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NOMECLATURE FOR ISOTOPE, NUCLEAR AND RADIOANALYTICAL
TECHNIQUES

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Preface Introduction Glossary References

PREFACE

Entries for this document originated in two ways. They have either been defined in
recent IUPAC sources (below) or, being absent in those sources are nevertheless thought
to be necessary in what would be a comprehensive glossary. The glossary on the
following pages is comprised of more than one thousand terms. Approximately half of
these have appeared in none of the previous sources. This indicates, at least to a degree,
the vitality of developments in the application of nuclear methods to problems of
chemical analysis. The list has been reviewed by members of the IUPAC Commission on
Radiochemistry and Nuclear Techniques (V.7). The intended audience includes experts,
novices, occasional users, and developers of potential new techniques or applications. In

compliance with the guidelines for drafting IUPAC recommendations, changes to the originally published definitions or recommendations have been minimal.

Any references for definitions are indicated with abbreviations coded so as to be easily recognizable (see pp. 97-98). The major reference list appears after the alphabetical entries and includes compilations of IUPAC recommendations. Previous Sources:

Compendium of Chemical Terminology: IUPAC Recommendations, V. Gold, K. L. Loening, A. D. McNaught, and P. Sehmi (1987)

Compendium of Analytical Nomenclature, 2nd ed., H. Freiser and G. H. Nancollas, Chapt. 16 "Recommendations for Nomenclature of Radiochemical Methods", Blackwell Sci., Oxford (1987)

Glossary of Terms Used in Nuclear Analytical Chemistry: Provisional, Pure & Appl. Chem. 54, 1533 (1982) Prepared by M. de Bruin

Nomenclature for Radioanalytical Chemistry: Provisional, IUPAC

Analytical Chemistry Division Commission on Analytical Nomenclature and Clinical Chemistry Division Commission on Automation and Clinical Chemistry Techniques. Prepared by R. Van Grieken, M. de Bruin, and R. Haeckel (in press)

Additional resources for seeking newer techniques included the Annual Reviews of Nuclear Science and Particle Physics; the invaluable reviews by W. Ehman, S. Yates et al. which appear in the journal Analytical Chemistry; Radiochemistry and Nuclear Methods of Analysis), by W. Ehman and D. E. Vance, John Wiley & Sons, NY (1991); and Handbook of Radioanalytical Chemistry) by J. T-lgyessy and E. Bujdosû, CRC Press, Boca Raton (1991).

In deciding on an appropriate title for this collection, the possibilities included words such as "dictionary", "glossary", "nomenclature" and "terminology". Below are definitions of these that helped the author in deciding simply on "nomenclature". The complete title "Nomenclature for Isotope, Nuclear and Radioanalytical Techniques" is meant to imply the use of isotopes, nuclear techniques and radiochemical techniques in problems of chemical analysis. There was no intention of including, for example, nuclear magnetic resonance nor mass spectrometry per se, each of which are adequately dealt with elsewhere.

Definitions (from the Oxford English Dictionary, Second Edition, Clarendon [1989]):
DICTIONARY A book of information or reference on any subject or branch of knowledge, the items of which are arranged in alphabetical order.

NOMENCLATURE The terminology of a science.

TERMINOLOGY The system of terms belonging to any science or subject; technical terms collectively; nomenclature.

GLOSSARY A list with explanations of abstruse, antiquated, dialectal or technical terms; a partial dictionary.

Suggestions from A. Gosman, A. Motl, V. MTMcka, and A. Zeman were deeply appreciated. Finally, the advice and cooperation of several fellow Commission V.7 titular and associate members and national representatives, J-P. Adloff, P. Benes, D. C. Hoffman, Y-F. Liu, V. P. Kolotov, B. F. Myasoedov, E. Roth, H. von Gunten, and I. Zvara is gratefully acknowledged.

INTRODUCTION

The introductory paragraphs to the existing glossaries on nuclear and radioanalytical techniques are quoted below as they succinctly express the thought and motivation that went into the current effort. Without these documents, the current endeavor would have been a burdensome task indeed.

Introduction from the 1982 IUPAC "Glossary of terms used in Nuclear Analytical Chemistry". "This glossary lists close to 400 terms and definitions commonly used in radiochemistry, with emphasis on radioanalytical chemistry. Part of the definitions have been taken, sometimes with minor modifications, from existing glossaries of such organizations as the International Organization for Standardization and the International Electrotechnical Commission. In cases where no acceptable definition could be found, a new definition is proposed."

Introduction from "Nomenclature for Radioanalytical Chemistry" prepared by R. Van Grieken et al. (in press). "Recently IUPAC has issued a Glossary of Terms used in Nuclear Analytical Chemistry (Pure and Appl. Chem., Vol. 54, No 8, pp. 1533-1554, 1982), listing nearly 400 terms which are of interest in nuclear analysis. In the present compilation a number of definitions from this IUPAC- Glossary have been repeated. However less emphasis was placed on terms from the realm of nuclear technology, nuclear physics and radioactivity measurements; for such terms, the Glossary should be consulted. In the present work, many new terms have been included, which are relevant in radiometric analysis, in radioimmunoassay and related techniques. As far as possible, these definitions have been taken from existing compilations by organizations active in the field of clinical chemistry, sometimes with minor modifications, while, in cases where no acceptable definition could be found, a new definition is proposed.

The choice of the terms has mostly been based on practical experience. We selected these terms which were either ambiguous or confusing hitherto, or which are not obvious or clear to beginning workers in radioanalytical chemistry.

It is hoped that the present nomenclature will be useful to chemists and physicists who use radioactivity, in any way, for the purpose of quantitative analysis, and to those working in clinical chemistry, biochemistry, nuclear medicine and related disciplines."

The glossary on the following pages includes more than 1000 entries. Of these items, just over 100 appear (as definitions or cross references to definitions) in all previous sources. However, several hundred appear in none of the previous sources. Some are omissions. Most reflect the continued, significant growth in methods and development of new techniques. Many acronyms have been included as well, a decision motivated by their proliferating utilization, unfortunately often without clarification in many publications. It is anticipated that many terms or important acronyms are missing from the list. The author would appreciate input from the practicing community. Listings with previously approved IUPAC definitions exist have kept those definitions in almost all circumstances.

The Glossary has no legal status and is not intended to serve as a basis for adjudicating on problems of definition such as might arise in litigation of any sort.

AAO Acid aluminum oxide, an inorganic ion-exchanger.

ABSOLUTE ACTIVATION ANALYSIS See activation analysis, absolute

ABSOLUTE ACTIVITY See Activity

ABSOLUTE COUNTING A measurement performed under such well-defined conditions that the absolute activity of a sample can be derived directly from the observed count rate.

ABSOLUTE FULL ENERGY PEAK See full energy peak efficiency, absolute

ABSOLUTE PHOTOPEAK EFFICIENCY See photopeak efficiency, absolute

ABSORBED DOSE See dose, absorbed

ABSORBER A substance used to absorb energy from any type of radiation . IUPAC82.

ABSORPTION (, ENERGY) A phenomenon in which radiation transfers to matter which it traverses some or all of its energy. CAN.

ABSORPTION COEFFICIENT (ENERGY) See absorption coefficient, linear

ABSORPTION COEFFICIENT, LINEAR Of a substance, for a parallel beam of electromagnetic radiation of specified energy: the quantity m in the expression mDx for the fraction of the energy removed by absorption in passing through a thin layer of thickness Dx of that substance.. In general, a specification is added of the type of

interaction in the energy absorption process (e. g. photoelectric, Compton, pair, total). For radiation consisting of charged particles, stopping power is preferred. IUPAC82..

ABSORPTION COEFFICIENT, MASS Absorption coefficient (linear) in which the layer of thickness Dx is expressed in units of mass per unit area so that the units for the quantity m are area per unit mass.

ABSORPTION CROSS SECTION For incident neutrons, the sum of all the microscopic or partial cross sections in which the incident neutron does not reappear as a product.

ABSORPTION CURVE A graph showing the relationship between the fraction of radiation absorbed and its energy, range, or wavelength. M.

ABSORPTION EDGE The energy or wavelength corresponding to a discontinuity in the absorption coefficient of a substance towards radiation . M.

ABUNDANCE, ISOTOPIC The relative number of atoms of a particular isotope in a mixture of the isotopes of an element, expressed as a fraction of all the atoms of the element. IUPAC82..

ABUNDANCE, NATURAL ISOTOPIC Of a specified isotope of an element, the isotopic abundance in the element as found in nature. IUPAC82..

ABUNDANCE RATIO, ISOTOPIC See abundance, isotopic

ACCELERATED TEST METHOD A procedure, preferably one for which a standard protocol has been developed, that is used in a laboratory to produce in a reasonably short time (days or months) effects that would otherwise be observed only over much longer times (decades to millennia). Generally this requires adjusting parameters such as temperature (and pressure), radioactive dose rate, etc., that affect the kinetics of a chemical reaction. WASTE.

ACCELERATOR A device for generating a beam of high-velocity charged particles.

ACCELERATOR MASS SPECTROMETRY A highly sensitive technique of mass spectrometry in which the sample, after ionization, is separated not only by mass but also by atomic number . To accomplish this, ions in the beam are accelerated to several MeV per mass number.

ACCEPTABLE LIMIT Limit acceptable to the regulatory body. See authorized limit . WASTE.

ACCEPTOR In a solid state detector, an atom of a substance added to a semiconductor crystal to increase the number of holes in the conduction band. M.

ACCOUNTABILITY Quantitative accounting for nuclear material, inventories, and transfers, through a system of measurements, records and reports. GNST

ACID DIGESTION In treating samples, the use of acid to chemically decompose a material into its simpler constituents (usually soluble) thereby releasing the analytes for subsequent analysis.

ACTINIDE An element which is any of the second (5f) series of f-block elements or inner transition elements commencing with actinium at atomic number 89 and ending with lawrencium at atomic number 103.

ACTINIUM SERIES The naturally occurring decay chain commencing with ^{235}U (formerly known as actino-uranium) and with ^{207}Pb as the stable end product. The mass number of each radioactive member of the actinium series is representable as $4n+3$ where n is an integer. FKKM.

ACTINOIDS See actinides

ACTINOMETER Any instrument, based on observable chemical reaction, used to measure the intensity of radiant energy. M.

ACTIVATED SLUDGE Term sometimes used with reference to radioactive effluent treatment processes employing biological slimes and sludges to concentrate the radioactive materials. NM.

ACTIVATION The process of inducing radioactivity by irradiation . In general, a specification is added of the type of incident radiation (e.g., nuclear, neutron, photon) or its energy (e. g. thermal, fast). IUPAC82..

ACTIVATION ANALYSIS A method of elemental or isotopic analysis based on the measurement of characteristic radiation) from nuclides formed directly or indirectly by activation). In general, a specification is added of the type of the incident radiation (e. g. neutron, proton) and its energy (e. g. , thermal, fast). IUPAC94

ACTIVATION ANALYSIS, ABSOLUTE A method of activation analysis in which the elemental concentrations in the material are calculated from known nuclear constants, irradiation and measurement parameters, rather than by comparing with known standards. IUPAC94.

ACTIVATION ANALYSIS, INSTRUMENTAL A method of activation analysis in which element specificity is obtained by using appropriate irradiation conditions, radiation measurement techniques and mathematical techniques for the interpretation of the measurement results. IUPAC82..

ACTIVATION ANALYSIS, NEUTRON See activation analysis .

ACTIVATION ANALYSIS, NON-DESTRUCTIVE An activation analysis procedure in which after the irradiation , no chemical and physical operations are applied which cause a change of any properties of the sample. IUPAC82..

ACTIVATION ANALYSIS, POST Synonymous with activation analysis, post , which is preferred.

ACTIVATION ANALYSIS, RADIOCHEMICAL A method of activation analysis in which, after the irradiation , chemical or physical separation is applied. IUPAC94.

ACTIVATION CROSS SECTION See cross section, microscopic

ACTIVATION DETECTOR A radiation detector in which the induced radioactivity produced by exposure in a radiation field is used to determine particle flux density or particle fluence . NM.

ACTIVATION FOIL An activation detector in the form of a foil. NM.

ACTIVATION PRODUCT] An element made radioactive by bombardment with charged particles, photons, or neutrons.

ACTIVE DEPOSIT The non-gaseous, radioactive descendants of radon from the natural radioactive series (decay chain). FKMM.

ACTIVE (NEUTRON) ASSAY OR INTERROGATION A non-destructive measurement technique in which the sample is exposed to (neutron) irradiation which causes a reaction (usually nuclear) that can be measured. GNST

ACTIVITY The number of nuclear decays occurring in a given quantity of material in a time interval, divided by that time interval. Synonymous with disintegration rate .

ACTIVITY CONCENTRATION For a specified radionuclide , the activity of a material divided by its volume.

ACTIVITY CURVE See decay curve . NM.

ACTIVITY, MOLAR For a specified isotope in a compound, the activity of one mole of the compound.

ACTIVITY, SPECIFIC For a specified radionuclide , the activity of a material divided by the mass or volume of that material.

ADC Analog-to-digital converter

ADSORBENT A material that has the property of adsorbing radionuclides (see adsorption). WASTE.

ADSORPTION The enrichment of one or more components in an interfacial layer. C.

AES Auger electron spectroscopy.

AGE, NEUTRON See Fermi age .

AGE, RADIOACTIVE See radioactive age

AGGREGATE RECOIL An atom of the source material which is ejected from the surface of a radioactive source. This occurs principally in α -particle disintegrations. NM.

AGONIST A chemical which can not only combine with a receptor , like an antagonist , but when it does so stimulates it, resulting in an observable effect. (Oxford English Dictionary, 2nd ed.)

AIRBORN DEBRIS OR WASTE Radioactively contaminated matter, generally small solid particles or liquid droplets, that has become suspended by the air. WASTE.

AIR EQUIVALENT A measure of the effectiveness of an absorber of radiation equal to the thickness of a layer of air at STP that absorbs the same fraction of radiation or results in the same energy degradation as the air. M.

ALARA As low as reasonably achievable, in reference to radiation hazards. NCRP.

ALBEDO The reflection factor a surface, such as paraffin, has for neutrons. M.

ALI Annual limit of intake.

ALPHA See alpha particle .

ALPHA-DECAY Radioactive decay in which an alpha particle is emitted. IUPAC82..

ALPHA-EMITTER A nucleus that undergoes radioactive decay by emitting an alpha particle .

ALPHA-PARTICLE Alpha-particle. A 4He nucleus emitted during a nuclear transformation . IUPAC82.. Also called an α -ray or just an alpha.

AMALGAM EXCHANGE A rapid and efficient separation procedure for a number of cations from aqueous solution into a mercury amalgam of their elements. NAC.

AMPLIFIER, BIASED LINEAR PULSE A pulse amplifier which, within the limits of its normal operating characteristics, has a constant gain for that portion of an input pulse that exceeds the threshold value and that produces no output for pulses whose amplitude is below the threshold. IUPAC82..

AMPLIFIER, LINEAR PULSE A pulse amplifier which, within the limits of its normal operating characteristics, delivers an output pulse of amplitude proportional to that of the input pulse.

(AMPLITUDE TO TIME CONVERTER)

AMS Accelerator mass spectrometry .

ANALOG TO DIGITAL CONVERTER (ADC) A pulse amplitude analyzer which produces an digital number proportional to the amplitude of the pulse presented at its input. The three types are the linear ramp converter (Wilkinson type), the successive approximation ADC, and the flash ADC.

ANALYTE The substance in a specimen to be analyzed in an assay. NM.

ANALYTICAL RADIOCHEMISTRY See radioanalytical chemistry .

ANGULAR CORRELATION In reference to radiation in coincidence , the dependence of the direction of one radiation with respect to its coincident partner.

ANGULAR CORRELATION COEFFICIENTS In the probability distribution $W(q)$ for the angle q between two coincident radiations, the relative weighting factors, a_{2n} for the $\cos^{2n}q$ terms in $W(q) = 1 + a_2\cos^2q + a_4\cos^4q + \dots$

ANION EXCHANGE The process of exchanging anions between solution and an anion exchanger . C.

ANION EXCHANGER An ion exchanger with anions as counter-ions. C.

ANNEALING In radiation of materials, the process of returning displaced atoms to their original position by heating or irradiation with electrons or gamma rays . The original displacement can have been caused by a variety of processes including recoils from nuclear transformations .

ANNIHILATION An interaction between a particle and its antiparticle in which the pair is converted into annihilation photons .

ANNIHILATION PHOTONS Photons produced as the result of annihilation of a particle with its antiparticle . The summed energy of the annihilation photons must equal the mass-energy equivalent of the summed masses of the annihilating particles.

ANNIHILATION RADIATION Radiation resulting from annihilation . IUPAC82..

ANNUAL LIMIT OF INTAKE Annual limit of intake, in reference to radiation dose. The activity of a radionuclide that, taken into the body during a year, would provide a

committed effective dose equivalent to a person equal to the annual occupational effective dose equivalent limit or, in some cases, the organ dose equivalent limit. NCRP.

ANTAGONIST A substance that binds to a receptor but does not activate it, in the process of blocking the binding of the natural agonist and so preventing its action. NM.

ANTAGONISTIC EFFECT

ANTIBODY A serum or cell-bound protein, part of which provides the specificity for binding an antigen .

ANTICOINCIDENCE The occurrence of an event that is unaccompanied by one or more other specified events at the same time; equivalent to a Boolean "not".

ANTI-COMPTON GAMMA-RAY SPECTROMETER See gamma-ray spectrometer, anti-Compton

ANTIGEN Any substance that will induce antibody formation after parenteral application to a vertebrate animal. KE.

ANTINEUTRINO The antiparticle of the neutrino, emitted with the negative beta particle in beta decay .

ANTIPARTICLE Of a given particle , a particle with the same rest mass and opposite charge; the two can undergo annihilation .

APPEARANCE POTENTIAL The minimum potential which the electron beam in an ion source must traverse in order to acquire enough energy to produce ions of a specified nuclide or molecular fragment. M.

ARCHAEOLOGY The application of the measuring techniques of the hard sciences to the remains left by ancient peoples. P.

ARTIFICIAL ELEMENT An element which has been produced through nuclear transformation and which does not otherwise exist in nature.

ARTIFICIAL RADIOACTIVITY See induced radioactivity

ASHING Dry or wet mineralization as a method of preconcentration of trace substances. C.

ASSAY 1. The quantitative determination of a specified analyte . 2. The measurement of the quantity of a chemical constituent, or of the activity of an enzyme, hormone or other biological compound, or biological potency of a drug in a biological material. IUPAC94.

ASSAY KIT A set of components (reagents and other necessary materials) and procedural instructions packaged together and designed for the estimation in vitro of a specified analyte, when used according to the instruction. IUPAC94.

ASSAY METER An instrument used for the assay of radioactive material. It can comprise a radiation detector sensitive to the emissions from the radioactive material and a counting rate-meter or a scaler . NM.

ASYMMETRY Denoting absence of symmetry. Sometimes a quantitative measure of a peak so characterized.

ATOM The smallest unit quantity of an element that is capable of existence whether alone or in chemical combination with other atoms of the same element or other elements. NIC.

ATOMIC MASS Rest mass of an atom in its nuclear and atomic ground state . IUPAC82..

ATOMIC MASS, RELATIVE The ratio of the mass per atom of an element, averaged over a specified nuclidic composition, to 1/12 of the mass of an atom of nuclide ^{12}C . The term atomic weight is also used for this quantity. IUPAC82..

ATOMIC MASS UNIT A special unit of mass, equal to 1/12 of the rest mass of an atom of nuclide ^{12}C in its nuclear and atomic ground state . IUPAC82..

ATOMIC NUMBER Number of protons contained in a nucleus . Synonymous with proton number . IUPAC82..

ATOMIC PILE An obsolete synonym for a nuclear reactor . NM.

ATOMIC WEIGHT Atomic mass

ATTENUATION The reduction of a radiation quantity upon its passage through matter. Attenuation results from interactions of the radiation with the matter it traverses.

ATTENUATION COEFFICIENT Of a substance, for parallel beam of specified radiation , the quantity m in the expression mDx for the fraction removed by attenuation in passing through a thin layer of thickness Dx of that substance. According as Dx is expressed in terms of length, mass per unit area, moles or atoms per unit, m is called respectively the linear, mass, molar, or atomic attenuation coefficient . IUPAC82..

ATTENUATION FACTOR A measure of the opacity of a layer of material for radiation traversing it; the ratio of the incident intensity to the transmitted intensity. NM.

AUGER EFFECT The emission of an electron from an atom ; accompanies the filling of a vacancy in an inner electron shell.

AUGER ELECTRON Electron originating in the Auger effect . IUPAC82..

AUGER ELECTRON SPECTROSCOPY Any technique in which a specimen is bombarded with keV-energy electrons or X-rays, and the energy distribution of the electrons (Auger electrons) produced through radiationless de-excitation of the atoms in the sample is recorded. C.

AUGER (ELECTRON) YIELD The fraction of the atoms having a vacancy in an inner orbital which relaxes by emission of an Auger electron . C.

AUTHORIZED LIMIT Limit set for a given radionuclide or source or for a given environment by a national or international environmental authority. WASTE.

AUTO-IONIZATION The radiationless transition from an atom to an equal energy level in the continuum of an ion. M.

<AUTOMATIC SAMPLE CHANGER >

AUTORADIOGRAM See autoradiograph

AUTORADIOGRAPH A radiograph of an object containing radioactive substance, produced by itself when it is placed upon photographic plate or film.

AUTORADIOGRAPHY A collection of techniques whereby radioactivity is visually localized within solid specimens by means of the close apposition of a detector layer. J.

AUTORADIOGRAPHY, WHOLE BODY Autoradiography of cross-sectional slices. J.

AUTORADIOLYSIS Radiolysis of a radioactive material resulting directly or indirectly from its radioactive decay . IUPAC94.

AVERAGE LIFE The average life of an atom or nuclear system in a specified state. For an exponentially decaying system, it is the average time for the number of atoms or nuclei in a specified state to decrease by a factor e. Synonymous with mean life . IUPAC82..

AVERAGE LOGARITHMIC ENERGY DECREMENT In moderation of neutrons, it is the average of the natural logarithm of the ratio of the energy of a neutron before a collision to that after a collision.

BACKGROUND The term employed to designate the value indicated by a radiation measuring device in the absence of the source whose radiation is to be measured, when the device is placed under its normal conditions of operation. IUPAC82..

BACKGROUND RADIATION Radiation from any source other than the one to be detected or measured.

BACK EXTRACTING See stripping

BACKSCATTER Scattering of radiation in a generally backward direction. In the assay of radioactivity, it applies to the scattering of radiation into the radiation detector from any material except the sample and the detector. IUPAC82..

BACKWASHING In an ion-exchange column, an upward flow of eluant through the resin bed serving to clean and reconstitute the exchanger bed. M.

BADGE A dosimeter that is clipped onto clothing or worn as a "ring" on the finger and which is later processed to quantify exposure to radiation.

BALLISTIC DEFICIT In proportional counters, when pulses are shaped using time constants adjusted so that the slow component of the drift of ions do not contribute to the pulse amplitude, the shaped pulse has a lower amplitude than that corresponding to an infinite time constant by an amount known as the "ballistic deficit".

BARN A unit of area used in expressing nuclear cross sections : 1 barn = 10^{-28} m². IUPAC82.. (Not a SI unit. Symbol is "b".)

BATCH PROCESS A process, particularly in reference to separations, that is not continuous and which is conducted with discrete quantities of materials or a limited number of reagents. M.

BATEMAN EQUATIONS The set of coupled differential equations that expresses the amounts of reactants and products as a function of time as these species are undergoing both production and loss by nuclear reaction and radioactive decay.

BEAM Collimated radiation for the purpose of irradiation .

BEAM CURRENT In a charged particle accelerator, the electric current determined by the number, velocity, and charge of the particles.

BEAM DUMP See beam stop

BEAM HOLE In a reactor, a hole through the shielding which allows a beam of radiation, especially fast neutrons, to escape. M.

BEAM MONITORING Measuring the intensity or energy flux density of a beam .

BEAM STOP Material at the end of a beam placed there to completely stop and absorb the remaining beam particles .

BEAM TRAP See beam stop

BECQUEREL SI unit of activity or nuclear transition rate equal to one per second (symbol 1 Bq). Caveat illustration: The activity of 1 nanomole of ⁴⁰K (half life = 1.25 X 10⁹ years) would be approximately 10.5 Bq but the gamma activity of that same nanomole would be only 1.13 Bq because only 10.7% of ⁴⁰K's decays involve a gamma branch. To avoid ambiguity, the latter should be referred to as 1.13 gamma Bq.

BETA DECAY Nuclear decay in which a beta particle is emitted or in which orbital electron capture occurs. IUPAC82..

BETA EMITTER An atom or nucleus which undergoes radioactive decay by emitting a beta particle (b) and an antineutrino or neutrino . The former accompanies a b- and the latter a b+.

BETA PARTICLE A negative or positive electron which has been emitted by a nuclear particle in a nuclear transformation . IUPAC82..

BGO DETECTOR A solid scintillation detector material based on bismuth germanate.

BETA STABILITY LINE On a graph of neutron number or of mass number vs atomic number and displaying one or more properties of each nucleus, the locus of stable nuclei. (Synonym: Segre curve)

BIASED LINEAR PULSE AMPLIFIER See amplifier, biased linear pulse .

BI-ISOTOPIC MONITOR The use of ⁹⁵Zr and ⁹⁷Zr for determination of the thermal to epithermal neutron flux ratio by activation analysis .

BIFUNCTIONAL CHELATE Complexing agent with two sites for complexation. NM.

BINDING In competitive radioassay , the reactive forces between ligand and binding agent describable by the mass action law and measurable by the fraction of reagent tracer bound in the ligand-binding agent complex. NM.

BINDING AGENT In competitive radioassay , the test reagent chosen, most commonly antibody, to react specifically with the substance under test via mass action, reversible reaction. NM.

BINDING CAPACITY The amount of specific binding sites available per quantity of binding reagent. The extrapolated point of the X-axis of a Scatchard plot performed under defined conditions. NM.

BINDING ENERGY The energy necessary to break a nucleus into specified constituents; the total binding energy is the energy requirement to disassemble the nucleus entirely into protons and neutrons. The binding energy of a neutron in a nucleus

is synonymous with its separation energy from that nucleus. It is the energy equivalent of the difference between the sum of the masses of the constituent neutrons and protons and the measured mass of that nucleus.

BIOCONJUGATE An agent (usually a chelate used to conjugate radionuclide to an antibody .

BIOLOGICAL HALF-LIFE For a substance the time required for the amount of that substance in a biological system to be reduced to one half of its value by biological processes, when the rate of removal is approximately exponential. IUPAC82..

BNCT Boron neutron capture therapy.

BOILING WATER REACTOR A nuclear power reactor with enriched ^{235}U fuel and boiling light water as moderator and coolant.

BOLUS A contiguous mass, such as a medically administered dose of labeled compound.

BOMBARDMENT Irradiation in a beam of particles or photons.

BORON CARBIDE FILTER In epithermal neutron activation analysis , a thickness of boron carbide (B_4C) that is used instead of the more usual cadmium filter which is used to achieve the cadmium cutoff . In this way, one may avoid the induced activity that grows into the cadmium with use.

BORON CHAMBER An ionization chamber that is lined or filled with boron or boron compounds. M.

BORON NITRIDE FILTER In epithermal neutron activation analysis , a thickness of boron nitride (BN) can replace the more usual cadmium filter used to achieve the cadmium cutoff . In this way, one may avoid the induced activity that grows into the cadmium with use.

BOWEN'S STANDARD KALE A reference material for the analysis of plant materials with known concentration values and ranges for a group of macroelements (Na, K, Ca, Mo, O, P, S, N, and Cl) as well as 30 trace elements. HRC.

Bq The symbol for the becquerel unit of activity of a radioactive substance.

BRAGG CURVE A graph of specific ionization due to a charged particle passing through a material as a function of the penetration depth of that particle relative to its range; that is, as a function of its residual range . FFKM.

BRAGG PEAK A peak in a Bragg curve showing that the amount of ionization per millimeter of tissue or other stopping medium traversed by charged particles increases sharply as the particles slow down near the ends of their tracks. NM.

BRAGG RULE The mass stopping power of a compound or mixture for charged particles is approximately given by the weighted sum of the stopping powers of all the components atoms. FFKM.

BRANCHING DECAY Nuclear decay which can proceed in two or more different ways. IUPAC82..

BRANCHING FRACTION In branching decay the fraction of nuclei which decay in a specified way. Synonymous with branching probability IUPAC82..

BRANCHING PROBABILITY See branching fraction .

BRANCHING RATIO The ratio of the branching fraction for two or more specified modes of decay. IUPAC82..

BREIT-WIGNER FORMULA A formula describing the rapidly varying cross section for a nuclear reaction in the vicinity of one or more resonances . NM + FKMM.

BREMSSTRAHLUNG The electromagnetic radiation associated with the acceleration or deceleration of charged particles in the presence of a Coulomb field.

BREMSSTRAHLUNG, INNER Bremsstrahlung which may accompany the emission or absorption of a charged particle by a nucleus . IUPAC82..

BUILD-UP FACTOR In the passage of radiation through a medium, the ratio of the total value of a specified radiation quantity at any point to the contribution to that value from radiation reaching the point without having undergone a collision. NM.

BURIAL GROUND A place for burying unwanted radioactive objects to prevent their escape or escape of their radiations. M.

BURN-UP Induced nuclear transformation of atoms during reactor operation. IUPAC82..

BURN-UP FRACTION The fraction of an initial quantity of a given nuclide that has undergone burn-up . IUPAC82..

BURN-UP, SPECIFIC The total energy released through induced nuclear transformations divided by the mass of a nuclear fuel. IUPAC82..

BURST A sudden increase or appearance of particles or fragments emitted, of short duration, as in a nuclear bomb explosion.

BWR See boiling water reactor .

BY-PRODUCT Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material. The tailings or waste products produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. NM.

CA Carrier added. J.

CADMIUM CUTOFF In neutron irradiations, the energy value which, for a given experimental configuration, is determined by the condition that if a cadmium cover surrounding a detector were replaced by a fictitious cover black to neutrons below this value and transparent to neutrons with energy above this value, the observed detector response would be unchanged. NM.

CADMIUM RATIO The ratio of the response of an uncovered neutron detector to that of the same detector under identical conditions when it is covered with cadmium of a specified thickness. M.

CAGE EFFECT See clathrate .

CAMAC MODULE A standardized modular instrument compatible with a bin or crate that houses and powers the instrument and that also has a built-in digital data bus to provide computer communications with the unit.

CANDU Canadian heavy-water moderated nuclear reactor using natural uranium as fuel.

CAPTURE A process in which an atomic or nuclear system acquires an additional particle . In general a specification is added of the type of the captured particle or its energy. IUPAC82..

CAPTURE CROSS-SECTION The cross section for capture . IUPAC82.

CAPTURE, ELECTRON A nuclear transformation in which the nucleus captures an orbital electron . Often the shell from which the electron is captured is indicated. (K-, L-, etc.) IUPAC82..

CAPTURE GAMMA RADIATION The gamma radiation emitted in radiative capture . IUPAC82..

CAPTURE, RADIATIVE Capture of a particle by a nucleus followed by immediate emission of gamma radiation . IUPAC82..

CAPTURE, RESONANT Capture of a particle exactly matching the product's resonance energy .

CARRIER An inactive material deliberately added to a specified radioactive substance to ensure that the radioactivity will behave normally in all subsequent chemical and physical processes.

CARRIER-FREE A preparation of a radioactive isotope which is 'free' from stable isotopes of the element in question. More precisely, a preparation of a radioactive isotope of high specific activity to which no isotopic carrier was intentionally added and which was not produced by irradiation of stable isotope of the same element.

CARRIER, HOLD-BACK A non-radioactive carrier of a radioactive nuclide used to prevent that particular radioactive species from contaminating other radioactive species in a chemical operation.

CARRIER, ISOTOPIC A carrier which differs only in isotopic composition from the trace substance it has to carry.

CARRIER, NONISOTOPIC A carrier which is not an isotope (that is, it is a different element) of the trace substance or substances it has to carry. A scavenger of radioactive elements.

CARRIER PROTEINS Macroscopic amounts of nonlabeled proteins present with trace amounts of radiolabeled proteins. NM.

CASCADE, AUGER In the Auger effect , when the emission of an Auger electron leads to the creation of a new vacancy that relaxes by a subsequent Auger effect.

CASCADE, GAMMA See gamma cascade .

CATCHER FOIL In an irradiation of a target, a foil used to stop and retain nuclear reaction products that recoil out of the target.

CATION EXCHANGE The process of exchanging cations between solution and a cation exchanger . C.

CATION EXCHANGER An ion exchanger with cations as counter-ions. C.

CBA See competitive binding assay .

CDD Concentration dependent distribution.

CELL, HOT See hot cell .

CEMA An intermediate dosimetric quantity: the converted energy, per unit mass, expended by charged primary particles which in turn had been produced by uncharged particles. (Radiation Research, 130 15 [1992].)

CEMS Conversion electron Mossbauer spectroscopy.

CERENKOV DETECTOR A charged particle detector based on the Cerenkov effect . IUPAC82..

CERENKOV EFFECT Emission of radiation in the visible and ultraviolet spectrum arising when a charged particle crosses a medium with a velocity greater than that of light in the same medium. IUPAC82..

CERENKOV RADIATION Radiation resulting from the Cerenkov effect . IUPAC82..

CF Carrier-free. J.

CHAIN FISSION YIELD The fraction of fissions giving rise to fission fragments of a particular mass number .

CHAIN REACTION In nuclear reactions, a process in which a reaction produces more than one reaction product (such as neutrons) that induces subsequent nuclear reactions.

CHARACTERISTIC CURVE (OF A GM COUNTER) The dependence of the response of a (Geiger-Müller) detector on the applied voltage. GM counters are operated in the "plateau" voltage region of the characteristic curve where the count rate is essentially unaffected by small changes in the operating voltage.

CHARACTERISTIC X-RADIATION X-radiation consisting of discrete wavelengths which are characteristic of the emitting element.

CHARGE EXCHANGE In the interaction between two particles at least one of which is charged, the exchange of charge by those particles.

CHARGED-PARTICLE ACTIVATION ANALYSIS Nuclear activation analysis in which the irradiation is done using charged particles such as protons or alphas.

CHARGE TRAPPING In a semiconductor detector, once electrons and holes are formed by radiation, they can become immobilized for relatively long periods by impurities in the crystal lattice and this "trapping" can prevent the charge carrier from contributing to the measured pulse.

CHELATE A chemical which can undergo or has undergone chelation with an element.

CHELATING RESIN An ion exchange resin in which the counter-ions are retained by a chelate functional group on the resin.

CHELATION In molecular or complex ion structure, the formation or presence of bonds (or other attractive forces) from two or more separate binding sites within the same ligand to a single central atom. C.

CHEMICAL DOSIMETER A dosimeter in which the dose is measured by observing the extent, under specified conditions, of a chemical reaction caused by the ionizing radiation to be measured. IUPAC82..

CHEMICAL ISOTOPE EXCHANGE Exchange of isotopes of a given element between different molecules or between different chemical forms of this element in the course of a chemical reaction.

CHEMICAL NEUTRON ACTIVATION ANALYSIS (CNAA) A variation of activation analysis where a single element or group separations are employed prior to irradiation. Synonymous with activation analysis with preconcentration .

CHEMICAL YIELD The fraction of the amount of an element or chemical compound (remaining) following a specified chemical reaction or separation. IUPAC82..

CHEMILUMINESCENCE Emission of light as a result of a chemical reaction in which there is no apparent change in temperature. M.

CHEMISORPTION Adsorption in which the forces involved are valence forces of the same kind as those operating in the formation of chemical compounds. C.

CHEMISTRY, NUCLEAR The scientific discipline dealing with understanding and applying effects of a chemical and physicochemical nature caused by the nucleus of an atom, its transformations through decay and reactions, and nuclear radiation.

CHEMISTRY, RADIATION See radiation chemistry .

CHEMONUCLEAR REACTION A chemical reaction induced by nuclear radiation or fission fragments. NM.

CHOPPER A mechanical device, conceptually like a camera shutter, for controlling the precise timing of a beam .

CHLORAMINE-T A common oxidizing agent used in radioiodination of proteins. N-chloro-4-methylbenzenesulfonamide sodium salt. NM.

CHROMATOGRAM A graphical or other representation of a detector response, effluent concentration, or other quantity used as a measure of effluent concentration versus time or the volume of the effluent. C.

CHROMATOGRAPH 1.) To separate by chromatography . C. 2.) The assembly of apparatus for carrying out chromatographic separations. CAN.

CHROMATOGRAPHY A method used primarily for the separation of the compounds of a sample in which components are distributed between two phases, one of which is stationary while the other moves. C.

Ci Symbol for the curie , a unit of activity equal to 3.7×10^{10} becquerels . (Not a SI unit.)

CINAA Cyclic instrumental neutron activation analysis. See cyclic activation analysis .

CLADDING An external layer of material (usually of Zircalloy, stainless steel, magnesium), directly surrounding nuclear fuel or other substance that seals and protects it from the environment and protects the environment from radioactive material produced during irradiation. WASTE.

CLATHRATE An inclusion compound; that is, a complex in which one compound (the host) forms a crystal lattice containing spaces in the shape of long tunnels or channels in which molecular entities of a second chemical species (the guest) are located. If the host spaces are closed on all sides so that the guest is "trapped", such compounds are known as clathrates or "cage compounds" . C.

CMCP Coincident measurement of complementary particles.

CNAA Chemical neutron activation analysis.

COCKROFT-WALTON GENERATOR An electrostatic device for generating high voltages through staged rectifiers and transformers. The generators are used to accelerate charged particles. FFKM.

COCKTAIL (a) In nuclear medicine; ingested mixture containing radioactive or isotopic tracers for medical studies. (b) in liquid scintillation counting, a mixture of organic solvents and fluors into which the sample is dispensed for counting. NM.

COCRYSTALLISATION See Coprecipitation .

COINCIDENCE The occurrence of two or more events at the same time; equivalent to a Boolean "and" .

COINCIDENCE CIRCUIT An electronic circuit which produces a usable output pulse only when each of its inputs receives a pulse within a specified time interval. IUPAC82..

COINCIDENCE, DELAYED The occurrence of two or more events separated by a short but measurable time interval. IUPAC82..

COINCIDENCE, PROMPT The occurrence of two or more events separated by a time interval which is less than a specified small value. IUPAC82..

COINCIDENCE, RANDOM A coincidence of events occurring in different atoms or between measured atoms and other atoms, including background and unknown sources.

COINCIDENCE, TRUE A coincidence of events triggered by a single cause. (Contrast with random coincidence above.)

COINCIDENCE CORRECTION A correction to the count rate of a radiation due to losses or gains when two radiations arrive at and are processed by the detector within the coincidence resolving time .

COINCIDENCE RESOLVING TIME The greatest time interval that can elapse between the occurrence of two or more consecutive signal pulses, in order that the measuring device processes them as a coincidence . IUPAC82..

COINCIDENT MEASUREMENT OF CHARGED PARTICLES A technique used in charged particle activation analysis of light elements in thin targets in which an emitted charged particle is detected in coincidence with the recoiling product nucleus. CRC.

COLD TEST A test of method, process, apparatus, or instrumentation with highly radioactive materials replaced by inactive materials or materials that may contain radioactive tracers. NM.

COLLATERAL SERIES A radioactive decay series, initiated by transmutation, that eventually joins one of the four natural actinide decay chains. Also called a collateral chain. M

COLLECTION EFFICIENCY The chemical yield of a particular collection step in a separation, the step being either chemical or physical in nature.

COLLECTRON A neutron detector in which an electric current is produced without the application of an external power source though the emission of β particles by a short-lived radionuclide. This radionuclide is produced by neutron activation in the part of the detector called the "emitter". NM.

COLLIMATION The limiting of a beam of radiation to the required dimensions and angular spread. IUPAC82..

COLLIMATOR An arrangement of absorbers used for collimation . IUPAC82..

COLLISION DENSITY In neutron transport theory, the number of collisions per cm^3/s undergone by a neutron with energy E , equal to the neutron flux divided by the scattering mean free path. NM.

COLUMN (IN CHROMATOGRAPHY) The tube that contains the stationary phase and through which the mobile phase passes. C.

COLUMN GENERATOR See radioisotope generator .

COMPARATIVE LIFETIME See $t_{1/2}$ value .

COMPARATOR A known amount of an element, capable of being activated, that is simultaneously irradiated with the test portion in the context of activation analysis . If one comparator is used (single comparator method) , it is essentially identical to a flux monitor (except that this term is not necessarily linked to activation analysis).

COMPETITIVE BINDING ASSAY Assay based on the competition between a labeled and an unlabeled ligand in the reaction with a receptor binding agent (e.g. antibody, receptor, transport protein). IUPAC94.

COMPETITIVE PROTEIN-BINDING ASSAY A competitive binding assay in which the binding agent is a protein. KE.

COMPLEX A molecular entity formed by a loose association involving two or more component molecular entities (ionic or uncharged) or the corresponding chemical species. The binding between the components is normally weaker than in a covalent bond. C.

COMPOUND NUCLEUS A transient nucleus formed when two nuclear particles fuse completely; analogous to the activated complex in the transition state theory of chemical reactions.

COMPTON EDGE In a gamma-ray spectrum, the maximum energy deposited by gamma-rays which are scattered by the Compton effect and consequently deposit less than the full energy peak . A continuum of measured energies is detected below the edge determined by the Compton effect.

COMPTON EFFECT The inelastic scattering of a photon by a free or weakly bound electron which afterwards occurs as a free electron. Part of the energy and momentum of the incident photon is transferred to the electron and the remaining part is carried away by the scattered photon. Synonymous with Compton scattering .

COMPTON ELECTRON The energetic electron resulting from the Compton effect. IUPAC82..

COMPTON SCATTERING See Compton effect .

COMPTON SHIFT The change in wavelength or energy of scattered radiation due to the Compton effect . M.

COMPTON SUPPRESSION SPECTROMETER See gamma-ray spectrometer, anti-Compton .

CONTAINMENT Any procedure which prevents the transport of radioactivity .

CONTAMINATION The presence of an unwanted radioactivity in a material or the environment in a concentration exceeding the required limit or natural background.

CONVERSION ELECTRON Electron ejected from the atom in the process of internal conversion . IUPAC82..

CONVERSION, INTERNAL A transition between two energy states of a nucleus where the energy difference is given to an orbital electron which is thereby ejected from the atom . IUPAC82..

CONVERSION COEFFICIENT, INTERNAL For a transition between two specified energy levels of a nuclide , the ratio of the transition probabilities for internal conversion and gamma ray emission. IUPAC82..

COOLING, RADIOACTIVE Of a strongly radioactive material, the decrease of its activity by nuclear decay . IUPAC82..

COORDINATION The formation of a covalent bond, the two shared electrons of which have come from only one of the two parts of the molecular entity linked by it, as in the reaction between a Lewis acid and a Lewis base to form a Lewis adduct; alternatively, the bonding formed in this way. C.

COPRECIPITATION The simultaneous precipitation of a normally soluble component with a macro-component from the same solution by the formation of mixed crystals, by adsorption , occlusion, or mechanical entrapment. (Applies generally to a radionuclide at the tracer level.) C.

COSMIC RAYS High-energy particles irradiating the earth, including electrons, muons, protons, alphas, and heavy-ions, which originate extraterrestrially from the sun and from galactic and extra-galactic sources.

COULOMB BARRIER The repulsive potential energy between two charged particles at a separation distance corresponding approximately to contact.

COUNT 1. Information corresponding to a pulse processed for counting. 2. Number of pulses recorded during a measurement. IUPAC82..

COUNTER, RADIATION A radiation detector which measures a count rate but does not perform energy spectrum analysis .

COUNTER TUBE Radiation detector consisting of a gas-filled tube or valve whose gas amplification is much greater than one, and in which the individual ionizing events give rise to discrete electrical pulses. Often an expression is added indicating the geometry (e. g. end window), composition of the gas (e. g. helium) or the physical process essential for its operation (e. g. proton recoil, fission). IUPAC82..

COUNTER TUBE, GEIGER-MULLER A counter tube operated under such conditions that the magnitude of each pulse is independent of the amount of energy deposited in it. IUPAC82..

COUNTER TUBE, PROPORTIONAL A counter tube operated under such conditions that the magnitude of each pulse is proportional to the amount of energy deposited in it. IUPAC82..

COUNTER, WELL-TYPE A radiation detector shaped with a cylindrical cavity or well into which a sample may be placed for counting in a geometry that approaches 4 π .

COUNTING, ABSOLUTE A measurement under such well-defined conditions that the activity of a sample can be derived directly from the observed counting rate . IUPAC94.

COUNTING EFFICIENCY The ratio between the number of particles or photons counted with a radiation counter and the number of similar particles or photons emitted by the radiation source . IUPAC82..

COUNTING LOSS A reduction of the counting rate resulting from phenomena such as the resolving time or the dead time . IUPAC82..

COUNTING RATE The number of counts occurring in unit time. CAN

COW See radioisotope generator .

CPAA Charged-particle activation analysis.

CPBA Competitive protein-binding assay .

CRAA Critical reflection activation analysis.

CRITICAL ABSORPTION In a pair of neighboring elements whose absorption edges for x-rays straddle the energy for a particular photon energy, the one that absorbs more strongly is called the critical absorber for the photon.

CRITICAL MASS The minimum amount of fissile material necessary to sustain a chain reaction .

CRITICAL REFLECTION ACTIVATION ANALYSIS An activation analysis procedure for depth profiling of impurities in which activation is measured as a function of the angle of neutron reflection. FR.

CROSS BOMBARDMENT A method for assigning the mass to a radioactive nuclide by producing it in different nuclear reactions. NM.

CROSS FIRE In autoradiography, the spread of images into film grains appearing over features other than those which emitted the particles. J.

CROSS-LINKING Covalent bonding between polymer chains.

CROSS REACTION Ability of substances other than the analyte to bind to the binding reagent and ability of substances other than the binding reagent to bind the analyte in competitive binding assays . IUPAC94.

CROSS SECTION See cross section, microscopic .

CROSS-SECTION, ACTIVATION The cross section for the formation of a radionuclide by a specified reaction. IUPAC82..

CROSS-SECTION, CAPTURE The cross section for capture . IUPAC82..

CROSS-SECTION, EFFECTIVE In neutron induced reactions, an average cross section used to calculate a reaction rate per nucleus when the flux from the neutron source is known. NAC.

CROSS-SECTION, EFFECTIVE THERMAL A fictitious cross section for a specified (neutron-induced) reaction which, when multiplied by the 2200 metre-per-second flux density , gives the correct reaction rate. Synonymous with Westcott cross section . IUPAC82..

CROSS-SECTION, MACROSCOPIC The cross section per unit volume of a given material for a specified process. For a pure nuclide , it is the product of the microscopic cross section and the number of target nuclei per unit volume; for a mixture of nuclides, it is the sum of such products. IUPAC82..

CROSS-SECTION, MICROSCOPIC A measure of the probability of a specific interaction or reaction between an incident radiation and a target particle or system of particles. It is the reaction rate per target particle for a specified process divided by the flux density of the incident radiation. See cross-section, Westcott . C.

CROSS-SECTION, PARTIAL See cross-section, microscopic

CROSS-SECTION, THERMAL The microscopic cross section appropriate to thermal neutrons .

CROSS-SECTION, TOTAL The sum of all partial cross sections .

CROSS-SECTION, WESTCOTT See cross section, effective thermal .

CRUD Insolubly bulky corrosion products from fuel elements, condenser systems, water purification systems, etc., inside (water-cooled) nuclear reactors.

CRYPTAND A molecular entity comprising a cyclic ligand assembly that contains three or more binding sites held together by covalent bonds and which defines a molecular cavity in such a way as to bind (and thus "hide" in the cavity) another molecular entity, the guest (a cation, anion, or a neutral species) more strongly than do the separate parts of the assembly (at the same total concentration of binding sites). The adduct thus formed is called a cryptate .

CRYPTATE The adduct formed between a cryptand and a "guest" molecular entity, trapped within the cryptand's structure.

CRYSTAL DIFFRACTION SPECTROMETER See spectrometer, crystal diffraction

CUMULATIVE FISSION YIELD The fraction of fissions which have resulted in the production of a given nuclide , either directly or indirectly, up to a specified time. If no time is specified, the yield is considered to be the asymptotic value at scission .

CUMULATIVE FRACTION RELEASED OR

CUMULATIVE PENETRATION A term for expressing leach rates of radionuclides from solidified waste forms based upon depletion of the radionuclide to a certain sample depth. WASTE

CURIE A unit of activity equal to exactly 3.7×10^{10} nuclear decays per second or 3.7×10^{10} becquerels. IUPAC82.. (Not capitalized. Not a SI unit. Symbol is "Ci".)

CURRENT DENSITY Rate of flow across a surface per unit area of that surface. M.

CUTIE PIE A colloquial term for a portable ionization chamber for determining relatively stable dose rates. NM.

CYCLIC ACTIVATION (ANALYSIS) Activation analysis in which the sensitivity for short-lived radioactivities is enhanced through accumulating spectra produced during repetitive short irradiations.

CYCLIC INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS See cyclic activation analysis .

CYCLOTRON A particle accelerator in which the particles travel in a succession of semicircular orbits of increasing radii under the influence of a magnetic field and are accelerated at the beginning of each such orbit by traversing an electric field produced by a high-frequency generator. IUPAC82.. These are sometimes classified as levels I, II, III, and IV, corresponding respectively to particle energies less than 10 MeV, 20 MeV, 45 MeV, and 200 MeV. NM.

CXMS Conversion X-ray Mossbauer spectroscopy.

DAC Derived air concentration .

DALTON A unit of molecular weight used in some life sciences. Its use is discouraged.

DATING, RADIOACTIVE The determination of the radioactive age of an object from its content of radioactive substances and of their daughter products . IUPAC82.

DAUGHTER (PRODUCT) Any nuclide which follows a specified radionuclide in a decay chain . IUPAC82.

DEAD TIME Constant and known value imposed on the resolving time by a paralysis circuit , usually in order to make the correction for resolving time losses more accurate. IUPAC82..

DEAD TIME CORRECTION Correction to be applied to the observed number of pulses in order to take into account the number of pulses lost during the resolving or dead time . IUPAC82..

DE BROGLIE WAVELENGTH In the quantum mechanical description of matter, the wavelength of a particle, from which all behavior is understandable, and whose magnitude relative to the environment determines whether or not classical physics is a justifiable approximation to reality.

DECAY CHAIN A series of nuclides in which each member transforms into the next through nuclear decay until a stable nuclide has been formed. Synonymous with radioactive chain and radioactive decay series .

DECAY CONSTANT For a radionuclide , the probability λ for the nuclear decay of one of its nuclei in unit time, i.e., the rate constant for radioactive decay, a first order reaction. It is given by $\lambda = (1/Nt)(dNt/dt)$, in which Nt is the number of nuclei of concern existing at time t . Synonymous with disintegration constant. IUPAC82..

DECAY CURVE A graph showing the relative amount of radioactive substance remaining after any time interval. IUPAC82..

DECAY CURVE ANALYSIS A mathematical procedure for deconvoluting a decay curve into the separate contributions from each radioactivity in a complex sample.

DECAY ENERGY The total energy change when a nuclide in its ground state undergoes radioactive decay to a daughter product in its ground state. It is identical to the Q-value for the spontaneous reaction.

DECAY, RADIOACTIVE Nuclear decay in which particles or gamma radiation are emitted or the nucleus undergoes spontaneous fission. IUPAC82..

DECAY (NUCLEAR) A spontaneous nuclear transformation.

DECAY SCHEME A graphical representation of the energy levels of the members of a decay chain showing the path by which nuclear decay occurs.

DECAY SERIES See decay chain.

DECONTAMINANT Any chemical reagent(s) used in the act of decontamination.

DECONTAMINATION The act of removing contamination from materials, organisms, an environment, etc.

DECONTAMINATION FACTOR The ratio of activity after decontamination to that before decontamination.

DELAYED BETA DECAY Radioactive decay to a daughter product which is unstable towards emission of a beta-particle which is then emitted in some fraction of decay events.

DELAYED COINCIDENCE A measurement using a coincidence circuit in which it is required that in order to be recorded, the occurrence of two events be separated by an electronically imposed time delay.

DELAYED FISSION Radioactive decay to a daughter product which is unstable towards fission and consequently undergoes fission in a measurable fraction of decay events.

DELAYED NEUTRON ACTIVATION ANALYSIS A method for measuring heavy elements, particularly uranium, thorium, and plutonium by activation to induce fission leading to delayed-neutron emitting products from which the neutrons are measured.

DELAYED NEUTRON EMISSION Radioactive decay to a daughter product which is unstable towards emitting a neutron and consequently does so in some fraction of decay events. Half-lives for delayed neutron emission are long compared to neutron emission associated directly with nuclear reactions or fission.

DELTA RAYS Secondary electrons, ejected by the primary ionizing interactions of charged particles passing through matter, provided their energy exceeds a few hundred eV.

DENSITOMETRY Measurement of the response of an emulsion layer as blackening. The negative log of the transmittance of light is proportional to the electron exposure. J.

DEPLETED MATERIAL Any substance in which the isotopic abundance of a stable isotope has been reduced from its natural value by artificial or natural means.

DERIVATIVE ACTIVATION ANALYSIS A method of activation analysis in which the element or chemical entity to be determined is either replaced by, or complexed with, a surrogate substance for which activation analysis has an enhanced sensitivity. FR.

DERIVED AIR CONCENTRATION A concentration of a given radionuclide in air, obtained by means of a stylized model for the constantly maintained activity concentration of that radionuclide in air, which if breathed by the reference man for a working year of 2000 hours under conditions of light physical activity (breathing rate 1.2 m³/h) would result in an inhalation of one ALI (annual limit of air intake). Also the concentration which for 2000 hours of air immersion would lead to the irradiation of any organ or tissue to the appropriate limit. WASTE.

DESCENDANT In a radioactive decay chain, any member of that chain except the parent.

DETECTION EFFICIENCY The ratio between the number of particles or photons detected and the number of similar particles or photons emitted by the radiation source. IUPAC82..

DETECTOR, 1/n A neutron detector for which the cross section of the detection reaction varies inversely with neutron speed. IUPAC82..

DETECTOR, DIFFUSED JUNCTION SEMICONDUCTOR A semiconductor detector in which the p-n or n-p junction is produced by diffusion of donor or acceptor impurities. IUPAC82..

DETECTOR EFFICIENCY (, INTRINSIC) The ratio of the number of particles or photons detected to the number of similar particles or photons which have struck face of a radiation detector. When multiplied by the geometry factor, it yields the absolute detector efficiency.

DETECTOR, FOIL See foil detector

DETECTOR, LIQUID SCINTILLATOR A scintillation detector of which the scintillating medium is a liquid. The sample is often dissolved in the scintillating liquid. IUPAC82..

DETECTOR, RADIATION An apparatus or substance for the conversion of radiation energy to a form of energy which is suitable for detection and or measurement.

DETECTOR, SCINTILLATION See scintillation detector

DETECTOR, SEMICONDUCTOR See semiconductor detector

DETERMINAND The element or chemical species to be determined. HRC.

DEUTERON A hydrogen nucleus of mass number 2.

DICHROMATOGRAPHY A technique based on the differential absorption of two x-rays or gamma-rays, which closely bracket the critical absorption edge of an element.

DIFFUSED JUNCTION SEMICONDUCTOR DETECTOR See semiconductor detector, diffused junction

DIGESTION A chemical process for softening or solubilizing a material with heat, chemical reagents, and moisture.

DIS Deep inelastic scattering.

DISCRIMINATOR A basic function unit comprising an electronic circuit which gives an output pulse for each input pulse whose amplitude lies above a given threshold value. IUPAC82..

DISINTEGRATION CONSTANT See decay constant .

DISINTEGRATION, NUCLEAR Nuclear decay involving a splitting into more nuclei or the emission of particles . IUPAC82..

DISINTEGRATION RATE See activity .

DISTRIBUTION RATIO The ratio of the total analytical concentration of a substance in the stationary phase to its total analytical concentration in the mobile phase, usually measured at equilibrium.

DISPLACEMENT ANALYSIS One of several general terms for competitive binding assay , most often used to refer to a variant technique wherein the addition of tracer is delayed to enhance assay sensitivity. NM.

DISPLACEMENT, RADIOACTIVE Originally established empirically, this connects the type of radioactive decay (a or b) with the displacement, caused by the change in nuclear charge, of the daughter relative to the parent in the periodic table of elements. NM.

DONOR In a solid state detector, an impurity that is added to a pure semiconductor material to increase the number of free electrons. M.

DOPPLER BROADENING Frequency spreading that occurs in single-frequency radiation when the radiating atoms do not all have the same velocity and may each give rise to a different Doppler shift . M.

DOPPLER SHIFT The amount of change in the observed frequency of a wave due to the Doppler effect, that is, relative motion of the source and detector. M.

DOPPLER SHIFT ATTENUATION The dependence of a gamma-ray line shape on by velocity changes in a decelerating ion. The effect can be used to determine the stopping power of heavy ions in various materials if an emitter with a known lifetime is used.

DOSE A general term denoting the quantity of radiation (energy) absorbed. For special purposes, it must be appropriately qualified, c. q. absorbed, maximum permissible, mean lethal.

DOSE, ABSORBED The energy imparted to matter by ionizing radiation in a suitable small element of volume divided by the mass of that element of volume. IUPAC82..

DOSE EQUIVALENT (, EFFECTIVE) The absorbed dose multiplied by the quality factor and the product of all other modifying factors N , aimed at expressing on a common scale, for different types of radiations and distributions of absorbed dose , the biological effects associated with an exposure . IUPAC82.. Also called just the dose equivalent . NCRP.

DOSE METERS or

DOSIMETERS An instrument that measures the total dose of nuclear radiation received during a given time period. M.

DOSIMETRY The technique of measurement of dose .

DOUBLE IRRADIATION TECHNIQUE In activation analysis , the irradiation of identical samples at positions of very different fast-to-thermal neutron flux. The technique is used to resolve interferences of different analyte elements leading to the same final product. KE.

DOUBLE LABELING labeling with two isotopes at two different sites on the same molecule.

DOUBLE RADIOIMMUNOASSAY A radioimmunoassay in which small amounts of antibody-antigen complex serve as antigen in a second antibody-antigen reaction that acts to scavenge the labeled substance.

DOUBLING TIME The amount of time required before the quantity of a substance doubles when the rate of growth is approximately exponential.

DRIFT (OF A CHARGED PARTICLE) The movement of current carriers in a semiconductor under the influence of an applied voltage. M.

DSCEMS Depth selective conversion electron Mossbauer spectroscopy.

DVI Prefix to an element indicating another element in the same column but two rows lower in the periodic table having the light elements located at the top. Derived from the Sanskrit word for two. See also eka .

DWELL TIME The time increment during which pulses are stored in a multichannel pulse height analyzer operating in the multiscaling mode. (See multiscaling.)

DYNODES An electrode, used in photomultipliers, whose primary function is secondary emission of electrons. M.

EC Electron capture (q. v.)

ECD See electron capture detector .

EDTA A metal chelating agent , ethylenediaminetetraacetic acid.

EDXRF See energy dispersive x-ray fluorescence analysis .

EFFECTIVE CADMIUM CUT-OFF (ENERGY) In a given experimental configuration, the energy value determined by the condition that the detector response would be unchanged if the cadmium cover surrounding the detector was replaced by a fictitious cover opaque to neutrons with energy below this value and transparent to neutrons with energy above this value. IUPAC82..

EFFECTIVE THERMAL CROSS-SECTION See cross section, effective thermal .

EFFICIENCY (OF A COUNTER) See counting efficiency .

EFFICIENCY, INTRINSIC See detector efficiency, intrinsic .

EFFLUENT, RADIOACTIVE Any solid, liquid or gaseous radioactive waste material discharged from a system. IUPAC82..

EKA Prefix to an element indicating another element in the same column but one row lower in the periodic table having the light elements located at the top. Derived from the Sanskrit word for "one". This nomenclature scheme has been used historically for designating new, or unknown elements. Thus, gallium was eka-aluminum; element 118 would be eka-radon.

ELASTIC RECOIL DETECTION ANALYSIS A type of ion beam analysis and Rutherford backscattering spectroscopy in which an ion beam strikes a sample at a grazing angle and recoiling ions are detected. The technique is used for depth profiling, particularly for light-elements in a heavy matrix. C.

ELASTIC SCATTERING See scattering, elastic .

ELECTRODEPOSITION A method of thin sample preparation in which an electric current is used to deposit sample material.

ELECTROMAGNETIC RADIATION Electromagnetic waves and the associated energy; photons.

ELECTROMETER A device for measuring electric charges or electric currents.

ELECTRON A stable elementary particle having an electric charge of $\pm 1.60219 \times 10^{-19}$ C and a rest mass of 9.1095×10^{-31} kg. When used without specification the term means the negatively charged electron, which is also called the negatron. Its anti-particle, the positively charged electron, is called positron . IUPAC82..

ELECTRON, AQUEOUS A hydrated electron; an electron solvated by water molecules. M.

ELECTRON ACCELERATOR An accelerator in which the beam particles are electrons .

ELECTRON CAPTURE See capture, electron .

ELECTRON CAPTURE DETECTOR 1.) A very sensitive detector for the presence of certain classes of molecules, most notably chlorine-containing molecules. It is based on a steady current produced by a long-lived beta-emitter and the measurable perturbations in that current caused by the presence of small quantities of molecules that scavenge or capture the electrons. 2.) A detector for electron capture decay.

ELECTRON, COMPTON See Compton electron .

ELECTRON, CONVERSION See conversion electron .

ELECTRON, SECONDARY An electron emitted as a result of momentum transfer from some primary radiation. M.

ELECTRON SPECTROSCOPY FOR CHEMICAL ANALYSIS Type of spectroscopy involving the measurement of the kinetic energy of electrons emitted by chemical substances usually as a result of excitation by monochromatic X-rays. C.

ELECTRON VOLT A unit of energy corresponding to 1.6022×10^{-19} J.

<ELECTROPHORETIC ION FOCUSING>

ELECTROSCOPE A device for measuring very small electrostatic charges.

ELECTROSPRAYING A soft (non-violent) sample ionization technique, applicable particularly to large and complex species in solution, for producing intact ions in vacuo. Solutions pass through a needle maintained at a few kilovolts relative to a chamber. The resulting field at the needle tip charges the surface of the emerging liquid, dispersing it by Coulomb forces into a spray of small charged droplets.

ELEMENT A substance in which the nucleus of each atom is characterized by having exactly the same number of protons .

ELEMENTARY PARTICLE See particle, elementary .

ELUANT Liquid used to extract one material from another as in chromatography. The term eluent is preferred.

ELUATE The effluent emerging from a chromatographic bed when elution is carried out.

ELUENT The liquid or gas entering a chromatographic bed and used to effect a separation by elution. C.

ELUTE To remove or separate by elution chromatography.

EMANATION 1. Radon 2. Any radioactive gas released by another radioactive substance.

EMANATION POWER A ratio of the amount of radon escaping a solid or solution, to the amount being formed.

EMANATION THERMAL POWER A thermoanalytical technique in which the release of radioactive emanation from a substance (and/or its reaction products) is measured as a function of temperature while the substance is subjected to a controlled temperature program. C.

EMANOMETRIC ANALYSIS A method of quantitative analysis which uses measurement of the radioactive isotopes of inert gases for the determination of appropriate elements. HRC.

EMULSION, NUCLEAR An ionization-sensitive material such as a photographic emulsion used for permanently recording the tracks of charged particles. GNST

ENAA Epithermal neutron activation analysis.

END LABELING Procedure in which terminal phosphate groups of DNA are removed and enzymatically replaced with radiolabeled groups. J.

END PRODUCT The final product of a nuclear reaction or process. M.

ENERGY (OF A RADIATION) Energy of the individual particles or photons of which radiation consists. IUPAC82..

ENERGY, BINDING See binding energy .

ENERGY DISPERSIVE X-RAY FLUORESCENCE ANALYSIS A method of X-ray fluorescence analysis where element specificity is obtained by measuring the energy spectrum of the induced X-radiation . IUPAC82..

ENERGY FLUX DENSITY See flux density, energy .

<ENERGY, IONIZING >.

ENERGY LEVEL The stable energy state that an atom or molecule or nucleus can assume. NM.

ENERGY RESOLUTION A measure, at given energy, of the smallest difference between the energies of two particles or photons capable of being distinguished by a radiation spectrometer. IUPAC82.. It is usually expressed as FWHM. See full-width at half-maximum .

ENERGY THRESHOLD The limiting kinetic energy of an incident particle or energy of an incident photon (both expressed in the laboratory system) below which a specified process cannot take place. IUPAC82..

ENRICHMENT Any process by which the isotopic abundance of a specified isotope in a mixture of isotopes of an element is increased. IUPAC82..

ENRICHMENT FACTOR For a material enriched in a specified isotope , the ratio between the isotopic abundance and the natural abundance of that isotope. IUPAC82..

ENRICHMENT, ISOTOPIC Any process by which the isotopic abundance of a specified isotope in a mixture of isotopes of an element is increased. C.

EOB End-of-bombardment.

EPICADMIUM NEUTRONS See neutrons, epicadmium .

EPITHERMAL NEUTRON ACTIVATION ANALYSIS Activation analysis using epithermal neutrons, i. e., those with energies usually just above thermal.

EPITHERMAL NEUTRONS See neutrons, epithermal .

EPSILON RAYS Tertiary electrons. See delta rays .

EQUILIBRIUM ISOTOPE EFFECT See isotope effect

EQUILIBRIUM, RADIOACTIVE Among the members of a decay chain , the state which prevails when the ratios between the activities of successive members remain constant. IUPAC82..

EQUILIBRIUM, SECULAR Radioactive equilibrium where the half life of the precursor isotope is so long that the change of its activity can be ignored during the period of interest and all activities remain constant. IUPAC82..

EQUILIBRIUM, TRANSIENT Radioactive equilibrium where the ratio of the (longer-lived) parent to (shorter-lived) daughter activity as a function of time is a constant less than unity.

ERD or ERDA Elastic recoil detection analysis .

ESCA Electron spectroscopy for chemical analysis.

ESCAPE PEAK, DOUBLE In a gamma-ray spectrum , the peak due to pair production in the detector and escape, from the sensitive part of the detector, of the two photons of 511 keV resulting from annihilation . IUPAC82..

ESCAPE PEAK, IODINE The x-ray escape peak in a gamma-ray spectrum using a NaI scintillation spectrometer and due to the escape of the 28 keV X-ray of the iodine in the scintillation crystal.

ESCAPE PEAK, SINGLE In a gamma-ray spectrum , the peak due to pair production in the detector and escape, from the sensitive part of the detector, of one of the photons of 511 keV resulting from annihilation . IUPAC82..

ESCAPE PEAK, X-RAY In a gamma or X-ray spectrum , the peak due to the photoelectric effect in the detector and escape, from the sensitive part of the detector, of the X-ray photon) emitted as a result of the photoelectric effect . IUPAC82..

EXCHANGE RATE The rate at which an exchange reaction occurs.

EXCHANGE REACTIONS Reactions in which two atoms or ions exchange places, either in two molecules or in the same molecule. M.

EXCITATION Process causing the transition of a system from one state to another of higher energy. IUPAC82..

EXCITATION ENERGY Minimum energy required to bring a system to a specified higher energy level. IUPAC82..

EXCITATION FUNCTION In nuclear reactions the dependence of the cross section for the reaction upon the energy of the projectile .

EXCITED STATE State of a system with energy higher than that of the ground state . IUPAC82..

EXPONENTIAL DECAY Variation of a quantity (generally the activity of a radionuclide) according to the law $A=A_0e^{-\lambda t}$ where A and A_0 are the values of the quantity being considered at time t and zero respectively, and λ is an appropriate constant. IUPAC82..

EXPOSURE For X- or gamma radiation in air: the sum of the electrical charges of all the ions of one sign produced after all electrons liberated by photons in a suitably small volume element of air are completely stopped, divided by the mass of the air in the volume element.

EXTRACTABLE SPECIES Any chemical species which can be separated through an extraction procedure.

EXTRACTION A separation method in which a liquid solvent causes the transfer of one or more analytes into it from contact with a second liquid or solid phase mixture. M.

EXTRACTION CHROMATOGRAPHY Synonymous with liquid-liquid chromatography. One liquid can be a film adsorbed on a solid stationary packing material.

EXTRACTION CYCLE A series of steps involving solvent extraction , stripping , and in some cases scrubbing . GNST

EXTRAPOLATED RANGE The distance from a radiation source at which the flux density has decreased to one-half of its initial value. It is calculated by extrapolation of the tangent to the flux density) versus distance curve to zero flux density.

FALLOUT, RADIOACTIVE The deposition on the ground of radioactive substances from nuclear explosions and other injections of radioactive material into the atmosphere. IUPAC82..

FAMILIES, RADIOACTIVE The naturally occurring decay chains associated with uranium-238, uranium-235, and thorium-232, and the artificial decay chain associated with neptunium-235.

FARADAY CUP A hollow collector, open at one end and closed at the other, used to collect and measure, beams of ions.

FAST Fast or forward alpha scattering technique .

<FAST ALPHA SCATTERING TECHNIQUE>

FAST NEUTRON ACTIVATION ANALYSIS Activation analysis using fast neutrons , usually from accelerator sources, in the MeV energy range, most frequently 14 MeV.

FAST NEUTRONS See neutrons, fast .

FEATHER ANALYSIS A technique for determining the range of a nuclide's beta rays in aluminum by comparing the absorption curve to that of a reference beta-emitting species. M.

FEATHER RULE A rule or equation for the maximum range of beta particles as a function of particle maximum energy. The equation is usually a linear one and when expressed in terms of mass per unit area does not vary widely with the atomic number of the absorber.

FENA Filtered epithermal neutron activation.

FERMI A unit of length useful on the nuclear scale and defined as 1 fermi = 1 fm = 10⁻¹⁵ meters. (Not a SI unit.) Synonymous with femtometer.

FERTILE 1. Of a nuclide : capable of being transformed, directly or indirectly, into a fissile nuclide by neutron capture . 2. Of a material: containing one or more fertile nuclides . IUPAC82..

FET AMPLIFIER A field-effect transistor amplifier.

FIGURE OF MERIT A measure of performance of a detection system that combines sensitivity and ability to record rapid or discontinuous spatial changes in source intensity. NM.

FILM BADGE A package containing one or more small photographic films for approximate measurement of radiation exposure , used for the purpose of monitoring personnel. IUPAC82..

FILTER (OF A RADIATION) Material interposed in the path of heterogeneous radiation to modify the spectral distribution of the radiation . IUPAC82..

FILTERED EPITHERMAL NEUTRON ACTIVATION ANALYSIS Epithermal neutron activation analysis in which various filters are used, frequently to change the influence of resonances on reaction probabilities.

FINGERPRINT, NUCLEAR A pattern of distinct radiation energies and type suitable to identify the emitting substance.

FISSILE 1. Of a nuclide : capable of undergoing fission by interaction with (slow) neutrons . 2. Of a material: containing one or more fissile nuclides . IUPAC82..

FISSION Spontaneous or induced Nuclear transformation in which a nucleus splits into two or more relatively large fragments and can be referred to in more detail as binary, ternary,... fission.

FISSION CHAMBER or **COUNTER** An ionization chamber , used to detect slow neutrons, the inside of which is coated with uranium from which highly ionizing, recoiling fission products may be produced.

FISSION FRAGMENTS Nuclei resulting from fission and possessing kinetic energy acquired from the fission process. IUPAC82..

FISSION ISOMER A highly deformed metastable nuclear state of a fissile nuclide.

FISSION NEUTRONS See neutrons, fission .

FISSION, NUCLEAR The spontaneous or induced division of a nucleus into two or more major parts, usually accompanied by the emission of neutrons, gamma radiation and, rarely, small charged nuclear fragments.

FISSION PRODUCTS Nuclides produced by fission and the daughter products of these nuclides. IUPAC82..

FISSION, SPONTANEOUS Nuclear fission which occurs without the addition of particles or energy to the nucleus . IUPAC82..

FISSION, THERMAL Fission caused by thermal neutrons . IUPAC82..

FISSION YIELD The fraction of fissions giving rise to a particular nuclide before any nuclear decay has occurred. IUPAC82..

FISSION YIELD, CHAIN The fraction of fissions giving rise to nuclei of particular mass number . IUPAC82..

FISSION YIELD, CUMULATIVE The fraction of fissions which have resulted in the production of a nuclide either directly or indirectly, up to a specified time. If no time is specified, the yield is considered to be the asymptotic value. IUPAC82..

FISSION YIELD, DIRECT The fraction of fissions giving rise to a particular nuclide before any nuclear decay has occurred. IUPAC82..

FISSION YIELD, INDEPENDENT The fraction of fissions which have resulted in the direct production of a given fission product nuclide .

FISSIONABLE See fissile .

FIXATION The incorporation of radioactive elements, usually fission products, into solid materials in such a way as to insure no significant release over long periods of exposure to the natural environment. NM.

FLOW COUNTER A radiation counter in which an appropriate atmosphere is maintained in a counter tube by allowing a suitable gas to flow through the volume. Such counters are operated in either the Geiger-Miller region or the proportional region. NM.

FLUENCE A measure of the time-integrated particle flux expressed in particles per unit area. M.

FLUOR A liquid or solid that is used in scintillation counters and that emits a flash of light when it is excited by radioactive or other radiation. B.

FLUORESCENCE Luminescence which occurs essentially only during the irradiation of a substance by electromagnetic radiation . IUPAC94.

FLUORESCENCE YIELD For a given excited state of a specified atom , the ratio of the number of excited atoms which emit a photon to the total number of excited states. IUPAC82..

FLUORIMETRY A method of analysis involving fluorescence by an analyte. M.

FLUOROGRAPHY Autoradiography involving the additional use of scintillation fluid or solid. Jones. Also known as photofluorography. NM.

FLUOROMETRY See fluorimetry .

FLUX The amount of a substance passing through an area per unit time. See also flux density .

FLUX DENSITY In a multicomponent mixture, the flux density N_B of a species B is a vector which indicates the direction in which the species moves and the amount of substance of B passing through a plane perpendicular to the vector, divided by the time and by area. Sometimes the flux density is simply called flux . However, this is not consistent with the usage in vector theory. C.

FLUX DENSITY, ENERGY For mono-directional radiation , the energy traversing in a time interval a small area perpendicular to the direction of the energy flow, divided by that time interval and by that area. IUPAC82..

FLUX DENSITY, NEUTRON See flux density, particle .

FLUX DENSITY, PARTICLE (OR, PHOTON) At a given point in space, the number of particles or photons incident in a time interval on a suitably small sphere centered at that point, divided by the cross-sectional area of that sphere and by that time interval. The particle flux density is identical with the product of the particle density and the average speed of the particles. IUPAC82..

FLUX DENSITY, 2200-METRE-PER-SECOND A fictitious flux density expressed as the product of the total number of neutrons per cubic metre and a neutron speed of 2200 metres per second. IUPAC82..

FLUX DEPRESSION The lowering of the particle flux density in the neighborhood of a sample due to absorption of particles in the sample. IUPAC82..

FLUX MONITOR A known amount of activatable material irradiated together with a sample; the induced radioactivity is used as a measure for a particular flux density during the irradiation. IUPAC82..

FLUX PERTURBATION The lowering of the flux density in a sample as a result of both flux depression and self shielding . Sometimes a specified flux density can increase as a result of the change of the energy of the particles in the sample, e.g., the increase of the thermal neutron flux density in hydrogen containing material. IUPAC82..

FNAA Fast neutron activation analysis .

FOIL DETECTOR A small piece of foil used to measure flux densities by activation . IUPAC82..

FORCE, NUCLEAR The force acting between nucleons. Synonymous with strong force.

FORWARD ALPHA SCATTERING TECHNIQUE Determination of elastically scattered alpha particles with a detector at forward angles; the method uses the energy of the detected particle to deduce the scattering mass for light target elements.

FOUR- COUNTING Measuring radiation from a source with a detector or detector system that covers all directions from the source; that is, with a 100% geometry factor .

FRACTION, BOUND In radioassays , the fraction of the incubation mixture which, after separation, contains the analyte bound to the binding reagent.

FRACTION, FREE In radioassays , the fraction of the incubation mixture which, after separation, does not contain the bound analyte.

FRACTIONAL CRYSTALLIZATION A class of chemical separation by fractionation which takes advantage of slight differences in solubility of different compounds in a solvent, the least soluble crystallizing first and removed from the mother liquor .

FREE RADICAL See radical .

FRENKEL DEFECT A crystal defect consisting of a vacancy and an interstitial atom which arises when an atom is moved out of a normal lattice site and forced into an interstitial position. M.

FREQUENCY OF EMISSION In imaging with gamma rays, it is the branching fraction of each gamma ray. NM.

FRICKE DOSIMETER A dosimeter based on the oxidation of aqueous Fe⁺² to Fe⁺³ by ionizing radiation. Ch.

ft VALUE The product of the half-life of a beta-decaying nuclide and a function (the Fermi function) that depends on the decay energy and transition type. M.

FUEL CYCLE The sequence of steps, such as mining, processing, fabrication, utilization, reprocessing, and refabrication, through which nuclear fuel may pass.

FUEL ELEMENT The smallest structurally discrete part of a reactor which has fuel as its principal constituent. IUPAC82..

FUEL, NUCLEAR Material containing fissile nuclides , which when placed in a reactor enables a chain reaction to be achieved.

FUEL REPROCESSING The processing of nuclear fuel , after its use in a reactor, to remove fission products and recover fissile and fertile material. IUPAC82..

FULL ENERGY PEAK In a radiation spectrum , the part of the spectral response curve corresponding to the total energy of the detected radiation .

FULL ENERGY PEAK EFFICIENCY, ABSOLUTE For a radiation spectrometer viewing a source of radiation, the fraction of events of a given energy radiation that are registered in that radiation's full energy peak .

FULL ENERGY PEAK EFFICIENCY, INTRINSIC The detector efficiency when considering only events where the total energy of the radiation is absorbed in the sensitive volume of the detector . IUPAC82..

FULL WIDTH AT HALF MAXIMUM (FWHM) In a distribution curve comprising a single peak, the width of that peak at half its maximum amplitude.

FULL WIDTH AT TENTH MAXIMUM (FWTM) In a distribution curve comprising a single peak, the width of that peak at one-tenth its maximum amplitude.

FUSION, NUCLEAR The process in which nuclei undergo nuclear fusion reactions . IUPAC82..

FUSION REACTION, NUCLEAR A reaction between any two nuclei which results in their complete coalescence to give a compound nucleus equal to the sum of the two constituent nuclides.

FWHM See full width at half maximum .

FWTM See full width at tenth maximum .

G See G-value .

GAIN (MULTIPLIER TUBE) Ratio of output to input electrical power. NM.

GAMMA CASCADE Two or more different gamma rays emitted successively, that is, in coincidence , as a single nucleus passes through one or more energy levels.

GAMMA QUANTUM A photon , a single unit of electromagnetic radiation , usually nuclear in origin.

GAMMA RADIATION Electromagnetic radiation emitted in the process of nuclear transformation or particle annihilation . IUPAC82..

GAMMA RADIATION, CAPTURE See capture gamma radiation .

GAMMA-RAY SPECTROMETER A system for determining the energy spectrum of gamma rays .

GAMMA-RAY SPECTROMETER, ANTI-COMPTON A gamma-ray spectrometer in which the effect of the Compton scattering is at least partly compensated by an anticoincidence requirement on the full energy peak .

GAMMA-RAY SPECTRUM A spectrum of photon radiation.

GAMOW BARRIER The potential barrier which retards the escape of alpha-particles from the nucleus. M.

GAS JET A gas transport system using a stream of helium gas to thermalize and very rapidly transport recoil products from nuclear reactions to a collector and detection apparatus.

GAS-FLOW COUNTER A proportional counter tube in which the gas between the cathode and anode is constantly, but slowly, replenished through flow.

GAS-TRANSPORT SYSTEM See gas jet .

GEIGER-MULLER COUNTER TUBE See counter tube, Geiger-Müller .

GEIGER-MULLER REGION The range of operating voltage of a counter tube in which each ionizing event gives rise to an output pulse having an amplitude independent of the number of ions initially produced in the sensitive volume by that ionizing event. IUPAC82..

GEIGER-MULLER THRESHOLD The minimum voltage necessary for a counter tube to operate in the Geiger-Müller region . IUPAC82..

GENERATOR See radioisotope generator .

GENETIC RELATION A reference to the connection between two nuclides which are members of the same decay chain .

GEOMETRIC ATTENUATION The reduction of radiation due only to the effect of the distance between the point of interest and the source, excluding the effect of any matter present.

GEOMETRY (, COUNTING) A term used colloquially to signify the arrangement in space of the various components in an experiment, particularly the source and the detector in radiation measurements. IUPAC82..

GEOMETRY FACTOR The average solid angle in steradians at the source subtended by the aperture or sensitive volume of the detector , divided by 4. IUPAC82..

GERMANIUM DETECTOR A diffused junction semiconductor detector in which germanium is the base solid state material.

GERMANIUM DETECTOR, Ge(Li) A diffused junction semiconductor detector into which lithium has been diffused from the surface and which must be maintained at low (liquid nitrogen) temperatures. It is used in high resolution gamma ray spectrometry. NAC.

GERMANIUM DETECTOR, HIGH PURITY A semiconductor detector of ultrahigh purity, usually referred to as intrinsic germanium. The detector is used for high resolution gamma ray spectroscopy and must be operated at low (liquid nitrogen) temperatures to reduce leakage noise but need not be otherwise maintained at low temperatures. NAC.

GERMANIUM DETECTOR, INTRINSIC See germanium detector, high purity .

GLOVE BOX An enclosure in which material may be manipulated in isolation from the operator's environment. This manipulation is effected by gauntlet gloves or flexible plastic devices fixed to ports in the walls of the box. IUPAC82..

GM COUNTER See counter tube, Geiger-Müller .

GRAIN YIELD The average number of silver grains per electron strike on the recording layer of autoradiography film. J.

GRANDDAUGHTER In a sequence of radioactive decays , the daughter of the daughter .

GRAY SI unit of absorbed dose ; 1 gray = 1 joule/kilogram. IUPAC82..

GRENZ RAYS X-rays produced in the region of 5 to 20 kV. NM.

GROUND STATE The state of lowest energy of a system. IUPAC82..

GROUP PRECONCENTRATION An operation (process) as a result of which several components are isolated in one step. This may be achieved in one of two ways: by transport either of the matrix or of the microcomponents into a second phase. C.

GROUP SEPARATION See group preconcentration .

GROWTH AND DECAY CURVE A graph showing the relative amount of radioactivity remaining after any time interval and in which the radioactivity also shows growth from a parent nuclide.

GROWTH CURVE (OF ACTIVITY) Curve giving the activity of a radioactive nuclide as a function of time and showing the increase of the activity through the decay of the parent substance or as a result of activation . IUPAC82..

GUARD FOIL In an irradiation of a target, a foil that is used on one side of that target to exactly compensate for nuclear reaction products that recoil out of the opposite side and are otherwise lost.

G-VALUE The number of specified chemical events produced in an irradiated substance per 100 eV of energy absorbed from ionizing radiation .

Gy Symbol for the absorbed dose unit gray . Not to be confused with an old notation for gigayear, also Gy, but now Ga

Planck's constant, h , divided by 2π .

HALF LIFE, BIOLOGICAL For a substance, the time required for the amount of that substance in a biological system to be reduced to one-half of its value by biological processes, when the rate of removal is approximately exponential. IUPAC94.

HALF LIFE, EFFECTIVE For a radioactive substance, the time required for the amount of that substance in a biological system to be reduced to one half of its value by both radioactive decay and biological processes, when the rate of removal is approximately exponential. IUPAC94.

HALF LIFE, PARTIAL In nuclei undergoing branching decay , the half-life that would be evident if a particular branch were the sole means of decay. The partial half-life of a nucleus by a specific mode of decay is the (total) half-life divided by the branching fraction for that specific decay path.

HALF LIFE, RADIOACTIVE For a single radioactive decay process, the time required for the number of atoms or the activity to decrease to half its value by that process.

HALF THICKNESS The thickness of a specified substance which, when introduced into the path of a given beam of radiation , reduces the value of a specified radiation quantity by one half. CAN

HALF-VALUE LAYER See half thickness .

HALF-VALUE THICKNESS See half thickness .

HALO A luminous or colored circle seen in the light around an object; frequently applied to radioactive inclusions in minerals.

HAP Hydrated antimony pentoxide, an inorganic ion-exchanger.

HAPTEN A substance, particularly of low molecular weight, which cannot to induce antibody formation by itself, but which when combined with larger molecules such as proteins can do so. This combination is called an immunogen .

HARD RADIATION Radiation whose particles or photons have a high energy and, as a result, penetrate materials relatively easily. M.

HARDENING (NEUTRONS) The increase in the fraction of higher energy neutrons in a reactor beam flux due to preferential absorption of low-energy neutrons by a sample.

HD VALUE In autoradiography , a measure of resolution corresponding to the distance from a straight radiographic line that accounts for 50% of the grains. J.

HEALTH PHYSICS A division of occupational health dealing particularly with protection of personnel from the harmful effects of ionizing radiation . NM.

HEAVY ELEMENTS A term often used with reference to the actinides and still heavier elements.

HEAVY ION A nucleus consisting of more than one nucleon. Frequently, the term is further restricted to nuclei with atomic numbers greater than two.

HEAVY ION ACCELERATOR An accelerator in which the beam consists of heavy ions .

HEAVY ION REACTION A nuclear reaction in which the interacting nuclei are heavy ions .

HEAVY WATER Water containing a significant fraction (up to 100%) of deuterium in the form of D₂O or HDO. IUPAC82..

HELIUM JET See gas jet .

HETEROGENEOUS COUNTING A technique in solid state scintillation counting of radiochromatograms in which the scintillant is solid bead material with which a flow cell is packed and that does not chemically interact with the eluting medium. J.

HFR High flux reactor

HIAA Heavy-ion activation analysis

HIGH FLUX REACTOR A nuclear reactor designed to produce neutron flux densities several orders of magnitude greater than in conventional reactors.

HMD Hydrated manganese dioxide, an inorganic ion-exchanger.

HOLD-BACK CARRIER See carrier, hold back

HOMOGENEOUS COUNTING A technique for counting radiochromatograms in a flow cell by injecting liquid scintillant into the eluting medium. Jones.

HOT ATOM An atom in an excited energy state or having kinetic energy above the ambient thermal level, usually as a result of nuclear processes. IUPAC82..

HOT CELL A heavily shielded enclosure for highly radioactive materials. It may be used for their handling or processing by remote means or for their storage. IUPAC82..

HOT LABORATORY A heavily shielded, specially equipped laboratory to protect personnel working with large amounts of substances emitting gamma radiation and to protect the environment from contamination.

HPGe See germanium detector, high purity . Also known as intrinsic germanium.

HPLC High performance liquid chromatography.

HWR Heavy water reactor, that is, one moderated and cooled with heavy water .

HYDROLYSIS Reaction with water as a solvent involving the rupture of one or more bonds in the reacting solute. For weak electrolytes, this can alter the acidity and subsequent chemical behavior of the aqueous solvent.

HYPERFINE STRUCTURE Small differences in energy states of atoms or molecules that have different orientations between nuclear spin and electron angular momentum owing to the interaction between the nuclear and electron magnetic moments. FKMM.

IBA Ion beam analysis .

ICPMS Inductively coupled plasma mass spectrometry.

IDA Isotope dilution analysis .

IDMS Isotope dilution mass spectrometry.

IMMUNOASSAY An assay procedure based on the reversible and non-covalent binding of an antigen by an antibody . Immunoassays can be employed to detect or quantify either antigens (haptens) or antibodies. IUPAC94.

IMMUNOGEN A substance that induces an immune response, one that stimulates the production of specific antibody or lymphocytes.

IMMUNORADIOMETRIC ASSAY An assay procedure based on the reversible and non-covalent binding of an antigen by a specific antibody labeled with a radioactive nuclide as tracer . IUPAC94. Synonymous with radiometric assay. KE.

IMMUNORADIOMETRIC ASSAY, TWO-SITE An immunoradiometric assay involving two sets of antibodies, one of which is labeled , that combine with different immunoreactive sites of an antigen molecule. IUPAC94.

INAA Instrumental neutron activation analysis .

INDEPENDENT FISSION YIELD See fission yield, independent .

INDICATOR, RADIOACTIVE A radioactive substance which functions as an indicator for various chemical, physicochemical, etc. processes, e.g., absorption, precipitation or extraction.

INDUCED RADIOACTIVITY Radioactivity induced by irradiation . IUPAC82..

INELASTIC SCATTERING Scattering in which the total kinetic energy of the two collision partners changes.

INFINITE SOURCE THICKNESS For a specified radiation, the minimum thickness of a flat preparation of a radioactive material where the intensity of the specified radiation at the surface does not increase when the thickness is increased by adding more of similar radioactive material. IUPAC82..

INNER BREMSSTRAHLUNG See bremsstrahlung, inner .

IN SOURCE See isotopic neutron source . KE.

INSTRUMENTAL ACTIVATION ANALYSIS See activation analysis, instrumental .

INSTRUMENTAL PHOTON ACTIVATION ANALYSIS Activation analysis in which high-energy photonuclear reactions are used for the activation. KE.

<INTAKE>

INTEGRAL FLUX The total particle flux density encompassing all particle energies. KE.

INTEGRATED FLUX See fluence . KE.

INTENSITY OF RADIATION The energy per unit time entering a small sphere in a time interval, divided by the area of the great circle of the sphere and the time interval. For mono-directional radiation, this reduces to the energy flux density . IUPAC82..

INTERCOMPARISON, ANALYTICAL A procedure which gives insight into the accuracy of results of analytical procedures by comparing the results obtained in the analyses of identical samples at different laboratories and preferably with different analytical methods. IUPAC82..

INTERFERENCE, NUCLEAR In activation analysis for a particular element producing a radionuclide, the formation of that same radionuclide from another element.

INTERFERENCE, SPECTRAL An interference caused by 1.) unresolved overlapping with a neighboring spectral peak, 2.) disturbing of proper spectrometer response at a peak due to high levels of background or of other radionuclides.

INTERNAL CONVERSION See conversion, internal .

INTERNAL CONVERSION COEFFICIENT See conversion coefficient, internal .

INTERNAL MONITOR Beam monitoring in which the monitor is part of the target or target assembly being irradiated.

<INTERNAL TARGET >

INTERSTITIAL Pertaining to or situated in the interspaces of a tissue or other structure. NM.

INTRINSIC EFFICIENCY See detector efficiency .

INTRINSIC FULL ENERGY PEAK EFFICIENCY See full energy peak efficiency, intrinsic .

INTRINSIC Ge DETECTORS See Germanium detector, high purity .

INTRINSIC PHOTOPEAK EFFICIENCY See photopeak efficiency, intrinsic .

INVERSE SQUARE LAW The intensity of radiation from a point source in free space is inversely proportional to the square of the distance from the source. Presence of absorbers necessitates corrections to this law. IUPAC82..

ION An atomic or molecular particle having a net electric charge. IUPAC82..

ION BEAM A charged-particle beam.

ION BEAM ANALYSIS A collective term for any of a variety of techniques that involve irradiation of a sample with an ion beam for the purpose of analysis. Included are particle-induced gamma and x-ray emission, Rutherford backscattering spectroscopy, nuclear microprobes and other methods of nuclear reaction analysis .

(ION CHROMATOGRAPHY)

ION DENSITY The number of ions per unit volume. Also known as ion concentration. M.

ION EXCHANGE 1. In surface chemistry, if the adsorption of one or several ionic species is accompanied by the simultaneous desorption (displacement) of an equivalent amount of one or more other ionic species, this process is called ion exchange. 2. The process of exchanging ions between a solution and an ion exchanger . C.

ION EXCHANGE CHROMATOGRAPHY Separation based mainly on differences in the ion-exchange affinities of the components. C.

ION EXCHANGER A solid or liquid, inorganic or organic, containing ions exchangeable with others of the same sign present in a solution in which the exchanger is considered to be insoluble. A monofunctional ion exchanger contains only one type of ionogenic group, that is, a group which is either ionized or capable of dissociation into fixed ions and mobile counter-ions. C.

IONIZATION The formation of ions by addition or removal of electrons from atoms , molecules, or groups of molecules or by the division of molecules. IUPAC82..

IONIZATION CHAMBER A radiation detector which employs an electric field for the collection at the electrodes of charges associated with the ions produced in the sensitive volume by ionizing radiation , without charge multiplication. The solid angle (2, 4) subtended when using the detector is sometimes specified. IUPAC82..

IONIZATION CURRENT The passage of a charged particle through a gas causes ionization; if an electric field is applied across the gas a current (due to the motion of the ions produced) flows between the electrodes. NM.

IONIZATION DENSITY The density of the ionization, produced in the path of a charged particle passing through matter, depends upon the amount of charge, the velocity of the particle, and the nature of the matter. NM.

IONIZATION ENERGY The minimum energy required to ionize an atom or molecule which is originally in the ground state . IUPAC82..

IONIZATION POTENTIAL See ionization energy .

IONIZING RADIATION Any radiation consisting of directly or indirectly ionizing particles or a mixture of both or photons with energy higher than the energy of photons of ultraviolet light or a mixture of both such particles and photons. IUPAC82..

IONIZATION, SPECIFIC See specific ionization .

ION MICROPROBE The probe used in ion probe microanalysis .

ION PAIR A pair of oppositely charged ions, or an electron and a cation, held together by Coulombic attraction without formation of a covalent bond.

ION GEMINATE PAIRS Ion pairs in which oppositely charged particles are held together at certain equilibrium distance by Coulomb attraction.

ION PROBE MICROANALYSIS Any technique in which the specimen is bombarded by a focused beam of (primary) ions (diameter less than 10 mm) and the (secondary) ions ejected from the specimen are detected after passage through a mass spectrometer . C.

IPAA See instrumental photon activation analysis .

IPAC Integral perturbed angular correlation .

IPMA Ion probe microanalysis .

IRIDIUM ANOMALY The name given to the sharp maximum observed in iridium abundance versus depth profile of certain geologic formations. Discovered in 1979, the interpretation remains controversial.

IRMA See immunoradiometric assay .

IRMS Isotope ratio mass spectrometer.

IRRADIATION Exposure to ionizing radiation . IUPAC82..

ISOBARS, NUCLEAR Nuclides having the same mass number but different atomic numbers . IUPAC82..

ISODIAPHERES Nuclei having equal neutron excesses.

ISOMER One of two or more nuclides having the same mass number A and atomic number Z , but existing for measurable times in different nuclear energy states.

ISOMERIC STATE An excited nuclear state having a mean life long enough to be observed.

ISOMERIC TRANSITION A spontaneous transition between two isomeric states of a nucleus or between an isomeric state and the ground state of a nucleus.

ISOMERS, NUCLEAR See isomer .

ISORAD In nuclear geology , contours of equal radioactivity.

ISOSPIN In nuclear structure, a quantum mechanical formalism in which the charge on a nucleon is treated like the spin of an electron, that is, half-integral with two possible orientations. The 0 and +1 charges become $+(1/2)$ and $-(1/2)$ isospins. FKMM.

ISOTONES Nuclides having the same neutron number but different atomic numbers . IUPAC82..

ISOTOPES Nuclides having the same atomic number but different mass numbers . IUPAC82..

ISOTOPE DILUTION Mixing of a given nuclide with one or more of its isotopes . IUPAC82..

ISOTOPE DILUTION ANALYSIS A method of quantitative analysis based on the measurement of the isotopic abundance of a nuclide after dilution by mixing with one or more of its isotopes.

ISOTOPE DILUTION ANALYSIS, DIRECT Isotope dilution analysis used for the determination of a non-radioactive element with the aid of one of its radionuclides . IUPAC94.

ISOTOPE DILUTION ANALYSIS, REVERSED Isotope dilution analysis used for the determination of the isotopic carrier in a solution of a radionuclide with the aid of one of its stable isotopes. IUPAC94.

ISOTOPE DILUTION ANALYSIS, SUBSTOICHIOMETRIC A method of isotope dilution analysis . The final isotopic abundance is estimated from the amount of the nuclide present in a quantity of the relevant element separated from the sample. That quantity must be identical to the quantity isolated from a standard solution of the radioisotope added. The analysis requires that the separations be substoichiometric, adding identical but smaller than stoichiometric amounts of the reagent to the standard and diluted sample solutions.

ISOTOPE EFFECT The difference in behavior between two substances of which only the mass numbers of one or more of the constituent atoms are different.

ISOTOPE EXCHANGE Any process which does not lead to usual physicochemical changes of the system, but changes the distribution of the isotopes of the given element between different chemical forms, different phases, or inside molecules. (Roginskij, S. Z.: Theoretische Grundlagen der Isotopenchemie. VEB-Deutscher Verlag der Wissenschaften, Berlin 1962.) The exchange of places between isotopes of atoms in different valency states, in different molecules or ions, or in different sites in the molecule or ion. IUPAC82..

ISOTOPE EXCHANGE ANALYSIS A method of quantitative analysis based on the isotope exchange between isotopes of the element to be determined and other isotopes of this element in different valency state or in different molecules. IUPAC94.

ISOTOPE FARM A closed biological growth chamber in which biochemically labeled compounds are produced by growth in an isotopically enriched nutrient environment.

ISOTOPE, STABLE A nuclide which is not radioactive.

ISOTOPE GEOCHRONOLOGY Determining the age of geological materials using radiochemical or other isotopic dating techniques.

ISOTOPE GEOLOGY Investigation of geological phenomena by means of stable and radioactive isotopes of elements and of changes in their abundance.

ISOTOPE HYDROLOGY The study of the properties and distribution of water on the surface of the earth, in the soil and rocks, and in the atmosphere as measured using stable and radioactive isotopes and measurements of their abundances.

ISOTOPE RATIO MASS SPECTROMETRY A mass spectroscopic instrument with low resolution but excellent precision able to determine very small changes in the isotopic composition of gas samples. J.

ISOTOPIIC ABUNDANCE See abundance, isotopic .

ISOTOPIIC CARRIER See carrier, isotopic .

ISOTOPIIC MODIFICATION Preparing a compound that has a macroscopic composition such that the isotopic ratio of nuclides for at least one element deviates measurably from that occurring in nature.

ISOTOPIIC NEUTRON SOURCE Neutron sources generated by a spontaneously fissioning nuclide or by a nuclear reaction induced by radiation from one radioisotope in a mixture.

ISOTOPIIC NUCLIDES Isotopes.

ISOTOPIIC SEPARATION Operation for the purpose of modifying an isotopic abundance in a mixture of isotopes . IUPAC82..

ISOTOPIIC SUBSTITUTION A process in which all molecules have a specified nuclide at a specified position. KE.

<ISOTOPIIC TARGET >

ISOTOPIIC TRACER See tracer, isotopic.

ISOTOPOMER Chemically identical structures that differ in the atomic mass of one or more of their elements. J.

ISOTRON A device for sorting isotopes of an element in which ions are accelerated to a fixed energy in a strong electric field and an radiofrequency field then selects ions according to their velocity which is inversely proportional to the square root of their mass. M.

IT Isomeric transition .

IVNAA In vivo neutron activation analysis .

IVPGAA In vivo prompt gamma neutron activation analysis . CRC.

JET TRANSFER Rapid transport of radionuclides using a gas jet, e.g., a helium jet . See gas jet .

JUNCTION, P-N Of a semiconductor detector, the intermediary zone between a p-type and n-type semiconductor.

<JUNCTION DIVIDE DETECTOR >

K-CAPTURE See K-electron capture .

KERMA K)inetic e)nergy r)leased in ma)terial.

ko FACTOR In activation analysis , the ratio of the product of atomic weight, isotopic abundance of activated nuclide, abundance of gamma-ray being measured, and the 2200 m/s cross section for an analyte element and a monitor nuclide. Its use in the ko method enables independence from irradiation conditions (thermal-to-epithermal ratio) and from counting conditions. The factor can be determined experimentally or from tabulated constants. KE.

K-ELECTRON CAPTURE Radioactive decay of a nucleus by electron capture in which the electron captured by the nucleus was originally in the K-shell (1s atomic orbital).

keV kiloelectronvolt; 10³ electronvolts.

KRYPTONATES A solid compound or metal into which ⁸⁵Kr has been incorporated by ion bombardment or thermal

LABEL A marker, tag or indicator distinguishable by the observer but not by the system and used to identify a tracer . IUPAC82..

LABELED Made identifiable by a label . IUPAC82..

LABELING The act of incorporating a label into a chemical.

LABELING, AUTOLOGOUS The radiolabeling of cells or plasma from a patient before re-administration to the same patient. J.

LABELING, COLD Chemical or biochemical synthesis which incorporates a preformed label into a desired product.

LABELING, CONJUGATION Labeling of a substance by conjugation with a labeled molecule. IUPAC94.

LABELING, END Procedure in which terminal phosphate groups of DNA are removed and enzymatically replaced with radiolabeled groups. J.

LABELING, EXCHANGE Labeling of a substance by isotope exchange . IUPAC94.

<LABELING, EXCITATION >

LABELING, GENERAL Labeling in which compounds are nonuniformly labeled where the position of the radioactive atom in the molecule varies from one molecule to the other. Also called random labeling. NM.

LABELING, ISOTOPIC Labeling in which the resulting product is only different from the initial one by its isotopic composition. IUPAC94.

LABELING, NON-ISOTOPIC Labeling in which the resulting product has a different chemical composition from the initial one. IUPAC94.

LABELING, RECOIL Labeling by a chemical reaction initiated by recoil. IUPAC94.

LABELING, (SITE) SPECIFIC Isotopic labeling at a definite location on a complex molecule. J, KE.

LABELING, WILZBACH Labeling of a substance by exposing it to tritium gas. IUPAC94.

LANTHANIDES An element which is any of the first series of f-block elements or inner transition elements commencing with lanthanum at atomic number 57 and ending with lutetium at atomic number 71.

LANTHANOIDS See lanthanides .

<LASER-INDUCED MASS SPECTROSCOPY

LASER OPTOACOUSTIC SPECTROSCOPY An optical spectroscopy technique in which an optoacoustic modulator is used to produce an equidistant series of sharp pulses in a laser beam.

LATENCE TIME (OF A DETECTOR) See dead time .

L-CAPTURE See L-electron capture .

LEACH RATE The rate at which radioactivities are leached from solid waste aggregates by solubilization in water or aqueous liquid.

LEAD CASTLE, CAVE OR HOUSING A structure, made of lead bricks, to enclose small radioactive sources. The structure may or may not contain viewing or handling facilities. NM.

LEAD EQUIVALENT The thickness of lead, which, under specified conditions or irradiation, affords the same protection as the material under consideration. NM.

LEAD GLASS Glass into which lead oxide is incorporated. M. Used for shielding purposes when limited visual observation is still necessary.

LEAKAGE In reactors, the loss of neutrons to the surroundings. In general, all radiation except the useful beam.

L-ELECTRON CAPTURE Radioactive decay of a nucleus by electron capture in which the electron captured by the nucleus was originally in the L-shell (2s or 2p atomic orbital).

LEAST SQUARES TECHNIQUE A procedure for replacing the discrete set of results obtained from an experiment by a continuous function which best approximates the discrete results.

LEPD Low-energy photon detector.

LET Linear energy transfer.

LETHARGY (OF A NEUTRON) A measure of the energy lost by neutrons in the slowing down due to multiple scatterings in the moderator. D.

LEWIS EFFECT A peak in the thick target yield curves of narrow resonances near the resonance energy, due to the quantized character of charged-particle energy loss in penetrating matter. (Proc. of 3rd Int'l Conf on Chem. Analysis, Nucl. Inst. Meth. B66 11 [1992].)

LIFETIME See average life .

LIGAND A substance or part of a substance that binds to a specific receptor. IUPAC94.

LINAC A linear accelerator .

LINEAR ANALYZER A position sensitive detector, used in radiochromatography imaging, in which there is no motion of detector relative to sample. J.

LINEAR ACCELERATOR An accelerator in which the beam travels in a straight line during the entire acceleration process.

LINEAR ELECTRON ACCELERATOR An evacuated metal tube in which electrons pass through a series of small gaps (usually in the form of cavity resonators in the high frequency range) so arranged and spaced that, at a specific excitation frequency, the stream of electrons on passing through successive gaps gains additional energy from the electric field in each gap. IUPAC82..

LINEAR ENERGY TRANSFER The average energy locally imparted to a medium by a charged particle of specified energy, per unit distance traversed. IUPAC82..

LINEAR PULSE AMPLIFIER See amplifier, linear pulse .

LIQUID DROP MODEL A model of the nucleus in which the qualitative similarities to the cohesive forces of an ordinary liquid are recognized. The effects of volume energy and surface effects are supplemented by a variety of more subtle effects of both classical and quantum nature.

LIQUID EMULSION Nuclear (photographic) emulsion manufactured in gel form so that after heating it can be poured to the desired shape at the desired time. NM.

LIQUID ION-EXCHANGER See ion-exchanger, e.g., di-(2-ethylhexyl) phosphoric acid (HDEHP) is a liquid cation exchanger.

LIQUID SCINTILLATION COUNTER A radiation counter utilizing a liquid scintillation detector .

LIQUID SCINTILLATION DETECTOR See detector, liquid scintillation .

LITHIUM-DRIFTED DETECTOR See germanium detector, Ge(Li) .

LIVE TIME For a measurement, the time during which a radiation measuring assembly is capable of processing events occurring in the radiation detector . It equals the clock time minus the integrated resolving or dead time . IUPAC82..

LIXIVIATION Extraction from a solid mixture by washing or percolation. M.

LLOD Lower limit of detection; synonymous with limit of detection. CRC

LOD Limit of detection. CRC

LOGIT In competitive binding assays , the logit-log dose relationship, in which the response is defined by $R = \text{logit}(y) = \log[y/(1-y)]$ where $y = b/b_0$ with b = fraction of tracer bound and b_0 = value of b with no unlabeled ligand in the system. Logit transformed assay data frequently yield straight-line dose-response curves, amenable to statistical analysis. IUPAC94.

LOSS FREE COUNTING A scheme for correcting for dead time losses. It uses a pulser in conjunction with calculating the number of lost pulses during a dead period to augment the next spectral pulse artificially.

LOW LEVEL COUNTING Any counting system in which special care is used to optimize the counting efficiency and reduce the background count rate. Such features as anticoincidence shielding and special materials are usually employed.

LPO METHOD A radioiodination procedure employing the enzyme lactoperoxidase. KE.

LUMINESCENCE A phenomenon in which the absorption of primary radiation by a substance gives rise to the emission of electromagnetic radiation characteristic for that substance. IUPAC82..

MACROCYCLES An organic molecule with a large ring structure, usually containing over fifteen atoms. M.

MACROPOROUS ION EXCHANGER An ion exchanger with pores that are large compared to atomic dimensions. C.

MAGIC NUMBERS In the shell model of nuclear structure, nuclei with certain neutron numbers and certain proton numbers are observed to be particularly stable. The values of these so-called "magic" numbers are 2, 8, 20, 28, 50, and 82. A higher shell at neutron number 126 exists and there are theoretical predictions about additional shells for protons and neutrons.

MANIPULATOR A hand-operated or -controlled device for remotely handling radioactive materials. IUPAC82..

MAN-MADE ELEMENT See artificial element.

MASKING AGENT A substance preventing the interfering reaction of one or more foreign substances in a determination by conversion into soluble complexes, different oxidation states, or other unreactive forms. D.

MASS DEFECT The difference between the sum of the rest masses of protons and neutrons which form a nucleus and the measured mass of the same nucleus.

MASS-ENERGY EQUIVALENCE The equivalence of mass m and energy E as expressed in Einstein's equation $E = mc^2$.

MASS EXCESS The excess of the measured mass of an atom over its mass number.

MASS NUMBER The total number of neutrons and protons in a nucleus. Synonymous with nucleon number.

MASS SPECTROMETRY The use of instruments that analyze ions by mass-to-charge ratio to measure abundances of isotopes.

MATRIX (IN ANALYSIS) In analysis: refers to the analytical sample, considered as an assemblage of constituents, with all their individual properties. The combined effect that the various constituents of the matrix may exert on the measure of the analysis of the element is referred to as the matrix effect. C.

MAXIMUM PERMISSIBLE CONCENTRATION An expected upper limit for the concentration of a specified radionuclide in a material taken into the body below which continuous exposure (or in the case of occupational maximum permissible concentration, exposure for 40h/wk) to the material is not considered biologically harmful. NM.

<MAXIMUM PERMISSIBLE DOSE EQUIVALENT>

MCA Multichannel analyzer. See pulse height analyzer, multichannel .

MEAN FREE PATH The average distance traveled by a particle between collisions.

MEAN LIFE, RADIOACTIVE The average lifetime of a radioactive nuclide . IUPAC82..

MEAN LIFETIME See average life .

MEAN LINEAR RANGE See range, mean linear .

MEAN MASS RANGE See range, mean mass .

MEASURED SPECTRUM See spectrogram .

MECHANISM A detailed description of the pathway leading from the reactants to the products, including as complete a characterization as possible of the composition, structure and other properties of reaction intermediates and transition states. C.

METASTABLE STATE An isomeric state in an energy state higher than the ground state . IUPAC82..

meV millielectron volt = 1/1000 electron volt.

MeV Million electron volts or megaelectronvolt.

MIBK Methylisobutylketone, a common solvent used in extraction separations.

MICROAUTORADIOGRAPHY Autoradiography for viewing with a microscope. J.

MICROSCOPY, NUCLEAR Use of nuclear microprobes to investigate the elemental structure of biological objects.

MICRO-PIXE Particle-induced x-ray emission spectroscopy in which the particle beam is highly collimated and focused allowing position sensitive analysis. KE.

MICROTRON A cyclotron for accelerating electrons.

MILKING The process of separating a radioactive tracer from a parent radionuclide bound in a radioisotope generator .

MINERALIZATION 1. Formation of mineral in vivo, e.g., in bone, tooth, etc. 2. Use of reagents and various procedures to completely solubilize a solid sample mixture for analysis. (Not recommended.)

MIRROR NUCLEI A pair of isobars in which the atomic and neutron number of one equals the neutron and atomic number of the other, respectively.

MIXED LABELED A specifically labeled compound is referred to as mixed labeled when the isotopically substituted compound has more than one kind of modified atom. C.

MNAA Molecular neutron activation analysis .

MODERATION Reduction of the neutron energy by scattering without appreciable capture . IUPAC82..

MODERATOR A material used to reduce neutron energy by moderation). IUPAC82..

MODIFICATION, ISOTOPIC A process in which a compound has been given an abnormal isotopic ratio in one or more elements present. KE.

MOLECULAR ACTIVATION ANALYSIS See molecular neutron activation analysis .

MOLECULAR NEUTRON ACTIVATION ANALYSIS A variation of radiochemical neutron activation analysis in which chemical speciation (often by bioanalytical techniques) is involved in pre-irradiation separation. Synonymous with chemical neutron activation analysis , which is preferred.

MOLECULAR WEIGHT Also known as the relative molecular mass of a substance, the molecular weight is the ratio of the average mass per formula unit of a substance to 1/12 of the mass of an atom of nuclide ^{12}C . C.

MONITOR, BEAM See beam, monitoring .

MONITOR, FLUX See flux monitor .

MONOENERGETIC RADIATION Radiation consisting of particles of a single kinetic energy or photons of a single energy or wavelength.

MOSBAUER EFFECT Resonance absorption of gamma radiation by nuclei arranged in a crystal lattice in such a way that the recoil momentum is shared by many atoms. IUPAC82..

MSSBAUER SPECTROMETRY The spectroscopic technique based on the Mossbauer effect .

MOSBAUER NUCLIDE Any radioactive nuclide that may serve as a radiation source in Mossbauer effect experiments.

MOTHER In radiochemistry, synonymous with parent . See parent .

MOTHER LIQUOR The liquid that has passed through a chemical process.

MPC Maximum permissible concentration .

Mu The symbol for muonium used to emphasize the analogy of muonium to atomic hydrogen.

MULTICHANNEL (PULSE HEIGHT) ANALYZER See pulse height analyzer, multichannel .

MULTIPLE SCATTERING Successive rescattering of radiation within the scattering medium. C.

MULTIPLICATION NEUTRON The process in which a neutron produces on the average more than one neutron in a medium containing fissile material. IUPAC82..

MULTISCALING A mode of operation of a multichannel pulse height analyzer for studying the time dependence of radiation. The analyzer, when operated in the "multiscaling" mode, stores all pulses in a fixed channel until a preset time, the "dwell time", elapses, after which the pulses are stored in the next channel, and so on. Dwell times are typically microseconds or larger.

MU-MESIC ATOM or MOLECULE An atom or molecule which has captured a negatively charged muon into a stable atomic or molecular orbital.

MUON Mu-meson; a fundamental particle related to the electron.

MUONIUM An atomic system consisting of a muon and an oppositely charged electron .

N 1. Neutron number . 2. In dosimetry, the factor designed to take into account all parameters influencing a dose equivalent , except the absorbed dose and type and energy of the radiation . IUPAC82...

NAA Neutron activation analysis .

NaI(Tl) DETECTOR A scintillation crystal made of thallium-activated sodium iodide and used as a scintillation detector .

NATURAL ISOTOPIC ABUNDANCE See abundance, natural isotopic .

NATURAL RADIOACTIVITY Radioactivity of naturally occurring nuclides in materials where the isotopic abundance of that nuclide is natural . IUPAC82..

NCA No carrier added. J.

NDP (1). Neutron diagnostic probe. (2). Neutron depth profiling.

NEGATRON A negative beta-particle .

NEUTRINO Any of several neutral, possibly massless particles always involved with electrons in beta-decay nuclear transformations.

NEUTRON ACTIVATION See activation .

NEUTRON ACTIVATION MASS SPECTROMETRY (NAMS) A technique in which the products of activation are detected by mass spectrometry. For example, in determining boron in biological samples, neutron activation produces alphas by the $^{10}\text{B}(n,\alpha)$ reaction and the alphas are subsequently measured as ^4He in the mass spectrometer. FR.

NEUTRON CAPTURE A nuclear reaction in which a neutron is absorbed by a target nucleus producing an isotope one mass number greater in its ground or excited states.

NEUTRON DENSITY The number of free neutrons divided by the containing volume. Partial densities may be defined for neutrons characterized by such parameters as energy and directions. IUPAC82..

NEUTRON DEPTH PROFILING A method of charged particle activation analysis in which deuterons of specific energy undergo (d,n) reactions in which the neutron energy spectrum is measured by time-of-flight techniques. The energy is a measure of the deuteron's energy when the reaction occurred and therefore a probe of how deep the reacting element is in the sample. The intensity of detected neutrons is a measure of reacting element concentration. NAC.

NEUTRON DIAGNOSTIC PROBE A device for prompt analysis that is a combination of a neutron generator , an alpha-particle counter for time-of-flight neutron spectrometry, and a detector for inelastic gamma-ray spectroscopy.

NEUTRON EXCESS The number of neutrons in excess of the number of protons in a nuclide .

NEUTRON FLUX See flux density, particle .

NEUTRON GENERATOR 1.) An accelerator, usually small, of light charged ions (p, d, t) which produces a flux of neutrons through nuclear reactions in a light element target.
2.) Any device which produces neutrons.

NEUTRON NUMBER The number of neutrons in a nucleus.

NEUTRONS, COLD Neutrons with a neutron temperature considerably lower than normal room temperature. IUPAC82..

NEUTRONS, DELAYED Neutrons emitted by fission products formed by nuclear decay (the observed delay is due to the lifetime of the preceding nuclear decay or decays).

NEUTRONS, EPICADMIUM Neutrons of kinetic energy greater than the effective cadmium cut-off for neutrons.

NEUTRONS, EPITHERMAL Neutrons of kinetic energy greater than that of thermal agitation. The term is often restricted to energies just above thermal. IUPAC82..

NEUTRONS, FAST Neutrons of kinetic energy greater than some specified value. This value may vary over a wide range and will be dependent upon the application, such as reactor physics, shielding or dosimetry. IUPAC82..

NEUTRONS, FISSION Neutrons originating in the fission process which have retained their original energy. IUPAC82..

NEUTRONS, INTERMEDIATE Neutrons of kinetic energy between the energies of slow and fast neutrons . In reactor physics, the range might be 1 eV to 0.1 MeV. IUPAC82..

NEUTRONS, PROMPT Neutrons accompanying the fission process without measurable delay. IUPAC82..

NEUTRONS, RESONANCE Neutrons , the energy of which corresponds to the resonance energy of a specified nuclide or element . If the nuclide is not specified, the term refers to resonance neutrons of ^{238}U . IUPAC82..

NEUTRONS, SLOW Neutrons of kinetic energy less than some specified value. This value may vary over a wide range and depends on the application. In reactor physics, the value is frequently chosen to be 1 eV; in dosimetry , the effective cadmium cut-off is used. IUPAC82..

NEUTRONS, THERMAL Neutrons in thermal equilibrium with the medium in which they exist. IUPAC82..

NEUTRON TEMPERATURE The temperature assigned to a population of neutrons when this population is approximated by a Maxwellian distribution. C.

NICK TRANSLATION Labeling procedure in which DNA is first "nicked" (broken) and a radioactive nucleotide is re-included by the action of DNA polymerase. J.

NIM MODULE An electronic component for nuclear instrumentation packaged in a standardized way to allow interchangeability with alternative units and to provide compatibility with equivalently standardized housing and powering units (bins) called NIM bins .

NIMBIN Standard bins for housing and supplying power to complementarily standardized electronics called nuclear instrument modules, or NIM modules .

NO CARRIER ADDED A preparation of a radioactive isotope which is essentially free from stable isotopes of the element in question. IUPAC94.

NONACTIVATION ANALYSIS Methods of analysis based on the interaction of nuclear radiation or X-rays with the sample, leading to absorption and backscattering, not to activation of the determined component. HRC.

NON-DESTRUCTIVE ACTIVATION ANALYSIS See activation analysis.

NON-IONIZING RADIATION Radiation , the energy of which is insufficient to produce ions in matter. Included are microwaves, infrared light, visible light and slow neutrons. In most cases, ultraviolet radiation may be considered a non-ionizing radiation too.

NON-SPECIFIC BINDING That portion of the tracer used in a competitive binding assay that is found in the bound fraction, independent of the binding reaction. Also expressed as minimum binding. NM.

NRA Nuclear reaction analysis.

NSB See non-specific binding .

NUCLEAR ACTIVATION ANALYSIS See activation analysis.

NUCLEAR CHEMISTRY See chemistry, nuclear .

NUCLEAR DECAY See decay, nuclear .

NUCLEAR EMULSION A photographic emulsion specially prepared for the detection of nuclear particles. Such emulsions are generally thicker and contain a higher concentration of silver halide than those used for standard photography. The emulsion is usually deposited on a glass plate. NM.

NUCLEAR FISSION See fission, nuclear .

NUCLEAR FORCE See force, nuclear .

NUCLEAR FUSION See fusion, nuclear .

NUCLEAR GEOLOGY Application of nuclear science and techniques to geologic studies.

NUCLEAR ISOMERS See isomers, nuclear .

NUCLEAR LEVEL One of the energy values at which a nucleus can exist for a measurable time ($>10^{-22}$ s).

NUCLEAR MEDICINE A branch of medicine "taken to embrace all applications of radioactive materials in diagnosis or treatment or in medical research with the exception of the use of sealed radiation sources in radiotherapy". (World Health Organization, 1972); "the clinical and laboratory medical specialty that employs for diagnosis, therapy, and research the nuclear properties of radioactive and stable nuclides to evaluate metabolic, physiologic, and pathologic conditions of the body" (American Board of Nuclear Medicine); "devoted to the diagnosis, treatment, research, and prevention of disease by making use of unsealed radioactive sources and of the properties of stable radionuclides" (Council of Europe and the Society of Nuclear Medicine Europe). Direct therapy using accelerators is also included.

NUCLEAR MICROPROBE A charged-particle or ion beam with excellent spatial resolution and used for nuclear reaction analysis . FR.

NUCLEAR MIGRATION Transport of nuclides from their point of origin by natural processes.

NUCLEAR PARTICLE See particle, nuclear .

NUCLEAR PHARMACEUTICALS See radiopharmaceuticals .

NUCLEAR RADIUS The geometrical radius of the atomic nucleus; because of the relative incompressibility of nuclear matter, it is approximately proportional to the cube root of the atomic number of the nucleus.

NUCLEAR REACTION A transformation of a nucleus which occurs (i) when another nuclear particle approaches closely enough to be influenced by the mutual attractive nuclear force between them or (ii) when affected by an electromagnetic force of sufficient strength.

NUCLEAR REACTION ANALYSIS Charged-particle induced nuclear reactions for determination of elements, usually depth profiling of light elements. FR.

NUCLEAR REACTOR See reactor, nuclear .

NUCLEAR RESONANCE BROADENING A technique used for obtaining concentration depth profiles by comparing resonant charged-particle capture gamma-ray yields from an unknown distribution in a sample to those yields from a known distribution of the same isotope. Frequently, the latter distribution is just the natural isotopic mixture.

NUCLEAR RESONANCE SCATTERING Mössbauer effect .

NUCLEAR SOLID STATE TRACK DETECTOR See solid state track detector .

NUCLEAR SPECTROSCOPY The measurement of the energy spectrum of particles emitted or scattered from nuclei.

NUCLEAR SPIN See spin, nuclear .

NUCLEAR TRANSFORMATION See transformation, nuclear .

NUCLEAR TRANSITION See transition, nuclear .

NUCLEIDE Nuclide is preferred.

NUCLEON A proton or a neutron . IUPAC82..

NUCLEONICS The practical applications of nuclear science and the techniques associated with these applications. NM.

NUCLEON NUMBER Number of nucleons in a nucleus . IUPAC82..

NUCLEOPORE FILTER A filter with micron and submicron sized pores. The pores are of controlled and uniform size, produced by chemically etching radiation damage tracks of heavy ions with which the filters are bombarded as part of the production process.

NUCLEUS The positively charged central portion of an atom , excluding the orbital electrons . IUPAC82..

NUCLIDE A species of an atom characterized by its mass number, atomic number and nuclear energy state, provided that the mean life in that state is long enough to be observable. IUPAC82..

NUCLIDIC MASS The rest mass of a nuclide expressed in atomic mass units. IUPAC82..

OFF-LINE Reference to a procedure or measurement done in conjunction with an accelerator or reactor but neither at the reaction site nor at the exact time the reaction occurs.

OKLO REACTORS Naturally occurring nuclear reactors which operated at the Oklo mine in Gabon, Africa nearly 2×10^9 years ago. Geological uranium deposits partially depleted of fissile uranium. In the past, the ores were substantially more enriched in fissile uranium. The combination of the richness of the ore, its higher ^{235}U content (~3%) at the time, and presence of water (to act as moderator) caused the formation to behave as a natural fission reactor; burning fuel, producing fission radionuclides, and boiling off water, the latter resulting in "shut-down". This behavior can cycle.

ON-LINE Reference to a procedure or measurement done in conjunction with an accelerator or reactor and performed at the reaction site or at the exact time the reaction occurs.

PAA Photon activation analysis. See instrumental photon activation analysis.

PAC Perturbed angular correlation.

PACKING FRACTION The mass excess of a nucleus divided by the mass number; that is, the average mass excess per nucleon.

PAES Positron-annihilation-induced Auger-electron emission spectroscopy.

PAIR ATTENUATION COEFFICIENT The attenuation coefficient when only the pair production process is taken into account. IUPAC82..

PAIR PRODUCTION The simultaneous formation of an electron and a positron as a result of the interaction of a photon of sufficient energy ($> 1.02 \text{ MeV}$) with the field of a charged particle.

PARALYSIS TIME See dead time.

PARENT A nuclide which is a precursor to another nuclide in a decay chain.

PARITY A symmetry property of a spatial wave function. The parity is said to be even (or +) if the wave function is left unchanged by reversing the sign of all the coordinates, odd (or -) if the sign of the wave function is thereby changed. NM.

PARTIAL CROSS SECTION The portion of the total cross section corresponding to a particular final reaction channel, that is, to a distinct set of reaction products.

PARTIAL DECAY CONSTANT For a radionuclide, the probability in unit time for the decay of one of its nuclei by one of several modes of decay. IUPAC82..

PARTICLE A nuclear or an elementary particle . IUPAC82..

PARTICLE DENSITY The number of particles divided by the containing volume. IUPAC82..

PARTICLE FLUX DENSITY See flux density, particle .

PARTICLE-INDUCED DESORPTION MASS SPECTROMETRY Time-of-flight mass analysis of a sample that is desorbed from a surface as a result of bombardment by microbeams of charged particles , most often heavy-ions, for instance with a nuclide decaying by spontaneous fission .

PARTICLE-INDUCED GAMMA EMISSION Charged particle activation analysis in which the gamma radiations are detected (on line) from the electromagnetic de-excitation of the product nuclei. CRC.

PARTICLE-INDUCED PROMPT PHOTON SPECTROMETRY See particle-induced gamma emission .

PARTICLE-INDUCED X-RAY EMISSION SPECTROSCOPY Any technique in which a specimen is bombarded with a focused beam of high-energy particles (protons, α -particles, or heavier ions) and the characteristic x-ray spectrum generated in the specimen is recorded. C.

PARTICLE, NUCLEAR A nucleus or any of its constituents in any of their energy states. IUPAC82..

PARTICLE, ELEMENTARY A particle in which, at the present, no structure can be observed at moderate energies. IUPAC82..

PARTITION COEFFICIENT Distribution ratio of a radionuclide between two phases.

PASSIVE ASSAY OR INTERROGATION A non-destructive measurement of nuclear material content or element or isotopic concentration of an item carried out by observing spontaneous radiations . SAFE.

PDMS Particle-induced desorption mass spectrometry .

PEAK ANALYSIS The extraction of relevant peak parameters (i.e., position, area) from a measured spectrum . IUPAC82..

PEAK AREA METHOD A method of peak analysis in which a peak area is calculated by subtracting an estimate of the underlying continuum in a relevant part of a measured spectrum . IUPAC82..

PEAK FITTING A method of peak analysis in which a relevant part of a spectrum is fitted with a theoretical response function. IUPAC82..

PEAK-TO-COMPTON RATIO In a gamma-ray spectrum, the relative heights of the full energy peak to the broad continuum that lies below its Compton edge . It is a measure of a detector's ability to distinguish full energy peaks from the general smooth background in a complex spectrum.

PELLICLE In nuclear emulsions , the thin layer or film of photographic emulsion material.

PENETRATION FACTOR The fraction of particles (or probability per particle) which pass through a classically forbidden barrier. The barrier can be due to centripetal and Coulomb effects, for example.

PERTURBED ANGULAR CORRELATIONS Angular correlations between coincident radiations in which the angular correlation coefficients have a time-dependent factor which depends on the lifetime of the intermediate state and on the interaction of the nuclear electromagnetic moments with the local atomic or molecular electric field.

PESA See proton elastic scattering analysis .

PET Positron emission tomography

PGAA Prompt gamma-ray activation analysis. See prompt gamma-ray neutron activation analysis .

PGNAA Prompt gamma-ray neutron activation analysis .

PHA Pulse height analysis or analyzer .

PHOTOACTIVATION Activation induced by photons, that is, by electromagnetic radiation.

PHOTOEFFECT See photoelectric effect .

PHOTOELECTRIC ATTENUATION COEFFICIENT The attenuation coefficient when only the photoelectric process is taken into account. IUPAC82..

PHOTOELECTRIC EFFECT The complete absorption of a photon by an atom with the emission of an orbital electron . Synonymous with photoeffect . IUPAC82..

PHOTOELECTRIC PEAK Of a spectrum of gamma radiation , the part of the spectral response curve corresponding to the absorption in the radiation detector by the photoelectric effect of the detected gamma energy. In most cases the peak also contains

the events caused by multiple processes and use of the expressions total absorption peak or full energy peak is to be preferred. Synonymous with photopeak . IUPAC82..

PHOTOELECTRON The electron ejected from an atom which completely absorbs a photon in the photoelectric effect .

PHOTOFRACTION The fraction of detected gamma-rays that produce output signals in the photopeak region. NM.

PHOTOMULTIPLIER TUBE A vacuum tube containing a photosensitive layer which serves as the cathode for an electron multiplier.

PHOTON A quantum of electromagnetic radiation . IUPAC82..

PHOTON ACTIVATION See activation .

PHOTONEUTRON A neutron which is ejected from a nucleus as a consequence of the absorption of a photon .

PHOTONUCLEAR REACTION A nuclear reaction induced by absorption of a photon .

PHOTOPEAK See photoelectric peak .

PHOTOPEAK EFFICIENCY, ABSOLUTE Of a gamma-ray spectrometer , the counting efficiency when only considering the events recorded in the photopeak . IUPAC82..

PHOTOPEAK EFFICIENCY, INTRINSIC The detector efficiency when only considering counts resulting from the photoelectric effect . IUPAC82..

PIG A small shielding container for storing or carrying radioactive material or for housing a detector system for measuring radioactivity.

PIGE Particle-induced gamma emission .

PIGME See particle induced gamma emission .

PILE Obsolete term for a nuclear reactor . NM.

PILE-UP The processing by a radiation spectrometer of pulses resulting from the simultaneous absorption of independent particles or photons in a radiation detector . As a result they are counted as one single particle or photon with energy between the individual energies and the sum of these energies. IUPAC82..

P.I.N SEMICONDUCTOR DETECTOR See semiconductor detector, P.I.N.

PIPPS Particle-induced prompt photon spectroscopy .

PIXE Particle-induced x-ray emission .

PLASMA DESORPTION MASS SPECTROMETRY See Particle-induced desorption mass spectrometry .

PLATEAU The plot of counting rate against voltage applied to a Geiger counter in the presence of a constant source of radiation. As the voltage is increased from zero, this counting rate first rises sharply to a plateau several hundred volts long. Over the plateau the counting rate rises very slowly, and at the end it increases rapidly as instability sets in. NM.

PM Photomultiplier tube.

PNEUMATIC TUBE A cylindrical pipe for transporting a rabbit (sample) by means of compressed air.

POCKET ION CHAMBER A small dosimeter having a physical appearance similar to a fountain pen, used to monitor the amount of radiation to which an individual is exposed. NM.

POPOP diphenyloxazolbenzene, used in liquid scintillation spectroscopy as a wavelength shifter.

POSITION SENSITIVE DETECTOR A radiation detector which records not only physical properties of the radiation, but also where it impinges on the detector surface.

POSITRON A positively charged electron . IUPAC82..

POSITRON ANNIHILATION The conversion of a positron and its antiparticle, the electron, into annihilation radiation .

POSITRON DECAY Radioactive decay in which the emission of a positron by the decaying nucleus occurs, accompanied by an emitted neutrino.

POSITRON EMISSION TOMOGRAPHY An external technique for the rapid serial reconstruction of the spatial distribution of any positron-emitting radioisotope that has been administered in vivo . J.

POSITRON-ANNIHILATION-INDUCED AUGER-ELECTRON EMISSION SPECTROSCOPY A form of Auger electron emission spectroscopy based on the use of thermalized positrons whose annihilation excites the Auger emission. The surface analysis technique is particularly sensitive to the outermost few nanostroms layer.

POSITRONIUM The short-lived atom consisting of a positron and electron.

POSTLABELING A method for determination and measurement of covalent DNA adducts based on enzymatic incorporation of ^{32}P into DNA nucleotides.

POWER, STOPPING See stopping power .

PPO 2,5-diphenyloxalol, used in liquid scintillation spectrometry as a primary scintillator.

PRA Prompt radiation analysis. Use prompt gamma neutron activation analysis .

PREAMPLIFIER An amplifier whose primary function is boosting the output of a low-level frequency source to an intermediate level so that the signal may be further processed without appreciable degradation of the signal-to-noise ratio of the system. M.

PRECISION A measure for the reproducibility of measurements within a set, that is, of the scatter or dispersion of a set about its central value. IUPAC82..

PRECONCENTRATION In trace analysis: a process resulting in an increase in the concentration or the amount of the components of interest. As a synonym, enrichment is not recommended.

PRECURSOR Of a nuclide , any radioactive nuclide which precedes that nuclide in a decay chain . IUPAC82..

PROJECTILE A particle in a beam being used for irradiation .

PROMPT GAMMA A gamma ray which is emitted from an excited state of a nucleus immediately upon formation of that excited state by a previous decay step or reaction.

PROMPT GAMMA NEUTRON ACTIVATION ANALYSIS Neutron activation analysis in which the radiation of the neutron capture gamma-ray cascade is detected on-line , that is, simultaneously with the production. KE.

PROMPT NEUTRON ACTIVATION ANALYSIS See prompt gamma neutron activation analysis .

PROMPT RADIATION ANALYSIS See prompt gamma neutron activation analysis .

PROOFREADER "A malefactor who atones for making your writing nonsense by permitting the compositor to make it unintelligible." Ambrose Bierce in The Devil's Dictionary .

PROPORTIONAL COUNTER (TUBE) See counter tube, proportional .

PROTON A single nucleon, of mass number one, which is the nucleus of the hydrogen atom.

PROTON ELASTIC SCATTERING ANALYSIS Elastic recoil detection analysis using a proton beam.

PROTON NUMBER See atomic number .

PROTON MICROBEAM A highly collimated and focused beam of protons. KE.

Ps The symbol for positronium used to emphasize the analogy of positronium to atomic hydrogen.

PSEUDOCYCLIC ACTIVATION ANALYSIS A variation of cyclic activation analysis in which a delay is introduced between irradiation and spectrum acquisition. FR.

PSEUDO-RADIOCOLLOID An inactive colloid which incorporates radionuclides.

PULSE AMPLITUDE ANALYZER A sub-assembly for determining the distribution function of a set of pulses in terms of their amplitudes. Synonymous with pulse height analyzer . IUPAC82..

PULSE AMPLITUDE SELECTOR A circuit which gives an output pulse for each input pulse whose amplitude lies within a chosen interval. Synonymous with single channel pulse height analyzer . IUPAC82..

PULSE HEIGHT ANALYSIS The process of determining the spectrum of radiation energies through use of a pulse height analyzer .

PULSE HEIGHT ANALYZER See pulse amplitude analyzer .

PULSE HEIGHT ANALYZER, MULTICHANNEL A pulse amplitude analyzer which includes a storage function to record the number of pulses received per channel. IUPAC82..

PULSE HEIGHT ANALYZER, SINGLE CHANNEL See pulse amplitude selector .

PULSED NEUTRONS Neutrons of transient high flux density produced in certain reactors when control rods are removed. KE.

PULSED REACTOR ACTIVATION ANALYSIS Activation analysis using pulsed neutrons . KE.

PUREX PROCESS A separation scheme for recovering plutonium and uranium from fission products in reactor fuel. The process is based on the efficient partitioning of Pu and U into TBP . Ch.

PURITY, ISOTOPIC See abundance, isotopic .

PURITY, RADIOCHEMICAL For a material, the fraction of the stated isotope present in the stated chemical form. IUPAC82..

PURITY, RADIONUCLIDIC Of a material, that fraction of the total activity which is present in the form of the stated radionuclide (including its daughter products). IUPAC82..

PWR Pressurized water reactor.

QF Quality factor .

QUALITY FACTOR The linear-energy-transfer -dependent factor by which absorbed dose is multiplied to obtain dose equivalent . IUPAC82.

QUALITY OF RADIATION Penetration of radiation: frequently measured by its half-value layer, the thickness of some standard material which transmits 50% of the incident radiation. NM.

QUANTUM YIELD The number of moles transformed in a specified process, physically (e.g., by emission of photons) or chemically, per mole of photons absorbed by the system. C.

QUENCHING 1. The process of inhibiting continuous or multiple discharges following a single ionizing event in certain types of radiation detectors), particularly in (Geiger-Müller counter tubes . 2. The deactivation of an electronically excited state by non-radiative process, e.g., as a source of error when using liquid scintillation detectors . 3. The shortening of the lifetime of positronium by its interaction with other species. IUPAC94, partial.

QUENCHING CORRECTION Correction for errors due to different quenching for standards and test portions. When using liquid scintillation detectors , these corrections can be based on the standard addition or sample channels ratio method, or the use of automated external standardization. IUPAC94.

Q-VALUE In a nuclear transformation, the energy equivalent of the difference in atomic masses between the reactants and products, all in their nuclear ground states.

Q₀-VALUE The ratio of resonance integral to thermal cross section in activation analysis .

R Symbol for the roentgen .

RABBIT A small container propelled pneumatically or hydraulically through a tube leading between the laboratory and a location in a nuclear reactor or other device where irradiation of a sample can take place.

RAD A unit of absorbed dose . (Not a SI unit.) 1 rad is 0.01 J absorbed per kg of any material. 1 rad = .01 gray). NCRP.

RADIATION A term embracing electromagnetic waves as well as fast moving particles . IUPAC82..

RADIATION, ANNIHILATION See annihilation radiation .

RADIATION, BACKGROUND See background radiation .

RADIATION, CERENKOV See Cerenkov radiation .

RADIATION CHEMISTRY That part of chemistry which deals with the chemical effects of ionizing radiation , as distinguished from photochemistry associated with visible and ultraviolet electromagnetic radiation . IUPAC82..

RADIATION COUNTER See counter, radiation .

RADIATION DETECTOR See detector, radiation .

RADIATION EFFECTS Any of several effects brought about by the interactions of radiation with matter; effects such as radiolysis, ionization , excitation, and defect formation.

RADIATION, HARD See hard radiation .

RADIATION HAZARD Hazard that exists in a region where there is a radiation field, other than what is considered to be normal background radiation . IUPAC82..

RADIATION INACTIVATION METHOD A method for estimating protein size based on the correlation between the radiation dose applied and the amount of protein activity surviving the dose. { Anal. Bioch. ~May 1990.}

RADIATION, IONIZING See ionizing radiation .

RADIATION LENGTH The distance traveled by a charged particle through matter over which its energy is decreased by a factor e.

RADIATION, MONOENERGETIC See monoenergetic radiation .

RADIATION, NATURAL Radiation originating from natural radioactivity .

RADIATION, PENETRATING Gamma-rays, x-rays or neutrons with low interaction cross sections.

RADIATION, SOFT See soft radiation .

RADIATION SOURCE An apparatus or material emitting or capable of emitting ionizing radiation . IUPAC82..

RADIATION SPECTRUM The components of radiation arranged in order of their wavelengths, frequencies or quantum energies. For particle radiation they are arranged in order of their kinetic energies. IUPAC82..

RADIATIVE CAPTURE See capture, radiative .

RADICAL A molecular entity possessing an unpaired electron such as $\bullet\text{CH}_3$, $\bullet\text{SnH}_3$, $\bullet\text{Cl}$ (or $\text{Cl}\bullet$). (In these formulae the dot, symbolizing the unpaired electron, should be placed so as to indicate the atom of highest spin density, if this is possible.) Paramagnetic metal ions are not normally regarded as radicals. C.

RADIOACTIVE The property of unstable nuclides of undergoing spontaneous nuclear transformations with the emission of radiation .

RADIOACTIVE AGE Of an object, the time, estimated from measurement of the isotopic composition, during which the content of a radioactive species within that object has remained unchanged except for nuclear decay . IUPAC82..

RADIOACTIVE CHAIN See decay chain .

RADIOACTIVE CONTAMINATION A radioactive substance in a material or place where it is undesirable. IUPAC82..

RADIOACTIVE COOLING See cooling, radioactive .

RADIOACTIVE DATING See dating, radioactive .

RADIOACTIVE DECAY See decay, radioactive .

RADIOACTIVE EQUILIBRIUM See equilibrium, radioactive .

RADIOACTIVE FALLOUT See fallout, radioactive .

RADIOACTIVE HALF-LIFE See half-life, radioactive .

RADIOACTIVE INDICATOR See indicator, radioactive .

RADIOACTIVE PERIOD See radioactive mean life .

RADIOACTIVE SERIES See decay chain .

RADIOACTIVE SOURCE Any quantity of radioactive material which is intended for use as a source of ionizing radiation . IUPAC82..

RADIOACTIVE TRACER A tracer containing a radioactive label . IUPAC82..

RADIOACTIVE TRACER TECHNIQUE In analysis: a technique for investigating recovery, loss, behavior, and speciation of a microcomponent, in which a radioactively-labeled element or compound chemically identical with the microcomponent is added to the sample, and its behavior is followed by radioactivity measurements.

RADIOACTIVE WASTE Unwanted radioactive materials obtained in the processing or handling of radioactive materials. IUPAC82..

RADIOACTIVITY The property of certain nuclides of showing radioactive decay . IUPAC82..

RADIOACTIVITY, ARTIFICIAL See induced radioactivity .

RADIOACTIVITY, INDUCED See induced radioactivity .

RADIOACTIVITY, NATURAL See natural radioactivity .

RADIOALLERGO(AD)SORBENT TEST (RAST) An isotopic technique for the demonstration of reagins (a class of antibody) directed against specific allergens. B

RADIOANALYTICAL CHEMISTRY That part of analytical chemistry in which the application of radioactivity is an essential step in the analytical procedures. Synonymous with analytical radiochemistry . See analytical radiochemistry .

RADIOANALYTICAL PURIFICATION See radiochemical purification .

RADIOANALYTIC IMAGING A technique of separation and analysis of reaction products from a radiolabeled starting material. The products are separated by thin layer chromatography using an autoradiograph to quantitatively and qualitatively visualize the results. The technique can be used to study photodegradation, for example. { W. Fostiak et al. Am. Env. Lab. (Feb. 1991) 10}

RADIOAUTOGRAPH See autoradiograph .

<RADIOBIOGEOCHEMISTRY >

RADIOCHEMICAL PURIFICATION Chemical separation applied to a radioactive preparation in order to improve the radiochemical purity . IUPAC82..

RADIOCHEMICAL PURITY See purity, radiochemical .

RADIOCHEMICAL SEPARATION Separation by a chemical means of the radioactive isotopes of (a) specified element(s) from a mixture of isotopes. IUPAC82..

RADIOCHEMICAL YIELD 1. For the isotopes of a specified element, the yield of a radiochemical separation, expressed as a fraction of the activity originally present. IUPAC82.. Also called the recovery. 2.) In radiation chemistry, the number of species transformed by radiation per 100 eV of absorbed energy: represented by the symbol G, the G-value.

RADIOCHEMISTRY That part of chemistry which deals with radioactive materials. It includes the production of radionuclides and their compounds by processing irradiated or naturally occurring radioactive materials, the application of chemical techniques to nuclear studies, and the application of radioactivity to the investigation of chemical, biochemical or biomedical problems. IUPAC94.

RADIOCHEMISTRY, ANALYTICAL That part of analytical chemistry in which the application of radioactivity is an essential step in the analytical procedures. Synonymous with radioanalytical chemistry.

RADIOCHROMATOGRAM A graphical or other representation of a radiation detector response as a function of time produced by chromatographic separation of a mixture of radioactive species.

RADIOCHROMATOGRAPH A measuring assembly designed to measure the spatial or time distribution of the activity of a mixture of radioactive components after separation by a chromatographic method. IUPAC82..

RADIOCOLLOID A radioactive substance in colloidal form. The radioactivity usually has little effect on the physicochemical properties of the colloid. See also pseudoradiocolloid.

RADIOECOLOGY The scientific discipline dealing with the migration, transfer, and concentration of radionuclides in the environment and with the effect of environmental radioactivity on living organisms.

<RADIOELECTROPHORESIS >

RADIOELEMENT An element having no stable isotope. Also used to indicate an element which is naturally radioactive. NM.

<RADIOENVIRONMENTAL CHEMISTRY >

RADIOENZYMATIC ASSAY An assay of the enzymatic activity of a substance based on the use of a radioactive substance. IUPAC94.

RADIOEXCHANGE An exchange reaction in which one of the exchanging species is radioactive .

RADIOGENIC Resulting from radioactive decay, usually in reference to natural products such as lead.

RADIOGRAPH A visual representation of an object produced by placing the object between a source of ionizing radiation and a photographic plate or film. IUPAC94.

RADIOGRAVIMETRIC ANALYSIS An analytical procedure in which the activity of a precipitate is used as a measure of its mass. IUPAC94.

RADIOIMMUNOASSAY An analytical procedure based on the reversible and non-covalent binding of an antigen (hapten) by a specific antibody employing radioactively labeled antigen (hapten) to measure the fraction of the antigen (hapten) bound to a substoichiometric amount of antibody. IUPAC94.

RADIOIMMUNOASSAY, SOLID PHASE ANTIBODY Method of radioimmunoassay employing an antibody bound to a solid phase. IUPAC94.

RADIOIMMUNOELECTROPHORESIS Immuno-electrophoresis in which either the antibodies or antigens are radioactively labeled. B.

RADIOIODINATION The process of incorporating the radionuclides of iodine (usually ^{125}I , ^{131}I or ^{123}I) in, or of covalently linking a radioiodinated substance to, a substance. IUPAC94.

RADIOISOTOPE A radioactive isotope of a specified element. IUPAC82..

RADIOISOTOPE DILUTION ANALYSIS A method of isotope dilution analysis making use of a radionuclide . IUPAC94.

RADIOISOTOPE GENERATOR A system in which a long-lived radioisotope is permanently bound and decays to a shorter-lived daughter radioisotope that may be chemically removed or eluted. The latter process is referred to as milking the generator. The radioisotope generator is colloquially termed a "cow". KE.

RADIOLIGAND Radioactive ligand

RADIOLUMINESCENCE Light emissions caused by radiations from radioactive materials. NM.

RADIOLYSIS The chemical decomposition of materials by ionizing radiation . IUPAC82..

RADIOMETRIC ANALYSIS A method of analysis in which measurement of the activity is an essential step. IUPAC94.

RADIOMETRIC ASSAY A non- competitive binding assay in which the receptor is labeled instead of the ligand. Synonymous with immunoradiometric assay . KE.

RADIOMETRIC TITRATION A titration in which a radioactive indicator is used to monitor the end-point of the titration. IUPAC94.

RADIONUCLIDE A nuclide that is radioactive . IUPAC94.

RADIONUCLIDIC PURITY See purity, radionuclidic .

RADIOPHARMACEUTICAL A radioisotopically labeled pharmaceutical.

RADIOPHARMACOLOGY The study of the preparation and properties of radioactive drugs and their therapeutic and diagnostic uses.

RADIOPOLAROGRAPHY A tool for studying electrochemical phenomena in which labeled ions are reduced polarographically and the resulting drop is counted. The radioactivity of a given number of drops is proportional to the amount of the element deposited and also to the current. It is a low concentration technique. KE.

RADIOREAGENT Reagent labeled with radioactivity . KE.

RADIORELEASE ANALYSIS An analytical procedure based on the release of radioactivity from the reagent by reaction with the analyte . IUPAC94.

RADIORECEPTOR ANALYSIS See radioreceptor assay .

RADIORECEPTOR ASSAY Competitive binding assay employing a receptor protein that is not an antibody .

<RADIOTHERMOCHROMATOGRAPHY >

RADIOTHERMOLUMINESCENCE The reappearance of luminescence in radioluminescent materials brought about by heating. Quartz and certain types of glass show the effect. NM.

RADIOTOXICITY The ability of a substance to give rise to adverse biological toxic effects as a result of the ionizing radiation it emits. NM.

RADIOTRACER TECHNIQUE See radioactive tracer technique .

RADWASTE Radioactive waste .

RAFFINATE In solvent extraction between an organic phase and an aqueous phase, the aqueous phase after equilibrium has been established. Ch.

RANDOM COINCIDENCE See coincidence , random.

RANGE The distance from a radiation source to the point where the flux density has vanished. A more explicit term is the mean linear range .

RANGE, EXTRAPOLATED See extrapolated range .

RANGE, MEAN LINEAR In a given material, for specified charged particles of a specified energy, the average displacement of the particles before they stop. IUPAC82..

RANGE, MEAN MASS The mean linear range multiplied by the mass density of the material. IUPAC82..

RANGE, RESIDUAL The penetration depth of a charged particle yet remaining to be traveled before the particle is stopped in the material.

RANGE-ENERGY RELATION The dependence of the mean linear range of a charged particle in a particular substance on the particle's initial energy.

RANGE STRAGGLING The stochastic dispersion of displacement (range) of charged particles about their mean linear range .

RARE EARTH See lanthanide .

RAST See radioallergosorbent test .

RATEMETER An electronic sub-assembly which gives a continuous indication proportional to the average counting rate over a predetermined time interval (time constant). IUPAC82..

RBE Relative biological effectiveness.

RBS Rutherford backscattering spectroscopy.

RCP Radiochemical purity .

REACTION, NUCLEAR A transmutation or nuclear excitation induced by radiation from an external source.

REACTION ENERGY See Q-value .

REACTION CHAIN ACTIVATION See secondary particle activation analysis .

REACTOR, NUCLEAR A device in which a self-sustaining nuclear fission chain reaction can be maintained and controlled. The term is sometimes applied to a device in which a nuclear fusion reaction can be produced and controlled. IUPAC82..

RECEPTOR A chemical compound on a cell membrane or in a cell that binds other chemicals. NM.

RECOIL The motion acquired by a particle through a collision with or the emission of another particle or electromagnetic radiation . IUPAC82..

RECOIL ATOM The atom struck by a particle with which it is has undergone either elastic or inelastic scattering or reaction, or an atom or ion remaining after a radiation has been emitted.

RECOVERY In trace analysis: the yield of a preconcentration step expressed as quantities of the concentrated component. C. See also yield, radioactive .

REE Rare earth element(s); that is, lanthanides .

REFERENCE MATERIAL A homogeneous material, available in sufficient amounts, which can be used for comparing analysis results obtained at different laboratories and/or with different techniques. IUPAC82..

RELATIVE ATOMIC MASS See atomic mass, relative .

RELATIVE BIOLOGICAL EFFECTIVENESS The ratio of the appropriate value of the biological effectiveness of the radiation in question to that of x-radiation with an average specific ionization of 100 ion pairs per micron of water, for the particular biological effect under consideration and for the condition under which the radiation is received. IUPAC82..

RELATIVE COUNTING A measurement in which the activity of a sample is derived from the ratio between the count rates observed for the sample and for a source of known activity . IUPAC82..

REM See Roentgen equivalent man .

RESOLUTION The use of the word resolution should be restricted to peak resolution . The concept should be distinguished clearly from that of resolving power , which should be restricted to instruments. The resolving power of an instrument used in an analytical procedure may well have its impact on the selectivity of the overall procedure. C.

RESOLUTION ENHANCER 1.) Detector designs that reduce degradation of resolution by compensating for ballistic effects) or charge trapping , for example. 2.) Mathematical procedures, usually called "filters", for improving the ability to accurately resolve close peaks.

RESOLVING POWER The central position of the response curve of a spectrometer of monoenergetic radiation divided by the width at one half of its height. Sometimes the width at the 1/eth of its height, sometimes the inverse of the above definition is used. IUPAC82..

RESOLVING TIME The smallest time interval which must elapse between the occurrence of two consecutive ionizing events or signal pulses, in order that the measuring device be capable of detecting each of them separately.

RESOLVING TIME, COINCIDENCE See coincidence resolving time .

RESOLVING TIME CORRECTION Correction to be applied to the observed number of pulses in order to take into account the number of pulses lost during the resolving time . IUPAC82..

RESONANCE The enhancement of the response of a system to a periodic driving force when the driving frequency is equal to a natural frequency of the system. For nuclear systems, this manifests itself as a particular reaction having a cross section maximum.

RESONANCE ENERGY The energy of a particle entering a nuclear reaction, this energy being just sufficiently high to lead to the formation of reaction products in one of their excited states . IUPAC82..

RESONANCE INTEGRAL The integral, over all or some specified portion of the resonance energy range, of the cross section divided by the energy of a radiation. IUPAC94.

REST MASS The mass of a particle in its ground state and at rest. It represents the Newtonian mass and does not include the additional mass acquired by a particle in motion due to the relativistic effect.

RETENTION Of atoms undergoing a nuclear transformation , that fraction which remains in or reverts to its initial chemical form. IUPAC82..

REVERSED PHASE CHROMATOGRAPHY A term of historical interest in liquid-liquid chromatography referring to an elution procedure in which the stationary phase is non-polar, e.g. paper treated with hydrocarbons or silicones. C.

RIA Radioimmunoassay

RNAA Radiochemical neutron activation analysis. See activation analysis, radiochemical .

ROENTGEN A unit of exposure. 1 roentgen = 1 R = 2.58×10^{-4} C/kg. (Not a SI unit.

ROENTGEN EQUIVALENT MAN (rem) A unit of dose equivalent which depends on linear energy transfer and a quality factor . (Not a SI unit.) $1 \text{ rem} = .01 \text{ J/kg} = 1 \text{ rad} \times \text{quality factor}$. $1 \text{ rem} = 0.01 \text{ sievert (Sv)}$.

RRA Radioreceptor analysis .

RSMR Rayleigh scattering of Mössbauer resonance.

RUTHERFORD An obsolete unit of activity equal to 10^6 disintegrations per second. NM.

RUTHERFORD SCATTERING OR RUTHERFORD BACKSCATTERING SPECTROSCOPY Any technique using high-energy particles directed toward a sample, in which the bombarding particles, after scattering, are detected and recorded as a function of energy and/or angle. The technique is mostly used for determining the depth distributions of elements based on the energy of the backscattered particle. C.

SAFEGUARDS Measures employed to prevent or detect the diversion of nuclear material and to protect against sabotage. GNST.

SALTING OUT Improving the extraction of a substance by the addition of an electrolyte to the aqueous phase. C.

SARGENT CURVES OR SARGENT DIAGRAM Graphs of logarithms of radioactive disintegration constants of beta-emitting radioisotopes against corresponding logarithms of their maximum beta-particle energies. D.

SATURATION Of an irradiated element for a specified isotope , the steady state reached when the disintegration rate of the nuclide formed is equal to its production rate. IUPAC82..

SATURATION ACTIVITY For a specified isotope , the value of the activity of an irradiated element, when a state of saturation is reached. IUPAC82..

SATURATION ANALYSIS A type of competitive binding assay where the specific reactor substance binding sites are all occupied (saturated) with ligand.

SATURATION CORRECTION Also known as saturation factor, the factor applied to an induced activity that transforms the activity into a hypothetical activity in an irradiation of infinite duration, that is, into a saturation activity .

SCALER A sub-assembly for counting electrical pulses and containing one or more scaling circuits . IUPAC82..

SCALING CIRCUIT An electronic circuit which produces an output pulse after a specified number of pulses has been received at its input.

SCATCHARD PLOT In radioimmunoassays , for example, a graph of bound-to-free ratio vs the concentration of bound antigen. KE.

SCATTERING A process in which a change in direction or energy of an incident radiation is caused by interaction with a particle , a system of particles , or a photon . IUPAC82..

SCATTERING, COMPTON See Compton effect .

SCATTERING, ELASTIC Scattering in which the total kinetic energy is unchanged. IUPAC82..

SCATTERING, INELASTIC Scattering in which the total kinetic energy changes. IUPAC82..

SCATTERING RECOIL COINCIDENCE SPECTROMETRY In depth profiling, a technique combining Rutherford backscattering spectroscopy and elastic recoil detection analysis . The recoil is detected in coincidence with the scattered beam particle.

SCAVENGER A reagent used for scavenging . IUPAC82..

SCAVENGING In radiation chemistry : binding radicals or free electrons with a scavenger . In radiochemistry : the use of a precipitate to remove from solution by adsorption or coprecipitation, a large fraction of one or more radionuclides .

SCINTIGRAM An image of the distribution of activity obtained with a scintillation camera following the internal administration of a radionuclide. NM.

SCINTILLANT Scintillating material, fluor .

SCINTILLATING MATERIAL Any substance constituting an appropriate medium for the detection of radiation by means of the scintillation phenomenon. IUPAC82..

SCINTILLATION Burst of luminescence of short duration caused by an individual high-energy particle . IUPAC82..

SCINTILLATION COCKTAIL The solution of fluors used for liquid scintillation counting . B.

SCINTILLATION COUNTER Radiation counter incorporating a scintillation detector . IUPAC82..

SCINTILLATION CRYSTAL A scintillation material that is crystalline in nature (as opposed to polymeric, for example).

SCINTILLATION DETECTOR A radiation detector using a medium in which a burst of luminescence radiation is produced along the path of an ionizing particle . IUPAC82..

SCINTILLATION SPECTROMETER A measuring assembly incorporating a scintillation detector and a pulse amplitude analyzer , used for determining the energy spectrum of certain types of radiation . IUPAC82..

SCINTILLATOR A finite quantity of scintillating material intended to be the element sensitive to radiation in a scintillation detector . IUPAC82..

SCINTIPLAST Plastic scintillator . D.

SCISSION The stage in the fission mechanism when the highly deformed nucleus divides into at least two fragments.

SCRUBBING In liquid-liquid distribution, the process of removing impurities from the separated phase containing the main substance. C.

SEALED SOURCE A radioactive source sealed in a container or having a bonded cover, where the container or cover has sufficient mechanical strength to prevent contact with and dispersion of the radioactive material under the conditions of use and wear for which it was designed. NM.

SECONDARY PARTICLE ACTIVATION ANALYSIS An activation method in which energetic particles from a primary reaction on a nuclide of interest subsequently undergo a secondary activation reaction on another nuclide producing a more easily detected radioactivity. FR.

SECONDARY RADIATION Radiation emitted by any matter irradiated with electromagnetic or ionizing radiation . IUPAC82..

SECULAR EQUILIBRIUM See equilibrium, secular .

SEGRE CURVE See beta stability line .

SELF-ABSORPTION The absorption of radiation by the emitter. IUPAC82..

SELF-ABSORPTION FACTOR Of a radiation source, the ratio between the amount of radiation emitted by the source and the amount of radiation produced by the radioactive nuclei present in the source. Synonymous with source efficiency .

SELF-RADIOLYSIS The radiolysis of a substance or mixture brought about by one of the substance's or mixture's own radioactive components.

SELF-SHIELDING The lowering of the flux density in the inner part of a sample due to absorption in the outer layers of the sample. IUPAC82..

SEMICONDUCTOR Material whose conductivity, due to charges of both signs, is normally in the range between that of metals and insulators and in which the electric charge carrier density can be changed by external means. IUPAC82..

SEMICONDUCTOR DETECTOR Radiation detector using a semiconductor in which free electric charges are produced along the path of an ionizing particle . IUPAC82..

SEMICONDUCTOR DETECTOR, DIFFUSED JUNCTION A semiconductor detector in which the P-N or N-P junction is produced by diffusion of donor or acceptor impurities. IUPAC82..

SEMICONDUCTOR DETECTOR, P.I.N. A semiconductor detector consisting of a compensated region between a P and an N region. The compensated region is often referred to as "intrinsic". IUPAC82..

SEMICONDUCTOR DETECTOR, SURFACE BARRIER A semiconductor detector utilizing a junction due to a surface inversion layer. IUPAC82..

SENSITIVE VOLUME OF A DETECTOR That part of the volume of a radiation detector in which radiation can be detected.

SENSITIVITY In diagnostic tests, the number of test results registered as true positives in relation to the actual number of positives in the group tested. The minimum signal that can be detected satisfactorily. The lowest concentration of test substance measurable in an assay, or the minimal difference in test substance concentrations distinguishable by a given assay, usually a function of the steepness of the assay curve. NM.

SEPARATION ENERGY Of a particle, the energy required to remove that particle (e. g. , neutron, proton, alpha) from the nucleus.

SEPARATION, RADIOCHEMICAL See radiochemical separation .

SEQUESTERING AGENT Or sequestrants, are compounds capable of binding metal ions so that they no longer exhibit their normal reactions in the presence of precipitating agents. Most sequestrants owe their action to the formation, with the metal ion, of stable coordination compounds of chelates. NM.

SERIAL DILUTION The progressive dilution, by the same factor, of standard or sample in a row of tubes so that the first tube contains the highest concentration of test substance.

SERIES, RADIOACTIVE See decay chain .

SF Spontaneous fission.

SHADOWING The local reduction of the particle flux density due to the presence of a nearby absorber. GNST.

SHIELDING Protecting against penetrating radiation by using an absorbing layer of matter. Also, such matter itself.

SIEVERT Unit of dose equivalent . (Not capitalized. Symbol = Sv.) 1 sievert = 1 gray X quality factor .

SIGMOID CURVE S-shaped curve, approaching linearity in the middle and curved at either end. NM.

Si(Li) DETECTOR A lithium-drifted silicon detector. A diffused junction semiconductor detector in which silicon is the base solid state material.

SINGLE CHANNEL PULSE HEIGHT ANALYZER See pulse amplitude selector .

SINGLE COMPARATOR METHOD In quantitative activation analysis , a method in which a known amount of activatable isotope is irradiated simultaneously and under identical conditions with an unknown amount of the isotope. NAC.

<SLOWPOKE REACTOR >

SNAP Space Nuclear Auxiliary Power; a radioactive source for power generation in satellites and space craft.

SNR Signal-to-noise ratio.

SOFT RADIATION Radiation whose particles or photons have a low energy and consequently do not penetrate materials easily. M.

SOLID STATE TRACK DETECTOR An insulating solid in which the paths of nuclear particles suffer radiation damage of sufficient permanency that they may be rendered visible through chemical etching processes. NAC.

SOLUTE The minor component of a solution which is regarded as having been dissolved by the solvent . C.

SOLVENT A liquid (usually the major component of a solution) which is used to dissolve a solute or solutes. C.

SOLVENT EXTRACTION Process of removing one or more constituents of a mixture from immiscible solvents by preferential solubility in a specific solvent. D.

SORBENT Material which has a large capacity for absorbing moisture or other gas or fluid. D.

SORPTION It is sometimes difficult or impossible to discriminate experimentally between adsorption and absorption : in such cases it is convenient to use the non-committal term sorption. In ion exchange, sorption is the uptake of electrolytes or non-electrolytes by ion exchangers through mechanisms other than pure ion exchange . C.

SOURCE EFFICIENCY See self-absorption factor .

SOURCE, EXTENDED In contrast to a point source , below, a source of radiation whose size is not constrained to approximate a point.

SOURCE, POINT A source of radiation which is confined to a small point or spot.

SOURCE, RADIOACTIVE Any quantity of radioactive material which is intended for use as a source of ionizing radiation . IUPAC94.

SOURCE, SEALED See sealed source .

SOURCE STRENGTH The strength of a radioactive source, meaning the amount of radioactive material contained in it, usually expressed in curies or becquerels. NM.

SOURCE, VOLUMINOUS See source, extended .

SPALLATION PRODUCT A product of a spallation reaction .

SPALLATION REACTION A nuclear reaction in which the projectile induces the ejection of neutrons, protons and/or light heavy ions from the struck target nucleus.

SPECIAL NUCLEAR MATERIAL Fissionable and other material related to military use.

SPECIATION A term that refers to the physicochemical forms of a radionuclide under a particular set of ambient conditions (pH, Eh, ligands present, etc.).

SPECIFIC ACTIVITY See activity, specific .

SPECIFIC BURN-UP See burn-up, specific .

SPECIFIC ENERGY The energy imparted by ionizing radiation to matter. NM.

SPECIFIC IONIZATION The number of ion pairs formed per unit distance along the track of an ionizing particle passing through matter. IUPAC82..

SPECIFICITY In radioimmunoassays , a measure of the discrimination between antigens by the antigen-antibody site of the antibody . KE.

SPECT Single photon emission computerized tomography. J.

SPECTRAL HARDENING See hardening .

SPECTROGRAM A spectrum as recorded by a spectrometer . IUPAC82..

SPECTROGRAPH Graphical representation of a spectrum.

SPECTROMETER A measuring assembly used for determining the spectrum of a radiation . IUPAC94.

SPECTROMETER, ALPHA (, BETA, GAMMA-RAY, X-RAY) A measuring assembly incorporating a radiation detector and a pulse amplitude analyzer , used for determining the energy spectrum of alpha (beta, gamma, x) radiation. IUPAC82..

SPECTROMETER, ANTI-COMPTON GAMMA-RAY See gamma-ray spectrometer, anti-Compton .

SPECTROMETER, CRYSTAL DIFFRACTION A spectrometer , in which diffraction by a crystal is used to obtain the energy spectra of electromagnetic radiation as well as of slow neutrons . IUPAC82..

SPECTROMETER, SCINTILLATION See scintillation spectrometer .

SPECTROMETER, X-RAY See spectrometer, alpha (, beta, gamma-ray, x-ray).

SPECTRUM (,RADIATION) The components of radiation arranged in order of their wavelengths, frequencies or quantum energies. IUPAC94.

SPECTRUM ANALYSIS The interpretation of the information present in an energy spectrum in terms of radiation energy and intensity . IUPAC82..

SPECTRUM, MEASURED See spectrogram .

SPIKE The isotopically distinct label (radioactive or stable) added to a sample undergoing analysis by any of several isotopic methods.

SPIKING The process of adding a spike to a sample undergoing analysis.

SPILL A contamination as a result of an accident during some process or procedure involving radioactivity.

SPIN, NUCLEAR The intrinsic angular momentum of an elementary particle or system of particles such as a nucleus. NM.

SPINTHARISCOPE An instrument for viewing scintillations of charged particles on a luminescent screen, usually with the aid of a microscope. M.

SPONTANEOUS FISSION See fission, spontaneous .

SRA See substoichiometric radiochemical analysis .

SRCS See scattering recoil coincidence spectrometry .

SSE-IDA See sub- and superequivalence isotope dilution analysis .

SSTD Solid state track detector.

STABLE Not radioactive .

STANDARD MATERIAL A reference material for which, for specified element concentrations, values are recommended by some official body. These values should be based on the consistent results obtained by using independent analytical techniques. IUPAC82..

STANDARD REFERENCE MATERIAL Term exclusively used for a standard material issued by the National Bureau of Standards, USA. IUPAC82..

STAR A nuclear event, recorded in photographic emulsion , in which the tracks of three or more charged particles radiate from a single point. NM.

STOPPING POWER Of a substance, for charged particles of specified energy, the average energy loss in passing through a thin layer of that substance, divided by the thickness of that layer. IUPAC82..

STRAGGLING A term used to express the fact that the ranges of charged particles of a given energy in matter are not constant but show a small spread about the mean range. This uncertainty in the range occurs because the loss of energy by charged particles is not a continuous process, but one in which energy is transferred in discrete amounts to the electrons in the matter through which the particle is passing. NM.

STRIPPING The process of back-extraction of a substance from an extract, usually into an aqueous phase. C.

STRONTIUM UNIT A measure of the concentration of ^{90}Sr in food and in the body measured relative to calcium. One strontium unit is 1 millibecquerel ^{90}Sr per gram calcium. NM.

SUB- and SUPEREQUIVALENCE ISOTOPE DILUTION A technique of substoichiometric radiochemical analysis in which two series of solutions containing sample and spike are compared; one is isotopically diluted with increasing amounts of

carrier and the other has multiples of sample and spike but no carrier. The amount of unknown element in the sample is obtained by graphic analysis following activity ratio determinations. FR.

SUBSTOICHIOMETRIC RADIOCHEMICAL ANALYSIS An isotope dilution technique combining a radioactive tracer and a reagent which is intentionally applied in amounts that are insufficient to react completely with the analyte .

SUB-TRACE ANALYSIS Trace analysis with sample size 10^{-3} - 10^{-4} g and constituent content ≤ 100 ppm (0.01%). C.

SUM PEAK In a spectrum of radiation , the part of the response corresponding to the total absorption in a detecting material of the combined energies of two coincident radiations .

SUM PEAK METHOD A method of analysis in which the sum peak of two gamma rays is counted and in which the intensity ratios of the sum peak to the single peak can be used and changes in the ratios due to the chemical environments of the emitting nuclide can be observed. P.

SUPEREQUIVALENCE ISOTOPE DILUTION See sub- and superequivalence isotope dilution .

SUPERHEAVY ELEMENT A term often used with reference to elements of atomic number well beyond 110.

SUPERNATANT The clear solution associated with a settled, centrifuged, or filtered precipitate.

SURFACE BARRIER SEMICONDUCTOR DETECTOR See semiconductor detector, surface barrier .

SURVEY METER A battery-powered portable device containing a gas ionization chamber or other detection device for monitoring radiation levels. NM.

Sv Symbol for the unit, the sievert .

SYNCHROCYCLOTRON An ion accelerator, the chief components and configurations of which are similar to those of a cyclotron and in which the phase of the accelerating potential is synchronized with the frequency of the accelerated particles by frequency modulation to compensate for relativistic increases in mass at high speeds.

SYNCHROTRON An accelerator in which ions are accelerated around a fixed circular path by a radiofrequency potential and maintained in the path by a magnetic field that varies with time.

SYNCHROTRON RADIATION Electromagnetic radiation produced by any charged particle forced to travel in a nonlinear orbit such as a proton in a storage ring. NAC.

SYNERGISM A characteristic exhibited when two separate agents in combination produce an effect greater than the sum of that produced by each agent separately.

SYNROC The name given to a group of specially formulated zirconium-based ceramics that were originally developed for immobilizing high-level (radioactive) waste .

SZILARD-CHALMERS EFFECT The rupture of the chemical bond between an atom and a molecule of which the atom is a part, as a result of a nuclear reaction of that atom . IUPAC82..

TAC Time-to-amplitude converter.

TAGGED See labeled .

TANDEM ACCELERATOR A two-staged accelerator, usually applied to accelerators of the Van de Graaff variety.

TARGET The material subjected to bombardment by radiation, high-energy particles, or high-energy nuclei for the purpose of producing a nuclear reaction. NM.

TARGET CHEMISTRY

TARGETRY The design of target composition and structure to optimize the production of a desired nuclide and minimize impurities made through nuclear reactions.

TBP Tributylphosphate, a solvent used in extraction separations.

TDMES Time differential Mössbauer emission spectroscopy.

TDPAC Time differential perturbed angular correlation measurement.

THERMAL COLUMN A large body of moderator , adjacent to or inside a reactor to provide thermal neutrons for experiments. IUPAC82...

THERMAL FISSION See fission, thermal .

THERMAL IONIZATION MASS SPECTROMETRY A high-precision mass spectroscopic technique for the analysis of metal ions in which the sample is applied to a metal strip to which thermal energy is applied for ionization. J.

THERMOCHROMATOGRAM The response of a detection system to a separation by thermochromatography .

THERMOCHROMATOGRAPH A device for performing a separation by thermochromatography .

THERMOCHROMATOGRAPHY A column chromatographic separation technique based on the variation with temperature of the affinity of different chemical species in the analyte towards an absorbent which lines the column.

THERMOLUMINESCENCE Luminescence produced in certain substances by heating. NM.

THERMOLUMINESCENT DETECTOR A type of crystal used to monitor radiation exposure by emitting light; often used in film badges or ring badges. NM.

THICK TARGET YIELD The yield or reaction rate per incident beam particle for a thick target, that is a target in which the attenuation of the beam through the target along the beam direction cannot be neglected. NAC.

THORIUM SERIES Natural decay chain commencing with ^{232}Th and ending with stable ^{208}Pb . The mass number of each member of the series is representable as $4n$ where n is an integer.

THRESHOLD ENERGY See energy, threshold .

TIME CONSTANT 1.) A convenient measure of the rate of a capacitor charging or discharging; namely, the time for the current to have reached a fraction, $1/e$, of its initial value. 2.) The time needed for a detector response to reach a fraction, $1/e$, of its final value if the detector is suddenly exposed to a radiation flux.

TIME-OF-FLIGHT A method of mass analysis based on measuring the time needed for an ion to traverse a known distance between source and detector.

TIME-TO-AMPLITUDE CONVERTER (TAC) An electronic instrument which converts the time interval between two timing (logic) signals into an output pulse with an amplitude that is proportional to the time interval.

TITER or TITRE (IN RADIOIMMUNOASSAYS) A measure of the level of antibodies .

TITRATION, RADIOMETRIC See radiometric titration .

TLD Thermoluminescence detector.

TOF Time-of-flight .

TOTAL ABSORPTION PEAK See full energy peak .

TOWNSEND AVALANCHE In a proportional counter , the gas multiplication cascade of secondary electrons. KE.

TRACEE The chemical moiety or mixture to which a tracer is being administered and in which it is more or less homogeneous. (Not recommended.)

TRACER Labeled member of a population used to measure certain properties of that population. IUPAC82...

TRACER, GENERALLY LABELED A tracer in which the position of the label is not defined. IUPAC94.

TRACER, INTRINSIC An isotope, present naturally in a given sample, that may be used to trace a given element through chemical and physical processes. NM.

TRACER, ISOTOPIC A tracer which only differs in isotopic composition from the substance to be traced.

TRACER, NOMINALLY LABELED A tracer in which the label is present in a specified position. IUPAC94.

TRACER, SPECIFICALLY LABELED A tracer in which the label is present in a specified position. IUPAC94.

TRACER, STEREOSPECIFICALLY LABELED A tracer in which the label is present in a stereospecific position. IUPAC94.

TRACER, UNIFORMLY LABELED A tracer in which the label is uniformly distributed over its possible positions. IUPAC94.

TRACK, NUCLEAR Of an ionizing particle , its path as revealed by a track detector . IUPAC82...

TRACK DETECTOR, NUCLEAR A detector which makes the paths of ionizing particles visible, either directly (e.g. cloud chamber) or after suitable treatment (photographic emulsion, polymers). IUPAC82...

TRACK ETCHING For exposed solid state track detectors , the process of making the radiation damaged particle paths visible by chemically removing the material along the path. NAC.

TRANSACTINIDES Elements beyond the actinide series, that is, elements with atomic numbers greater than 103.

TRANSACTINOIDS See transactinides .

TRANSFORMATION, NUCLEAR The change of one nuclide into another.

TRANSIENT EQUILIBRIUM See equilibrium, transient .

TRANSITION, ISOMERIC See isomeric transition .

TRANSITION, NUCLEAR For a nucleus a change from one state into another; a nuclear transformation .

TRANSMUTATION 1. Any change of one element into another. 2. Any change of one nuclide into another.

TRIGA REACTOR A nuclear reactor with uranium-zirconium-hydride fuel elements which usually operates at a steady state level but which can be made to generate very short pulses with neutron fluxes thousands of times greater than the steady state level. It is useful for pulsed reactor activation analysis.

TRIPLE-MONITOR-METHOD In neutron activation analysis the use of a Au monitor in addition to the bi-isotopic monitors for flux parameter calibrations.

TRITIATION Hydrogenation using tritium-labeled hydrogen.

TRITIUM (BREEDING) RATIO The number of tritons produced per fusion event. GNST.

TRITON The nucleus of hydrogen with mass number three; the tritium nucleus.

TTA Thenoyltrifluoroacetone, a chelating agent commonly used in radiochemical separations.

ULTRATRACE ANALYSIS This term could be used generally to describe the whole area of trace analysis using micro-sized samples, but could be more precisely specified as trace analysis with sample size $\approx 10^{-4}$ g and constituent content ≈ 100 ppm (0.01%). C. See subtrace analysis .

UNSEALED SOURCE A radioactive source which is not encapsulated, in contrast to a sealed source .

UNSTABLE Radioactive.

URANIUM SERIES The natural decay chain commencing with ^{238}U and ending with stable ^{206}Pb . The mass number of each member of the series is representable as $4n+2$ where n is an integer.

VAN DE GRAAFF ACCELERATOR An electrostatic generator in which a high potential is produced by the accumulation of electric charge conveyed to an insulated

conductor by a continuously moving belt. The potential generated is used for accelerating charged particles. NM.

WASTE, HIGH-LEVEL (i) The highly radioactive liquid, containing mainly fission products, as well as some actinides, which is separated during chemical reprocessing of irradiated fuel (aqueous) waste from the first solvent extraction cycle and those waste streams combined with it. (ii) Spent reactor fuel, if it is declared a waste. (iii) Any other waste with a radioactivity level comparable to (i) or (ii). WASTE.

WASTE, LOW-LEVEL Waste which, because of its low radionuclide content, does not require shielding during normal handling and transportation. WASTE.

WELL DETECTOR Special type of counter in which the detector is shaped in the form of a well to contain the sample whose radioactivity is to be counted in nearly 4 π geometry.

WESTCOTT CROSS-SECTION See cross section, effective thermal.

WIGNER EFFECT Displacements of atoms from their positions in a crystal structure by radiation. NM.

WILZBACH LABELING See labeling, Wilzbach.

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