

Adopted Levels, Gammas

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia		NDS 127, 69(2015)	1-Apr-2015

$Q(\beta^-) = -18601$ SY; $S(n) = 19385$ I6; $S(p) = 5504.3$ 4; $Q(\alpha) = -8142.5$ 5 [2012Wa38](#)
 $\Delta Q(\beta^-) = 401$ (syst) [2012Wa38](#).

 ^{22}Mg LevelsCross Reference (XREF) Flags

A	^{22}Al ε decay	F	$^{12}\text{C}(^{16}\text{O}, ^6\text{He})$	K	$^{24}\text{Mg}(p, t)$
B	^{23}Si εp decay	G	$^{12}\text{C}(^{22}\text{Mg}, ^{22}\text{Mg}')$	L	$^{24}\text{Mg}(\alpha, ^6\text{He})$
C	$^1\text{H}(^{21}\text{Na}, \gamma)$	H	$^{12}\text{C}(^{23}\text{Al}, ^{22}\text{Mg}\gamma)$	M	$^{25}\text{Mg}(^3\text{He}, ^6\text{He})$
D	$^1\text{H}(^{21}\text{Na}, p)$: res	I	$^{18}\text{Ne}(\alpha, p)$		
E	$^{12}\text{C}(^{12}\text{C}, 2n\gamma)$	J	$^{20}\text{Ne}(^3\text{He}, n), (^3\text{He}, n\gamma)$		

E(level) [†]	J ^π	T _{1/2} ^{&}	XREF	Comments
0.0	0 ⁺	3.8755 s 12	ABC EF HIJK M	$\% \varepsilon + \% \beta^+ = 100$ $\delta \langle r^2 \rangle(^{26}\text{Mg}, ^{22}\text{Mg}) = +0.214$ fm ² 5 (stat) 51 (syst) (2012Yo01). $\langle r^2 \rangle^{1/2} = 3.0691$ fm 7 (stat) 86 (syst) (2012Yo01). J ^π : L=0 in (p,t). T _{1/2} : From 2003Ha20 . Other value: 3.857 s 9 (1972Ha58 , 1975Ha21). 2015Ha07 Weighted average of data in 2003Ha20 and 1975Ha21 is 3.8752 s 24 at 2σ (2015Ha07). J ^π : L=2 in (p,t); E2 γ to 0 ⁺ . T _{1/2} : From weighted average of 2.9 ps 10 (1975Gr04) and 1.3 ps 9 (symmetric value of 0.7 ps +15-3 (1972Ro20)) in ($^3\text{He}, n$), ($^3\text{He}, n\gamma$). J ^π : E2 γ to 2 ⁺ , member of isobaric triplet. J ^π : L=(2) and natural parity in (p,t). (M1) to 2 ⁺ , γ's to 0 ⁺ and 4 ⁺ . E(level): From ($^{12}\text{C}, 2n\gamma$). J ^π : L=2 in ($^3\text{He}, n$) and L=(2) and natural parity in (p,t). J ^π : Assigned in 2005Se02 ($^{12}\text{C}, 2n\gamma$) based on γ ray feeding and transition characteristics. J ^π : (M1+E2) γ to 4 ⁺ . 2005Se02 ($^{12}\text{C}, 2n\gamma$) assigned 4 ⁺ comparing with a 4 ⁺ state at 5146.0 keV in ^{22}Ne mirror. Natural parity in (p,t). J ^π : Dipole γ to 2 ⁺ . 2005Se02 ($^{12}\text{C}, 2n\gamma$) assigned 2 ⁻ comparing with a 2 ⁻ state at 5146.0 keV in ^{22}Ne mirror. J ^π : γ to 0 ⁺ . XREF: J(5464). J ^π : Dipole γ to 2 ⁺ . 2005Se02 ($^{12}\text{C}, 2n\gamma$) assigned 3 ⁺ in analogy with a 3 ⁺ state at 5641.2 keV in ^{22}Ne mirror. Natural parity in 2001Ba17 (p,t) probably doubtful – 2005Se02 note the strength is noticeably suppressed. J ^π : L=2 in and natural parity in (p,t); L=2 in ($^3\text{He}, n$). Γ _p /Γ<0.20 (2003Da36). J ^π : γ's to 2 ⁺ and 4 ⁺ . XREF: J(5980). Γ _p /Γ=0.98 1 (2003Da36). E(level): From (p,t). J ^π : L=0 in ($^3\text{He}, n$) and (p,t). E(level): From 6036.2 8 (p,t), 6042 13 ($^{21}\text{Na}, \gamma$), 6051 4 ($^3\text{He}, ^6\text{He}$), 6041 11 ($^{16}\text{O}, ^6\text{He}$), 6059 9 ($\alpha, ^6\text{He}$) using The Limitation of Relative Statistical Weight method (1985ZiZY). J ^π : Natural parity in 2001Ba17 (p,t), L=0 in (p,t). However,
1247.02 3	2 ⁺	2.0 ps 8	ABC EF H JK M	
3308.22 6	4 ⁺	200 fs 45	A C EF H JK M	
4402.0 3	2 ⁺	<21 fs	C EF JK M	
5035.4 5	2 ⁺	<0.07 ns	EF JK M	
5089.3 8	(1 ⁺)		E K M	
5293.11 16	(4 ⁺)	44 fs 15	A E H JK	
5296.0 4	(2 ⁻)		E J	
5318 4	(1,2,3)	<17 ns	J	
5452.4 4	(3 ⁺)	<0.07 ns	A E JK	
5711.4 7	2 ⁺	28 fs 10	C EF JK M	
5838 5	2 ⁺ , 3, 4 ⁺	<17 ns	C J	
5953.8 8	0 ⁺		C JK	
6043 3	(0 ⁺)		C F KLM	

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Adopted Levels, Gammas (continued) ^{22}Mg Levels (continued)

E(level) [†]	J ^π	T _{1/2} ^{&}	XREF		Comments
6226.1 10	(4 ⁺)		A C F	K M	2003Da36 assign 1 ⁻ . Γ _p /Γ=0.97 3 (2003Da36). E(level): From (p,t). J ^π : L=4 in (³ He,n); Analogue state of 6345.1 (J ^π =4 ⁺) in ²² Ne. (2009Ma68).
6242.7? 11			C F	M	XREF: F(6255). E(level): From (²¹ Na,γ). Evaluator lists this level as doubtful based on observations in 2009Ma68 (p,t). It is noted that 2001Ba17 (p,t) measured a peak at 6241.1 keV 51 (width 26 keV 6) and suggested as a doublet. 2005Se02 (¹² C,2nγ) resolved the doublet by measuring a 6 ⁺ state at 6254 keV. 2009Ma68 measured only one level at 6226.1 keV 10 (width 13 keV). Evaluator's note: Average of 6254.23 and 6226.1 is 6240.1.
6254.23 [‡] 21	6 ⁺		E	JKL	XREF: K(6226). E(level): From (¹² C,2nγ). J ^π : L=6 in ((p,t) – see comments for level at 6226.1), Q γ to 4 ⁺ .
6313 5	4 ⁺	<17 ns	A	JK	E(level): Weighted average of 6307 8 (²² Al β ⁺ decay) and 6317 6 (p,t). J ^π : L=4 in (p,t) and (³ He,n).
6325.6 10	(1 ⁺) [#]	13.6 keV 14	CD	K M	E(level): From (²¹ Na,γ). J ^π : Analogue state of 6853.5 (J ^π =(1 ⁺)) in ²² Ne. Γ: Other value – 16 keV 3 ((²¹ Na,γ) – 2004Da17).
6476 8			A		
6578 7	(1 ⁻) [#]	12.8 keV 15	D	JK	E(level): From (p,t). J ^π : From differential cross section fittings (2005Ru01). Γ _p =11.9 keV 14 and Γ _{p'} =0.94 keV 11 ((²¹ Na,p) – 2005Ru01).
6608 2	(2 ⁺) [#]	17.9 keV 16	CD F	KLM	E(level): Weighted average of 6611 11 (²¹ Na,p), 6606 7 (p,t), 6605.4 25 (²¹ Na,γ), 6616 4 (³ He, ⁶ He), 6606 11 (¹⁶ O, ⁶ He), 6606 9 (α, ⁶ He). J ^π : L=0 and natural parity in (²¹ Na,p), analogue state of 6819.4 (J ^π =2 ⁺) in ²² Ne. Γ: Other values: – 30 keV 7 ((²¹ Na,γ) – 2004Da17). Γ _p =17.6 keV 15 and Γ _{p'} =0.3 keV 1 ((²¹ Na,γ) – 2005Ru01); Γ _p =23 keV 7 ((²¹ Na,p) – 2009He12).
6724 8			A		
6766 12	(3 ⁻) [#]	105 keV 33	D F	JKLM	J ^π : L=3 in (³ He,n). But (1 ⁺ ,2 ⁺) in 2008He04 (²¹ Na,p). E(level): Weighted average of 6792 17 (²¹ Na,p), 6770 20 (³ He,n), (³ He,nγ), 6768.8 12 (p,t), 6771 5 (³ He, ⁶ He), 6767 20 (¹⁶ O, ⁶ He), and 6766 12 (α, ⁶ He). Also Γ _p =94 keV 32 and Γ _{p'} =11.1 keV 8 (2005Ru01); Γ _p =64 keV 20 (2009He12).
6865 8	(3 ⁺) [#]		A		J ^π : From ²² Al β ⁺ decay, log ft=5.6 from (4) ⁺ .
6876.0 12	(1 ⁻) [#]		D F	K M	E(level): From (p,t).
6983 9	(3 ⁻)			J	J ^π : L=3 in (³ He,n).
7027 9	[3 ⁺] [@]			K	
7048 5	[4 ⁺] [@]		A	K	E(level): Weighted average of 7052 8 (²² Al β ⁺ decay) and 7045 7 (p,t).
7060 7				K	
7079 8	[1 ⁻] [@]			K	
7132 8	(5 ⁺)		A		J ^π : From ²² Al β ⁺ decay, log ft=4.75 from (4) ⁺ .
7218.3 10	0 ⁺			JKLM	E(level): From (p,t). J ^π : L=0 in (³ He,n).

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Adopted Levels, Gammas (continued) ^{22}Mg Levels (continued)

E(level) [†]	J ^π	XREF		Comments
7254 8	(1 ⁻) [#]	A	D	XREF: D(7270).
7338 13	(2 ⁺) [#]		D K	E(level): From (p,t).
7384 8	(3 ⁻) [#]		D F K M	E(level): Weighted average of 7402 13 ($^{16}\text{O}, ^6\text{He}$), 7389 12 (p,t), and 7373 9 ($^3\text{He}, ^6\text{He}$).
7573 8		A		
7599.5 29	(2 ⁺) [#]		D KLM	XREF: D(7585). E(level): From (p,t). $\Gamma_p=23$ keV 7 ($^{21}\text{Na}, p$) – 2009He12).
7674 18	(1 ⁻) [#]		D F	XREF: D(7654).
7741.1 2			K M	XREF: M(7757). E(level): From (p,t).
7810 40	(2 ⁻) [#]		D J	XREF: D(7802). J^π : Unnatural parity ($^{21}\text{Na}, p$).
7928 3	[2 ⁺] [@]		D F JKLM	XREF: D(7920). E(level): Weighted average of 7920.6 15 (p,t), 7931 5 ($^3\text{He}, ^6\text{He}$), 7964 16 ($^{16}\text{O}, ^6\text{He}$), 7938 9 ($\alpha, ^6\text{He}$).
8007.0 14	[3 ⁻] [@]	A	D KL	E(level): from (p,t). J^π : Natural parity ($^{21}\text{Na}, p$).
8062 16			F	
8180.3 17	[2 ⁺] [@]		D F KLM	XREF: F(8203)L(8197)M(8229). E(level): From (p,t).
8290 40		A	J	XREF: A(8339).
8398 8	[2 ⁺] [@]	A	D F KLM	XREF: D(8353). E(level): Weighted average of 8416 8 ($^{22}\text{Al } \beta^+$ decay), 8394 21 ($^3\text{He}, ^6\text{He}$), 8396 15 ($^{16}\text{O}, ^6\text{He}$), 8380 10 ($\alpha, ^6\text{He}$), 8383 13 (p,t).
8519.3 21	(3 ⁻) [#]		D F JKLM	XREF: F(8547)J(8550)M(8487). E(level): From (p,t). $\Gamma_p=60$ keV 20 ($^{21}\text{Na}, p$) – 2009He12).
8579 6		A	D K M	E(level): Weighted average of 8589 8 ($^{22}\text{Al } \beta^+$ decay), 8598 20 ($^3\text{He}, ^6\text{He}$), and 8572 6 (p,t).
8657.5 17			D F KL	XREF: D(8677)F(8613)L(8644). E(level): From (p,t).
8727	(2 ⁺) [#]		D	
8743 14	[4 ⁺] [@]		K	
8784.5 23	[1 ⁻] [@]		F KLM	XREF: F(8754). E(level): From (p,t).
8827	(1 ⁻) [#]		D	
8933.1 29	[2 ⁺] [@]		D F KL	E(level): Weighted average of 8925 19 ($^{16}\text{O}, ^6\text{He}$) and 8921 9 ($\alpha, ^6\text{He}$).
8991 7	(1 ⁻) [#]	A	D L	XREF: D(9050). E(level): Weighted average of 8985 8 ($^{22}\text{Al } \beta^+$ decay) and 9029 20 ($\alpha, ^6\text{He}$).
9080 7			F KL	XREF: L(9029). E(level): Weighted average of 9082 7 (p,t) and 9066 18 ($^{16}\text{O}, ^6\text{He}$).
9157 4	(4 ⁺) [#]		D F KL	XREF: F(9172). E(level): From (p,t).
9248? 20			F	
9318 12			F K	E(level): Weighted average of 9329 26 ($^{16}\text{O}, ^6\text{He}$), 9315 14 (p,t).
9378? 22			L	E(level): Weighted average of 9378 22 ($^{16}\text{O}, ^6\text{He}$), 9315 14 (p,t).
9452? 21			F	
9481 18	[3 ⁻] [@]		F K	E(level): Weighted average of 9452 21 ($^{16}\text{O}, ^6\text{He}$) and 9492 13 (p,t).
9529 7		A	F KL	XREF: A(9518). E(level): Weighted average of 9518 8 ($^{22}\text{Al } \beta^+$ decay), 9533 24 ($^{16}\text{O}, ^6\text{He}$), 9542 12 ($\alpha, ^6\text{He}$), and 9546 15 (p,t).

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Adopted Levels, Gammas (continued) ^{22}Mg Levels (continued)

E(level) [†]	J ^π	XREF		Comments
9640 9		F	L	J ^π : [2 ⁺] in 2009Ma68 (p,t) and (1 ⁻) in 2009Ch28 (p,t). E(level): Weighted average of 9638 21 ($^{16}\text{O}, ^6\text{He}$) and 9640 10 ($\alpha, ^6\text{He}$).
9712 21	[0 ⁺] [@]	a	F K	E(level): From ($^{16}\text{O}, ^6\text{He}$).
9751.6 27	(2 ⁺ , 1 ⁺) [@]	a	KL	E(level), J ^π : From (p,t). 2009Ma68 (p,t) propose [2 ⁺] from mirror analogy with 10137 keV level in ^{22}Ne .
9859 5	[0 ⁺] [@]	F	KL	E(level): Weighted average of 9827 44 ($^{16}\text{O}, ^6\text{He}$), 9853 11 ($\alpha, ^6\text{He}$), and 9861 6 (p,t).
9960 7		A	F L	XREF: A(9965). E(level): Weighted average of 9965 8 ($^{22}\text{Al } \beta^+$ decay), 9924 28 ($^{16}\text{O}, ^6\text{He}$), and 9953 13 ($\alpha, ^6\text{He}$).
10084 13	[2 ⁺] [@]	F	KL	XREF: L(10128). E(level): Weighted average of 10087 15 (p,t) and 10078 24 ($^{16}\text{O}, ^6\text{He}$).
10168 9	[3 ⁺] [@]	F	K	E(level): From (p,t).
10271.7 17	[2 ⁺] [@]	F	KL	XREF: F(10297). E(level): Weighted average of 10297 25 ($^{16}\text{O}, ^6\text{He}$) and 10260 10 ($\alpha, ^6\text{He}$).
10418 8	[4 ⁺] [@]	A	F KL	XREF: L(10389). E(level): Weighted average of 10413 10 ($^{22}\text{Al } \beta^+$ decay), 10429 26 ($^{16}\text{O}, ^6\text{He}$), and 10430 19 (p,t). J ^π : From (p,t). 2009Ch28 , also in (p,t), propose (1 ⁻). Considering the presence of this level in $^{22}\text{Al } \beta^+$ decay, evaluator lists [4 ⁺].
10572 22		F	I	E(level): Weighted average of 10580 50 (α, p) and 10570 25 ($\alpha, ^6\text{He}$).
10665 11	[3 ⁻] [@]	A	F KL	E(level): Weighted average of 10678 12 ($^{22}\text{Al } \beta^+$ decay), 10660 28 ($^{16}\text{O}, ^6\text{He}$), 10627 20 ($\alpha, ^6\text{He}$), and 10667 19 (p,t).
10768 13	[2 ⁺] [@]	F	i KL	E(level): Weighted average of 10750 31 ($^{16}\text{O}, ^6\text{He}$), 10776 20 ($\alpha, ^6\text{He}$), and 10768 21 (p,t).
10876 14	[4 ⁺] [@]	F	i K	E(level): Weighted average of 10881 15 (p,t) and 10844 38 ($^{16}\text{O}, ^6\text{He}$).
10901 17		F	I L	E(level): Weighted average of 10910 50 (α, p), 10844 38 ($^{16}\text{O}, ^6\text{He}$), and 10915 20 ($\alpha, ^6\text{He}$).
11001 11	[0 ⁺] [@]	F	I KL	E(level): Weighted average of 10990 50 (α, p), 10980 31 ($^{16}\text{O}, ^6\text{He}$), 11015 20 ($\alpha, ^6\text{He}$), and 10999 15 (p,t).
11122 17		F	I L	E(level): Weighted average of 11130 50 (α, p), 11135 40 ($^{16}\text{O}, ^6\text{He}$), and 11118 20 ($\alpha, ^6\text{He}$).
11231? 20			L	
11314 16	[4 ⁺] [@]	A	KL	E(level): From 11313 20 ($\alpha, ^6\text{He}$) and 11317 27 (p,t).
11410 8		A		
11499 17	[2 ⁺] [@]		K	
11594 12			KL	E(level): Weighted average of 11581 20 ($\alpha, ^6\text{He}$) and 11603 16 (p,t). J ^π : (3 ⁻ , 4 ⁺) in 2009Ch28 and [1 ⁻] in 2009Ma68 both in (p,t).
11748 17	[0 ⁺] [@]		KL	E(level): Weighted average of 11742 20 ($\alpha, ^6\text{He}$) and 11760 30 (p,t).
11914 13			KL	E(level): Weighted average of 11881 20 ($\alpha, ^6\text{He}$) and 11937 17 (p,t). J ^π : (1 ⁻ , 2 ⁺) in 2009Ch28 and [0 ⁺] in 2009Ma68 both in (p,t).
12003? 20			L	
12185 17	[3 ⁻] [@]		KL	E(level): Weighted average of 12169 20 ($\alpha, ^6\text{He}$) and 12220 30 (p,t).
12474 26	[2 ⁺] [@]		K	
12665 17	[3 ⁻] [@]		K	
13014 37		A	K	E(level): Weighted average of 13018 56 ($^{22}\text{Al } \beta^+$ decay) and 13010 50 (p,t). J ^π : [0 ⁺] in (p,t) not consistent, considering population of this level in $^{22}\text{Al } \beta^+$ decay from (4) ⁺ .
14012 3		A	G	E(level): IAS of ^{22}Al g.s., J ^π =4 ⁺ . Other value: 14044 keV 15 (1982Ca16).

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Adopted Levels, Gammas (continued) ^{22}Mg Levels (continued)

† From least squares fit to γ -ray energies for excited levels up to 5838 keV.

‡ From ($^{12}\text{C}, 2n\gamma$).

From R-matrix analysis in 2014Zh05 ($^{21}\text{Na}, p$).

@ Based on mirror analogy with ^{22}Ne nucleus in 2009Ma68 (p,t).

& From ($^3\text{He}, n$), ($^3\text{He}, n\gamma$), except otherwise noted. Γ_{tot} from ($^{21}\text{Na}, p$) – additional data listed in the comments section.

<u>$\gamma(^{22}\text{Mg})$</u>								
$E_i(\text{level})$	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult. [#]	δ	Comments
1247.02	2 ⁺	1246.98 [†] 3	100	0.0	0 ⁺	E2		B(E2)(W.u.)=26 11
3308.22	4 ⁺	2061.09 [†] 5	100	1247.02	2 ⁺	E2		B(E2)(W.u.)=21 5
4402.0	2 ⁺	1090 [‡] 50	6 [‡] 5	3308.22	4 ⁺			
		3154.7 [‡] 3	100 [‡] 5	1247.02	2 ⁺	(M1)		B(M1)(W.u.)>0.029
		4400 [‡] 50	9 [‡] 5	0.0	0 ⁺	[E2]		B(E2)(W.u.)>0.33
5035.4	2 ⁺	3788.0 [‡] 5	100 [‡] 5	1247.02	2 ⁺	(M1)		B(M1)(W.u.)>5.1×10 ⁻⁶
		5037 [‡] 6	14 [‡] 5	0.0	0 ⁺	[E2]		B(E2)(W.u.)>8.3×10 ⁻⁵
5089.3	(1 ⁺)	3841.0 [†] 10	55 [†] 9	1247.02	2 ⁺			
		5089.9 [†] 12	100 [†] 10	0.0	0 ⁺			
5293.11	(4 ⁺)	1984.80 [†] 14	100	3308.22	4 ⁺	(M1+E2)		
5296.0	(2 ⁻)	893.98 [†] 9	100	4402.0	2 ⁺	D		E_γ : Placement from ($^{12}\text{C}, 2n\gamma$).
5318	(1,2,3)	4070 [‡] 5	100 [‡] 21	1247.02	2 ⁺			
		5317 [‡] 6	43 [‡] 21	0.0	0 ⁺			
5452.4	(3 ⁺)	2143.5 [†] 6	29 [†] 5	3308.22	4 ⁺			
		4205.4 [†] 5	100 [†] 7	1247.02	2 ⁺	D		
5711.4	2 ⁺	4463.5 [‡] 10	100 [‡] 3	1247.02	2 ⁺	M1+E2	-0.17 10	B(M1)(W.u.)=0.007 3; B(E2)(W.u.)=0.08 5
		5711 [‡] 1	15 [‡] 3	0.0	0 ⁺	[E2]		B(E2)(W.u.)=0.12 5
5838	2 ⁺ , 3, 4 ⁺	2530 [‡] 45	25 [‡] 19	3308.22	4 ⁺			
		4590 [‡] 5	100 [‡] 19	1247.02	2 ⁺			
6242.7?		2934.3 ^{&}		3308.22	4 ⁺			E_γ : From ($^{21}\text{Na}, \gamma$). Evaluator lists this γ -ray as doubtful based on the existence of the level at 6242.7 keV 11. Please see comments for the depopulating level.
6254.23	6 ⁺	2945.8 [†] 2	100	3308.22	4 ⁺	Q		
6325.6	(1 ⁺)	5077.9 [@]		1247.02	2 ⁺			
		6324.6 [@]		0.0	0 ⁺			
6608	(2 ⁺)	2205.9 [@]		4402.0	2 ⁺			
		5360.3 [@]		1247.02	2 ⁺			

† From ($^{12}\text{C}, 2n\gamma$).

‡ From ($^3\text{He}, n$), ($^3\text{He}, n\gamma$).

From γ -ray angular distribution measurements in ($^{12}\text{C}, 2n\gamma$), ($^3\text{He}, n$), ($^3\text{He}, n\gamma$) and RUL.

@ Placement from ($^{21}\text{Na}, \gamma$), calculated by evaluator from level energy difference, recoil energy subtracted.

& Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)