^{38}Cl β^- decay (37.230 min) 1986Wa22,1996Mi05,1968Va06

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 152, 1 (2018)	30-Sep-2017

Parent: ^{38}Cl: E=0; J$^\pi$=2$^-$; T$_{1/2}$=37.230 min *14*; Q(β^-)=4916.72 *22*; %β^- decay=100.0

^{38}Cl-J$^\pi$,T$_{1/2}$: From Adopted Levels of ^{38}Cl.

^{38}Cl-T$_{1/2}$: Additional information 1.

^{38}Cl-Q(β^-): from 2017Wa10.

1986Wa22: ^{38}Cl source ions were from β^- decay of ^{38}S produced by bombardment of 81% enriched ^{36}S by 3.1 MeV triton beam. γ rays were detected with a Compton suppression spectrometer (CSS) consisting of a NaI(Tl) annulus and an intrinsic coaxial Ge detector. Measured Eγ, Iγ. Deduced levels, J, π, parent decay branching ratios. Comparisons with available data and shell-model calculations.

1996Mi05: ^{38}Cl source ions were produced by thermal neutron irradiation of a polyvinylidene chloride film at the Kyoto University Research Reactor. β particles and γ rays were detected with a proportional counter and a HPGe detector, respectively, in 4$\pi\beta\gamma$ coincidence. Measured Eβ, Iβ, Eγ, Iγ, $\beta\gamma$-coin. Deduced levels, β-decay branching ratios, absolute γ-emission probabilities. Comparisons with available data.

1968Va06 (also a note about ^{38}Cl decay in 1967Va03): ^{38}Cl source ions were produced via ^{37}Cl(d,p) with 5 MeV deuterons provided by the Van de Graaff at Natuurkundig Laboratorium impinged on natural NaCl or CoCl$_2$ or Na^{37}Cl (89% enriched). β particles were detected with a magnetic spectrometer equipped with a thin plastic scintillator and γ rays were detected with a Ge(Li) detector. Measured Eβ, Iβ, β-spectrum shape, Eγ, Iγ. Deduced levels, decay branching ratios, log *ft*.

1988An03: ^{35}Cl source ions were produced by thermal neutron irradiation of RbCl at the Strasbourg University Reactor. γ rays were detected by a NaI(Tl) detector and a Ge(Li) detector. Measured Eγ, γ(t). Deduced levels, T$_{1/2}$. Comparisons with available data.

2012Kr03: Sources of ^{38}Cl were prepared by neutron irradiation of samples of NH$_4$Cl powder in the pneumatic transfer facility of the Oregon State University TRIGA reactor. γ rays were detected with two Ge spectrometers. Measured Eγ, Iγ.

2000Ha08: measured γ spectra at the University of Michigan, the Japan Atomic Energy Research Institute and Nagoya University. Deduced relative intensity for 1642γ.

2011Fi11: derived γ-emission probabilities for 1642γ and 2168γ and g.s. β^- feeding from the measured k$_0$-factors (composite nuclear constants) in J. Radioanal. Chem. 60, 461 (1980).

2004HaZW: measured total-absorption γ-ray spectrum. Deduced β feedings. No details are available.

2003Su38: measured Eγ, Iγ. Deduced γ-ray emission probabilities.

2001Ko07: measured β spectrum using small HPGe detector.

1995Ke16, 1984Ke14: measured counting losses.

1989He11, 1986HeZY (thesis): measured Eβ, Iβ, shape factor.

1982De08: measured Eβ, $\beta\gamma$, β-endpoint energy.

1973Sp06, 1973Ro32, 1972Vi11, 1971En01, 1969GuZV, 1967Vo07, 1965Ro16, 1964Ph02, 1964Ma05; 1967Vo07: measured Eγ, Iγ.

1972Em01, 1969St23, 1965KaZY (thesis): measured T$_{1/2}$.

1968He06: measured $\beta\gamma$(circ pol), $\beta\gamma(\theta)$.

1954Kr53: measured $\gamma\gamma(\theta)$.

1950La02: measured Eβ, Iβ, magnetic spectrometer.

Others: 1964Gr34, 1963Wi11, 1962Mo21, 1958Ne10, 1950Co69, 1946Ho02, 1936Va01.

Additional information 2.

Total decay energy deposit of 4919 keV *26* calculated by RADLIST code is in agreement with the expected value of 4916.72 keV *22* indicating the completeness of the decay scheme.

^{38}Ar Levels

E(level)†	J$^\pi$#
0.0	0$^+$
2167.467 *9*	2$^+$
3376.9?‡	0$^+$
3810.187 *21*	3$^-$

Continued on next page (footnotes at end of table)

^{38}Cl β^- decay (37.230 min) 1986Wa22,1996Mi05,1968Va06 (continued)

^{38}Ar Levels (continued)

E(level)[†]	J^{π}[#]
3936.5?[‡]	2^+
4565.5?[‡]	2^+

[†] From a least-squares fit to γ-ray energies, unless otherwise noted.
[‡] Rounded values from Adopted Levels.
[#] From Adopted Levels.

β^- radiations

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(351.22[#] *22*)	4565.5?	<0.02	>6.3	av Eβ=111.914 *80*
(980.22[#] *22*)	3936.5?	<0.007	>8.4	av Eβ=365.201 *95*
(1106.53 *22*)	3810.187	32.9 *5*	4.906 *7*	av Eβ=420.107 *97* E(decay): 1110 *10* from 1950La02. Iβ^-: values from different measurements: 33.4 *3* (1996Mi05), 31.3 *6* (1968Va06), 35.0 *14* (1973Sp06), 31 (1950La02),
(1539.82[#] *22*)	3376.9?	<0.02	>9.6[1u]	av Eβ=639.07 *10*
(2749.25 *22*)	2167.467	11.1 *2*	7.015 *8*	av Eβ=1181.41 E(decay): 2770 *50* from 1950La02. Iβ^-: values from different measurements: 11.4 *5* (1996Mi05), 11.1 *8* (1968Va06), 10.6 *5* (1973Sp06), 16 (1950La02).
(4916.72 *22*)	0.0	56.0 *6*	9.235[1u] *5*	av Eβ=2243.90 E(decay): 4193 *5* from 1968Va06, 4810 *50* from 1950La02. Iβ^-: weighted average of 55.2 *6* (1996Mi05), 54.4 *18* (1973Sp06), 57.2 *8* (2011Fi11) and 57.6 *13* (1968Va06). Other: 53 (1950La02),

[†] From γ-ray intensity imbalance at each level except for ground state where noted otherwise. Values given in comments are those from measurements of absolute γ-ray intensities (1996Mi05 and 1973Sp06) and β-spectrum with magnetic spectrometer (1968Va06 and 1950La02); 2011Fi11 derive absolute γ-ray intensities and β^--decay branches from available experimental k_0-factors.
[‡] Absolute intensity per 100 decays.
[#] Existence of this branch is questionable.

γ(^{38}Ar)

Iγ normalization: From the sum of γ feedings to g.s.: Iγ(2167γ)+Iγ(3810γ)=100−Iβ^-(g.s.), with Iβ^-(g.s.)=56.0 *6* (see comment for ground state β feeding).

E_γ	I_γ[†@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	Comments
1209.4[‡&]	<0.045[‡]	3376.9?	0^+	2167.467	2^+	E2		%Iγ<0.02
1642.68 *2*	74.82 *15*	3810.187	3^-	2167.467	2^+	E1(+M2)	+0.016 *13*	%Iγ=32.9 *5* E_γ: weighted average of 1642.668 *10* (2012Kr03), 1642.714 *16* (1986Wa22), 1642.42 *15* (1973Sp06), 1642.4 *2* (1972Vi11), 1642.2 *3* (1971En01), and 1642.16 *13* (1968Va06), with reduced

Continued on next page (footnotes at end of table)

^{38}Cl β^- decay (37.230 min) 1986Wa22,1996Mi05,1968Va06 (continued)

$\gamma(^{38}Ar)$ (continued)

E_γ	I_γ [†@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	Comments
							χ^2=5.9. It should be noted that the precise value of 1642.32 *1* in 1988An03 is in disagreement with the other two most precise values of 2012Kr03 and 1986Wa22 and excluded in the averaging above. The average including 1988An03 is 1642.53 *7* with a large reduced χ^2=129. Other: 1642 *2* (1973Ro32). I_γ: weighted average of 75.5 *6* (2012Kr03), 74.2 *2* (2011Fi11), 74.96 *11* (2000Ha08), 74.8 *5* (1996Mi05), 74.7 *19* (1986Wa22), 76.8 *7* (1973Sp06), 74 *4* (1973Ro32), 73.4 *18* (1972Vi11), 73.8 *19* (1971En01), 73.8 *9* (1968Va06). Other: 80.7 *21* (1967Vo07). Other values reported as absolute intensity: 33.4 *3* (1996Mi05), 33.33 *11* (2003Su38), 31.9 *6* (2011Fi11). (1642γ)(2167γ)(θ): A_2=−0.024 *37*, A_4=−0.094 *42* (1954Kr53) consistent with J(3810)=3 and pure dipole for 1642γ.
2167.400 *9*	100.0	2167.467	2$^+$	0.0	0$^+$	E2	%Iγ=44.0 *6* E_γ: weighted average of 2167.395 *10* (2012Kr03), 2167.406 *9* (1986Wa22), 2167.41 *12* (1973Sp06), 2167.5 *5* (1972Vi11), 2167.6 *4* (1971En01), 2167.60 *16* (1968Va06). It should be noted that another precise value of 2167.71 *1* in 1988An03 is in disagreement with values of most measurements including the other two most precise measurements 2012Kr03 and 1986Wa22, and is therefore considered as an outlier and excluded in the averaging. Other: 2167 *2* (1973Ro32). I_γ: other values reported as absolute intensity: 44.8 *3* (1996Mi05), 44.86 *14* (2003Su38), 43.0 *8* (2011Fi11).
2398.1[‡&]	<0.045[‡]	4565.5?	2$^+$	2167.467	2$^+$		%Iγ<0.02
3810.01 *7*	0.059 *4*	3810.187	3$^-$	0.0	0$^+$	[E3]	%Iγ=0.0259 *18* E_γ: weighted average of 3810.03 *7* (1988An03) and 3809.98 *7* (2012Kr03). Others: 3810 *2* (1968Va06), 3806 *3* (1973Ro32). I_γ: weighted average of 0.071 *10* (2012Kr03), 0.062 *4* (1996Mi05) 0.055 *7* (1973Ro32), 0.061 *5* (1968Va06), and 0.055 *4* (1967Vo07). Other value reported as absolute intensity: 0.000278 *18* (1996Mi05).
3936.1[‡&]	<0.015[‡]	3936.5?	2$^+$	0.0	0$^+$	[E2]	%Iγ<0.007

† Relative intensities normalized to Iγ(2167γ)=100.
‡ Energies are rounded values from Adopted Gammas and intensity limit from 1986Wa22.
# From Adopted Gammas.
@ For absolute intensity per 100 decays, multiply by 0.440 *6*.
& Placement of transition in the level scheme is uncertain.

^{38}Cl β^- decay (37.230 min) 1986Wa22,1996Mi05,1968Va06

Decay Scheme

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