



PROTACTINIUM-227

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Pa-227
Atomic number (Z): 91
Mass number (A): 227
Neutron number (N): 136

RADIOACTIVE DECAY

Decay modes: α , Electron capture
Half-life: 38.3 [m]
Decay constant: $3.0163\text{e-}04$ [1/s]
Daughters: Ac-223 (85.0%), Th-227 (15.0%)
Radioactive daughters: Ac-223, Th-227

DOSIMETRIC CONSTANTS

Mean alpha energy: 5.5649 [MeV]
Mean electron energy: 0.02261 [MeV]
Mean photon energy: 0.02335 [MeV]
Air kerma rate constant, Γ_{10} : $7.373\text{e-}18$ [$\text{Gy} \cdot \text{m}^2/\text{Bq} \cdot \text{s}$]
Air kerma coefficient, K_{air} : $7.373\text{e-}18$ [$\text{Gy} \cdot \text{m}^2/\text{Bq} \cdot \text{s}$]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : $8.952\text{e-}13$ [$\text{Gy} \cdot \text{kg}/\text{Bq} \cdot \text{s}$]
Equilibrium dose constant for alphas, Δ_{α} : $8.916\text{e-}13$ [$\text{Gy} \cdot \text{kg}/\text{Bq} \cdot \text{s}$]

Equilibrium dose constant for betas/electrons, $\Delta_{\beta,\beta^+,e^-}$: 3.623×10^{-15} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 3.741×10^{-15} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

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

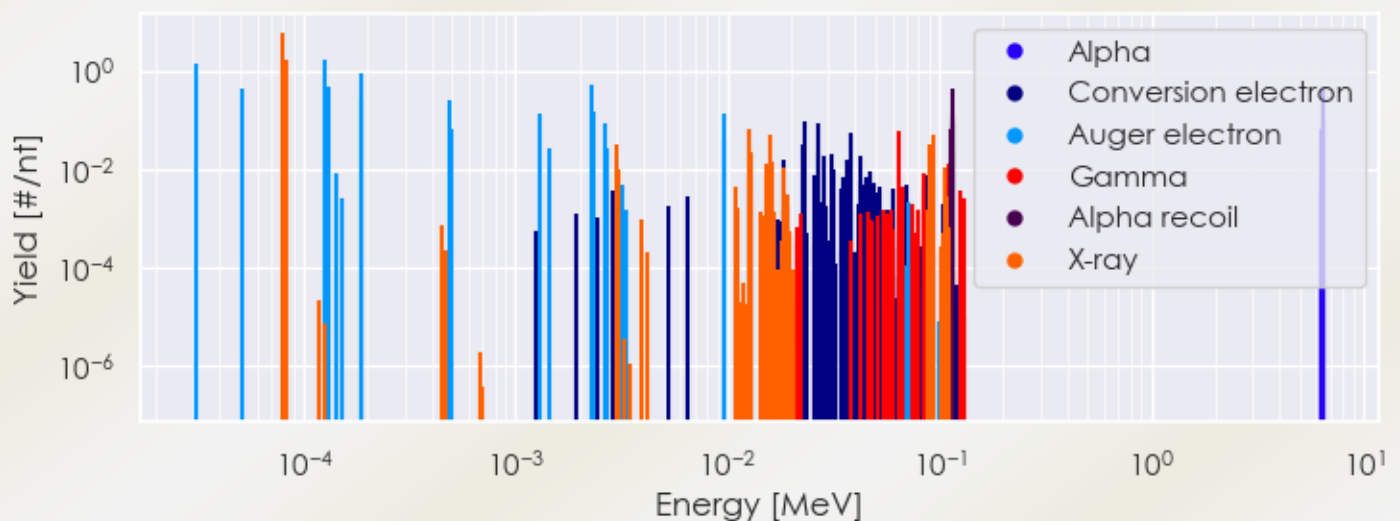
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Pa-227 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/Pa-227 Summary 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/Pa-227 Summary Spectrum.csv](http://www.mirdsoft.org/products/MIRDspecs/Pa-227%20Summary%20Spectrum.csv)

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
7.95587e-05	6.043e+00	X-ray
8.22404e-05	1.721e+00	X-ray
2.97508e-03	3.180e-02	X-ray
1.26589e-02	6.604e-02	X-ray
1.29764e-02	2.307e-02	X-ray
1.52434e-02	1.353e-02	X-ray
1.57834e-02	4.797e-02	X-ray
1.62775e-02	1.395e-02	X-ray
1.84875e-02	1.055e-02	X-ray
6.46200e-02	6.120e-02	Gamma
9.03299e-02	3.103e-02	X-ray
9.37949e-02	5.016e-02	X-ray
1.06073e-01	1.121e-02	X-ray
1.10050e-01	1.242e-02	Gamma
3.11369e-05	1.380e+00	Auger electron
5.13466e-05	4.145e-01	Auger electron
1.25901e-04	1.636e+00	Auger electron
1.32341e-04	4.583e-01	Auger electron
1.86641e-04	9.093e-01	Auger electron
1.87940e-04	2.593e-01	Auger electron
4.90702e-04	2.523e-01	Auger electron
4.92788e-04	6.757e-02	Auger electron
1.29567e-03	1.302e-01	Auger electron
1.43166e-03	2.678e-02	Auger electron
2.26826e-03	5.228e-01	Auger electron
2.31238e-03	1.504e-01	Auger electron
2.66167e-03	8.684e-02	Auger electron

2.72493e-03	2.577e-02	Auger electron
9.65672e-03	1.296e-01	Auger electron
9.69095e-03	3.961e-02	Auger electron
1.26942e-02	6.373e-02	Auger electron
1.28128e-02	1.969e-02	Auger electron
1.85520e-02	1.513e-02	Conversion electron
2.25520e-02	3.102e-02	Conversion electron
2.32370e-02	9.138e-02	Conversion electron
2.65170e-02	8.258e-02	Conversion electron
2.67520e-02	2.139e-02	Conversion electron
2.84520e-02	1.797e-02	Conversion electron
3.08520e-02	2.006e-02	Conversion electron
3.67520e-02	1.613e-02	Conversion electron
3.84961e-02	5.482e-02	Conversion electron
4.24000e-02	1.880e-02	Conversion electron
6.35586e+00	6.797e-02	Alpha
6.37488e+00	2.237e-02	Alpha
6.40050e+00	8.087e-02	Alpha
6.41417e+00	1.299e-01	Alpha
6.42233e+00	1.007e-01	Alpha
6.46398e+00	4.319e-01	Alpha
1.14081e-01	6.797e-02	Alpha recoil
1.14422e-01	2.237e-02	Alpha recoil
1.14882e-01	8.087e-02	Alpha recoil
1.15127e-01	1.299e-01	Alpha recoil
1.15274e-01	1.007e-01	Alpha recoil
1.16021e-01	4.319e-01	Alpha recoil

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/SNMMI-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6