



MOLYBDENUM-89

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Mo-89
Atomic number (Z): 42
Mass number (A): 89
Neutron number (N): 47

RADIOACTIVE DECAY

Decay modes: β^+ , Electron capture
Half-life: 2.11 [m]
Decay constant: 5.4751×10^{-3} [1/s]
Daughters: Nb-89 (100.0%)
Radioactive daughters: Nb-89

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]
Mean electron energy: 1.96204 [MeV]
Mean photon energy: 1.21727 [MeV]
Air kerma rate constant, Γ_{10} : 8.195×10^{-18} [Gy $\cdot$ m²/Bq $\cdot$ s]
Air kerma coefficient, K_{air} : 4.563×10^{-17} [Gy $\cdot$ m²/Bq $\cdot$ s]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : 3.144×10^{-13} [Gy $\cdot$ kg/Bq $\cdot$ s]
Equilibrium dose constant for alphas, Δ_{α} : 0.000×10^0 [Gy $\cdot$ kg/Bq $\cdot$ s]

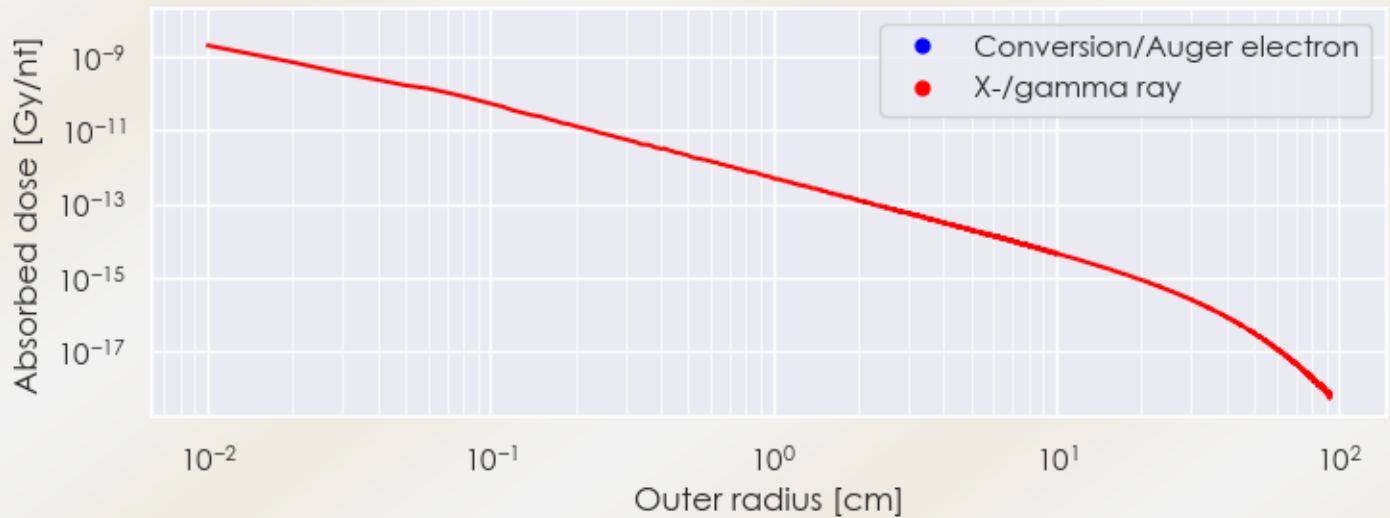
Equilibrium dose constant for betas/electrons, $\Delta_{\beta-\beta^+,e^-}$: $3.144\text{e-}13$ [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : $1.950\text{e-}13$ [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

Dose point kernel source: **Graves, et al. Medical Physics. 2019 Nov.; 46(11):5284-5293.**

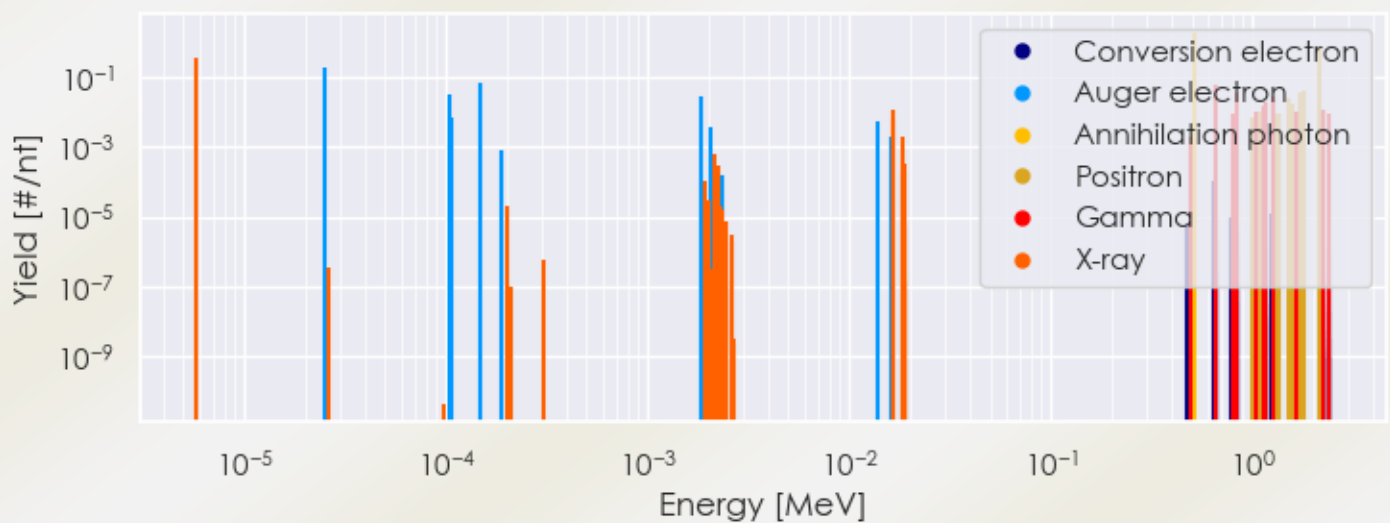
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Mo-89 DPK.csv

SUMMARY SPECTRA (PLOT)

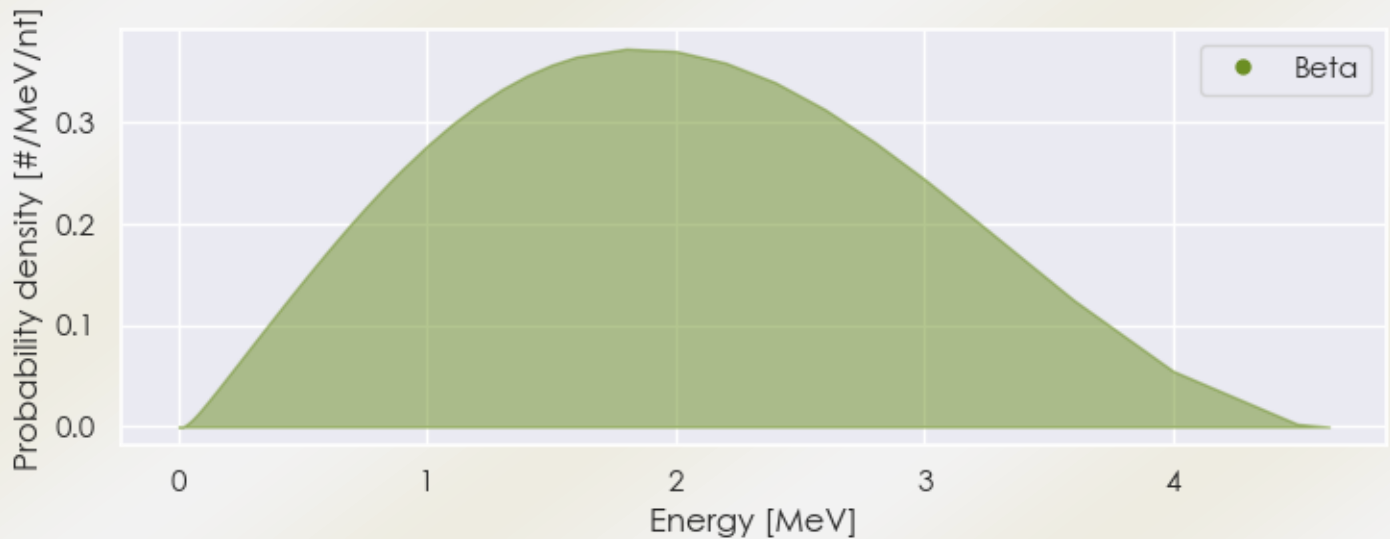
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/Mo-89 Summary Spectrum.csv

BETA SPECTRA (PLOT)

Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated beta spectra file here: www.mirdsoft.org/products/MIRDspecs/Mo-89 Beta Spectrum.csv

TABULATED DATA

SUMMARY SPECTRA (TABLE)

Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**

Note: Radiations with yield < 0.01 are excluded from the table, but are available in the linked *.csv data.

Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/Mo-89 Summary Spectrum.csv

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
5.83035e-06	3.616e-01	X-ray
1.65789e-02	1.196e-02	X-ray
5.11000e-01	1.934e+00	Annihilation photon
6.58600e-01	5.838e-02	Gamma
8.44000e-01	3.780e-02	Gamma
1.13100e+00	1.470e-02	Gamma
1.15530e+00	1.848e-02	Gamma
1.27200e+00	2.898e-02	Gamma
2.22100e+00	1.197e-02	Gamma
1.28037e+00	1.364e-02	Positron

1.52456e+00	2.630e-02	Positron
1.57997e+00	1.753e-02	Positron
1.72807e+00	3.507e-02	Positron
1.81661e+00	4.188e-02	Positron
2.13267e+00	7.890e-01	Positron
2.53253e-05	1.781e-01	Auger electron
1.03507e-04	3.050e-02	Auger electron
1.48959e-04	7.215e-02	Auger electron
1.85287e-03	2.905e-02	Auger electron

USEFUL LINKS

Isotope decay characteristics are periodically updated as better measurements can be made - changes that may not be reflected on this page. Please see useful links:

National Nuclear Data Center (NNDC): <https://www.nndc.bnl.gov/nudat3/mird/>

International Atomic Energy Agency (IAEA) Livechart: <https://www-nds.iaea.org/relnsd/vcharthtml/VChartHTML.html>

REFERENCE LINKS

ICRP Report 107: <https://www.icrp.org/publication.asp?id=ICRP%20Publication%20107>

Graves et al. Dose Point Kernels: <https://doi.org/10.1002/mp.13789>

MIRD Decay Schemes 2nd Edition: https://sites.snmmi.org/SNMML-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6