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To our children and all students who may gain from this book.

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Preface

This illustrated dictionary has been specially prepared for students (foreign language students studying Science in English) studying Biology, Chemistry, General Science, Physical Science and Physics. It is the result of a careful analysis of the needs of such students and should be an invaluable aid in their day-to-day learning and in their preparation for examinations.

As well as containing definitions and explanations of the terms used in the above courses, with illustrations where appropriate, the dictionary contains explanations of terms used in Integrated and Combined Science together with many terms of an agricultural, astronomical, geological and medical nature.

As it is extremely difficult to limit the contents of such a dictionary to 'O' level standard, many headwords are included that are above this level and that may be of interest to 'A' level students. A few headwords that are not strictly scientific are also included because of their common usage in everyday scientific terminology. In books of this type, it is common practice to use italics or asterisks to indicate that a word used in an entry is found as a headword elsewhere in the book. This system has not been used here, as almost all scientific words used in the definitions and explanations of headwords are found as headwords elsewhere in the dictionary. Where cross-references are given for additional information, they appear at the end of an entry. SI units are used throughout. IUPAC names are used for chemicals with a few exceptions; however, alternative names which are still in common use are given as headwords with a cross-reference to the IUPAC name. The Appendix contains tables providing a wide range of information together with other items of scientific interest for both student and teacher.

It has been our aim to provide explanations that are easily understood, whilst maintaining a high academic standard.

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Note to the reader

Nomenclature

Chemicals are normally referred to by their IUPAC names, with the main entry for the chemical under that name. Alternative names are listed in brackets after the headword, and are also given as headwords with a cross reference to the main entry.

Exceptions are made where the fully systematic name is considerably more complex than is required for a dictionary at this level; in the case of plastics, e.g. Perspex (poly(methyl 2-methylpropenoate)); and in the case of chemicals which are much more frequently used in biology, e.g. glycerol (propane-1,2,3-triol). In these cases the most commonly used name is the one used here.

Decimals

There are two international systems for denoting decimals, both of which are widely used. For purposes of completeness, this book employs both. Throughout the main text, decimal figures have been given using the decimal comma, followed by the same figure in brackets using the decimal point. For reasons of space, the decimal comma alone is used in the Appendix.

A

abdomen 1. In vertebrates, a region of the body containing the digestive organs, e.g. stomach and intestines; in mammals it is separated from the thorax by the diaphragm. 2. In arthropods, the posterior part of the body.

Abegg's rule of eight *See* Periodic Table of the Elements.

aberration 1. The displacement of a heavenly body's true position due to the motion of the observer with the Earth. 2. A certain defect in lenses or mirrors in which a true image is not formed. There are several types of aberration, e.g. (1) Chromatic aberration (chromatism), in which an image with coloured fringes is formed because the refractive index of glass is different for light of different colours (wavelengths). This causes the light to disperse into a coloured band. (2) Spherical aberration of lenses, in which rays of light refracted at the periphery of a lens cross the principal axis nearer to the lens than rays refracted near the centre. Spherical aberration is also observed in concave mirrors.

abiotic Non-living.

abomasum (reed) The fourth or true stomach in ruminants.

A-bomb Atomic bomb. *See* fission.

abortion The premature birth of a mammalian embryo or foetus. In humans, if the developing embryo or foetus is expelled before the 28th week of pregnancy, the premature birth is considered an abortion. After this period the birth is not considered an abortion. From a medical point of view, the term miscarriage means the same as abortion. An abortion may be either spontaneous or induced.

abrasive A substance used for rubbing or grinding down surfaces, e.g. carborundum, corundum, diamond powder.

abscisic acid A plant hormone which acts as a growth inhibitor. It is present in fruits, seeds, buds, leaves, etc. Sometimes abscisic acid is called abscisin or dormin.

abscisin *See* abscisic acid.

abscission The natural loss of parts of plants, e.g. the shedding of leaves and fruits.

abscission zone A region at the base of a leaf or other part of a plant. It consists of the abscission layer of loose, dry cells which become separated before the fall of leaves or fruit, and the protective layer of cork tissue.

absolute Not relative; independent.

absolute alcohol Ethanol (ethyl alcohol) containing not less than 99% pure ethanol by mass. *See also* alcohol.

absolute humidity The amount of water vapour present in the air (atmosphere), measured in kilograms or grams of water per cubic metre (m^3) of air. *See also* relative humidity.

absolute refractive index *See* refractive index.

absolute temperature *See* thermodynamic temperature.

absolute zero The lowest theoretically possible value of thermodynamic temperature, equal to 0 kelvin (K) or −273,16°C (−273.16°C).

absorbance *See* transmittance.

absorption 1. The process in which a liquid or a gas is taken up and retained by a solid or a liquid, forming a uniform solution. Absorption in solids is sometimes called sorption. 2. In spectroscopy, the process in which a substance receives and retains certain wavelengths of radiant energy. 3. In atomic physics, the process in which some elements like cadmium and boron pick up ('capture') neutrons produced in fission processes. 4. In biology, the passage of material through living cells or vessels.

absorption of radiation *See* radiant energy.

absorption spectrum *See* spectrum.

absorptivity *See* transmittance.

abyssal Inhabiting deep water, i.e. below approximately 1000 metres.

a.c. *See* alternating current.

Acarina (Acari) A large and varied order of arachnids, including ticks and mites; some are important parasites, e.g. cattle ticks.

acceleration Rate of change of velocity with time expressed in metres per second per second (m/s^2 or $m\,s^{-2}$). If the velocity is increasing, acceleration is usually considered as positive. When the velocity is decreasing, acceleration is considered as negative and is commonly called a deceleration or retardation.

acceleration of free fall (acceleration due to gravity) Symbol: g. The standard value of g is $9{,}80665\,m\,s^{-2}$ ($9.80665\,m\,s^{-2}$). This value varies slightly with latitude, from $9{,}78049\,m\,s^{-2}$ ($9.78049\,m\,s^{-2}$) at 0° to $9{,}83221\,m\,s^{-2}$ ($9.83221\,m\,s^{-2}$) at latitude 90°.

accelerator 1. A positive catalyst, i.e. a catalyst which increases (accelerates) the rate of a chemical reaction. 2. A machine in which the kinetic energy of charged particles such as electrons and protons is increased by accelerating them in electric fields using a high potential difference. *See also* cyclotron.

acclimatise To become adapted to a new environment by slow changes in physiology.

accommodation The ability of the eye to produce clear images of objects at different

distances by altering the focal length of the eye lens. This is brought about by the action of the ciliary muscles and the elasticity of the lens.

accumulator A device for storing electricity, consisting of one or more secondary cells. *See also* cell.

acetabulum The cavity on each side of the pelvic girdle into which fits the head of the femur, forming the hip joint in vertebrates.

acetaldehyde *See* ethanal.

acetate *See* ethanoate.

acetate rayon *See* rayon.

acetic acid *See* ethanoic acid.

acetone *See* propanone.

acetyl chloride (ethanoyl chloride) *See* acyl chloride.

acetylcholine (ACh) A tissue hormone found in the majority of synapses. It is a neurotransmitter in the parasympathetic nervous system and is believed to play a part in the transmission of nerve-impulses across a synapse. Acetylcholine is inactivated by the enzyme cholinesterase, which is found in all nervous tissue. *See also* choline.

acetylene *See* ethyne.

acetylsalicylic acid *See* 2-hydroxybenzoic acid *and* aspirin.

ACh *See* acetylcholine.

achene A dry, one-seeded, indehiscent fruit formed from a single carpel.

Achilles tendon (Achilles' heel) The tendon of the heel.

achromatic Having no colour. (1) White, black and grey are achromatic colours. (2) An achromatic lens is free from chromatic aberration.

acid A substance existing as molecules or ions which can donate hydrogen ions, H^+ (protons). Less accurate definitions include the following: (1) reacts with some metals to evolve hydrogen; (2) reacts with a base to form a salt and often water (neutralisation); (3) has a pH less than 7; (4) turns blue litmus red. *See also* acid–base theories.

acid–base theories 1. *Broensted–Lowry theory:* An acid is a substance which can donate one or more protons (hydrogen ions), H^+, to a base. A base is a substance which can accept one or more protons from an acid. The relationship between an acid and a base is therefore:

$\text{acid} \rightleftharpoons H^+ + \text{base}$

In aqueous solutions, in which there are no free hydrogen ions but H_3O^+ (oxonium ions) instead, the expression is:

$\text{acid} + H_2O \rightleftharpoons H_3O^+ + \text{base}$

i.e. H_2O is acting as a base and H_3O^+ as an acid. The change can then be generalised to:

$\text{acid(1)} + \text{base(2)} \rightleftharpoons \text{acid(2)} + \text{base(1)}$

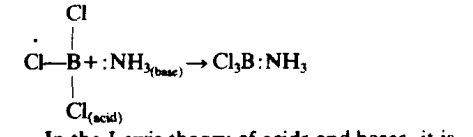
in which acid(1) conjugates with base(1) and acid(2) conjugates with base(2). *Example:* with hydrochloric acid, HCl, one gets:

$HCl + H_2O \rightleftharpoons H_3O^+ + Cl^-$

2. *Lewis theory:* An acid is a substance which can accept a pair of electrons to form a coordinate bond. A base is a substance which can donate a pair of electrons to form a coordinate bond. E.g.

$H^+_{(acid)} + :\ddot{O}—H^-_{(base)} \rightleftharpoons H:\ddot{O}—H$ i.e.

$H^+ + OH^- \rightleftharpoons H_2O$ or



In the Lewis theory of acids and bases, it is seen that substances containing no hydrogen can act as acids, i.e. the theory embraces reactions in which protons are not involved. The Broensted–Lowry theory is the most generally accepted of the two.

acid chloride *See* acyl chloride.

acid halide *See* acyl chloride.

acidic Having the properties of an acid.

acidic hydrogen One or more hydrogen atoms in molecules of acids which can be liberated in aqueous solution to form hydrogen ions, H^+ (protons). *Example:* in ethanoic acid (acetic acid), CH_3COOH, only the hydrogen atom present in the carboxyl group, —COOH, is an acidic hydrogen atom.

acidic oxide *See* oxide.

acidify To make a solution acidic.

acid radical In an acid, the group attached to the acidic hydrogen atom or atoms. *Example:* in ethanoic acid (acetic acid), CH_3COOH, the ethanoate group (acetate group), CH_3COO^-, is the acid radical.

acid salt *See* salt.

aclinic line *See* magnetic equator.

acoelomate Having no coelom.

acoustics The study of sound.

acquired character A character that develops during the life of an individual as it responds to the environment. It is not passed on to the next generation.

acrophobia An exaggerated, abnormal fear of high places.

ACTH Adrenocorticotrophic hormone. *See* corticotrophin.

actin *See* myosin.

actinides *See* actinoids.

actinoids (actinides, actinons) The series of fourteen elements following actinium, including the transuranic elements. The actinoids are all radioactive and have closely related chemical properties because the outer electron structure is almost the same for them all. From americium (atomic number 95), the

characteristic oxidation number is +3. Experiments carried out to determine the electronic configurations of the actinoids have proved inconclusive.

actinons *See* actinoids.

action *See* Newton's laws of motion.

activated carbon A highly porous form of carbon (usually charcoal) with an enormous surface area, enabling it to adsorb large quantities of gases or dissolved or suspended substances. Activated carbon is commonly used in gas masks.

activated charcoal *See* activated carbon.

activation energy Symbol: *E*. The least amount of energy an atom, molecule, etc. must acquire before it is able to react chemically: i.e. the minimum amount of energy necessary to start a chemical reaction. A positive catalyst decreases the activation energy of a chemical reaction, thus providing a new pathway for it.

active mass *See* mass action (law of).

active transport A process involving the movement of materials into cells by means other than diffusion and osmosis. Energy is expended by the cell in this process, which often takes place against concentration gradients.

activity coefficient *See* mass action (law of).

activity series of metals (reactivity series of metals) Metallic elements arranged in order of their decreasing chemical reactivity with water or dilute acids. Hydrogen is included in this series. Metals placed above hydrogen liberate it from water and from certain dilute acids, whereas metals placed below hydrogen do not. Also, a metal placed above another in the series may displace this other metal from its compounds. *Example:* zinc, Zn, will replace copper, Cu, in copper(II) sulphate, $CuSO_4$, to form zinc sulphate, $ZnSO_4$, and free copper:

$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

The activity series of metals should not be confused with the electrochemical series of metals. *Example:* in the activity series sodium is placed above calcium, but in the electrochemical series calcium is placed above sodium.

actomyosin *See* myosin.

acyl chloride (acid chloride) One of a class of organic compounds called acyl halides (acid halides) which can be prepared by the reaction between a carboxylic acid and phosphorus trichloride, PCl_3, or phosphorus pentachloride, PCl_5. Ethanoyl chloride (acetyl chloride), CH_3COCl, is an acyl chloride derived from ethanoic acid (acetic acid), CH_3COOH:

$3CH_3COOH + PCl_3 \rightarrow 3CH_3COCl + H_3PO_3$

From the reaction it is seen that the hydroxyl group in the acid has been replaced by a chlorine atom. Other acyl halides contain fluorine, bromine and iodine instead of chlorine. They are all used in the organic synthesis of other compounds.

acyl halide *See* acyl chloride.

Adam's apple The projection of thyroid cartilage of the larynx, especially prominent in men.

adaptation The process by which an organism becomes adjusted to its environment. *See also* specialisation.

Addison's disease A disease in which there is a lack of certain hormones produced by the cortex of the adrenal gland. Symptoms include weakness, loss of weight, vomiting, hypotension and a dark brown pigmentation of the skin. The function of the kidneys is impaired, causing an accumulation of urea in the blood. The disease is treated by giving the patient cortisone and derivatives of this hormone.

addition dimerisation *See* dimer.

addition polymerisation *See* polymerisation.

addition reaction A chemical reaction in which an unsaturated compound takes up atoms or groups of atoms. *Example:* when ethene, $CH_2{=}CH_2$, reacts with hydrogen, H_2, ethane, $CH_3{-}CH_3$, is formed:

$CH_2{=}CH_2 + H_2 \rightarrow CH_3{-}CH_3$

The double bond in ethene is converted into a single bond in ethane, i.e. the unsaturated ethene is converted into the saturated ethane. *Compare* elimination reaction; *See also* substitution reaction.

adenine A nitrogenous, cyclic organic base (purine base) which is part of the genetic code in DNA, where it pairs with thymine. It is also a part of RNA, NAD, AMP, ADP and ATP.

adenine nucleoside *See* adenosine.

adenoids In some mammals, gland-like structures situated where the nasal passage enters the throat. Lymph circulates through the adenoids, helping to remove bacteria from the blood. Together with the tonsils, the adenoids help in guarding the body against micro-organisms entering through the mouth or nose.

adenosine (adenine nucleoside) A nucleoside with adenine as its base.

adenosine diphosphate (ADP) A nucleotide associated with energy transfer in living organisms also involving adenosine triphosphate, ATP. ADP is a complex molecule consisting of adenine, a carbohydrate part (ribose) and two phosphate groups. Energy from respiration or from sunlight in photosynthesis is used to build up ATP from ADP and phosphate. This energy transfer takes place in the mitochondria of the cell. *See also* Krebs' cycle.

adenosine monophosphate (AMP) A nucleotide consisting of adenine, a carbohydrate part (ribose) and one phosphate group. It is formed by hydrolysis of ADP, by which energy is released together with one phosphate group.

adenosine triphosphate (ATP) A nucleotide consisting of adenine, a carbohydrate part (ribose) and three phosphate groups. It is the energy carrier of the living cell and is formed from ADP. Hydrolysis of ATP releases energy, at the same time yielding ADP and phosphate.

ADH Antidiuretic hormone. *See* antidiuretic.

adhesion The interaction between surfaces of different materials in contact, which causes them to cling together. *Compare* cohesion.

adhesive A substance used for sticking surfaces together, e.g. glue and cement.

adiabatic Occurring without heat loss or heat gain to a system.

adipose tissue In animals, connective tissue whose cells contain large quantities of fat. *See also* areolar tissue.

ADP *See* adenosine diphosphate.

adrenal gland (suprarenal gland) An organ of hormone secretion in vertebrates, situated just above the kidney. It is a ductless gland which secretes adrenalin(e) and noradrenalin(e) into the bloodstream. In mammals, the adrenal gland consists of two main parts, the medulla and the cortex. Adrenalin(e) and noradrenalin(e) are produced by the medulla, whereas the cortex produces hormones such as sex hormones and cortisone.

adrenalin(e) A hormone secreted by the adrenal gland. It causes excitement and stimulation, affecting circulation and muscular action. In medicine, adrenalin(e) is used as a heart stimulant and to constrict blood vessels. *See also* fear *and* glycogenolysis.

adrenocorticotrophic hormone (ACTH) *See* corticotrophin.

adsorption The attachment of molecules of gases or liquids to the surface of another substance (usually a solid). Adsorption occurs on substances like silica gel and activated carbon.

adventitious Describes tissues and organs which occur in an unusual place. *See* adventitious roots.

adventitious roots Roots which are not developed from the radicle of the seed, but produced on some other part of the plant. They may grow directly from a stem, e.g. in tulip and onion. Some plants may even produce adventitious roots from leaves.

aerate Expose to the mechanical or chemical action of air.

aerial 1. Inhabiting the air; e.g. roots growing above ground. 2. (antenna) The part of a radio system which transmits radio waves or receives them.

aerobe An organism which requires free oxygen (either gaseous or dissolved) in order to live. *Compare* anaerobe.

aerobic Describes organisms which require free oxygen (gaseous or dissolved) in order to live. *Compare* anaerobic; *see also* aerobic respiration.

aerobic respiration Respiration taking place in the presence of free oxygen (gaseous or dissolved in water). *Compare* anaerobic respiration.

aerodynamics The study of gases in motion. The branch of science concerned with the motion and control of solid objects (aircraft, rockets, missiles) in air.

aerosol 1. A suspension of extremely small particles of a liquid or solid in air or other gases. 2. A pressurised can with a spray mechanism for causing the suspension of particles.

aestivation 1. A period of dormancy in animals during summer or a dry season. 2. The arrangement of the parts in a flower-bud.

afferent Conducting towards, e.g. nerves conducting impulses to nervous centres. *Compare* efferent.

afferent neurone *See* sensory neurone.

affinity The tendency of two substances to combine. Chemical attraction.

afterbirth The placenta and foetal membranes discharged after the offspring's birth.

Ag Chemical symbol for silver.

agar A material obtained from certain red algae, a form of seaweed. It is a mixture of polysaccharides, commonly used as a base for bacterial, fungal and tissue cultures.

Agaricus *See* mushroom.

agate A very hard, naturally occurring form of silicon(IV) oxide, SiO_2. Agate consists of thin varying layers of many colours, the outer layers being oldest.

ageing process The gradual degenerative process of living cells, i.e. of tissue and tissue function. The causes of this process are still uncertain and many theories have been put forward in order to explain it. Current theories suggest that the ageing process in higher animals involves free radicals. These form naturally within the body and are very reactive, sometimes combining with each other. If they react with protein molecules or nucleic acids, the result will be a malfunction of these molecules. This eventually results in the death of the cell, then of tissue and finally of the entire organism. Some scientists think that vitamin E slows down the ageing process by keeping the free radical concentration low.

agglutination The process in which bacteria or red blood cells clump together. *See also* blood group.

agglutinin *See* blood group.

agglutinogen *See* blood group.

agoraphobia An exaggerated, abnormal fear of open places. *Compare* claustrophobia.

agranulocyte A lymphoid leucocyte with non-granular cytoplasm. About 30% of all leucocytes are agranulocytes, of which there are two types: lymphocytes (25%) and monocytes (about 5%).

agriculture The science or practice of cultivating the soil and keeping animals.

AIDS (Acquired Immune Deficiency Syndrome) A very serious disease which is probably caused by a virus. The disease was first diagnosed in the USA in 1980 and since then it has been diagnosed in other countries and 36 American states. Physicians fear that AIDS will come to affect more and more people in the future. Symptoms include weakness, loss of appetite, loss of weight, fever and swelling of the lymph nodes. The patient becomes more liable to catch infectious diseases and cancer. The number of certain lymphocytes in the blood of the patient is clearly below average and those which are present are not working properly. About 40% of the patients die within a year or two. The origin of the disease is not known, but it is assumed that it comes from West Africa or the southern part of Europe, as a certain serious skin disease found in these places is a complication to AIDS. Treatment with interferon has so far had some effect.

air The invisible mixture of gases surrounding the Earth. At sea level, the composition (in per cent by volume) is nitrogen, 78,1 (78.1); oxygen, 20,9 (20.9); argon, 0,94 (0.94); carbon dioxide, 0,03 (0.03). There are also minute amounts of other gases, such as helium, neon, krypton, xenon and radon, as well as varying amounts of water vapour. *See* Appendix.

air bladder *See* swim bladder.

air pore *See* stoma.

air pressure *See* pressure.

air pump A device for transferring air or other gases from one place to another. In some air pumps pressures of the order of 10^{-3} mm of mercury can be achieved. *See also* vacuum pump.

air sac In birds, a thin-walled, air-filled extension of the lungs, often extending into the bones. In some insects, a thin-walled widening of tracheae. In mammals the bronchioles terminate in air sacs which have thin elastic walls. *See* alveolus.

Al Chemical symbol for aluminium.

albedo The proportion of solar light which is reflected from the atmosphere and surface of a planet back into space.

albinism The absence of pigmentation in animals or plants which are normally pigmented.

albino Any animal or plant with a deficiency of pigment. In animals, the absence of colouring pigment (melanin) is seen in skin, hair and feathers, which are white, and eyes, which are usually pink. An albino is unusually sensitive to light.

albumen White of egg, of birds and some reptiles; the nutritive material surrounding the yolk. *See also* albumin.

albumin Any of a group of water-soluble proteins found in egg-white, blood serum and milk.

alburnum *See* sapwood.

Alcad-accumulator® Trade name for a nickel-cadmium alkaline cell (accumulator).

alchemy The medieval forerunner of modern chemistry. Alchemists sought the philosopher's stone, a substance that could change base metals into gold, and a liquid that could prolong life indefinitely (elixir of life).

alcohol The general name for a group of organic substances containing carbon, hydrogen and oxygen. An alcohol can be thought of as being derived from a hydrocarbon in which one or more hydrogen atoms have been replaced by a hydroxyl group, OH. Alcohols are either aliphatic or cyclic molecules. Examples of alcohols are methanol, CH_3OH; ethanol, C_2H_5OH; and phenyl methanol (benzyl alcohol), $C_6H_5CH_2OH$ (cyclic). Alcohols are divided into primary alcohols, containing the functional group $-CH_2OH$; secondary alcohols, containing the functional group

$$-\overset{|}{\underset{|}{C}}HOH;$$

and tertiary alcohols, containing the functional group

$$-\overset{|}{\underset{|}{C}}OH$$

The term 'alcohol' is often used for ethanol.

alcoholate *See* metal alkoxide.

alcohol thermometer A thermometer containing alcohol (usually ethanol). The instrument is useful at low temperatures, as ethanol has a lower freezing-point (−117°C) than mercury (−39°C).

aldehyde The general name for an organic substance containing the carbonyl group,

$$-\overset{|}{\underset{|}{C}}=O$$

in which one of the bonds of the carbon atom is attached to a hydrogen atom and the other one to a carbon atom (methanal is an exception). Aldehydes are either aliphatic or cyclic molecules, e.g. methanal (formaldehyde), H—CHO, and benzaldehyde, C_6H_5—CHO.

The group —CHO in aldehydes is called the aldehyde group. *Compare* ketone.

aldohexose *See* sugar.

aldopentose *See* sugar.

aldose A carbohydrate containing an aldehyde group, —CHO, e.g. glucose, $C_6H_{12}O_6$ or $CH_2OH(CHOH)_4CHO$. *See also* sugar.

aldrin $C_{12}H_6Cl_6$ A cyclic compound consisting of two fused six-membered rings. It is a pale yellow crystalline solid which is insoluble in water, but soluble in most organic solvents. Aldrin is used as an insecticide.

aleuroplast *See* leucoplast.

alfalfa *See* lucerne.

alga (pl. algae) A primitive, non-vascular photosynthetic plant, found growing aquatically and in damp situations, e.g. on tree trunks, soil and damp walls. Algae have neither stems, roots nor leaves. The most common varieties are the green, brown and red algae, all of which contain chlorophyll as well as other pigments. *See also* Cyanophyta.

alimentary canal (gut) The tube, from mouth to anus, concerned with ingestion, digestion and absorption of food. *See* Fig. 49.

alimentary system *See* digestive system.

aliphatic Describes organic compounds with carbon atoms arranged in straight or branched chains. *Compare* cyclic.

alive (live) An electrical conductor which is not at earth potential.

alkali A basic hydroxide which is soluble in water. Examples include sodium hydroxide, NaOH; potassium hydroxide, KOH; calcium hydroxide, $Ca(OH)_2$; and ammonium hydroxide, NH_4OH. Ammonium hydroxide is a solution of ammonia, NH_3, in water. The solution contains very few hydroxide ions, OH^-, as NH_4OH is not fully ionised: it is therefore a weak alkali. *See also* base.

alkali metals The metals (elements) found in Group IA of the Periodic Table of the Elements. These metals are lithium, sodium, potassium, rubidium, caesium and francium. They are very electropositive, soft, less dense than water and have low melting-points.

alkaline Having the properties of an alkali.

alkaline accumulator *See* Ni–Fe cell *and* nickel–cadmium alkaline cell (accumulator).

alkaline cell *See* Ni–Fe cell *and* nickel–cadmium alkaline cell (accumulator).

alkaline earth metals The metals (elements) found in Group IIA of the Periodic Table of the Elements. These metals are beryllium, magnesium, calcium, strontium, barium and radium. They are rather electropositive and harder and denser than the alkali metals.

alkaloid Any of a class of nitrogenous, organic bases found in certain plants. An alkaloid has a strong physiological effect; examples of alkaloids are caffeine, cocaine, nicotine and quinine.

alkane The general name for a group of hydrocarbons which are saturated, i.e. have only single bonds between the carbon atoms. The general formula of the alkanes is C_nH_{2n+2}, where $n \geq 1$. Examples of alkanes are methane, CH_4, ethane, C_2H_6, and propane, C_3H_8.

alkanoic acid *See* fatty acid.

alkene The general name for a group of unsaturated hydrocarbons which have one double bond between carbon atoms in each molecule. The general formula of the alkenes is C_nH_{2n}, where $n \geq 2$. Examples of alkenes are ethene, C_2H_4, and propene, C_3H_6.

alkine *See* alkyne.

alkoxide *See* metal alkoxide.

alkyl An aliphatic hydrocarbon group with the general formula C_nH_{2n+1}—, i.e. containing one less hydrogen atom than the corresponding alkane. *Example:* CH_3—, an alkyl group called methyl.

alkyl halide An organic compound in which a halogen atom is attached to an alkyl group. CH_3Cl, methyl chloride, and C_2H_5I, ethyl iodide. Alkyl halides are of great importance in organic synthesis because of the variety of compounds which can be made from them. *See also* amine *and* Williamson synthesis.

alkyne (alkine) The general name for a group of unsaturated hydrocarbons which have one triple bond between carbon atoms in each molecule. The general formula of the alkynes is C_nH_{2n-2}, where $n \geq 2$. Examples of alkynes are ethyne (acetylene), C_2H_2, and propyne, C_3H_4.

allantois An embryonic organ consisting of a membranous sac. In placental mammals, the allantois grows around the tail of the embryo. It supplies blood to the placenta and acts as an organ of nutrition, respiration and excretion.

allele (allelomorph) One of a set of alternative forms of the same gene. The alleles of a gene occupy the same relative position (locus) on homologous chromosomes, are able to mutate one to another and control the same characteristic, but do not necessarily produce the same effect.

allelomorph *See* allele.

allergen A substance, usually a protein, which causes an allergy. Examples of allergens are hair and pollen.

allergy An unusual reaction to a particular substance (allergen) which may be a food, pollen, an insect bite, a metal, a medicine, hair, house dust, etc. Hay fever is a common form of allergy. Symptoms of allergy can

include a running nose, breathing difficulty, a rash and oedema. *See also* asthma.

allo- Prefix meaning other.

allogamy Cross-fertilisation. *Compare* autogamy.

allomerism A similarity in the crystalline structure of molecules of different chemical composition.

allomorph *See* allomorphism.

allomorphism A variability in the crystalline structure of certain molecules. Different crystalline forms of the same substance are called allomorphs.

allotrope *See* allotropy.

allotropy The existence of several forms of an element in the same state, but with different physical rather than chemical properties, e.g. oxygen, O_2, and ozone (trioxygen), O_3. The different forms are called allotropes. *See also* polymorphism.

alloy A mixture of two or more metals, or of a metal and a non-metal. The properties of an alloy are different from its components' properties.

alluvial Describes deposits of finely divided material, such as earth and sand, left by flood.

Alnico® An alloy used to make permanent magnets. The alloy contains the following metals in varying proportions: aluminium, Al; nickel, Ni; cobalt, Co; iron, Fe; and copper, Cu.

alpha *(α)* The first letter of the Greek alphabet.

Alpha Centauri A very bright triple star system, often called Rigil Kent. It can be seen with the naked eye, appearing to be a single star. It is 4,26 light-years (4.26 light-years) away from Earth. *See also* Proxima Centauri.

alpha decay A spontaneous radioactive disintegration in which a parent nucleus of an element decays into an alpha particle, ^4_2He, and a daughter nucleus. This daughter nucleus will have two neutrons and two protons fewer than the parent; it will have a mass number four atomic mass units less and an atomic number two less.

alpha-naphthol test *See* Molisch's test.

alpha particle The nucleus of a helium atom, ^4_2He. Alpha particles are emitted from the nuclei of certain radioactive elements. Each particle has a double positive charge. *See also* alpha decay.

alpha ray A stream of fast-moving alpha particles, with a relatively low penetrating power. Alpha rays produce ionisation in gases through which they pass.

alternate Describes leaves, branches, etc., which occur at different levels successively on opposite sides of a stem.

alternating current (a.c.) An electric current which varies in strength and periodically reverses its direction. *See also* frequency.

alternation of generations In the life cycles of certain organisms, the occurrence of two or more generations in which a form of sexual reproduction alternates with a form of asexual reproduction. This occurs in coelenterates and some arthropods, but is more clearly seen in plants such as ferns and mosses. In the life cycles of these plants a haploid phase alternates with a diploid phase, i.e. a haploid gametophyte alternates with a diploid sporophyte.

alternator A device for producing an alternating current. *See also* generator.

altimeter An instrument for measuring height above sea-level. It is usually an aneroid barometer, calibrated to read directly in metres or feet.

altitude Height above sea-level or horizon.

alum A traditional name used for several double salts. It is most commonly used for aluminium potassium sulphate-12-water (potash alum), $AlK(SO_4)_2 \cdot 12H_2O$, which is used in dyeing, for the production of mordants and pigments and in water purification as a coagulant. In ammonium alum (aluminium ammonium sulphate-12-water) the potassium is replaced by the ammonium group (ion), NH_4^+. Originally the name 'alum' indicated the presence of the trivalent aluminium ion, Al^{3+}. However, it is now also used for other double salts containing trivalent ions. An example is chrome alum (chromium potassium sulphate-12-water), $CrK(SO_4)_2 \cdot 12H_2O$, which contains the trivalent chromium ion, Cr^{3+}.

alumina A naturally occurring form of aluminium oxide, Al_2O_3. Alumina is also called corundum and in an impure form, emery. Both are used as abrasives. *See also* ruby *and* sapphire.

aluminium An element with the symbol Al; atomic number 13; relative atomic mass 26,98 (26.98); state, solid. It is a very electropositive metal, mainly extracted from bauxite. Aluminium is used in making light and strong alloys, food containers, foil for wrapping, cooking utensils, overhead electric cables, paint, etc. In air, a very thin layer of aluminium oxide, Al_2O_3, is formed on the surface of aluminium. This oxide layer protects the aluminium from further atmospheric corrosion and renders it less reactive chemically.

aluminium oxide Al_2O_3. *See* aluminium; *see also* alumina *and* oxide.

aluminium sulphate $Al_2(SO_4)_3$ (anhydrous); $Al_2(SO_4)_3 \cdot 18H_2O$ (hydrated) An aluminium salt with two major uses: in textile dyeing and

as a flocculating agent in water and sewage purification.

alveolus (pl. alveoli) **1.** A terminal air sac, in lungs, where gaseous exchange takes place between air and blood. It is a cup-shaped cavity surrounded by a dense network of capillaries. An alveolus has a thin wall covered with a film of moisture in which air dissolves. The air then diffuses through the epithelium, the capillary wall and the plasma, and into red blood cells. Here oxygen combines with haemoglobin. Carbon dioxide in the blood diffuses into the alveoli and is eventually exhaled. *See* Fig. 1. **2.** A cavity in a gland. **3.** A cavity in the jaw-bone forming a tooth socket.

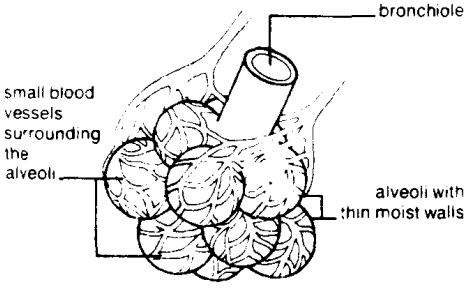


Fig. 1 Alveoli

AM Amplitude modulation. *See* modulation.

amalgam A liquid or solid alloy of mercury with one or more metals or non-metals. Important uses of amalgams are in the repair of dental caries and in the recovery of gold and silver from their ores.

amber (succinite) A yellow, translucent fossil resin, derived from an extinct species of pine. Amber is often found on sea-shores and is used for ornamental purposes. Often amber contains trapped insects or pieces of plants.

Ames' test A biological method used in the testing of chemicals, mainly for their carcinogenic effect on human beings. The test is carried out using salmonella bacteria and is based on the theory that if a certain chemical is able to induce a hereditary change in salmonella bacteria, it is probably able to do the same in human beings, i.e. it is likely to be carcinogenic.

amethyst A form of quartz, SiO_2, which is pale to dark violet or purple in colour. The colour is caused by impurities and may disappear on heating. Amethyst is a semi-precious stone.

amide The general name for a class of organic compounds containing the functional group

the amide group. Amides can be prepared by reacting an acyl halide with ammonia, NH_3, e.g.

$CH_3COCl + 2NH_3 \rightarrow CH_3CONH_2 + NH_4Cl$

Here ethanoyl chloride (acetyl chloride), CH_3COCl, is converted into ethanamide (acetamide), CH_3CONH_2. Amides are white solids with a neutral reaction when dissolved in water. They are used in the organic synthesis of other compounds. *See also* urea.

amide group *See* amide.

amine The general name for a class of organic compounds containing the functional groups $-NH_2$, $-NH-$ or $-N-$

Amines may be considered to be derived from ammonia, NH_3, in which one or more hydrogen atoms are replaced by an organic group such as an alkyl or aryl. Examples are CH_3NH_2, methylamine, and $C_6H_5NH_2$, phenylamine (aniline). Amines can be divided into primary, secondary and tertiary amines depending on the number of alkyl or aryl groups in the molecule: CH_3-NH_2 (methylamine) is a primary amine,

(dimethylamine) is a secondary amine and

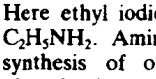
(trimethylamine) is a tertiary amine. The alkyl or aryl groups may be similar (as in these examples) or different, and amines containing both alkyl and aryl groups exist. Amines have an alkaline reaction when dissolved in water. They can be prepared by reacting an alkyl halide with ammonia, NH_3, and a strong alkali:

$C_2H_5I + NH_3 + OH^- \rightarrow C_2H_5NH_2 + I^- + H_2O$

Here ethyl iodide, C_2H_5I, gives ethylamine, $C_2H_5NH_2$. Amines are used in the organic synthesis of other compounds. *See also* phenylamine.

aminoacetic acid *See* glycine.

amino acid An organic acid containing the carboxyl group $-COOH$ and the amino group $-NH_2$. All peptides and proteins contain units of amino acids. About twenty different amino acids occur in nature. Ten of these are called essential amino acids as they cannot be synthesised in the human body for conversion into proteins; therefore they must be present in the diet. The chief amino acids from which natural proteins are made all contain an amino group in the α-position: i.e. the amino group is attached to the carbon atom adjacent to the carboxyl group. An example is



α-aminobutanoic acid. The simplest of all

amino acids is glycine, $H_2N—CH_2—COOH$. *See also* zwitterion.

aminobenzene *See* phenylamine.

4-aminobenzenesulphonamide *See* sulphanilamide.

aminoethanoic acid *See* glycine.

amino group The group $—NH_2$ (primary amino group), as found in peptides, proteins and several other organic compounds. *See also* amine.

ammeter An instrument for measuring electric current, having a low internal resistance. Two common types are the moving coil ammeter and the moving iron ammeter. *See also* moving coil instrument *and* moving iron instrument.

ammonia NH_3 A pungent-smelling gas, very soluble in water, giving a weak alkaline solution; i.e. in the chemical equilibrium

$NH_3+H_2O \rightleftharpoons NH_4^+ + OH^-$

the reverse reaction is favoured. Ammonia is prepared industrially by the Haber–Bosch process. It is used as a fertiliser and in the production of other compounds such as nitric acid.

ammoniacal liquor A solution of ammonia in water, produced during the manufacture of coal-gas. When treated with sulphuric acid, H_2SO_4, it produces ammonium sulphate, $(NH_4)_2SO_4$, an important fertiliser.

ammonia-soda process *See* Solvay process.

ammonite A member of an important group of fossils used for dating rocks of the Mesozoic age. Ammonites have flat, spiral shells.

ammonium alum *See* alum.

ammonium chloride NH_4Cl (sal ammoniac) An ammonium salt. When heated it sublimes. It is used in dry cells and as a flux in soldering.

ammonium cyanate *See* Wöhler synthesis.

ammonium dichromate(VI) $(NH_4)_2Cr_2O_7$ An ammonium salt. When heated, it decomposes into chromium(III) oxide, Cr_2O_3, nitrogen, N_2, and water vapour:

$(NH_4)_2Cr_2O_7 \rightarrow Cr_2O_3+N_2+4H_2O$

ammonium hydroxide NH_4OH A solution of ammonia in water. It contains no molecules of NH_4OH; instead it contains ammonium ions, NH_4^+, hydroxide ions, OH^-, unionised ammonia, NH_3, and water. *See also* ammonia.

ammonium ion NH_4^+ A monovalent group of atoms which has a positive electrical charge. The ammonium ion forms compounds which are similar to the salts of monovalent metals.

ammonium nitrate NH_4NO_3 An ammonium salt used as a fertiliser and in making explosives. When heated it decomposes into dinitrogen oxide (laughing gas), N_2O, and water vapour:

$NH_4NO_3 \rightarrow N_2O+2H_2O$

ammonium nitrite NH_4NO_2 An ammonium salt. When heated it decomposes into nitrogen, N_2, and water vapour:

$NH_4NO_2 \rightarrow N_2+2H_2O$

ammonium sulphate $(NH_4)_2SO_4$ An ammonium salt, mainly used as a nitrogenous fertiliser, obtained as a by-product of coal-gas manufacture. It is now manufactured from an aqueous ammonia solution, NH_3, saturated with carbon dioxide, CO_2, and mixed with powdered calcium sulphate, $CaSO_4$:

$CaSO_4+2NH_3+CO_2+H_2O \rightarrow (NH_4)_2SO_4+CaCO_3$

The calcium carbonate, $CaCO_3$, is filtered off and the ammonium sulphate crystallised. *See also* ammoniacal liquor.

amnion A foetal membrane of mammals, birds and reptiles. In birds and mammals it is the innermost of three membranes and encloses the amniotic cavity. This is filled with amniotic fluid which serves to cushion the embryo.

amniote One of a group of vertebrates, comprising mammals, birds and reptiles, whose embryos possess an amnion. *Compare* anamniote.

amniotic fluid *See* amnion.

Amoeba A single-celled aquatic protozoan, which is constantly changing shape by projecting temporary 'feet' or pseudopodia. It is just visible to the naked eye as an opaque white speck. *See also* phagocytosis.

amoeboid Resembling an *Amoeba*. Moving by pseudopodia. *See also* pseudopodium.

amorphous Without definite form or shape; lacking a crystal structure. Amorphous substances have no fixed melting-points, e.g. glass.

amorphous sulphur A non-crystalline form of sulphur which is often white and consists of very small particles which are difficult to filter. With water, amorphous sulphur may form a colloidal solution called milk of sulphur. Amorphous sulphur may be prepared by acidifying an aqueous solution of sodium thiosulphate, $Na_2S_2O_3$:

$Na_2S_2O_3+2H^+ \rightarrow S+SO_2+2Na^++H_2O$

AMP *See* adenosine monophosphate.

ampere *Symbol*: A. The SI unit of electric current. The ampere is the current which, if flowing in two straight parallel conductors of infinite length, placed one metre apart in a vacuum, will produce a force of 2×10^{-7} newtons per metre length on each conductor.

ampere-hour The quantity of electricity flowing in a conductor when a current of one ampere flows through it for one hour

1 ampere-hour = 3600 coulombs

Amphibia A class of cold-blooded, tetrapod vertebrates adapted for life on land and in water. Examples are frogs, toads and salamanders. Characteristics include pentadactyl limbs, a soft, moist skin without scales and external fertilisation. They are egg-laying,

and undergo metamorphosis from the larval stage to the adult stage. The larvae are aquatic, breathing with gills, while the adults live on land.

amphimixis The normal method of sexual reproduction by fusion of gametes. *Compare* apomixis.

Amphioxus (Branchiostoma) A genus of primitive, marine, invertebrate animals belonging to the cephalochordates, the lancelets. The species *Amphioxus lanceolatus* is about 5 cm long and is pointed at both ends. It has a dorsal fin along the whole length of its body and a caudal and ventral fin. It is a ciliary feeder, spending most of its life burrowed in sand with only its head end exposed. Amphioxus is the only chordate whose notochord is retained throughout life.

ampholyte (amphoteric electrolyte) A substance which is capable of exhibiting both acidic and basic properties. *See also* amphoteric *and* oxide.

amphoteric Having both acidic and basic properties. *Example:* water can behave as an acid:

$H_2O \rightleftharpoons H^+ + OH^-$

or as a base:

$H_2O + H^+ \rightleftharpoons H_3O^+$

amphoteric electrolyte *See* ampholyte.

amphoteric oxide *See* oxide.

amplexus In frogs and toads, the embrace of the female by the male, during which ova are squeezed from the female's body into the surrounding water prior to fertilisation.

amplifier A device for increasing the power of an electrical input. *See also* transistor.

amplitude The maximum extent of vibration or oscillation from the position of equilibrium. (1) The amplitude of an alternating current is the peak value of the current. (2) The amplitude of a pendulum is half the length of the swing.

amplitude modulation (AM) *See* modulation.

ampulla (pl. ampullae) A swelling at the end of each semicircular canal in the ear, containing a crista.

amputation The removal of a part of the body, e.g. a limb. Amputation is carried out when the part is seriously damaged or diseased.

a.m.u. *See* atomic mass unit.

amylase (diastase) A general name for any enzyme capable of breaking down polysaccharides into smaller carbohydrate units. Amylases are widely distributed in plants and animals. An example of an amylase is ptyalin, found in saliva.

amylopectin *See* starch.

amyloplast *See* leucoplast.

amylose *See* starch.

anabolism The building up of complex molecules from simpler ones, involving the taking up and storing of energy (gaseous or dissolved in water). *Compare* catabolism; *see also* metabolism.

anabolite A substance taking part in anabolism.

anaemia A deficiency of red cells in the blood, which may arise from a large loss of blood, a deficiency of iron in the diet, failure of the marrow to produce erythrocytes (red blood cells) or excessive destruction of the red blood cells.

anaerobe An organism living only in the absence of free oxygen (gaseous or dissolved in water). *Compare* aerobe.

anaerobic Describes organisms living in the absence of free oxygen (gaseous or dissolved in water). *Compare* aerobic; *see also* anaerobic respiration.

anaerobic respiration Respiration taking place in the absence of free oxygen (gaseous or dissolved in water). *Compare* aerobic respiration.

anaesthesia Insensibility to pain.

anaesthetic A substance used in relieving pain, either partial or complete. General anaesthetics affect the whole body, usually with loss of consciousness, whereas local anaesthetics only affect a limited part of the body.

anal Pertaining to or situated near the anus.

anal fin In fish, a median fin controlling rolling and yawing movements.

analgesia The absence or relief of pain. *See also* anaesthesia.

analgesic A pain-killing drug. *See also* anaesthetic.

analogous Describes parts of animals or plants which are similar in function or appearance but differ in structure and development, i.e. have a different origin. *Example:* the legs of a fly have the same function as those of a bird, i.e. they enable both animals to walk, but they have no common structural features. *Compare* homologous.

analysis (pl. analyses) Determination of the properties of matter. *Compare* synthesis; *see also* qualitative analysis *and* quantitative analysis.

anamniote One of a group of vertebrates, comprising amphibians and fish, whose embryos do not possess an amnion. *Compare* amniote.

anaphase The stage of mitosis or meiosis, following metaphase, when chromosomes separate and move towards opposite poles of the spindle.

anatomy The study of the structure of plants and animals, as determined by dissection.

androecium Collective name for the male reproductive organs (stamens) of a plant.

androgen One of a group of male sex hormones. Androgens are responsible for developing and maintaining many secondary sexual characteristics. *See also* testosterone.

anemometer An instrument for measuring the velocity of a fluid, particularly wind velocity.

aneroid Without liquid.

aneroid barometer An instrument used to measure air pressure. It consists of a partially evacuated metal drum which varies in width as the air pressure changes. The movement of the drum walls is transmitted through gears to a pointer which moves over a scale indicating the air pressure.

aneurin *See* thiamine.

angina pectoris A condition in which the supply of blood (oxygen) to the heart becomes inadequate. This causes acute chest pains which sometimes spread to the arms (particularly the left one) and to the neck and jaw. Angina pectoris may be a result of hardening and thickening of the coronary blood vessels (arteriosclerosis). It is treated with nitroglycerine tablets placed under the tongue, from where they are quickly absorbed into the blood stream. Nitroglycerine dilates the coronary blood vessels, allowing more blood to pass through. Sometimes angina pectoris is treated surgically. Many things may trigger an attack, such as physical exertion, the effort involved in eating and digesting a heavy meal, or anything that is strenuous. Attacks are often brief, lasting only a couple of minutes.

angiosperm A member of a major division of the plant kingdom. Angiosperms are flowering plants, distinguished from gymnosperms by having their ovules carried within a closed cavity, the ovary. *See also* Spermatophyta.

angle of declination (angle of variation) The angle between the geographic meridian and the magnetic meridian at a given place on the Earth. *See* Fig. 2.

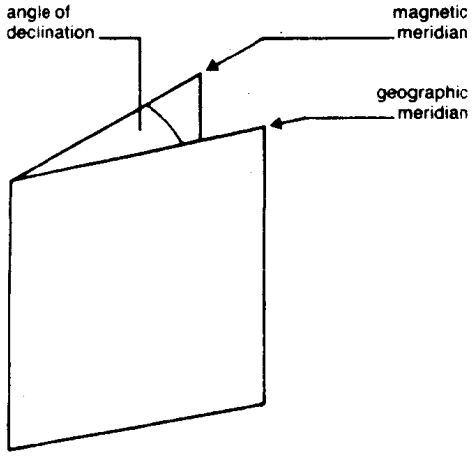


Fig. 2 Angle of declination

angle of deviation The angle between the incident ray and the refracted ray when a ray of light passes from one medium to another. *See* Fig. 3.

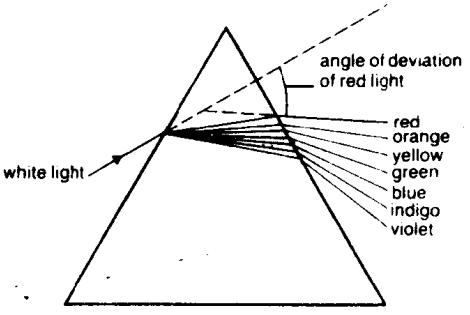


Fig. 3 Angle of deviation

angle of dip (angle of inclination) The angle made with the horizontal by a freely suspended magnetic needle at a place on the Earth's surface.

angle of incidence The angle between the incident ray of light, striking a reflecting or refracting surface, and the normal to the surface at the point of incidence. *See* Figs. 4 *and* 5.

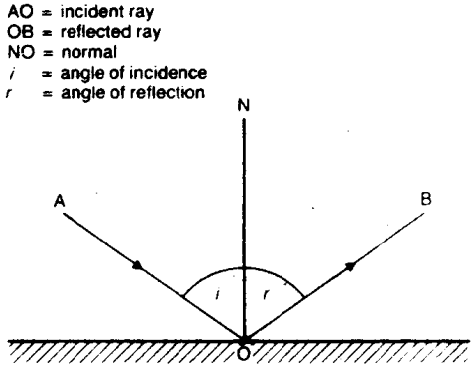


Fig. 4 Angle of incidence and angle of reflection

angle of inclination *See* angle of dip.

angle of reflection The angle between the reflected light ray from a surface and the normal to the surface at the point of reflection. *See* Fig. 4.

angle of refraction The angle between the refracted light ray and the normal to the surface at the point of refraction. *See* Fig. 5.

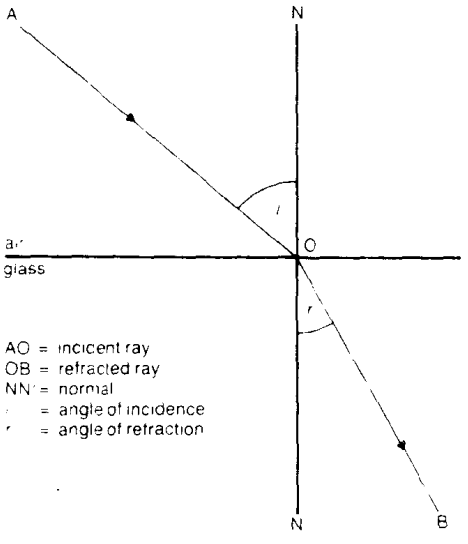


Fig. 5 Angle of refraction

angle of variation *See* angle of declination.

angstrom (Ångström or angstrom unit; Å, ÅU, AU) A unit of length equal to 10^{-8}cm (10^{-10}m).

angular magnitude The angle which an object subtends at the eye. This angle governs the apparent size of the object, as it determines the size of the image formed on the retina. *Example:* telegraph-poles appear to be shorter the further away they are, although they are the same height. *See* Fig. 6.

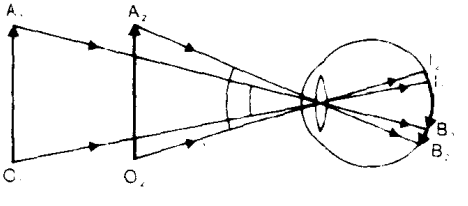


Fig. 6 Angular magnitude

angular velocity Symbol: ω; unit: radians per second (rad s^{-1}). The rate of motion of a body through an angle about an axis.

anhydride The substance obtained when the elements of water (hydrogen and oxygen) are removed from a compound. Examples of anhydrides are: sulphur trioxide, SO_3, the anhydride of sulphuric acid, H_2SO_4; and calcium oxide, CaO, the anhydride of calcium hydroxide, $Ca(OH)_2$. Usually an anhydride takes up water easily, and some of them are therefore good drying agents.

anhydrite A naturally occurring anhydrous form of calcium sulphate, $CaSO_4$.

anhydrous Without water. The term is often applied to salts which have no water of crystallisation. *Compare* hydrated.

aniline *See* phenylamine.

animal cell *See* cell.

animal charcoal (bone black, bone char) A substance obtained by charring animal material, especially bones.

animal pole 1. The region of an egg cell containing the nucleus and clear, active cytoplasm. 2. The side of a blastula where micromeres collect. *Compare* vegetal pole.

animal starch *See* glycogen.

anion An atom or group of atoms carrying a negative electrical charge. In the presence of an electric field, e.g. in electrolysis, an anion moves towards the positive electrode, the anode. *Compare* cation.

anneal To harden metals and glass by heating followed by slow cooling. The process also relieves strains in the material.

Annelida (Annulata) A phylum of ringed or segmented worms. Examples include earthworms and leeches. *See also* chaeta.

annual plant A plant which completes its life-cycle from seed germination to seed production and subsequent death in one year, e.g. maize.

annual ring The growth of secondary xylem (wood) in the stem of a woody plant in a temperate climate during one year. Annual rings appear as a series of concentric lines (rings) in a cross-section of a stem. One light ring and one darker ring are produced each year. From the number of annual rings the approximate age of the plant may be determined.

Annulata *See* Annelida.

anode The positive electrode of an electrolytic cell or discharge tube. *Compare* cathode.

anodise To produce a layer of oxide on the surface of metals by making the metal the anode in an electrolytic bath. The process hardens the surface of the metal, makes it more resistant to corrosion and enables it to absorb dyes.

anomalous expansion of water The irregular expansion of water. In the temperature range 0–4°C, water decreases in volume with increasing temperature, reaching its maximum density at 4°C. Above 4°C water expands when heated. *See* Appendix.

ANS *See* autonomic nervous system.

ant *See* Hymenoptera.

antabuse An organic drug containing several sulphur atoms which is used in the treatment of chronic alcoholism. It interferes with the normal metabolism of alcohol, resulting in the