

# RADIATION QUANTITIES AND UNITS GUIDE

## Activity

- ✦ The rate of disintegration per unit time is measured in curies and based on the following standard:

Unit	Quantity
1 curie (Ci)	$3.7 \times 10^{10}$ dps (disintegrations per second)
1 millicurie (mCi)	$3.7 \times 10^7$ dps = $1 \times 10^{-3}$ Ci
1 microcurie ( $\mu$ Ci)	$3.7 \times 10^4$ dps = $1 \times 10^{-6}$ Ci
1 nanocurie (nCi)	37 dps = $1 \times 10^{-9}$ Ci
1 picocurie (pCi)	$3.7 \times 10^{-2}$ dps = $1 \times 10^{-12}$ Ci
dps	cps/ efficiency of detector for specific radionuclide
1 becquerel (Bq)	1 disintegration per second

## Radiation Exposure

- ✦ The measurement of radiation exposure in air as ionizations per unit mass of air due to x-ray or gamma radiation

Unit	Quantity
1 Roentgen (R)	$2.58 \times 10^{-4}$ Coulomb/Kg air
1 milliroentgen	$2.58 \times 10^{-7}$ Coulomb/Kg air = $1 \times 10^{-3}$ R

## Absorbed Dose

- ✦ The measurement of radiation absorbed dose (rad) represents the amount of energy deposited per unit mass of absorbing material

Unit	Quantity
1 rad	100 ergs/gram
1 rad	$1 \times 10^{-2}$ Joule/kg
1 millirad (mrad)	$1 \times 10^{-5}$ Joule/kg = $1 \times 10^{-3}$ rad

## Dose Equivalent

- ✦ The measurement of biological effect of radiation requires a third unit called a quality factor (QF). The quality factor takes into account the different degrees of biological damage produced by equal doses of different types of radiation.
- ✦ 1 rem (Roentgen equivalent man) is the product of the amount of energy absorbed (rad) times the efficiency of radiation in producing damage (QF)

$$1 \text{ rem} = 1 \text{ rad} \times \text{QF}$$

For X and gamma radiations and most beta, the QF = 1. Therefore, 1 rem = 1 rad

Alpha radiation has a QF of 20

QF for neutrons ranges from 2 to 11

## S.I. System

- ✦ The S.I. system is widely used in Europe and is gradually being adopted in the United States

Current Unit	S.I. Units	Conversion
Curie (Ci)	Becquerel (Bq)	1 Ci = $3.7 \times 10^{10}$ Bq
rad	Gray (Gy)	1 rad = $1 \times 10^{-2}$ Gy
rem	Sievert(Sv)	1 rem = $1 \times 10^{-2}$ Sv