

VAN NOSTRAND  
CHEMIST'S  
DICTIONARY

中外科學書社

# THE VAN NOSTRAND CHEMIST'S DICTIONARY

---

## < BOARD OF EDITORS >

JURGEN M. HONIG, PH.D.

*Assistant Professor of Chemistry at Purdue University*

MORRIS B. JACOBS, PH.D.

*Director of Laboratories, Department of Air Pollution Control, N.Y.C.*

S. Z. LEWIN, PH.D.

*Assistant Professor of Chemistry, Washington Square College,  
New York University*

WILLIAM R. MINRATH, CH.E.

*Vice-President, D. Van Nostrand Company, Inc.*

GEORGE MURPHY, PH.D.

*Chairman, Department of Chemistry, Washington Square College,  
New York University*

MACMILLAN AND CO. LIMITED  
ST. MARTIN'S STREET, LONDON

1954

**The Van Nostrand Chemist's Dictionary, 1954**

---

主 編	Honig, Jacobs, Lewin & Murphy,
影 印	中 外 科 學 書 社
發 行	上海淮海中路671號 電話: 79088
照 相	聯 義 印 刷 廠
印 刷	
裝 訂	根 記 裝 訂 所
定 價	捌 元 捌 角 伍 分 (¥8.85)

---

1955 年 4 月初次照相印 31"×43" 1/20 (印數) 1—500

## PREFACE

THE CHEMIST'S DICTIONARY is designed to provide the widest possible coverage of the terms in which chemists are most commonly interested. The book includes, therefore, definitions of all the group terms of chemical substances; the elements, the ions, the radicals, the type-compounds and the classes of chemical substances are defined in light of present-day nomenclature. The book also gives definitions of the laws, reactions, mathematical equations and fundamental entities; the presentation extends into physics and other sciences when necessary to meet the needs of the chemist. Proper names are included as well as common names—a policy that has been followed not only in regard to the scientific terms, but for the many applications of chemistry.

A feature that facilitates ready reference is the **KEY WORD PLAN** of indexing. Each topic is defined as far as possible in basic terms, and then every word important to the explanation that is further defined elsewhere in the book is printed in bold-face type to serve as a reference to the article on that subject.

The applications of chemistry include names of industrial processes and plant and laboratory equipment. Coverage of definitions of the chemical tests, solutions, and reagents is provided. Since very many important tests and solutions, as well as laws, equations and reactions, are best known by the names of the men to whom they are accredited, the large number (more than 5000) of proper-name entries are a valuable feature of this book. Both the common-name and the proper-name terms basic to many phases of pure and applied chemistry are brought together for convenient reference.

While the inclusion of the terms of applied chemistry, even though they number several thousand, has required the most exacting and often arbitrary selections, the result will be, it is hoped, sufficiently useful to the vast majority of chemists to justify the obvious omissions if the book is viewed from the standpoint of a single, highly specialized field. In fact, the primary objective of this Dictionary is to furnish to the specialist in any one field the information in all fields up to the level of the specialist. To accomplish this purpose the definitions have been written, as far as possible, in the most commonly used terms; atomic entities, for example, are discussed either in the language of quantum mechanics or the "classical language" in accordance with the most common usage of the particular term. The same pragmatic viewpoint has determined the other editorial policies in the preparation of the book; structural formulas are employed only when necessary to clarify the structure of the compound or the course of the reaction under discussion. The numerical values of the various fundamental and derived constants are those deemed the best single values at

the time of writing. The definitions of the terms range in length from a few words to comprehensive articles, several pages long.

The Editors wish to acknowledge their indebtedness to all those who have assisted in the many tasks involved in the preparation of this Dictionary, not the least of which has been the choice of the terms to be included. The Editors sincerely trust that the chemists who use this book will feel free to communicate their comments on the selections that have been made or the scope of their treatment.

THE EDITORS

A. Symbol for the element argon (A). Symbol for the Angstrom unit ( $\text{\AA}$ ). Symbol for van der Waals constant ( $a$ ). Symbol for acceleration ( $A$  or  $a$ ). Symbol for activity ( $a$ ). Symbol for specific rotation  $[\alpha]$ . Symbol for accommodation coefficient ( $a$ ). Symbol for refracting angle of a prism ( $A$ ). Symbol for amplitude ( $A$ ). Symbol for area ( $A$ ). Symbol for atomic weight ( $A$ ). Symbol for Helmholtz function, or maximum isothermal work function: per atom or molecule,  $a$  or  $a_m$ , per mole,  $a$ ,  $A$ , or  $A_M$ , per unit mass,  $a$ , total value  $A$ . A factor in Richardson equation  $A$ . Symbol for width of slit (transparent portion)  $a$ . See also alpha.

**ABBE THEORY.** A relationship derived for the limiting width of an object visible under the microscope, which is expressed as directly proportional to the wave length of the light, and inversely proportional to the aperture.

**ABDERHALDEN-KAUTZSCH TEST REACTION.** On treatment with an ammoniacal copper solution, pyrrolidone carboxylic acid gives a precipitate, then a deep blue solution.

**ABDERHALDEN REACTION.** A serum test used in medical diagnosis, especially in pregnancy.

**ABDERHALDEN TEST REACTION FOR CYSTINE.** Treatment of cystine with  $\beta$ -naphthalene thiochloride and sodium hydroxide solution yields naphthalene-sulfocystine.

**ABDERHALDEN-SCHMIDT REAGENT.** A solution of 0.1 g. ninhydrin in 300 ml. water, used in testing for adrenalin, for proteins and for hydrolysis products derived from proteins. A blue color, obtained on warming a solution of the substance with a small quantity of the reagent, is given by these compounds.

**ABDERHALDEN-WEIL TEST REACTION.** Glutamic acid gives a blue color with ninhydrin.

**ABEGG RULE.** If the maximum positive valence exhibited by an element be numerically added to its maximum negative valence, there appears to be a tendency for the sum to equal 8. This tendency is exhibited especially by the elements of the 4th, 5th, 6th, and 7th groups and is known as the Abegg rule.

**ABEL-PENSKY APPARATUS.** A closed apparatus used in determining the flash point of liquids. (See also Pensky-Martens Apparatus.)

**ABEL REAGENT.** A solution of chromic acid (10%  $\text{CrO}_3$ ) used as an etching reagent in metallography.

**ABEL TEST REACTIONS FOR ETHYL SULFIDE.** (1) Upon addition of mercuric chloride to the aqueous or alcoholic solution of ethyl sulfide, the addition product (m.p.  $119^\circ\text{C}$ .) precipitates. (2) Ethyl sulfide in sulfuric acid solution gives with 1 drop normal aqueous iodine solution a precipitate of the iodine addition product, which settles as oily, brown drops.

**ABELIN TEST FOR ARSPHENAMINE.** Arsphenamine in aqueous solution containing a few drops hydrochloric acid gives with  $\frac{1}{2}\%$  aqueous sodium nitrite solution a greenish yellow fluorescent liquid, which becomes red when added to an alkaline 10% resorcinol solution.

**ABENSOUR TESTS FOR QUININE.** (1) To a quinine solution, bromine water is added until the fluorescence disappears, then the addition of an equal volume of ethyl alcohol and two drops of ammonia produces a green color.

(2) 10 ml. of slightly acid quinine solution, with 1 drop bromine water, 1 drop potassium ferrocyanide solution, and 1 drop 10% ammonia gives to chloroform, after shaking, a pink to red color.

**ABERRATION, CHROMATIC.** Unequal refraction of beams of radiation of more than one frequency producing a certain degree of dispersion.

**ABERRATION, SPHERICAL.** Unequal refraction of radiation attributable to



variation in the degree of curvature of the medium, resulting in distortion of the image produced.

**ABRAHAM THEORY.** A mathematical analysis yielding the relationship:

$$M = \frac{3M_0 \left( \frac{1+B^2}{2B} \cdot \log \frac{1+B}{1-B} - 1 \right)}{4B^2}$$

where  $M_0$  = electromagnetic mass of the electron for infinitely small velocities;  $M$  = transverse mass for a velocity  $v$ ;  $\frac{v}{c} = B$  in which  $c$  is the velocity of light.

**ABRAHAMSON REAGENT.** A reagent prepared by mixing a solution of 11.1 g. sodium tungstate dihydrate and 5 g. sodium citrate in 700 ml. water; with a solution of 13.6 g. sodium hydrogen sulfate in 200 ml. water. It is made up to 1 l., and is used to precipitate proteins from blood.

**ABRASION.** Erosion or grinding by friction, or shearing action.

**ABRASIVE.** A material used for wearing away a surface by friction, as in polishing. Sandpaper, steel wool, emery, and pumice are abrasives.

**ABSCISSA.** The distance between points measured along a horizontal scale; commonly the coordinate of the distance of a point from an origin, measured along the  $x$ -axis.

**ABSOLUTE.** Independent or unlimited, as an absolute condition, or completely pure or unadulterated, as a perfume base or alcohol.

**ABSOLUTE DENSITY.** See density, absolute.

**ABSOLUTE HUMIDITY.** See humidity, absolute.

**ABSOLUTE PRESSURE.** See pressure, absolute.

**ABSOLUTE TEMPERATURE.** See temperature, absolute.

**ABSOLUTE TEMPERATURE SCALE.** See temperature scale, absolute.

**ABSOLUTE UNIT.** See unit, absolute.

**ABSOLUTE ZERO.** The temperature at which the volume of an ideal gas would become zero. The value calculated from the limiting value of the coefficient of expansion of various real gases is  $-273.16^\circ \text{C}$ .

**ABSORBANCE.** The logarithm to the base 10 of the reciprocal of the transmittance. Generally, pure solvent is the reference material.  $A = \log_{10}(1/T)$ . See Law of Beer.

**ABSORBENT.** A substance, material, or solution able to imbibe, or "attract into its mass," or trap liquids or gases, commonly to remove them from a given medium or region.

**ABSORBENT, GAS.** A substance, solution, or mixture used for the selective absorption of gases, as in gas analysis or purification.

**ABSORBENT, LIGHT.** A substance or material that transmits radiations of some frequencies and absorbs others.

**ABSORPTIOMETER.** A graduated tube, closed at one end, used for the analysis of gases, performed by introducing an absorbing agent and noting the decrease in volume at constant pressure of the contents of the tube. Often incorrectly termed an eudiometer. Also an apparatus used to control the thickness of a film of liquid in spectrophotometry.

**ABSORPTION.** The imbibing or attracting into its mass of one substance (or form of energy) by another substance so that the absorbed substance or energy disappears physically. The phenomenon may be due to either molecular or chemical action. It is not to be confused with "adsorption" which is characterized by surface tension and condensation. In physiology, the term absorption connotes the conversion of ingested materials into part of the organism.

**ABSORPTION APPARATUS.** Certain forms of apparatus used especially in gas analysis by means of which a portion of the sample under examination is absorbed and its quantity subsequently determined.

**ABSORPTION BAND.** A region of the absorption spectrum in which the absorptivity passes through a maximum or inflection.

**ABSORPTION CELL.** A glass vessel used to hold liquids for the determination of their absorption spectra.

**ABSORPTION COEFFICIENT OF GASES.** In general, the volume of gas dissolved by a specified volume of solvent. A widely-used coefficient is the volume of gas, reduced to standard conditions, dissolved by unit volume of solvent when the partial pressure of the gas is one atmosphere.

**ABSORPTION COEFFICIENT, LINEAR.** A substance is said to possess a linear absorption coefficient if, in traversing a very small distance through the absorbing medium, the change of intensity of the incident radiation is proportional to the (small) distance traversed. Under these conditions the intensity of the emerging radiation falls exponentially with the thickness of the medium.

**ABSORPTION COEFFICIENT, MASS.** The quantity obtained by dividing the linear absorption coefficient (see absorption coefficient, linear) by the density of the absorbing medium.

**ABSORPTION COEFFICIENT OF LIGHT, MOLAR.** A constant that appears in one of the forms of statement of the Law of Beer (q.v.), which relates the light intensity at a selected frequency passing through a solution to the concentration of solute and the thickness of the absorbing layer. In the quantitative expression of Beer's law,  $I = I_0 e^{-\alpha cd}$ ,  $I$  is the intensity of light transmitted and  $I_0$  is the intensity of incident light (both for a given wave length);  $e$  is the natural logarithmic base;  $c$  is the concentration of the solution in moles per liter;  $d$  is the thickness of the transmitting layer; and  $\alpha$  is the molar absorption coefficient.

**ABSORPTION FACTOR.** In any absorbing system, especially in the case of absorption of radiation, the ratio of the total unabsorbed radiation to the total incident radiation, or to the total radiation transmitted in the absence of the absorbing substance. Cf. absorptivity.

**ABSORPTION LAGOON.** An artificial pond, used as a basin for the disposal of industrial waste water. The size must be sufficiently great, in relation to the porosity of the soil, that the loss of water by evaporation and ground infiltration is at least equal to the average inflow.

**ABSORPTION OF GASES.** The solution of gases in liquids is termed absorption. Such solutions obey the laws of Dalton and Henry (q.v.) unless the dissolved gas reacts with the solvent or forms a constant-boiling mixture with it.

**ABSORPTION OF LIGHT.** When a compound beam of light is passed through a medium, one or more of the component frequencies may disappear, so that the light which issues from the medium is changed in composition. The frequencies which have disappeared are said to have been absorbed. The property of absorbing certain frequencies is characteristic of a large number of substances and is a function of their constitution.

**ABSORPTION PAPER.** A specially-prepared filter paper used in fat determination.

**ABSORPTION SPECTRUM.** See spectrum, absorption.

**ABSORPTION TUBE.** An apparatus for the absorption of gases, totally or selectively.

**ABSORPTION VALUE.** See iodine value.

**ABSORPTION, UNILATERAL AND BILATERAL.** The degree of absorption of light in absorbent media varies with the wave length of the light. When the absorption increases or decreases steadily with the wave length, the condition is termed unilateral absorption; when, how-



ever, there occurs a minimum absorption at a certain frequency or frequency range with increased absorption at higher or lower frequencies, the condition is termed bilateral absorption.

**ABSORPTIVE POWER.** A mathematical expression of the capacity of a substance to absorb another substance or form of energy: absorption being defined as the apparent disappearance of the second substance, or the form of energy, into the first substance. When applied to radiant energy, this term denotes the fraction of the radiant energy incident upon a surface which is absorbed, and transformed into heat. The reciprocal term is reflective power.

**ABSORPTIVITY.** The ratio of the absorbance to the product of concentration and length of optical path. It is the absorbance per unit concentration and thickness — i.e., the specific absorbance. (See *Law of Beer*.)

**ABSORPTIVITY, MOLAR.** The absorptivity expressed in units of liter/(mole cm.); the concentration is in mole per liter and the cell length in centimeters.

**ABUNDANCE RATIOS.** The proportions of the various isotopes making up a particular specimen of an element.

**ABUNDANCE OF ELEMENTS.** The percentage distribution of the elements in the earth or the earth's crust. Tables have been prepared showing separately this distribution of the elements in the solid portion of the earth (commonly in the crust), in the liquid portion of the earth (i.e., oceans, seas, etc.), and in the gaseous portion of the earth (i.e., the atmosphere).

**Ac** (1) Symbol for the element actinium. (2) The prefix *ac-*, commonly italicized, is used as an abbreviation for *alicyclic*. (3) Abbreviation for *acetyl*, *acyl*, or *acetate*.

**ACCELERATION.** The rate of change of the velocity of an entity or a chemical reaction. When the acceleration is positive the reaction is increasing in velocity; when negative, the reaction is diminishing in velocity.

**ACCELERATOR.** (1) In general, any agent which increases the speed of a chemical reaction, but the term is used today in a more restricted sense. It is applied, for example, to materials used in the rubber industry to increase the speed of vulcanization and to improve the quality of the product; to substances used to increase the effectiveness of catalysts, which are better known as *promoters* (q.v.); and to substances used to increase the speed of a penetrant, which are better known as *introfiors* (q.v.).

(2) A particle accelerator, an apparatus which gives charged particles high speeds and imparts large amounts of energy. See *betatron*, *cyclotron*, *synchrotron*, etc.

**ACCEPTOR.** (1) A substance whose rate of reaction with another substance is accelerated by the occurrence of a reaction in which the second substance is involved. (2) An electron acceptor (q.v.).

**ACCESSORY FACTOR.** See *vitamin*.

**ACCOMMODATION COEFFICIENT.** A quantity defined by the equation:

$$a = \frac{T_3 - T_1}{T_2 - T_1}$$

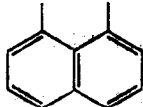
where  $T_1$  is the temperature of gas molecules striking a surface which is at temperature  $T_2$ , and  $T_3$  is the temperature of the gas molecules as they leave the surface,  $a$  is the accommodation coefficient. It is, therefore, a measure of the extent to which the gas molecules leaving the surface are in thermal equilibrium with it.

**ACCUMULATION COEFFICIENT.** A term sometimes used specifically to denote the rate of increase in the concentration of adsorbed molecules upon a surface, in relation to the concentration of that molecular species in the phase in contact with the surface.

**ACCUMULATOR.** See *cell*, *secondary*.

**ACE-** A word fragment derived from *acetic*, as used in *acennaphthene*.

**ACENAPHTHENYL.** The radical  $C_{12}H_9^-$ , derived from acenaphthene,  $H_2C-CH_2$ .



**ACET-.** Prefix denoting the presence of the radical  $CH_3C=$ .

**ACETAL.** A dialkyl ether of a hypothetical glycol. These glycols, if they existed, would contain two hydroxyl groups attached to one carbon atom, as occurs in chloral hydrate. Acetals are formed by the union of two alcoholic molecules with one of an aldehyde.

**ACETAMIDO.** The radical  $CH_3CONH-$ .

**ACETATE.** An ester or salt of acetic acid containing the radical  $CH_3COO-$ .

**ACETATE PROCESS.** A process for the preparation of a synthetic fiber from cotton linters, wood pulp, and other sources of cellulose. The material is acetylated, dissolved in acetone, and forced through spinnerets into a coagulating solution.

**ACETENYL.** See ethynyl.

**ACETIC.** Related to acetic acid,  $CH_3COOH$ .

**ACETIFIER.** Equipment used for the production of acetic acid, commonly by accelerated oxidation of fermented organic materials.

**ACETIMETER.** An instrument for acetimetry (q.v.).

**ACETIMETRY.** The process of determining the acetic acid strength of a solution.

**ACETIMIDO.** The radical  $CH_3C(:NH)-$ .

**ACETO-.** Prefix denoting the presence of the radical  $CH_3CO-$ .

**ACETOACETIC.** Related to acetoacetic acid,  $CH_3 \cdot CO \cdot CH_2 \cdot COOH$ .

**ACETOACETIC ESTER CONDENSATION.** See condensation, acetoacetic.

**ACETOLYSIS.** Reaction with a substance containing an acetyl group, as acetic acid or acetic anhydride. A decomposition reaction in which one of the reacting substances breaks up so as to yield an acetyl radical. Symbolically, a reaction of the type  $AB + CAc = AAc + CB$ , in which A, B, and C are various radicals, and Ac is the acetyl group,  $CH_3CO-$ .

**ACETOMETER.** Apparatus used in acetimetry (q.v.).

**ACETONE NUMBER.** The weight of a substance insoluble in acetone ( $CH_3-CO-CH_3$ ), useful in estimating the degree of polymerization and certain other properties of organic materials.

**ACETONITRIOLIC.** Related to acetonitriolic acid,  $CH_3(NO_2)C=NOH$ .

**ACETONYL.** The radical  $CH_3COCH_2-$ .

**ACETONYLIDENE.** The radical



**ACETOXY.** The radical  $CH_3COO-$ .

**ACETYL.** The radical  $CH_3CO-$ .

**ACETYL NUMBER OR VALUE.** A constant determined in oil and fat analysis, by treating the sample with acetic anhydride, saponifying the product, and titrating the acetic acid obtained, with potassium hydroxide. Specifically, the number of milligrams of potassium hydroxide required to neutralize the acetic acid liberated by saponification from 1 g. oil, fat, or wax acetylated with acetic anhydride.

**ACETYLACETONE REAGENT.** A solution of 0.5 g. acetylacetone in 100 g. alcohol or water, used as a test reagent for ferric iron. An orange-red color, best obtained in slightly acid solution, indicates the presence of ferric iron.

**ACETYLAMINO.** The radical  $CH_3CONH-$ .

**ACETYLATION OR ACETYLIZATION.**

A reaction or process whereby an acetyl radical,  $\text{CH}_3\text{CO}-$ , is introduced into an organic compound. Reagents often used for acetylation are acetic anhydride, acetyl chloride, acetic acid, etc.

**ACETYLBENZOIC.** Related to acetylbenzoic acid,  $\text{CH}_3 \cdot \text{CO} \cdot \text{C}_6\text{H}_4 \cdot \text{COOH}$ .

**ACETYLENE.** The compound  $\text{CH}:\text{CH}$ , which is the first member of the **acetylene series** (q.v.). The radical  $=\text{CHCH}=\text{}$  is sometimes termed the acetylene radical, as in acetylene tetrachloride,  $\text{Cl}_2\text{CHCHCl}_2$ , tetrachloroethane.

**ACETYLENE SERIES, ALKYNES.** A series of unsaturated hydrocarbons having the general formula  $\text{C}_n\text{H}_{2n-2}$ , and containing a triple bond between two carbon atoms, as  $-\text{C}\equiv\text{C}-$ . The name of the series is that of the simplest member, acetylene ( $\text{HC}\equiv\text{CH}$ ). The members of this series are also designated by changing the "yl" termination of the alcohol radicals of like carbon content to "yne"; e.g., acetylene,  $\text{C}_2\text{H}_2$ , is thus named ethyne; propylene,  $\text{C}_3\text{H}_4$ , is named propyne; butylene, or crotonylene,  $\text{C}_4\text{H}_6$ , is named butyne, etc.

**ACETYLFORMIC.** See pyruvic.

**ACETYLIDE.** The anion  $\text{C}_2^-$  or  $\text{HC}_2^-$ , or a compound containing one of these anions.

**ACETYLSALICYLIC.** Related to acetylsalicylic acid,  $\text{CH}_3\text{COO} \cdot \text{C}_6\text{H}_4\text{COOH}$ .

**ACHROMATIC.** Transmitting white light without resolution; or correcting such resolution as has already been caused by lenses and other optical elements or systems.

**ACHROMATIC CONDENSER.** See condenser, achromatic.

**ACHROMIC.** Free from color.

**ACHROMIC PERIOD.** The time required for complete fermentation of starch, as shown by its failure to produce a blue color with iodine. This period is used as a measure of enzymatic activity, with a standard starch solution, commonly 1%, in water.

**ACI-.** A prefix used to indicate the acid form, as aci-acetoacetic ester.

**ACICULAR.** Shaped like a needle.

**ACID.** I. Any substance that may ionize in solution to yield hydrogen ions, or, in more general terms, any substance that acts as a 'proton — hydrogen ion — donor. II. Any substance that contains hydrogen capable of being replaced by basic radicals. Acids are classified as monobasic, dibasic, tribasic, polybasic, etc., according to the number (one, two, three, many, etc.) of hydrogen atoms, replaceable by bases, contained in a molecule. They are further classified as (1) organic when the molecule contains carbon; (2) normal, if they are derived from nitrogen, phosphorus, or arsenic, and contain three hydroxyl groups; (3) ortho, meta, or para, according to the location of the carboxyl group in relation to another substituent in a cyclic compound, or (4) ortho, meta, or pyro, according to their composition.

**ACID, ALICYCLIC.** See alicyclic acid.

**ACID AMIDE.** Any organic compound containing the formamyl group  $-\text{CONH}_2$ . The general formula is  $\text{RCONH}_2$ , in which R is an organic radical in all cases except that of the simplest acid amide, formamide,  $\text{HCONH}_2$ .

**ACID ANHYDRIDE.** A compound derived from an acid by the elimination of one or more molecules of water from one or more molecules of the acid. The corresponding acids may commonly be regenerated from them by the addition of water, the process being often accompanied by an evolution of heat. In the early periods of chemical theory, the acid anhydrides were regarded as the true acids; e.g.,  $\text{SO}_3$  was considered the formula of sulfuric acid.

**ACID CAPACITY.** The neutralizing power of a base expressed as the number of hydroxyl ions available per molecule.

**ACID CHLORIDE.** A compound containing the radical  $-\text{COCl}$ .

**ACID DYE OR STAIN.** Dyes or stains of an acidic nature, or those which require an acid to set them. This term "acid stain" is often applied to water-soluble stains.

**ACID EGG.** An egg-shaped vessel of fitted heavy construction with appropriate piping which is used to move or raise corrosive liquids by the application of air pressure.

**ACID ESTER.** An ester of a polybasic organic acid in which one or more of the acidic hydrogen atoms are free, i.e., not replaced.

**ACID-FORMING ELEMENT.** See element, acid-forming.

**ACID FUNCTION.** Proton or hydrogen ion.

**ACID GROUP, CARBOXYLIC.** The radical  $-\text{COOH}$ .

**ACID HALIDE.** A compound containing the radical  $-\text{COX}$ , in which X is a halogen atom.

**ACID, HALOID.** An acid that contains no oxygen, but is composed of hydrogen and a halogen element.

**ACID HEAT.** The heat of reaction with an acid; a term used specifically to denote the heat formed in the reaction of organic compounds with sulfuric acid, an approximate measure of their degree of unsaturation.

**ACID HYDRAZIDE.** A compound containing the radical  $-\text{CONHNH}_2$ .

**ACID HYDROGEN.** The hydrogen atom in the acid group  $-\text{COOH}$ .

**ACID ION.** An ion which combines with one or more protons (hydrogen ions) to form molecules of acids.

**ACID NUMBER.** A term used in the analysis of fats or waxes to designate the number of milligrams of potassium hydroxide required to neutralize the free fatty

acids in 1 g. of substance. The determination is performed by titrating an alcoholic solution of the wax or fat with tenth or half-normal alkali, using phenolphthalein as indicator.

**ACID PEROXIDE.** A compound containing the radical  $-\overset{\text{O}}{\underset{\text{||}}{\text{C}}}-\text{O}-\text{O}-\overset{\text{O}}{\underset{\text{||}}{\text{C}}}-$ .

**ACID PUMP.** Any pump of resistant materials used to pump acids; or a special small pump used to fill or empty shipping containers used for acids.

**ACID RADICAL.** (1) The portion of the acid molecule apart from the hydroxyl group. Thus,  $-\text{NO}_2$  is the acid radical of nitric acid. (2) The negative ion of an acid, i.e.,  $\text{SO}_4^-$ ,  $\text{Cl}^-$ .

**ACID SALT.** A salt of a polybasic acid, in which not all of the acidic hydrogen atoms have been neutralized.

**ACID SOLUTION.** A solution having a pH value less than 7.0.

**ACID SULFATE.** A compound contain-

ing the radical  $\begin{array}{c} \text{O} \quad \text{OH} \\ \diagdown \quad \diagup \\ \text{S} \\ \diagup \quad \diagdown \\ \text{O} \quad \text{O}- \end{array}$  or yielding the ion  $[\text{HSO}_4]^-$ .

**ACID VALUE.** The acidity of a solution, commonly in terms of normality. Also see acid number.

**ACIDIC SOLVENT.** A solvent which is strongly protogenic, i.e., which has a strong tendency to donate protons and little tendency to accept them. Liquid hydrogen chloride and hydrogen fluoride are acidic solvents, and in them even such normally strong acids as nitric acid do not exhibit acidic properties, since there are no molecules which can accept protons; but, on the contrary, behave to some extent as bases by accepting protons yielded by the dissociation of the  $\text{HCl}$  or the  $\text{H}_2\text{F}_2$ .

**ACIDIFY.** To increase the acidity of a solution or other system, commonly by adding acid, until the pH reaches a value less than 7.0.

**ACIDIMETER.** (Obs.) A term formerly applied to a form of **hydrometer** used to determine the specific gravity of acid liquids.

**ACIDIMETRY.** The process of determining the amount of an **acid** present in a sample by titration against a standard alkaline solution; or, more broadly, the system of analysis by **titration** whose end point is recognized by a change in **hydrogen ion** concentration.

**ACIDITY.** The amount of **acid** present, expressed for a solution either as the molecular concentration of acid, in terms of normality, molality, etc., or the ionic concentration (hydrogen ions or **protons**) in terms of **pH** (the logarithm of the reciprocal of the hydrogen ion concentration). The acidity of a **base** is the number of molecules of monoatomic acid which one molecule of the base can neutralize.

**ACIDITY, DEGREE OF.** The hydrogen ion concentration of an acid.

**ACIDOPHILE.** Easily stained by acid dyes. This term is used commonly in bacteriology, biology, and medicine.

**ACID, PSEUDO.** See **pseudo acid**.

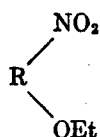
**ACIDULATE.** See **acidify**.

**ACIDYLATE.** See **acylate**.

**ACIDYLATION.** See **acylation**.

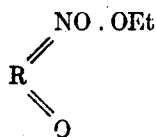
**ACI-NITRO.** See **isonitro**.

**ACI-NITRO COMPOUND.** One of a class of **isomers** of true **nitro compounds**, in which one of the two oxygen atoms that are joined to the nitro nitrogen by a double bond has become joined by one valence bond to another atom or radical, as by a **tautomeric shift** within the molecule. The nitrogen atom is then joined to the molecule by a double, instead of a single bond.



True nitro compound

Cf. **acid pseudo**.



Aci-nitro compound

**ACKER PROCESS.** A method of manufacturing sodium hydroxide from molten salt by **electrolysis**, with the addition of steam, and a cathode of molten lead.

**ACKERMANN TEST FOR GUANIDINE.** On heating 3 parts guanidine with 30 parts water, 6 parts 33% sodium hydroxide, and 4 parts benzenesulfonylchloride, white needles (m.p. 212° C.) are obtained.

**ACKERMANN TEST FOR THIO- $\beta$ -TOLYL- $\beta$ -NAPHTHYLAMINE.** With concentrated sulfuric acid a violet-blue color is formed, changed to red-violet by addition of nitric acid.

**ACME BURNER.** A special type of Bunsen burner.

**ACREE-ROSENHEIM TEST REACTION.** A test for **proteins** and **tryptophane** characterized by the formation of a purple ring in the interface between a solution of the sample containing formaldehyde and a layer of concentrated sulfuric acid.

**ACRIDYL.** The radical  $\text{C}_{13}\text{H}_9\text{N}-$  (from **acridine**).

**ACRINYL.** The radical *p*-hydroxybenzyl,  $\text{OH}-\text{C}_6\text{H}_4-\text{CH}_2-$ .

**ACROMETER.** A special hydrometer used for oils.

**ACRYL.** The radical  $-\text{CH}:\text{CHCHO}$  or  $\text{CH}_2:\text{C}(\text{CHO})-$ .

**ACRYLIC.** (1) Related to **acrylic acid**,  $\text{CH}_2:\text{CH}.\text{COOH}$ . (2) Related to one of a series of **acids** of the type formula,  $\text{C}_n\text{H}_{2n-1}\text{COOH}$ .

**ACRYLYL.** The radical  $\text{CH}_2:\text{CHCO}-$ .

**ACTINIC RAYS.** Radiations effective in producing chemical changes and biological action. This term is usually applied to the violet and ultraviolet portion of the **electromagnetic spectrum** which consists of radiations relatively effective in causing these changes, as contrasted with radiation in the long wave-length portion of the spectrum.

**ACTINIDE SERIES.** A term derived by analogy to the lanthanide series (q.v.), to denote elements of mass number 89-98 inclusive, actinium, thorium, protactinium, uranium, neptunium, plutonium, americium, curium, berkelium, and californium. The justification for this grouping is found in the existence in the higher elements of (III) oxidation states similar to actinium, and (IV) oxidation states similar to thorium. Certain similarities also exist between the atomic spectra and magnetic properties in the two series.

**ACTINIUM.** Radioactive element. Symbol Ac. Atomic number 89. It is a member of the actinium family in which it occurs as an atomic species of mass number 227, and a half-period of 21.7 years. It is formed from protactinium by  $\alpha$ -particle emission and emits in turn a  $\beta$ -particle to form radioactinium. Isotopes of actinium include mesothorium 2 which has a mass number of 228 and a half-period of 6.14 hours. It is a member of the thorium series being formed from mesothorium 1 by  $\beta$ -particle emission, and forms in turn, radiothorium, also by  $\beta$ -particle emission. Other actinium isotopes are known with mass numbers 222, 223, 224, 225, 226, 227, and 230. Valence 3.

**ACTINIUM SERIES.** See element, radioactive series.

**ACTINOMETER.** An instrument which measures the intensity of photochemically active radiation, by determining the fluorescence of a screen or the extent of a chemical decomposition reaction initiated by the incident radiation.

**ACTINOMETRY.** The determination of the photochemical intensity of light.

**ACTINON.** Isotope of radon. Symbol An. Atomic number 86. Mass number 219. Half-period 3.92 seconds. Produced as an emanation of actinium. See radioactive elements.

**ACTION.** As a physical concept, action is an expression for the product of twice the mean total kinetic energy of a system of particles, during a specified interval of

time, by the length of the interval. It is expressed by

$$S = 2 \int_{t_0}^{t_1} E_K dt,$$

in which  $E_K$  is the kinetic energy and  $t_0$  and  $t_1$  are the times of beginning and ending of the interval. Planck's constant  $h$  is the designation of the elementary quantum of action.

Maupertuis enunciated a law, known as the "principle of least action," which states that when a dynamic system is left to itself, unaffected by outside forces, so that its total energy cannot alter, any spontaneous change within the system takes place in such fashion that the action has the least possible value during the interval covered by the change.

In chemistry, the term action is frequently used as a synonym for reaction (q.v.).

**ACTION, INTERMOLECULAR, PRINCIPLE OF.** In determining the constitution of molecules by studying their decomposition products, it is assumed that radicals found in the cleavage products occupy contiguous positions in the original substance. This principle applies in such cases as the resolution of atropine into tropine and tropic acid.

**ACTIVATED ADSORPTION.** See adsorption, activated.

**ACTIVATED ATOM.** See atom, activated.

**ACTIVATED MOLECULE.** See molecule, activated.

**ACTIVATED SLUDGE.** A sediment produced by sewage, which contains various bacteria effective in breaking up organic materials, and therefore useful in breaking up and partly digesting fresh sewage, as in the activated sludge process.

**ACTIVATION.** The transformation of any material into a more reactive form, or into a form in which it functions more effectively, as in the regeneration of a metallic or inorganic catalyst, the transformation of an enzyme from inactive form



to active form, the treatment of various forms of finely-divided silica or carbon to render them more adsorbent, and the excitation of atoms or molecules.

**ACTIVATION ANALYSIS.** A method of analysis by means of isotopes in which a small quantity of an element that is difficult to determine is exposed to activating particles (e.g., deuterons in a cyclotron or neutrons in a nuclear reactor). One or more of the stable isotopes of the element are thus converted to radioisotopes which can be detected by their characteristic radiations and half-lives. By treating similarly a comparison sample containing a known proportion of the given element the analysis can be made quantitative.

**ACTIVATION ENERGY.** The excess energy over the ground state which must be acquired by molecules in order to take part in a particular reaction. The most common source of this additional energy is believed to be energy interchange occurring in collisions.

**ACTIVATION, ENTROPY OF.** The difference in entropy between the activated complex and the reactants, all of which are referred to their standard states. This quantity occurs in certain equations developed in the application of the theory of absolute reaction rates.

**ACTIVATION, HEAT.** The difference in heat content between the activated complex and the reactants, all of which are referred to their standard states.

**ACTIVATOR.** A substance which renders a material or a system active; commonly a catalyst (q.v.). A special use of this term occurs in the flotation process, where an activator assists the action of the collector (q.v.).

**ACTIVE.** Potent, effective — especially with the connotation of in motion, or producing motion or change.

**ACTIVE ALKALI.** A general term in various processes for the total content of various alkali metal salts, often expressed as the equivalent NaOH that is available for a particular reaction.

**ACTIVE CENTER.** Atoms which by their position on a surface, such as at the apex of a peak or on the edge or corner of a crystal, share with neighboring atoms an abnormally small portion of their electrostatic field and, therefore, have a large residual field available for catalytic activity or for adsorption.

**ACTIVE DEPOSIT.** Solid radioactive material, deposited by radioactive emanations on surfaces in contact with them.

**ACTIVE EARTH.** An adsorbent prepared from a naturally occurring mineral, especially one that is found in a disintegrated solid state, i.e., as an earth.

**ACTIVE IMMUNIZATION.** Any process by which means of protection against bacteria or their products is elaborated by an organism.

**ACTIVE MASS.** Mass per unit volume, usually expressed in moles per liter (a concentration factor).

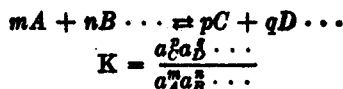
**ACTIVE OXYGEN TEST.** See oxygen test, active.

**ACTIVE PRINCIPLE.** The chemical compound, or group of compounds, to which the physiological action of a drug is attributed.

**ACTIVITY.** (1) The apparent effective concentration of a substance in a reacting system. In many relationships involving concentrations, it has been found that the use of actual concentrations does not give calculated results which agree with observed results, because of the attraction between molecules or ions due to the disturbing influence of interionic or intermolecular attraction. Consequently, in such calculations activities are used instead of concentrations. (2) The term activity is also applied to an expression of the magnitude of interionic forces. (3) Activity is also the rate at which an agent operates.

**ACTIVITY COEFFICIENT.** A multiplying factor applied to the concentrations of a component in a nonideal solution to convert to activities. This factor is a measure of the departure of the solution from ideal behavior.

**ACTIVITY CONSTANT.** In a reversible reaction which has reached equilibrium, the product of the activities of the substances produced by the direct reaction, divided by the product of the activities of the substances produced by the reverse reaction. Thus in the reaction,



where K is the activity constant.

**ACTIVITY, OPTICAL.** See optical activity.

**ACTOR.** In coupled or sympathetic reactions, the substance which takes part in both primary and secondary reactions as distinguished from the "inductor" and the "acceptor," both of which take part in but one of the reactions.

**ACYCLIC.** Not of cyclic or ring structure.

**ACYL.** An organic radical of the general formula, RCO-. These radicals are also called acid radicals, because they are often produced from organic acids by loss of a hydroxyl group. Typical acyl radicals are acetyl, CH<sub>3</sub>CO-, benzoyl C<sub>6</sub>H<sub>5</sub>CO-, etc.

**ACYLATION.** A reaction or process whereby an acyl radical (q.v.), such as acetyl, benzoyl, etc., is introduced into an organic compound. Reagents often used for acylation are the acid anhydride, acid chloride, or the acid of the particular acyl radical to be introduced into the compound.

**ACYLOIN CONDENSATION.** See condensation, acyloin.

**ADAMANTINE COMPOUND.** A compound having in its crystal structure an arrangement of atoms essentially that of diamond, in which every atom is linked to its four neighbors by covalent bonds. An example is zinc sulfide, but it is to be noted that the eight electrons involved in forming the four bonds are not provided equally by the zinc and sulfur atoms, the sulfur yielding its six valency electrons, and the zinc, two.

**ADAMKIEWICZ TEST REACTION.** Proteins dissolved in glacial acetic acid give a red-violet color and a green fluorescence when floated on concentrated sulfuric acid.

**ADAMS-HALL-BAILEY REAGENT.** A saturated aqueous solution of cobalt acetate and zinc acetate, which is then saturated with the mixture of the vapors obtained by treating copper with nitric acid. It is used as an analytical reagent for potassium and for sodium. With potassium, it gives a yellow precipitate, and with sodium, after filtration and the addition of uranyl acetate solution gives a yellowish-green precipitate.

**ADAPTOR, ADOPTER.** A piece of apparatus in the shape of a gradually narrowing tube, commonly bent in an obtuse angle, used to connect distillation and other apparatus, as a condenser and receiver.

**ADATOM.** A mobile, adsorbed atom.

**ADDITION.** See addition reaction.

**ADDITION AGENT.** A substance added to a process which, without entering into the main reaction, improves the quality or uniformity of the product.

**ADDITION COMPOUND.** See compound, addition.

**ADDITION POLYMERIZATION.** See polymerization, addition.

**ADDITION REACTION.** When two or more molecules react to produce but one product, the reaction is termed "addition" or, less commonly, a synthetical reaction. The direct union of carbon and hydrogen to produce acetylene or of sulfur and oxygen to produce sulfur dioxide are addition reactions.

**ADDITIVE COMPOUND.** See compound, additive.

**ADDITIVE PROPERTY.** A property of a system which is equal to the sum of the values of that property for the constituents of the system.

**ADDITIVITY, PRINCIPLE OF.** The properties of a solution of a strong electrolyte are the sum of the individual properties of its ions.

**ADELOMORPHIC.** Of indefinite structure.

**ADHESION.** In general, a condition in which two discrete entities or particles remain in close contact, or the force by which such a condition is maintained. Specifically, the term adhesion is often used in chemistry to denote the attraction between two unlike substances, as distinguished from cohesion, which is the internal force of attraction, molecular or otherwise, within a single substance or phase.

**ADHESION TENSION.** The work required to enlarge the surface between a solid and a liquid is called the adhesion energy, and it may be expressed as the adhesion tension in units of force per unit of surface.

**ADIABATIC.** Occurring without change in heat content, i.e., without gain or loss of heat by the system involved.

**ADIABATIC CALORIMETER.** See calorimeter, adiabatic.

**ADIABATIC ELASTICITY.** A term invented by Hugoniot to express the change of elasticity of the medium which is propagating an explosion wave, assuming that the medium is discontinuous in the vicinity of the wave.

**ADIABATIC EXPANSION.** Expansion without gain or loss of heat from outside the substance or system.

**ADIABATIC PROCESS.** Any process conducted without evolution or absorption of heat by the system involved.

**ADIACTINIC.** Not transmitting photochemically active rays.

**ADION.** An ion adsorbed on a surface that is held so that it is free to move on the surface but not away from it.

**ADIPIC.** Related to adipic acid,  $\text{COOH}(\text{CH}_2)_4\text{COOH}$ .

**ADIPYL.** The radical  $-\text{OC}(\text{CH}_2)_4\text{CO}-$ .

**ADJACENT POSITION.** In an organic compound having a ring structure, the position occupied by two or more atoms or radicals which are joined by valence forces to consecutive atoms in the ring.

**ADJUVANT.** A drug which assists the action of another drug.

**ADLER TEST REACTION FOR PENTOSE.** On heating a mixture of equal parts aniline (or toluidine) and glacial acetic acid with pentoses, an intense red color is obtained.

**ADLER TEST REACTION FOR WOOD.** On treatment with a hot solution of phenylhydrazine hydrochloride in glacial acetic acid, wood becomes green, and bark red to brown.

**ADLER TESTS FOR BLOOD.** (1) On acidulating with acetic acid an aqueous solution containing blood, and adding benzidine solution and hydrogen peroxide, a blue color is produced.

(2) Blood stains or spots on saturation with a solution of malachite green (leuco base form), and moistening with hydrogen peroxide, develop the green color of the dye.

Many modifications of these tests have been described.

**ADRIAN TEST FOR NITRITE.** Nitrites in acid solution give an orange-yellow color with guaiacol.

**ADRIAN TEST FOR OIL OF WINE.** On shaking with water, ether containing oil of wine gives a turbidity.

**ADRIAN TEST REACTION FOR ALDEHYDES.** To test ether for aldehydes, saturate with gaseous ammonia. A precipitate of aldehyde ammonia is positive. The ether must be neutral before testing.

**ADSORBATE.** A substance which is adsorbed.