1Nuclear Chemistry: Dosages of Nuclear Radiation to Humans

Quantitative measurement of nuclear radiation involves two types of units, those units which measure physical nuclear radiation itself and those units which measure the biological effect of nuclear radiation. Physical radiation units measure the activity of a source of radiation. The SI unit of physical nuclear radiation is the becquerel (Bq). A radiation source with an activity of one becquerel has one disintegration per second. An older unit of physical nuclear radiation which is still widely used is the curie (Ci); one curie is 3.7 x 10+10 Bq. Since the curie is a relatively large unit, its subdivisions of millicurie, microcurie, and picocurie are often encountered.

Biological radiation units measure the effect of nuclear radiation on living tissue. The SI unit of biological radiation effect is the gray. One gray corresponds to the transfer of one joule of energy to one kilogram of living tissue. The older unit of rad (rad or D) is exactly 0.01 gray and is now obsolete. However, the older unit of roentgen (R) is still in common use. The roentgen was originally devised as a measurement unit for use with X-rays or gamma rays, and is that quantity of radiation which generates 2.1 x 10+9 ion pairs/cm3 of dry air or 1.8 x 10+12 ion pairs/g tissue. One roentgen is 0.0096 Gy or very nearly one rad.

A one-roentgen dose of alpha radiation does not produce the same effect as does a one-roentgen dose of gamma radiation. For this reason, the rem was devised as a unit to measure the additive effects of different types of radiation, especially low-level radiation, for those who work with radioactive materials. The rem, or radiation equivalent in man, is the dose of any type of radiation which in man has the same health effect as one roentgen of X-ray or gamma radiation. The rem is the most common unit used to measure health effects of radiation.