

^{222}Rn α decay (3.8222 d) [1958Wa16](#),[1956Ma28](#),[1971Gr17](#)

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, M. S. Basunia, Murray Martin et al. ,		NDS 160, 405 (2019)	30-Oct-2019

Parent: ^{222}Rn : $E=0.0$; $J^\pi=0^+$; $T_{1/2}=3.8222$ d 9; $Q(\alpha)=5590.4$ 3; $\% \alpha$ decay=100.0

^{222}Rn - $T_{1/2}$: weighted average of 3.82146 d 85 ([2015Be07](#), from decay curve for integral γ -ray spectrum from 6 keV onwards, weighted average of four measurements: 3.82157 d 32 for 1301 h, 3.82134 d 30 for 1462 h, 3.82169 d 32 for 1185 h, and 3.82124 d 35 for 1357 h; statistical uncertainty of 0.00016 d and systematic uncertainty of 0.00004 d in [2015Be07](#) combined in quadrature, and total uncertainty increased to 0.00085, to have a maximum relative weight of 50%); 3.8195 d 30 ([2004Sc04](#), ionization chamber, reanalysis of [2004Sc04](#) data by [2018Po01](#) gave 3.825 d 5); 3.8224 d 18 ([1995Co34](#), 4π $\alpha\beta$ liquid scintillation counter, average of six measurements); 3.82351 d 170 ([1972Bu33](#), decay curve for integral γ -ray spectrum measured over 40 half-lives, average of two measurements, quoted uncertainty of 0.00034 increased to 0.00170 as in [1990Ho28](#) evaluation); 3.83 d 3 ([1958Sh69](#), calorimetry); 3.82290 d 170 ([1956Ma64](#), ionization chamber, average of three measurements, quoted uncertainty of 0.00027 increased to 0.00170 as in [1990Ho28](#)); 3.825 d 5 ([1956Ro31](#), calorimetry, quoted uncertainty of 0.004 increased to 0.005 as in [1990Ho28](#)); 3.825 d 6 ([1955To07](#),[1951To25](#), ionization chamber, average of two measurements, quoted uncertainty of 0.005 increased to 0.006 as in [1990Ho28](#)); 3.823 d 3 ([1924Cu01](#), ionization chamber, average of four measurements, quoted uncertainty of 0.002 increased to 0.003 as in [1990Ho28](#)); 3.825 d 4 ([1923Bo01](#), ionization chamber, average of four measurements). Other nominal recent value=3.81 d 12 ([2018Ap01](#)). Measurements prior to 1923, cited from compilation in [1995Co34](#) and [1995Co35](#): 3.811 d ([1921Bo01](#)); 3.847 d ([1913RuZZ](#)); 3.85 d ([1910Cu02](#)); 3.747 d ([1907Ru04](#)); 3.863 d ([1905Sa01](#)); 3.896 d ([1904Bu01](#)); 3.71 d ([1903Ru05](#)); 3.987 d ([1902Cu01](#)).

^{222}Rn - $Q(\alpha)$: From [2017Wa10](#).

^{222}Rn - $\% \alpha$ decay: $\% \alpha=100$ since $\% \varepsilon < 1 \times 10^{-4}$, estimated from $\log ft$ value for possible ε transition to ^{222}Fr .

[1958Wa16](#): measured $E\alpha$, $I\alpha$.

[1956Ma28](#): measured $E\gamma$.

[1971Gr17](#): measured $E\alpha$.

Others:

[2018St04](#), [2018Po01](#), [2015Be07](#): measured $T_{1/2}$ of ^{222}Rn decay, and emitted α and γ radiation to investigate annual, solar and diurnal oscillations of half-life, but no evidence found.

[1998Mo14](#): emission probabilities of γ rays from daughters of ^{222}Rn .

[1989Po03](#): measured $\alpha\gamma(\theta)$.

[1987Er06](#): measured $\alpha(x$ ray) coin, deduced K-shell ionization probability.

[1996Wi27](#), [1963Ba62](#), [1953Ba29](#), [1936Br05](#): measured $E\alpha$.

[1968Bi08](#): measured $\alpha\alpha(\theta)$.

$T_{1/2}$ (^{222}Rn isotope): [2015Be07](#), [2004Sc04](#), [1995Co34](#), [1972Bu33](#), [1958Sh69](#), [1956Ro31](#), [1956Ma64](#), [1951To25](#), [1924Cu01](#), [1923Bo01](#).

From (α)(K x-ray) coin, K-shell ionization probability following α decay is deduced to be 3.75×10^{-6} 25 ([1987Er06](#)).

[Additional information 1](#).

 ^{218}Po Levels

$E(\text{level})^\dagger$	$J^\pi^\dagger$	$T_{1/2}^\dagger$	Comments
0.0	0^+	3.097 min 12	
513 1	2^+		J^π : not 1 and 3 from $\alpha\gamma(\theta)$ (1989Po03).
676? 4			

† From the Adopted Levels.

‡ Derived from E_α and Q_α .

^{222}Rn α decay (3.8222 d) 1958Wa16,1956Ma28,1971Gr17 (continued) α radiations

$E\alpha^\dagger$	$E(\text{level})$	$I\alpha^\ddagger@$	HF#	Comments
4826 4	676?	≈ 0.0005	≈ 29	
4986 1	513	0.078 1	1.87 3	(4986 α)(510 γ)(θ): $A_2=+0.4$ 4, $A_4=-1.4$ 8 (1989Po03).
5489.48 30	0.0	99.92 1	1.00	$E\alpha$: from 1971Gr17. The original energy has been decreased by 0.18 keV, as recommended by 1991Ry01. Other measurements: 1936Br05, 1953Ba29, 1963Ba62, 1964Wa19, 1996Wi27.

† From 1958Wa16, except where indicated.

‡ From 1958Wa16.

$r_0(^{218}\text{Po})=1.54863$ 17 from HF(5489.48 α)=1.0.

@ Absolute intensity per 100 decays.

 $\gamma(^{218}\text{Po})$

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	$\alpha^\ddagger$	$I_{(\gamma+ce)}^\dagger$	Comments
510 2	0.076 1	513	2^+	0.0	0^+	[E2]	0.0306 6	0.078 1	$\alpha(K)=0.0213$ 4; $\alpha(L)=0.00704$ 13; $\alpha(M)=0.00177$ 4; $\alpha(N)=0.000453$ 9; $\alpha(O)=9.06\times 10^{-5}$ 17 $\alpha(P)=9.98\times 10^{-6}$ 19 E_γ : from 1956Ma28. I_γ : from $I(\gamma+ce)$ and $\alpha(\text{theory})$. Measured value is $I_\gamma\approx 0.07$ (1956Ma28). $I_{(\gamma+ce)}$: from $I\alpha$.

† Absolute intensity per 100 decays.

‡ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

 ^{222}Rn α decay (3.8222 d) 1958Wa16,1956Ma28,1971Gr17Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays

