide and nitrogen which results from firedamp explosions. **Chokedamp (or Blackdamp)** is mainly carbon dioxide.

Date Line, International—It is an imaginary line on the earth's surface, with local deviations, along longitude 180° from Greenwich. As the earth rotates, each day first begins and ends on the line. A traveller going east over the line sets his calendar back one day, and on going west adds one day.

DDT (Dichloro diphenyl trichloro ethane)—It is a synthetic contact insecticide which kills a wide variety of insects, including mosquitoes, lice and flies, by interfering with their nervous system. Being chemically stable and physically inert, it persists in the environment for many years. Its concentration in the course of natural food chains has led to the build up of dangerous accumulations in some fish and birds. This prompted the US to restrict the use of DDT in 1972. Although DDT was first made in 1874, its insecticidal properties were only discovered in 1939 by P.H. Muller.

Degreening—The process of decomposing the green pigment in fruits by ethylene (1000-2000 ppm) application or similar metabolic inducers to give a fruit its characteristic colour as preferred by consumers *e.g.*, in banana, citrus, grapes etc.

Dehumidifier—It is a device for removing water vapour from air, by passing the air over cooling fins to promote condensation or by adsorption by such materials as silica gel or alumina. It is a standard part of air-conditioning systems in hot climates, where low humidity is desirable.

Deliquescence—It is the absorption of atmospheric moisture by a solid until it dissolves to form a saturated solution. If it merely forms a crystalline hydrate, it is termed hygroscopic. The phenomenon depends on the relative humidity; sugar for example, deliquesces above 85% humidity.

Delta Rays—These are short electron tracks surrounding the track left by a fast charged particle in cloud chambers, bubble chambers or photographic emulsions. The primary particle dislodges electrons from the atoms of the medium concerned and the faster of these leave short tracks of their own before being brought to rest.

Denier—It is a unit used to describe the mass per unit length of silk or nylon yarn. The denier number of a yarn is its weight in grams per 9 km length.

Dermatology—Branch of medical science concerned with the diagnosis and treatment of skin diseases.

Deuterium—(D or H₂) is also known as heavy hydrogen, an isotope of hydrogen, whose nucleus (the deuteron) has one proton and one neutron. It is obtained as heavy water (D₂O) by the fractional electrolysis of water. Deuterium is the major fuel for nuclear fusion and is used in tracer studies.

Dactyliology—The technique of communication by signs made with fingers. It is generally used by the deaf.

Detergents—Water-soluble, surface active agents capable of wetting a variety of surfaces, removing greasy and oily deposits and retaining the dirt in suspension for ease of rinsing. While soap acts as a detergent, a large range of synthetic detergents, derived from petroleum are now available. These detergents contain hydrophilic groups such as sulphate, sulphonate or polyether which confer water solubility. Long hydrocarbon chains are hydrophobic groups enabling a detergent to dissolve oily materials. Synthetic detergents give lather even in hard water.

Dirty ice is the name given by space scientists to supercold grains of solid matter suspended in the thin gases which pervade the space between the stars. These particles are believed by some scientists to consist mainly of frozen methane and ammonia. Dirty ice comes from a small admixture of heavier elements such as iron. It plays an important role in the condensing process leading to the formation of stars and planets.

Dialysis is the process of selective diffusion of ions and molecules through a semi-permeable membrane which retains colloid particles and macromolecules. Medically, it is the process by which toxic and waste products are separated from the blood by means of porous membranes. The dialysis machine placed in the patient's abdomen cleans the blood and sends it back to circulation. Dialysis is performed repeatedly after short intervals in the cases of damaged kidneys.

Dinosaurs—Extinct gigantic members of the Reptilia that flourished for 120 million years from the triassic to the cretaceous periods.

Dry ice is solid carbon dioxide. It is made by compressing carbon dioxide gas to about 7MN/m² at -57°C, when it liquefies. The liquefied gas under a pressure of 58 atmospheres when subjected to a sudden release of pressure falls to the bottom in the form of 'snow', which is compressed into blocks.

Diamagnetism—It is very weak magnetization of a material in a direction opposing the magnetizing field, due to electron orbital distortion. It is a property of all materials, though sometimes masked by stronger paramagnetism or ferromagnetism.

Diastase—It is a mixture of enzymes present in malt which converts starch into maltose. This action forms the basis of the brewing process.

Diathermy—It is the use of electrically generated heat, particularly in surgery. Diathermy allows small blood vessels to be occluded and is often

used to incise the gastrointestinal tract, when it gives a bacteria free, non-bleeding edge. It has also been used to remove hairs, but the follicles may be scarred.

Diatoms—These are single celled fresh and salt water algae, important as food to many small animals.

Diels-Alder reaction—This reaction is also known as **diene synthesis** and is important in making plastics, insecticides and fungicides.

Diffusion—It is the gradual mixing of different substances placed in mutual contact due to the random thermal motion of their constituent particles. Most rapid with gases and liquids, it also occurs with solids. Diffusion rates increase with increasing temperature, the rate at which gases diffuse through porous membrane vary as the inverse of the square root of their molecular weight. Gaseous diffusion is used to separate fissile uranium-235 from non-fissile uranium-238, the gas used being uranium hexafluoride.

Dioptre—It is a unit used to express the focal power of optical lenses and is also known as reciprocal metre. The power of a converging lens in dioptries is a positive number equal to the reciprocal of its focal length in metres. Diverging lenses have negative powers.

Diploid—An organism or cell with two sets of chromosomes ($2x$) or two genomes.

Dipnoi or lungfish—It is sub-class of the osteichthyes that contains a large number of fossil forms and three living fresh water groups (**Protopterus, Lepidosiren and Neoceratodus**), found in the rivers of Africa, South America and Australia respectively. As their name suggests, the lungfishes have lungs, organs not found in other living fish. The African and South American lungfishes are unusual in their ability to aestivate in cocoons of mud during droughts.

Dipole moment—An electric dipole is a pair of equal and opposite electric charges a short distance apart. All ordinary manifestations of magnetism are the result of magnetic dipoles, whether these arise in the context of permanent magnets or electromagnets. In either case the dipole moment is a vector quantity descriptive of the dipole. Atomic nuclei and symmetric molecules often exhibit dipole or other multiple properties.

Dispersion—In optics, the separation of a mixture of light radiations according to colour (*i.e.*, wavelength). This can occur in refraction (when it is responsible for the rainbow and the production of a spectrum with a prism), in diffraction (as is applied in the grating spectroscopy), or in scattering (giving rise, *e.g.*, to the blue colour of the sky). The dispersive power of an optical medium is a measure of the extent to which its refractive index varies with wavelength.

Doppler's effect—The change observed in the wavelength of a sonic, electromagnetic or other wave because of relative motion between the wave source and an observer, is known as Doppler's effect.

Dormancy—It is a resting state that occurs in animals and plants, when growth stops and the internal processes, principally respiration, are slowed down. In animals dormancy during the winter is termed **Hibernation**, while dormancy in the summer or dry season, such as in the lung fish and earthworm, is termed **Aestivation**.

Dosimeter—It is a device worn by persons working in situations where they are exposed to ionizing radiations. It measures the dose of radiation to which they have been exposed.

Double refraction or Birefringence—It is the property of certain crystals to split a ray of unpolarized light into two rays plane polarized at right-angles to each other.

Ductility—The property of metals, alloy and some other substances to be drawn out or extruded without rupture or loss of strength is ductility. Gold is most ductile metal at normal temperatures.

Duralumin—It is aluminium-based alloy typically containing 4% copper, 1% magnesium, 0.7% manganese and 0.5% silicon. It is hard and strong as steel and being light, is used in aircraft construction.

Dynein—Accessory protein of the axoneme microtubules of eukaryotic cilium and flagellum.

[E]

e-Agriculture—A new approach to reduce knowledge gaps between scientists and farmers in repeat of farming risk, empowering farmers etc. The prominent **ICTs** (Information & Communication Technologies are: ICTS choupal, *i*-Kisan Projects, Kisan call centres, Village Knowledge Centre, Bhoomi Projects, MSSRF (M.S. Swaminathan Research Foundation) etc. in India.

Echo Sounder—Device for determining the depth of the ocean by sending a sound wave which strikes the bottom of the ocean and is reflected back; an application of SONAR. The depth is determined according to the time taken by echo's return.

Ecology—The study of the inter-relations of animals and plants with their environment both animate and inanimate.

Ecad—A habitat form, showing characteristics imposed by habitat conditions and non-genetic.

Ecotype—Species population exhibiting genetic adaptation to the local environment.

Entomology—The study of insects.

Epidemiology—The branch of medical science dealing with epidemic diseases.

Epigraphy—The study of inscriptions.

Ethnology—A branch of anthropology that deals with the origin, distribution and distinguishing characteristics of the races of mankind.

Eugenics—The study and application of scientifically directed selection in order to improve the genetic endowment of human populations.

Eugenol—Essential oil, present as major component in clove oil.

Efflorescence—Certain hydrated salts when exposed to air, lose their water of crystallisation and attain the amorphous form, sodium carbonate and magnesium sulphate are some of these.

Elasticity—The ability of a body to resist tension, torsion, shearing or compression and to recover its original shape and size when the stress is removed. Below the elastic limit, bodies obey Hooke's Law.

Electric arc—It is a high-current electric discharge between two electrodes. The current is carried by the gas plasma maintained by the discharge. Lightning is a naturally occurring arc.

Electron gun—It is that part of an electron tube which produces, accelerates, focuses and deflects a beam of electrons. A cathode emits electrons which pass through a grid to the steering anodes.

Electrolysis is the process of decomposing liquid compounds duly acidulated by passing a direct electric current through the liquid compound (electrolyte).

Electrons are negatively charged particles which revolve round the nucleus of the atom in certain orbits. The weight of these particles is negligibly small.

Electronics—An applied science dealing with the development and behaviour of electron tubes, semi-conductors and other devices in which the motion of electrons is controlled. It covers the behaviour of electrons in gases, vacuums, conductors and semiconductors. Its theoretical basis lies in the principles of electromagnetism and solid state physics.

Emasculation—Removal of immature anthers from hermaphrodite flowers.

Endoscopy is a harmless and painless method of diagnosing diseases of any of the hollow organs of the body (like throat, stomach or intestine) by looking directly into the affected organ using endoscope.

Electron Microscope—A microscope using a beam of electrons rather than light to study objects too small for conventional microscopes. Electron microscopes are used for structural defects and composition studies in a wide range of biological and inorganic materials.

Enhanced Graphic Adaptor (EGA) is an electronic circuit which allows text and graphics in upto 16 colours to be displayed on the screen at the same time. It is made following a standard, so it can be used with many visual display units.

Enzymes—These are proteinous organic catalysts which accelerate the chemical reactions occurring in the living organisms. They are generally specific for either one or a group of related reactions.

Escape velocity—The velocity that a less massive body must achieve in order to escape from the gravitational attraction of a more massive body; sometimes known as the parabolic velocity. The earth's escape velocity is 11.2 km/s.

Etiolation—Development of plant parts or plants in absence of light which results in chlorophyll degradation, more auxin accumulation & absence of more differentiated parenchymous cells in the etiolated sides.

Endotoxin—Glycolipids attached to cell wall of certain **Gram-negative** bacteria, giving them pathogenicity. Released during autolysis, *e.g.*, **Salmonella typhi** causing typhoid fever.

Exotoxin—Toxin released by a micro-organism into surrounding growth medium or tissue during growth phase of infection. Produced mainly by **Gram-positive** bacteria, such as the agents of botulism, diphtheria, shigella dysentery and tetanus. The alga **Prymnesium parrum** forms a potent exotoxin that causes extensive fish mortalities in brackish water conditions.

Exobiology or Xenobiology—The study of life beyond the earth's atmosphere.

[F]

Fax or Facsimile is a device used for transmission of a written document, photograph, map or any other graphic material electronically. It is one of the variants of E-mail.

Fauna—The animal life of a region or of a geological period is termed as fauna.

Fertilization—A fusion of male & female gamete to form a zygote.

Fibre optics is the use of special cables made of a material similar to glass. Data are sent as pulses of light through the cables. Fibre optics cables carry many more signals than ordinary cables of the same size. In fibre optics, electric pulses are changed into pulses of light.

Fire extinguisher—It is a portable appliance for putting out small fires. The now-obsolete **soda-acid extinguisher** contains a sodium bicarbonate solution and a small, stoppered bottle of sulphuric acid; depression of a plunger shatters the bottle, mixing the above chemicals so that carbon

dioxide (CO₂) gas is generated and forces out through a nozzle. **Foam extinguishers** employ a foaming agent (usually animal protein or certain detergents) and an aerating agent; they are effective against oil fires as they float on the surface.

Flora—All plants of a region or of a geological period are termed as flora.

Fullerenes—It is a family of newly discovered, the third allotropic form of carbon, quite distinct in structure and properties from the two earlier known forms—graphite and diamond. The first member of this new form of carbon is known as **Fullerene**. It was discovered in 1985 by a team of scientists led by Harold Kroto of the University of Sussex, U.K. and Richard Smalley of Rice University, USA.

Fly ash is a waste product from thermal power stations using coal.

Foot-Candle—The light intensity of one standard candle at a distance of one foot from a light source.

Foot print is the area that a transmission from a satellite can reach. A foot print is the amount of space a computer takes up on a desk or work-space.

Fossils—The remains, traces or impressions of living organisms that inhabited the earth during past ages and were buried and preserved for a long period in the rocks of the earth's crust.

Free Radicals—These are small highly charged molecular particles, and they possess strong oxidising power. A free radical is any atom or molecule that contains one or more unpaired electrons. Free radicals form in human body and are useful too. Superoxide anion, hydroxyl radical, single oxygen and nitric oxide are some examples of free radicals. Besides exposure to 'uv' rays, radiations and electromagnetic radiation free radicals are also produced by many insecticides, pesticides, weed killers, chemicals used in food industries and anticancer drugs itself. All type of pollution, smoking in particular, generate abundant free radicals. Even anxiety, depression, pessimistic personalities can produce more free radicals. Release of free radicals is a part of normal human metabolism. Excess free radical formation can cause tissue damage. It is known that much of the damage to DNA is done by radicals of oxygen, hydrogen peroxide, superoxides (O₂⁻). Free radicals are now considered responsible for neuro-degenerative disease, chronic inflammatory disease, cardio vascular disease and even cancer.

Fumigation—To destroy insect pests by exposure to poisonous gas or smoke.

Fungi—A class of plants which have no chlorophyll and hence get their food either from living plants or animals or from dead matter.

Fuel alcohol—Alcohol that is produced specifically for use as a fuel. Produced as either ethanol or methanol, it contains about half the energy density of gasoline.

Funny bone—It is part of the ulna bone at the elbow over which passes the ulnar nerve. If the point is struck sharply, it causes transient electric shock-like tingling.

Furfural (C₄H₃O.CHO)—It is a colourless liquid, an aldehyde similar to benzaldehyde and a heterocyclic compound derived from furan. It is made by digesting corn cobs, oat and rice hulls etc. with acid and is used as a solvent, a pesticide and an intermediate in making plastics and other compounds.

Fuse—It is a safety device placed in an electric circuit to prevent overloading. It usually comprises a wire of **Low-melting point** metal. Current passing through the wire heats it and excessive current heats it to the point where it melts, so breaking the circuit. Resettable circuit breakers offer an alternative to fuses.

Fusel oil—A mixture mainly of amyl and butyl alcohols, produced as a by-product of fermentation. It helps to flavour alcoholic beverages, but is separated by distillation from industrial ethanol and used for solvents.

[G]

Galaxy—The largest individual conglomeration of matter, containing stars, gases, dust and planets.

Gamma Rays—High energy photons of shorter (0.1 nm) wavelength, emitted from atomic nuclei during radioactive decay. Usually their emission follows the ejection of an electron (Beta ray) from the nucleus.

Genes are the carriers of the genetic information which is passed on from generation to generation by the combination of gametes. Genes consist of chain-like molecules of nucleic acids. DNA in most organisms and RNA in some viruses. The genes are normally located on the chromosomes found in the nucleus of the cell.

Genetics—The branch of biology dealing with heredity and variation.

Genetic drift—It is a process by which genetic information controlling certain features is lost from a population because it is not transmitted to the offspring.

Genome—A complete set of chromosome inherited as a unit from one parent.

Germanium is a semi-conductor and is used in electronic devices, especially wireless receivers and transistors. It is also used in alloys and for lenses and windows for infrared radiation.

Gigabyte (Gbite) is a unit of measurement of computer memory. A gigabyte is made up of one thousand million bytes. Computers use binary code, so a gigabyte is 2^{30} or 1, 073, 741, 824 bytes.

Gummosis—A general disorder of stone fruit, in which exudation and deposit of gum occurs.

Gun-cotton—It is a nitrocellulose with a high nitrate content, and is an explosive.

Gun metal—A type of bronze, normally 80% copper, 10% tin, 2% zinc. Formerly used for cannons, it is now used for gears, bearings and steam fittings. It is corrosion resistant.

Guttation—The exudation of water from the ends of the vascular system at the margins of leaves under humid conditions.

Gymnosperms—They form a division of flowering plants. Their seeds are naked, *i.e.*, not borne within their fruit and usually formed on open scales produced in cones. All are perennial plants, and mostly are evergreen.

Gynaecology—Branch of medicine and surgery, specializing in diseases of women, specifically disorders of female reproductive tract, often linked with obstetrics.

[H]

Half-Life—The time taken for half the nuclei of a sample of radioactive nuclide to decay.

Handshake—It is a number of signals sent between two devices to make sure that they are ready to exchange information. For example, a computer exchanges a handshake with a printer, fax or modem connected to 1%. If the handshake is not completed, the computer will not be able to communicate with the device.

Hard water—Water containing calcium and magnesium sulphates and hence forming scum with soap and depositing scale in boilers, pipes and kettles. Temporary hardness is due to calcium and magnesium bicarbonates and is removed by boiling, which precipitates the carbonates. Permanent hardness is due to the sulphates and is unaffected by boiling.

Heavy water—The usual chemical formula for water is H_2O . This signifies that two atoms of hydrogen are linked with one atom of oxygen to form one molecule of water. Each atom of hydrogen normally consists of one proton duly contained in its nucleus. If a neutron is added to this nucleus, the resulting atom is still hydrogen as far as the chemical properties are concerned, but the atomic weight becomes double. And this isotope of hydrogen is obviously known as heavy hydrogen or Deuterium and is attributed the symbol D. If this heavy hydrogen is made to combine with oxygen to form water, the result is formation of heavy water, D_2O .

Hibernation is a protective mechanism whereby certain animals reduce their activity and apparently sleep throughout winter.

Hi-Fi (High Fidelity)—An adjective applicable to systems carrying a signal with very little distortion, such as a good radio transmitter but also for a wide range of domestic equipment for sound reproduction.

Homeopathy—System of treatment based on a theory that a disease is cured by drugs whose effects mimic it and whose efficacy is increased by the use of extremely small doses, achieved by multiple dilutions.

Holography—An improved system of photography. Instead of the two-dimensional picture obtained by the ordinary photographic process, holography with the help of laser beams, reconstructs a three dimensional image of an object. The 3-D image thus obtained is called a hologram. It was invented by **Denis Gabor** in 1948. Holograms are also being used on valuable documents such as voter's identity cards and credit cards as an anti-forgery measure.

Histology is the branch of science in which tissues or anatomical parts of organisms are studied.

Horticulture—Branch of Agriculture which deals with cultivation of flowers, fruits, vegetables and ornamental plants.

Hydrography—The science of water measurements of the earth with special reference to their use for navigation.

Hormones—Substances produced in living organisms to affect growth, differentiation, metabolism, digestive function, mineral and fluid balance, and usually acting at a distance from their site of origin. Plant hormones, Auxins and Gibberellins, are particularly important in growth regulation. In animal and man, hormones are secreted by endocrine glands or analogous structures, into blood stream which carries them to their point of action.

Host—It is the computer in a network or online information service that provides information.

Hydroponics—The practice and science of growing plants without using soil by feeding them on nutrient solutions. India has a hydroponics investigation unit near Calcutta. Hydroponics culture is widely used in research on plant nutrition and on the effect of temperature and pH on roots.

Hydrolysis—It is a double decomposition and is affected by water. Reactive organic compounds such as acid chlorides and acid anhydrides are rapidly hydrolyzed by water alone, but others require acids, bases, or enzymes as catalysts. Industrial hydrolysis processes include the alkaline saponification of oils and fats to glycerol and soap and the acid hydrolysis of starch to glucose.

Hovercraft—A versatile marine, land or amphibious vehicle which supports its weight on a high pressure air cushion maintained by a system of fans.

Hydroelectric power—It is the electrical energy obtained from water. Falling water is used to drive a turbine.

Hybrid—It is an animal or plant produced by the union of two distinct species.

Hybrid Vigour—It describes only superiority of hybrid over better parent.

Hybridization—A process of forming a hybrid by cross pollination/inter breeding of plants of different species, races or varieties.

Hydrogen bomb—It is the thermonuclear bomb, very powerful and destructive bomb whose explosive energy is produced by nuclear fusion of two deuterium atoms or of a deuterium and a tritium atom.

[I]

Ideotype—Ideal type plant of a particular crop which performs in predictable manner in a particular environment.

In vitro—Latin word meaning “within glass” biological processes made to occur experimentally outside the organism in a test-tube or other container.

In vivo—A latin word, means “within the living organism.”

Immunity—The system of defense in the body which gives protection against foreign materials, specifically infectious micro-organisms such as bacteria, viruses, parasites and their products.

Impedance—The quantity that determines the amplitude of the current for a given voltage in an a.c. circuit. It is determined by the resistance R and the reactance X, according to the relationship.

$$Z^2 = R^2 + X^2$$

Implosion—It is a technique for detonating underground nuclear devices.

Incandescence—When an electric current is passed through a filament of high resistance, sufficient heat is produced to make it white hot. At this high temperature the filament begins to show incandescence.

Infra-red radiation—It is an electromagnetic radiation of wavelength between 780 nm and 1 mm, strongly radiated by hot objects and also termed heat radiation. Detected using photoelectric cells, bolometers and photographically. Military applications (including missile-detection and guidance systems and night-vision apparatus) and infra-red photography (often false-colour photography). Infra-red window is the spectral band between 7.5 and 11 μ m in which the atmosphere is transparent.

Inulin—Soluble polysaccharide, composed of polymerized fructose molecules, occurring as stored food material in many plants such as members of the compositae and in **dahlia tubers**.

Invar—An alloy composed of 64% iron, 36% nickel and a trace of carbon. Having a very small coefficient of thermal expansion, it is used for pendulums, tuning-forks, measuring devices whose dimensions must be independent of temperature.

Ideal gas—An ideal gas is one in which the molecules are assumed to have an infinitely small volume and have no attraction for each other.

Inositol—Water soluble carbohydrate (a sugar alcohol) required in larger amounts than vitamins for growth by some organisms.

Insecticides—Any substance toxic to insects and used to control them in situations where they cause economic damage or endanger the health of man and his domestic animals.

Intercropping—Growing 2 or more crops together on the same land *e.g.*, Cotton and Arhar (6 : 2 row ratio).

Interferons—Proteins secreted by cells following infection with viruses and which prevent viruses propagating in the cell, discovered by Alick Isaacs and Jean Lindenmann in 1957.

Ion—Atoms or group of atoms which have either lost or gained one or more electrons from its normal complement. Electrons carry a negative electrical charge, and if they are lost, the atom becomes a positively charged ion or cation. If electrons are gained, the atom becomes a negatively charged ion or anion.

Iconography—Teaching by pictures and models.

Isobar—Line drawn on a meteorological map joining points which are, at a given moment in time, experiencing the same air pressure.

Ionosphere—The zone of the earth's atmosphere extending outward from about 75 km above the surface in which most atoms and molecules exist as electrically charged ions. The sparse air at such heights gets ionized because of the impact of charged particles streaming into the atmosphere from outer space. The ionosphere plays an important role in radio transmission and can reflect short radiowaves. The presence of ionosphere was first predicted in 1902 by English Physicist Oliver Heaviside and an American Physicist Arthur E. Kennelly.

Isomers—These are chemical compounds having identical chemical composition and molecular formula, but differing in the arrangement of atoms in their molecules and having different properties. The two chief types are **stereoisomers**, which have the same structural formula and **structural isomers**, which have different structural formulae.

Isoprene—It is a colourless liquid (a conjugated diene) made by destructive distillation of rubber or from petroleum, and used to make synthetic rubber.

Isotopes—Atoms of an element having the same number of protons in its nucleus, but a different number of neutrons. These have the same chemical properties but different atomic masses.

Infra-red rays—Beyond the visible rays of spectrum, there are certain invisible rays of long wavelength but low frequency. These are known as infra-red rays.

[J]

Juvenile hormone (or Neotenin)—An insect hormone which maintains the presence of juvenile features in the larva. In its absence, adult features appear on moulting. It is also involved in normal egg production by female insects. In years to come it may find application in insect control by preventing the emergence of adults.

Jacob-Monad Theory—An influential theory of prokaryotic Gene Expression, of value in the explanation of eukaryotic gene expression. Its basic concept is that of the **operon**, a unit of translation, comprising a group of adjacent structural genes (Cistrons) on the chromosome, headed by a non-coding DNA sequence (the operator) whose configuration binds a protein (the repressor; or regulator) encoded by a regulator gene elsewhere on the chromosome.

[K]

Kapok—Water-resistant fibres obtained from the seeds of the silk-cotton or kapok tree (*Ceiba pentandra*).

Ketone—Class of organic compounds containing the carbonyl group ($>C=O$) of general formula R_2CO , where R is an organic radical. They are used as solvents and in industrial synthesis. The best known members are the solvent acetone $(CH_3)_2CO$ and camphor, $C_{10}H_{16}CO$, used in making plastics.

Kilowatt-hour is the commercial unit of electrical energy, being the energy consumed in one hour when the power is one kilowatt.

Kinetic energy—When bodies move they have energy by virtue of their motion, this is their kinetic energy. The kinetic energy of a rigid body of constant mass m , moving with a speed v , is $1/2 mv^2$.

Keratin—A fibrous insoluble, high in sulphur, found in the skin of vertebrates where it forms the major components of hair, feathers, nails, claws and hooves.

Kinesin—Ubiquitous and complex eukaryotic protein with the ability to bind separately to microtubules and organelles and then generate the force (through its ATPase activity) required to move the latter along the former. Kinesin-dependent organelle movement is usually, unlike dyne independent movement.

Kinetics—Dynamic processes involving motion and oftenly used as a suffix to indicate studies involving movement or rates of reactions.

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Kerosine or Paraffin oil—It is a mixture of volatile hydrocarbons having 10 to 16 carbon atoms per molecule, used as fuel, mostly produced from petroleum by refining and cracking. Kerosine boils between 150°C and 300°C.

Ketosis—It is a metabolic state in which break-down of body fats leads to the production of ketone bodies. These break down to acetone, which may be smelled in the breath. Ketosis occurs in diabetic coma where insulin lack alters the pattern of fat and glucose metabolism. It is also seen in starvation.

Krummholz—Region between the Alpine and tree lines, where trees are dwarfed and deformed owing to severe environmental conditions, particularly wind.

Kwashiorkor—Protein malnutrition simultaneous with the maintenance of relatively adequate calorie intake. In affected children it causes edema, skin and hair changes, loss of appetite, diarrhoea, liver disturbance and apathy.

[L]

Laser Listner is a new discovery, which can convert an ordinary window into a secret microphone from which messages can be picked up as far as the window is visible. The discovery is based on the theory that sound waves inside a room can produce minute vibrations in window glasses. If a beam of pure light from a laser is reflected from the window, it will pick up the vibrations which can later be turned back into speech.

Latent Heat—The quantity of heat absorbed or released by a substance in an isothermal change of state, such as fusion or vaporization.

Latex—Viscous, excretory fluid, which are protein, resins, sugars, starch, enzymes, alkaloids etc., secreted by cells of certain plants.

Laughing Gas is a colourless gas with a sweet odour, prepared by heating ammonium nitrate and used as a weak anaesthetic sometimes producing mild hysteria. It is chemically known as Nitrous Oxide (N₂O).

Layering—A method of propagation in which adventitious roots form before the new plant is severed from the parent plant.

Levulose—It is a kind of fructose (carbohydrate), present as major constituent of honey.

Light year—Astronomical measure of distance. It is the distance travelled by light in one year.

Liquid crystal display (LCD)—A liquid crystal sealed between two pieces of glass with a conductive coating. Liquid crystals normally twist light passing through, but a voltage applied between the glass disrupts the order of the molecules, so that the liquid is darkened and forms visible characters, used on watches, calculators etc.

Lead—It is soft bluish-grey metal, occurring as galena and also as cerussite and anglesite (lead sulphate). Lead (II) oxide (PbO) or litharge is yellow crystalline solid, used in Lead-acid storage batteries. Lead (IV) oxide (PbO₂) is brown crystalline solid, a powerful oxidizing agent used in matches, fireworks and dyes. Trilead tetraoxide (Pb₃O₄) or Red Lead is orange-red powder, used in paints, inks and magnets. Lead tetraethyl (Pb[C₂H₅])₄ is colourless liquid, used as an antiknock additive to gasoline.

Leaf Area Index (LAI)—The total leaf area of a plant or plants divided by the land area covered by the plant.

Lysergic acid diethylamide (LSD)—It is hallucinogenic drug based on ergot alkaloids. It may lead to psychotic reaction and bizarre behaviour.

[M]

Mach number—Ratio of the speed of an object or fluid to the local speed of sound, which is temperature dependent. Speeds are subsonic or supersonic depending on whether the mach number is less than or greater than one.

Mammalia—A class of the chordata, the members of which are distinguished from all other animals by their ability to suckle their young with milk produced by the mammary glands and by their possession of hairs.

Meteorology—The study of the atmosphere and its phenomena, weather and climate.

Mesons—A particle which holds the protons and neutrons of the atomic nucleus.

Mesophytes—Any plant that grows in conditions where the water supply is neither scanty nor abundant. Mesophytes have flat, expanded leaves.

Metabolism—The sum total of all chemical reactions that occur in a living organism.

Metatheria or Marsupials, a sub-class of mammalia that includes opossums and kangaroos, which give birth to very immature young that are transferred to the mother's pouch where they continue development.

Mirage—Optical illusion arising from the refraction of light as it passes through air layers of different densities. Mirage is often witnessed in deserts

when the objects on the surface of the earth at some distance appear as if reflected from surface of water owing to unequal heating of the different parts of atmosphere.

Mitochondria are rod-shaped cell organelles and concerned with cellular respiration and other metabolic activities to release energy in the form of ATP (Adenosine triphosphate).

Midnight Sun—Sun rises at the North pole on 21st of March and this pole remains in light till 23rd September. Thus even at night for some months the sun is visible near the North pole. This phenomena is called Midnight Sun.

Microwave Communication—Electromagnetic radiations of wavelength between 1 mm and 30 cm; used in Radar, telecommunication.

Mulch—Material used to cover the soil surface around plants.

Mulching—The practice of covering the soil surface nearby plant for moisture conservation & control of soil erosion by adding organic matter/wastes in soil.

Mitosis—Cell division in which one cell gives rise to two cells both of them genetically identical to the cell which, produced them (equational cell division).

Meiosis—Cell division in which one cell with two sets of chromosomes gives rise to four cells with one set of chromosomes each (Reduction Cell Division).

Mycorrhiza—Symbiotic association between a fungus and the root of a higher plant. Mycorrhizas are of common occurrence. Two main types exist :

(a) **Endotrophic**, in which the fungus is within the cortex cells of the root, *e.g.*, of Orchids; and

(b) **Ectotrophic**, where it is external, forming a mantle that completely invests the smaller roots, *e.g.*, of pine trees. Mycorrhizal plants benefit from the association, in ectotrophic forms particularly by the fungal transport of ions (*e.g.*, phosphate), which are otherwise relatively immobile in the soil, into the plant roots.

Myelin—Specialized layering of the membranes of glial cells (in the brain) and the Schwann cells (of the peripheral nervous system) which wrap around nerve fibres producing an electrically insulating sheath, interrupted at intervals, which facilitates rapid nerve impulse conduction. Its disorders include multiple sclerosis, encephalitis and neuritis.

[N]

Napalm bomb—Contains 10% carboxylic acids with aluminium hydroxide and 90% gasoline, which forms a gel, also called napalm. It burns hotly and sticks to its target.

Naphtha—Volatile mixture of liquid hydrocarbons, used as a solvent. It is obtained by distilling coal tar or shale oil or from the refining and cracking of petroleum.

Neon gas—An inert gas which produces crimson glow colour when an electric discharge passes through it, familiar in advertising signs. It is the earliest of the noble gases to be employed in discharge tubes, glows orange when excited and liquid neon is used as refrigerant.

Neoteny—The retention of larval characters by an organism which has reached sexual maturity, is known as neoteny or Paedogenesis.

Nuclear Fall out—When a nuclear device is detonated, radioactive isotopes gradually sail down-wind in the atmosphere. This is called nuclear fall-out. Some of the particles decay enroute but those which reach vegetation may cause serious diseases among those who consume such vegetation.

Nitrification—The natural process in which nitrogen in plant and animal wastes is oxidized, first to nitrites and then to nitrates, through the action of soil-borne microbes.

Nitrogen Fixation—Although nitrogen is a very inert element, yet it reacts under special conditions to form a number of useful products. The conversion of free atmospheric nitrogen into nitrogenous compounds is called the fixation of nitrogen. Lightning causes atmospheric nitrogen to combine with oxygen of the air to form nitrogen oxides. These oxides then combine with moisture in the air and are carried down by rain as nitrates, which are taken up by plants.

Non-Climacteric Fruits—Fruits showing a gradual decline in respiratory rate with ripening *e.g.*, Litchi.

Nuclear Fission—It is a nuclear reaction in which a heavy atomic nucleus (*e.g.*, uranium) splits into two approximately equal parts, emitting neutrons at the same time and thus releasing very large amount of nuclear energy. Fission can result spontaneously or it may be caused by the impact of the neutrons.

Nuclear Fusion—A nuclear reaction between light atomic nuclei as a result of which a heavier nucleus is formed and a large amount of nuclear energy is released.

Nuclear Reactor or atomic pile is an assembly or arrangement of apparatuses in which a nuclear fission chain reaction is developed and maintained in controlled conditions for producing electricity or radioactive isotopes.

Nylon—Group of polymers containing amide groups recurring in the chain. The commonest nylon is made by condensation of adipic acid and hexamethylene diamine. Nylon is tough and very strong and is extruded and drawn to make synthetic fibres.

Neurology—Branch of medicine, concerned with diseases of the brain, spinal cord and peripheral nervous system.

[O]

Ocean Thermal Energy Conversion (OTEC)—An experimental method of obtaining energy from deep stretches of ocean, where there is a marked difference in temperature between layers of water at the top and bottom of the sea.

Oncogenes—Genes that are believed to be involved in transforming normal cells to cancerous ones. Oncogenes are sections of DNA present in every cell, healthy and tumorous.

Ophthalmology—The branch of medicine and surgery concerned with diseases of vision and the eye.

Optics—Branch of science dealing with nature and properties of light.

Optical Fibre—It is a thin cylindrical cable made of glass fibres for transmitting light signals. Light is propagated down an optical fibre by total internal reflection.

Organic acid—An organic compound that is able to give up a proton to a base, *i.e.*, one that contains one or more carboxyl group or in some cases hydroxyl groups, *e.g.*, Phenol.

Organic Farming—Crop production system based on organic manures-FYM, Green Manuring, vermi compost, **NADEP**, crop residues, excluding chemical fertilizers, insecticides, fungicides, weedicides etc. is called organic farming for high value addition of products.

Osmosis—When a solution is separated from its pure solvent by a semi-permeable membrane, the molecules of the solvent only begin to flow across the membrane and reach the solution to dilute it more and more till the concentration is equal on both sides of the membrane. This phenomenon is known as osmosis.

Oxidation—It is a process involving either addition of oxygen or any other electro-negative radical or removal of hydrogen or any other electro-positive radical.

Oxidation number—It is the number of electrons that must be added to a positive ion or removed from a negative ion to produce a neutral atom. Pure elements have an oxidation number of 0. In electrovalent compounds the oxidation state is equal to the charge on the ion. In covalent compounds the electrons are notionally assigned to the more electronegative elements. Oxidation numbers are used in naming inorganic compounds.

Ozone-sphere—Ozone is three atom molecule of oxygen (O_3), which occurs naturally in the layer of the atmosphere known as the ozone-sphere,

extending from 32 to 48 km above the earth's surface. The more common form of oxygen in the air we breathe has two-atoms of oxygen (O₂). Ozone-sphere plays a vital part in maintaining conditions suitable for human life on the surface of the earth, for it shields out harmful ultra-violet radiations from the sun.

Oceanography—Science concerned with the study of the oceans. The study covers the movement of water, temperature, density and salinity variations, the nature of the ocean bed and the flora and fauna of the seas.

[P]

Parasitology—Branch of science dealing with the structure and life-history of parasites.

Parthenogenesis—The development into a new individual of an ovum that has not been fertilized by a sperm. It is usually regarded as an aberrant form of sexual reproduction.

Peptides—These are short chains of amino acids, the same building blocks used in proteins. Cationic peptides attack almost any bacterium or fungus with which they come in contact.

Phrenology—Study of the shape and detailed contours of the skull as indicators of personality, intelligence and individual characteristics.

Palaeomagnetism—It is the study of magnetization of iron and iron compounds in rocks. This technique is used to provide a historical survey of the changes in magnitude and direction of the Earth's magnetic field since the rocks were formed.

Pollination—In plants, the transfer of the male gamete (pollen) from the anther of a flower to the stigma of the same or another flower where subsequent growth of the pollen leads to the fertilization of the female gamete (the egg) contained in the ovule. This results in the production of a seed and the fruit.

Phosphorescence—Certain substances have the special property of shining in the dark and this phenomenon is termed as phosphorescence. The sulphides of calcium, barium and strontium possess this property.

Protoplasm—It is the living matter present in the cells of animals and plants.

Partons—These are said to be particles tinier than protons or neutrons. Upto now it had been thought that protons and neutrons, forming the core of an atom's nucleus, could not be divided. But bombardment of these particles by streams of electrons of upto 21 billion electro-volts has revealed that both protons and neutrons could be further sub-divided into partons.

Parthenocarpy—Development of fruits without prior fertilization. Occurs regularly in **Banana** and **Pineapple** (which are, therefore, seedless). Can be induced by certain Auxins in unfertilized flowers, *e.g.*, those of **Tomato**.