

NAME _____

Constants & Formulas

$e = 2.7183$ $\log_{10} e = 0.43429$ $\log_e 10 = 2.3026$
 $e^x = 10^{0.43429x}$ $x = e^{2.3026 \log_{10} x}$
 $\pi = 3.1416$ Sphere area: $4\pi r^2, \pi d^2$; volume: $4/3\pi r^3, 1/6\pi d^3$
 1 year = 365.26 days = 8766.2 hr = 525970 min = 3.1558×10^7 sec
 1 day = 24 hr = 1440 min = 86400 sec 1 hr = 3600 sec
 1 electron volt (eV) = 1.6022×10^{-12} erg 1 erg = 6.2415×10^5 MeV
 1 electrostatic unit of charge (esu) = 2.0819×10^9 electrons
 Elementary charge = 4.8032×10^{-10} esu = 1.6022×10^{-19} C
 1 atomic mass unit (amu) = 1.6606×10^{-24} g = 1.4918×10^{-3} erg = 931.48 MeV

Avogadro constant = 6.0220×10^{23} /mol
 Speed of light in vacuum = 2.9979×10^{10} cm/sec
 Electron rest mass = 9.1095×10^{-28} g = 5.4858×10^{-4} amu
 Proton rest mass = 1.6726×10^{-24} g = 1.0073 amu
 Neutron rest mass = 1.6750×10^{-24} g = 1.0087 amu
 W : energy to produce ion pair = ~34 eV (in air)
 1 Bq, dps = 2.7027×10^{-5} μ Ci 1 μ Ci = 3.7×10^4 Bq = 2.22×10^6 dpm
 1 roentgen (R) = 2.58×10^{-4} C/kg
 = 1 esu of charge/cm³ air (STP)
 = 1 esu of charge/0.001293 g of dry air
 = 2.08×10^9 ion pairs/cm³ air (STP)
 = 1.61×10^{12} ion pairs/g dry air
 = 7.08×10^4 Mev/cm³ air (STP)
 = 5.47×10^7 Mev/g dry air

1 Sv = 100 rem
 1 Gy = 100 rad = 1 J/kg = 10^4 erg/g
 Radioactive Decay

$$N = N_0 e^{-\lambda t} = N_0 e^{-\frac{0.693t}{T_{1/2}}} = N_0 10^{-\frac{0.301t}{T_{1/2}}} \quad (T_{1/2}: \text{Half Life})$$

Radiation Attenuation

$$I = I_0 e^{-\lambda t} = I_0 e^{-\frac{0.693t}{T_{1/2}}} = I_0 10^{-\frac{0.301t}{T_{1/2}}}$$

Radionuclides

Nuclide	Half Life	Type	Energy (MeV)		Rm ² hr Ci
			β	γ	
N ¹⁶	7.14s	β^-	4.27 – 68%	2.75 – 1%	2.40
			10.4 – 26%	6.13 – 69%	
O ¹⁹	29.1s	β^-		7.11 – 5%	0.52
			3.25 – 58%	0.197 – 97%	
			4.60 – 42%	1.37 – 59%	
Cr ⁵¹	27.7d	EC	-100%	0.320 – 9.8%	0.018
Mn ⁵⁴	312d	EC	-100%	0.835 – 100%	0.47
Fe ⁵⁹	44.6d	β^-	0.273 – 46%	0.143 – 1%	0.62
			0.466 – 53%	0.192 – 3%	
Co ⁵⁸	70.8d	EC β^+	- 85%	0.811 – 99%	0.55
			0.475 – 15%	0.864 – 0.68%	
Co ⁶⁰	5.27y	β^-		1.675 – 0.52%	1.30
			0.318 – 100%	1.173 – 100%	
				0.511 (β^+)	
				1.292 – 44%	
				1.332 – 100%	

Mass attenuation coefficient μ/ρ (cm²/g), Mass energy-absorption coefficient μ_{en}/ρ (cm²/g) & Density ρ (g/cm³)

Energy (MeV)	μ/ρ					μ_{en}/ρ
	Aluminum	Iron	Lead	Water	Concrete	Air
0.5	.0845	.0841	.161	.0969	.0877	.0297
0.6	.0780	.0770	.125	.0896	.0810	.0295
0.8	.0684	.0670	.0887	.0787	.0710	.0288
1	.0615	.0600	.0710	.0707	.0638	.0279
(1.25)	(.0558)	(.0544)	(.0616)	(.0642)	(.0579)	(.0267)
1.5	.0501	.0488	.0522	.0576	.0520	.0255
2	.0432	.0427	.0461	.0494	.0448	.0234
ρ (g/cm ³)	2.7	7.86	11.34	1.0	2.25	1.293×10^{-3}