

Table IV. Radioactive Decay Isotopes: Summary

Parent	Mode	Half-life	%Branching	N γ	E γ (σ (E γ)) for principal decay gamma rays
¹⁶ N	β^-	7.13(2) s	100	12	6128.63(5.90 $\times 10^{-8}$)
¹⁹ O	β^-	26.88(5) s	100	13	197.142(3.15 $\times 10^{-7}$), 1356.843(1.66 $\times 10^{-7}$)
²⁰ F	β^-	11.163(8) s	100	3	1633.53(0.0096)
²³ Ne	β^-	37.24(12) s	100	5	440.0(0.001400)
²⁴ Na	β^-	14.9590(12) h	100	6	2754.13(0.530), 1368.66(0.530)
²⁴ Na	IT	20.20(7) ms	99.95(1)	1	472.202(0.478)
²⁷ Mg	β^-	9.462(11) m	100	3	843.71(0.00298), 1014.30(0.00117)
²⁸ Al	β^-	2.2414(1) m	100	1	1778.92(0.232)
³¹ Si	β^-	157.3(3) m	100	1	1266.15(2.5 $\times 10^{-6}$)
³⁷ S	β^-	5.05(2) m	100	7	3103.4(2.8 $\times 10^{-5}$)
³⁸ Cl	β^-	37.24(5) m	100	2	2166.90(0.0568), 1642.5(0.0427)
³⁸ Cl	IT	715(3) ms	100	1	671.355(0.0122)
⁴⁰ K(nat)	EC	1.265(13) $\times 10^9$ y	10.86(13)	1	1460.822(3.24 s $^{-1}$ g $^{-1}$)
⁴² K	β^-	12.360(12) h	100	8	1524.6(0.020000)
⁴⁹ Ca	β^-	8.718(6) m	100	12	3084.40(0.00190)
⁴⁶ Sc	IT	18.75(4) s	100	1	142.528(4.88)
⁵¹ Ti	β^-	5.76(1) m	100	3	320.076(0.00860)
⁵⁰ V(nat)	β^-	1.4(4) $\times 10^{17}$ y	17(11)	1	783.29(8 $\times 10^{-7}$ s $^{-1}$ g $^{-1}$)
⁵⁰ V(nat)	EC	1.4(4) $\times 10^{17}$ y	83(11)	1	1553.77(3.8 $\times 10^{-6}$ s $^{-1}$ g $^{-1}$)
⁵² V	β^-	3.75(1) m	100	13	1434.10(4.81)
⁵⁵ Cr	β^-	3.497(3) m	100	7	1528.00(3.800 $\times 10^{-6}$)
⁵⁶ Mn	β^-	2.5789(1) h	100	10	846.754(13.10), 1810.72(3.62), 2113.05(1.91)
⁶⁰ Co	IT	10.467(6) m	99.76(3)	1	58.603(0.411)
⁶⁰ Co	β^-	10.467(6) m	0.24(3)	3	1332.89(0.068)
⁶⁵ Ni	β^-	2.51719(3) h	100	10	1481.84(0.003300), 1115.53(0.002190), 366.27(0.000680)
⁶⁴ Cu	EC	12.700(2) h	61.0(3)	1	1345.77(0.0155)
⁶⁶ Cu	β^-	5.120(14) m	100	3	1038.97(0.0598)
⁶⁹ Zn	β^-	13.76(2) h	0.033(3)	1	573.90(4.2 $\times 10^{-6}$)
⁶⁹ Zn	β^-	56.4(9) m	100	2	318.40(2.6 $\times 10^{-6}$), 871.70(5.5 $\times 10^{-7}$)
⁶⁹ Zn	IT	13.76(2) h	99.967(3)	1	438.634(0.0128)
⁷¹ Zn	β^-	2.45(10) m	100	23	511.60(1.60 $\times 10^{-4}$), 910.30(4.0 $\times 10^{-5}$), 390.0(1.97 $\times 10^{-5}$)
⁷¹ Zn	β^-	3.96(5) h	100	56	487.34(3.34 $\times 10^{-5}$), 620.19(3.04 $\times 10^{-5}$), 511.55(1.52 $\times 10^{-5}$)
⁷⁰ Ga	β^-	21.14(3) m	99.59(6)	2	1039.20(0.0070), 176.170(0.0030)
⁷² Ga	β^-	14.10(1) h	100	82	834.08(1.65), 2201.91(0.52), 629.96(0.490)
⁷² Ga	IT	39.68(13) ms	100	2	103.25(0.0526), 16.43(0.0125)
⁷¹ Ge	IT	20.40(17) ms	100	2	175.05(0.078)
⁷³ Ge	IT	0.499(11) s	100	2	53.440(0.0134)
⁷⁵ Ge	β^-	82.78(4) m	100	10	264.60(0.0180), 198.60(0.00190)
⁷⁵ Ge	IT	47.7(5) s	99.970(6)	1	139.68(0.0232)
⁷⁷ Ge	β^-	11.30(1) h	100	169	264.44(0.006400), 211.03(0.00367), 215.50(0.00341)
⁷⁷ Ge	IT	52.9(6) s	19(2)	1	159.61(0.00100)
⁷⁷ Ge	β^-	52.9(6) s	81(2)	17	215.53(0.0025)
⁷⁶ As	β^-	26.24(9) h	100	50	559.10(2.00), 657.05(0.279)
⁷⁷ Se	IT	17.36(5) s	100	1	161.9220(0.855)
⁷⁹ Se	IT	3.92(1) m	100	1	95.73(0.0031)
⁸¹ Se	β^-	18.45(12) m	100	10	275.93(0.001600), 290.04(0.00135), 828.27(0.00069)
⁸¹ Se	IT	57.28(2) m	99.949(13)	1	102.89(0.0065)
⁸⁰ Br	β^-	17.68(2) m	91.7(2)	4	616.3(0.39)
⁸⁰ Br	EC	17.68(2) m	8.3(2)	2	665.80(0.0628)
⁸⁰ Br	IT	4.4205(8) h	100	2	37.0520(0.428)
⁸² Br	β^-	35.30(2) h	100	31	776.517(0.990), 554.3480(0.838), 619.106(0.515)
⁸² Br	IT	6.13(5) m	97.6(3)	1	45.9490(0.00285)
⁸² Br	β^-	6.13(5) m	2.4(3)	16	776.50(0.00250), 1474.83(0.00090), 698.21(0.00053)
⁷⁹ Kr	IT	50(3) s	100	1	130.010(1.60 $\times 10^{-4}$)
⁸¹ Kr	IT	13.10(3) s	99.9975(4)	1	190.46(0.072)
⁸³ Kr	IT	1.83(2) h	100	2	9.4050(0.122)
⁸⁵ Kr	β^-	4.480(8) h	78.6(4)	6	151.195(0.0385)
⁸⁵ Kr	IT	4.480(8) h	21.4(4)	1	304.870(0.0071)
⁸⁷ Kr	β^-	76.3(6) m	100	28	402.587(0.000257), 2554.80(4.78 $\times 10^{-5}$), 845.44(3.80 $\times 10^{-5}$)
⁸⁶ Rb	β^-	18.631(18) d	99.9948(5)	1	1076.64(0.0301)
⁸⁶ Rb	IT	1.017(3) m	100	1	555.61(0.0407)
⁸⁸ Rb	β^-	17.78(11) m	100	30	1836.00(0.00714), 898.03(0.00468)
⁸⁵ Sr	EC	67.63(4) m	13.4(4)	1	150.75(0.00046)
⁸⁵ Sr	IT	67.63(4) m	86.6(4)	2	231.68(0.0029)
⁸⁷ Sr	IT	2.803(3) h	99.70(8)	1	388.526(0.0785)
⁹⁰ Y	IT	3.19(6) h	99.9979(2)	2	202.53(0.0018), 479.60(0.0016)
⁹⁷ Zr	β^-	16.744(11) h	100	31	743.36(0.00101)
⁹⁴ Nb	β^-	6.26(1) m	0.50(6)	1	871.1(0.00390)
⁹⁴ Nb	IT	6.26(1) m	99.50(6)	1	40.887(0.000574)
¹⁰¹ Mo	β^-	14.61(3) m	100	163	590.10(0.00380), 191.920(0.00360), 1012.47(0.00258)
⁹⁹ Mo	β^-	65.94(1) h	100	30	140.5110(0.0276), 739.500(0.00405)
¹⁰³ Ru	IT	1.69(7) ms	100	2	210.519(0.033)
¹⁰⁵ Ru	β^-	4.44(2) h	100	84	724.30(0.0760), 469.37(0.0281), 676.36(0.0251)
¹⁰⁴ Rh	β^-	42.3(4) s	99.55	14	555.81(3.14)
¹⁰⁴ Rh	IT	4.34(5) m	99.87(1)	4	51.50(5.2)
¹⁰⁷ Pd	IT	21.3() s	100	1	214.9(0.0024)

Table IV. Radioactive Decay Isotopes: Summary, continued

Parent	Mode	Half-life	%Branching	N_{γ}	$E_{\gamma}(\sigma(E_{\gamma}))$ for principal decay gamma rays
¹⁰⁹ Pd	IT	4.69(1) m	100	1	188.9900(0.0273)
¹¹¹ Pd	β^-	23.4(2) m	100	76	580.00(1.900 $\times 10^{-4}$), 70.43(1.68 $\times 10^{-4}$), 1459.0(1.25 $\times 10^{-4}$)
¹¹¹ Pd	IT	5.5(1) h	73(3)	1	172.18(0.0015)
¹⁰⁸ Ag	β^-	2.37(1) m	97.15(20)	1	632.98(0.369)
¹⁰⁸ Ag	EC	2.37(1) m	2.85(20)	11	433.96(0.0990), 618.86(0.052)
¹¹⁰ Ag	β^-	24.6(2) s	99.70(6)	13	657.50(1.86)
¹¹⁴ In	β^-	71.9(1) s	99.50(15)	1	1299.83(2.4 $\times 10^{-4}$)
¹¹⁴ In	IT	43.1(6) ms	100	1	311.646(0.13)
¹¹⁶ In	β^-	54.41(6) m	100	30	1293.54(131), 1097.30(87.3), 416.86(43.0)
¹¹⁶ In	IT	2.18(4) s	100	1	162.393(15.8)
¹¹⁶ In	β^-	14.10(3) s	100	10	1293.4(0.4700), 463.3(0.09300)
¹²³ Sn	β^-	40.06(1) m	100	5	160.32(0.00580)
¹²⁵ Sn	β^-	9.52(5) m	100	23	331.90(0.00830)
¹²² Sb	β^-	2.7238(2) d	97.59(12)	7	564.24(2.700)
¹²² Sb	IT	4.191(3) m	97.59(12)	3	61.4130(0.0200), 76.0590(0.0081)
¹²⁴ Sb	β^-	93(5) s	25(5)	4	498.40(0.068), 645.82(0.068), 602.72(0.068)
¹²⁴ Sb	IT	93(5) s	75(5)	1	10.8630(1.40 $\times 10^{-5}$)
¹²⁴ Sb	IT	20.2(2) m	100	2	10.8630(6.04 $\times 10^{-6}$), 25.9820(4.45 $\times 10^{-6}$)
¹³¹ Te	β^-	25.0(1) m	100	78	149.716(0.0630), 452.3230(0.0168)
¹³¹ Te	β^-	30(2) h	77.8(16)	171	773.67(0.00355), 852.21(0.00192), 793.75(0.00129)
¹³¹ Te	IT	30(2) h	22.2(16)	1	182.250(0.00026)
¹²⁸ I	β^-	24.99(2) m	93.1(6)	7	442.901(0.595)
¹²⁸ I	EC	24.99(2) m	6.9(1)	1	743.50(0.0051)
¹²⁵ Xe	IT	56.9(9) s	100	2	111.3(0.0027), 141.4(0.00091)
¹²⁹ Xe	IT	8.88(2) d	100	2	39.578(0.00069), 196.56(0.00042)
¹³⁷ Xe	β^-	3.818(13) m	100	83	455.490(0.00350)
¹³⁴ Cs	IT	2.903(8) h	100	3	127.5000(0.310)
¹³¹ Ba	IT	14.6(2) m	100	2	108.45(0.00150)
¹³³ Ba	IT	38.9(1) h	99.99	2	275.925(9.00 $\times 10^{-5}$)
¹³⁵ Ba	IT	28.7(2) h	100	1	268.218(0.00060)
¹³⁶ Ba	IT	0.3084(19) s	100	3	1048.073(0.000919), 818.514(0.000916), 163.9200(0.0002800)
¹³⁷ Ba	IT	2.552(1) m	100	1	661.657(0.00071)
¹³⁹ Ba	β^-	83.06(3) m	100	28	165.8570(0.074)
¹³⁸ La(nat)	β^-	1.05(3) $\times 10^{11}$ y	33.6(5)	1	788.7(0.273 s ⁻¹ g ⁻¹)
¹³⁸ La(nat)	EC	1.05(3) $\times 10^{11}$ y	66.4(5)	1	1435.795(0.539 s ⁻¹ g ⁻¹)
¹⁴⁰ La	β^-	1.6781(7) d	100	38	1596.21(5.84), 487.021(2.79), 815.772(1.430)
¹³⁷ Ce	EC	9.0(3) h	100	20	447.15(1.300 $\times 10^{-4}$), 10.61(5.6 $\times 10^{-5}$), 436.59(1.86 $\times 10^{-5}$)
¹³⁷ Ce	IT	34.4(3) h	99.22(3)	1	254.29(2.0 $\times 10^{-4}$)
¹³⁹ Ce	IT	54.8(10) s	100	1	754.24(3.5 $\times 10^{-5}$)
¹⁴² Pr	β^-	19.12(4) h	99.98	2	1575.6(0.426)
¹⁴⁹ Nd	β^-	1.728(1) h	100	213	211.309(0.0370), 114.314(0.0274), 270.166(0.0153)
¹⁵¹ Nd	β^-	12.44(7) m	100	471	116.800(0.0262), 255.680(0.0099), 1180.890(0.0089)
¹⁵⁵ Sm	β^-	22.2(3) m	100	50	104.320(1.43)
¹⁵² Eu	β^-	9.3116(16) h	73(3)	27	344.2790(37.3), 1314.670(14.60), 970.350(9.2)
¹⁵² Eu	EC	9.3116(3) h	27(3)	25	841.570(223), 963.390(183.0), 121.8(110)
¹⁵² Eu	IT	96(1) m	100	4	89.847(1.3000)
¹⁵⁵ Gd	IT	31.97(3) ms	100	3	86.545(0.00074), 13.47(7.6 $\times 10^{-5}$)
¹⁵⁹ Gd	β^-	18.56(8) h	100	20	363.5430(0.063), 58.0000(0.0118)
¹⁶¹ Gd	β^-	3.66(5) m	100	98	360.940(0.199), 314.920(0.075), 102.315(0.046)
¹⁵⁷ Dy	EC	8.14(4) h	100	25	326.16(0.018)
¹⁶⁵ Dy	β^-	2.334(6) h	100	55	94.700(10.6), 361.680(2.50), 633.415(1.69)
¹⁶⁵ Dy	β^-	1.257(6) m	2.24(11)	11	515.467(6.93), 361.471(2.42), 153.803(1.10)
¹⁶⁵ Dy	IT	1.257(6) m	97.76(11)	1	108.159(13.6)
¹⁶⁶ Ho	β^-	26.80(2) h	100	14	80.574(3.87), 1379.40(0.537)
¹⁶⁷ Er	IT	2.269(6) s	100	1	207.801(2.15)
¹⁷¹ Er	β^-	7.516(2) h	100	58	308.291(0.559), 295.901(0.251), 111.621(0.178)
¹⁶⁹ Yb	IT	46(2) s	100	1	24.200(5.6 $\times 10^{-6}$)
¹⁷⁵ Yb	β^-	4.185(1) d	100	6	396.329(1.42), 282.522(0.666), 113.805(0.417)
¹⁷⁵ Yb	IT	68.2(3) ms	100	1	514.868(9.0)
¹⁷⁷ Yb	β^-	1.911(3) h	100	24	150.6(0.073), 1080.20(0.0201), 1241.20(0.0125)
¹⁷⁷ Yb	IT	6.41(3) s	100	2	104.50(0.029), 227.02(0.0047)
¹⁷⁶ Lu(nat)	β^-	4.00E10(22) y	100	4	306.84(45.2 s ⁻¹ g ⁻¹), 201.83(37.9 s ⁻¹ g ⁻¹)
¹⁷⁷ Lu	β^-	6.73(1) d	100	6	208.3660(6.0), 112.9500(3.47)
¹⁷⁸ Hf	IT	4.0(2) s	100	6	426.380(0.1750), 325.559(0.1700), 213.439(0.1470)
¹⁷⁹ Hf	IT	18.67(4) s	100	2	214.3410(16.3)
¹⁸⁰ Hf	IT	5.5(1) h	99.7(1)	6	332.275(0.0586), 443.163(0.0509), 215.426(0.0506)
¹⁸² Ta	IT	15.84(10) m	100	5	171.580(0.00540000), 146.7740(0.00408), 184.951(0.00268)
¹⁸³ W	IT	5.2(3) s	100	6	107.9320(0.00438), 99.0790(0.00189), 52.5950(0.00157)
¹⁸⁵ W	IT	1.67(3) m	100	12	65.86(3.44 $\times 10^{-5}$), 131.550(2.56 $\times 10^{-5}$), 173.680(1.93 $\times 10^{-5}$)
¹⁸⁷ W	β^-	23.72(6) h	100	74	685.73(3.24), 479.550(2.59), 72.002(1.32)
¹⁸⁶ Re	β^-	3.7183(11) d	92.53(10)	8	137.157(5.29)
¹⁸⁶ Re	EC	3.7183(11) d	7.47(10)	1	122.640(0.250)
¹⁸⁸ Re	β^-	17.005(4) h	100	51	155.041(7.16)
¹⁸⁸ Re	IT	18.6(1) m	100	5	63.5820(0.279), 105.8620(0.140), 92.4640(0.066)
¹⁹¹ Os	IT	13.10(5) h	100	1	74.380(0.0032)
¹⁹³ Os	β^-	30.11(1) h	100	63	138.92(0.0467), 460.49(0.0432), 73.040(0.035)

Table IV. Radioactive Decay Isotopes: Summary, continued

Parent	Mode	Half-life	%Branching	N γ	E γ (σ (E γ)) for principal decay gamma rays
¹⁹² Ir	IT	1.45(5) m	99.9825	1	56.7190(0.085)
¹⁹⁴ Ir	β^-	19.28(13) h	100	65	328.448(9.1), 293.541(1.76)
¹⁹⁴ Ir	IT	31.85(24) ms	100	9	112.2310(0.302), 84.2840(0.168)
¹⁹⁷ Pt	β^-	19.8915(19) h	100	3	77.35(0.031), 191.437(0.006600)
¹⁹⁷ Pt	IT	95.41(18) m	96.7(4)	2	346.50(0.00132)
¹⁹⁹ Pt	β^-	30.8(4) m	100	42	542.98(0.0390), 493.75(0.0147), 317.03(0.0130)
¹⁹⁹ Pt	IT	13.6(4) s	100	2	391.93(0.0212)
¹⁹⁸ Au	β^-	2.69517(21) d	100	3	411.8(94.30)
¹⁹⁷ Hg	EC	23.8(1) h	8.6(7)	5	279.00(0.003300)
¹⁹⁷ Hg	IT	23.8(1) h	91.4(7)	2	133.98(0.0155)
¹⁹⁹ Hg	IT	42.6(2) m	100	3	158.30(0.000940), 374.10(2.47 \times 10 ⁻⁴)
²⁰⁵ Hg	β^-	5.2(1) m	100	13	203.750(0.00064)
²⁰⁶ Tl	β^-	4.200(17) m	100	2	803.30(3.5 \times 10 ⁻⁶)
²⁰⁷ Pb	IT	0.806(6) s	100	2	569.7(0.0014), 1063.662(0.0013)
²³² Th(nat)	α	14.05(6) \times 10 ⁹ y	100	2	63.810(10.7 s ⁻¹ g ⁻¹)
¹⁴⁰ Ba	β^-	12.752(3) d	100	16	537.261(0.066), 29.9660(0.0381), 162.6600(0.01680)
²³⁵ U(nat)	α	703.8(5) \times 10 ⁶ y	100	49	185.715(329 s ⁻¹ g ⁻¹), 143.760(63.0 s ⁻¹ g ⁻¹)
²³⁹ Np	β^-	2.3565(4) d	100	36	106.1230(0.723), 277.5990(0.382), 228.1830(0.286)
²³⁹ U	β^-	23.45(2) m	100	97	74.6640(1.30000)