1 Radiochemistry Definations

- Roentgen:

  the measurement of energy produced by Gamma or X-Ray radiation in a cubic centimeter of air.

- RAD:

  Radiation Absorbed Dose. Original measuring unit for expressing the absorption of all types of ionizing radiation (alpha, beta, gamma, neutrons, etc) into any medium. One rad is equivalent to the absorption of 100 ergs of energy per gram of absorbing tissue.

- REM:

  a measurement that correlates the dose of any radiation to the biological effect of that radiation. Since not all radiation has the same biological effect, the dosage is multiplied by a "quality factor" (Q). For example, a person receiving a dosage of gamma radiation will suffer much less damage than a person receiving the same dosage from alpha particles, by a factor of three. So alpha particles will cause three times more damage than gamma rays. Therefore, alpha radiation has a quality factor of three. Following is the Q factor for a few radiation types

- Gamma factor:

  Does rate at specific distance from a given amount of photon-emitting nuclide. (at 1 meter from 1 curie point source nuclide)

  Gamma Factor of F 18 = 0.69523 (R . m^2 / hr. Ci)

- Time, Distance and Shielding:

  Time: Less time spend near source less radiation received.

  Distance: Intensity of the radiation field decreases as distance is increased as $I_1(d_1)^2 = I_2(d_2)^2$

- Does equivalent:

  Dose equivalent (or effective dose) combines the amount of radiation absorbed and the medical effects of that type of radiation.

- Radioactivity:

  the property of certain nuclides of emitting radiation by spontaneous transformation of their nuclei. Various units of (radio)activity have been used including curie (1 Ci = 3.7 x 10^{10} disintegrations per second) and becquerel (1 Bq = 1 disintegration per second).

- Acute exposure:

  an exposure to radiation that occurred in a matter of minutes rather than in longer, continuing exposure over a period of time.

- Chronic exposure:

  exposure to a substance over a long period of time, possibly resulting in adverse health effects. See also acute exposure, fractionated exposure.

- ALARA:

  acronym for "As Low As Reasonably Achievable," means making every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical. This is a key principle in radiation protection and safety.

- Alpha particle:

  the nucleus of a helium atom, made up of two neutrons and two protons with a charge of +2. Certain radioactive nuclei emit alpha particles. Alpha particles generally carry more energy than gamma rays or beta particles, and deposit that energy very quickly while passing through tissue. Alpha particles can be stopped by a thin layer of light material, such as a sheet of paper, and cannot penetrate the outer, dead layer of skin.

- Atomic mass unit (amu):

  1 amu is equal to one twelfth of the mass of a carbon-12 atom.

- Atomic mass number:

  the total number of protons and neutrons in the nucleus of an atom.

- Atomic weight:

  the mass of an atom, expressed in atomic mass units. For example, the atomic number of helium-4 is 2, the atomic mass is 4, and the atomic weight is 4.00026.

- Background radiation:

  ionizing radiation from natural sources, such as terrestrial radiation due to radionuclides in the soil or cosmic radiation originating in outer space.

- Becquerel (Bq):

  the amount of a radioactive material that will undergo one decay (disintegration) per second.

- Biological half-life:

  the time required for one half of the amount of a substance, such as a radionuclide, to be expelled from the body by natural metabolic processes, not counting radioactive decay, once it has been taken in through inhalation, ingestion, or absorption

- Cesium-137 (Cs-137):

  has a half-life of 30.17 years and decays by beta and gamma radiation. Chernobyl power plant accident in 1986, which distributed Cs-137 to many countries in Europe

- Absorbed dose:

  The absorbed dose, measured in gray (Gy), represents the energy transmitted by radiation to living tissue. One gray corresponds to the energy of 1 joule (J) transmitted to 1 kilogramme (kg) of living tissue.

- Equivalent dose:

  For a given organ, the equivalent dose H (in Sv) is equal to the absorbed dose D (in Gy) multiplied by the radiation weighting factor WR. WR expresses the harmfulness of the radiation, which depends on the density of the ionisation produced along the particle's trajectory.

- Curie (Ci):

  the traditional measure of radioactivity based on the observed decay rate of 1 gram of radium. One curie of radioactive material will have 37 billion disintegrations in 1 second.

- Decay constant:

  the fraction of a number of atoms of a radionuclide that disintegrates in a unit of time. The decay constant is inversely proportional to the radioactive half-life.

- Dosimeter:

  a small portable instrument (such as a film badge, thermoluminescent dosimeter [TLD], or pocket dosimeter) for measuring and recording the total accumulated dose of ionizing radiation a person receives.

- Effective half-life:

  the time required for the amount of a radionuclide deposited in a living organism to be diminished by 50 percent as a result of the combined action of radioactive decay and biological elimination.

- Gamma rays:

  high-energy electromagnetic radiation emitted by certain radionuclides when their nuclei transition from a higher to a lower energy state. These rays have high energy and a short wave-length. All gamma rays emitted from a given isotope have the same energy, a characteristic that enables scientists to identify which gamma emitters are present in a sample. Gamma rays penetrate tissue farther than do beta or alpha particles but leave a lower concentration of ions in their path to potentially cause cell damage. Gamma rays are very similar to x-rays.

- Half-life:

  the time any substance takes to decay by half of its original amount. See also biological half-life, decay constant, effective half-life, radioactive half-life.

- Immediately Dangerous to Life or Health (IDLH):

  A level of exposure to airborne contaminants likely to cause (1) death; (2) immediate or delayed permanent adverse health effects; or (3) prevent escape from such an environment.

- Nuclear tracers:

  radioisotopes that give doctors the ability to "look" inside the body and observe soft tissues and organs, in a manner similar to the way x-rays provide images of bones. A radioactive tracer is chemically attached to a compound that will concentrate naturally in an organ or tissue so that an image can be taken.

- Radioluminescence:

  The luminescence produced by particles emitted during radioactive decay

- Roentgen (R):

  a unit of exposure to x-rays or gamma rays. One roentgen is the amount of gamma or x-rays needed to produce ions carrying 1 electrostatic unit of electrical charge in 1 cubic centimeter of dry air under standard conditions.

- Sensitivity:

  ability of an analytical method to detect small concentrations of radioactive material.

- Sievert (Sv):

  1 Sv = 1 Joule per kilogram. Used to measure the health effects of ionizing radiation (usually low doses), both external and internal.

- X-ray:

  electromagnetic radiation caused by deflection of electrons from their original paths, or inner orbital electrons that change their orbital levels around the atomic nucleus. X-rays, like gamma rays can travel long distances through air and most other materials. Like gamma rays, x-rays require more shielding to reduce their intensity than do beta or alpha particles. X-rays and gamma rays differ primarily in their origin: x-rays originate in the electron shell; gamma rays originate in the nucleus