

# SELECTED RADIOACTIVE ISOTOPES\*

OpenStax College

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Decay modes are  $\alpha$ ,  $\beta^-$ ,  $\beta^+$ , electron capture (EC) and isomeric transition (IT). EC results in the same daughter nucleus as would  $\beta^+$  decay. IT is a transition from a metastable excited state. Energies for  $\beta^\pm$  decays are the maxima; average energies are roughly one-half the maxima.

**Selected Radioactive Isotopes**

Isotope	$t_{1/2}$	Decay Mode(s)	Energy (MeV)	Percent		$\gamma$ -Ray Energy (MeV)	Percent
$^3\text{H}$	12.33 y	$\beta^-$	0.0186	100%			
$^{14}\text{C}$	5730 y	$\beta^-$	0.156	100%			
$^{13}\text{N}$	9.96 min	$\beta^+$	1.20	100%			
$^{22}\text{Na}$	2.602 y	$\beta^+$	0.55	90%	$\gamma$	1.27	100%
$^{32}\text{P}$	14.28 d	$\beta^-$	1.71	100%			
$^{35}\text{S}$	87.4 d	$\beta^-$	0.167	100%			
$^{36}\text{Cl}$	$3.00 \times 10^5$ y	$\beta^-$	0.710	100%			
$^{40}\text{K}$	$1.28 \times 10^9$ y	$\beta^-$	1.31	89%			
$^{43}\text{K}$	22.3 h	$\beta^-$	0.827	87%	$\gamma$ s	0.373	87%
						0.618	87%
$^{45}\text{Ca}$	165 d	$\beta^-$	0.257	100%			
$^{51}\text{Cr}$	27.70 d	EC			$\gamma$	0.320	10%
$^{52}\text{Mn}$	5.59d	$\beta^+$	3.69	28%	$\gamma$ s	1.33	28%

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						1.43	28%
<sup>52</sup> Fe	8.27 h	$\beta^+$	1.80	43%		0.169	43%
						0.378	43%
<sup>59</sup> Fe	44.6 d	$\beta^-$ s	0.273	45%	$\gamma$ s	1.10	57%
			0.466	55%		1.29	43%
<sup>60</sup> Co	5.271 y	$\beta^-$	0.318	100%	$\gamma$ s	1.17	100%
						1.33	100%
<sup>65</sup> Zn	244.1 d	EC			$\gamma$	1.12	51%
<sup>67</sup> Ga	78.3 h	EC			$\gamma$ s	0.0933	70%
						0.185	35%
						0.300	19%
						others	
<sup>75</sup> Se	118.5 d	EC			$\gamma$ s	0.121	20%
						0.136	65%
						0.265	68%
						0.280	20%
						others	
<sup>86</sup> Rb	18.8 d	$\beta^-$ s	0.69	9%	$\gamma$	1.08	9%
			1.77	91%			
<sup>85</sup> Sr	64.8 d	EC			$\gamma$	0.514	100%
<sup>90</sup> Sr	28.8 y	$\beta^-$	0.546	100%			
<sup>90</sup> Y	64.1 h	$\beta^-$	2.28	100%			
<sup>99m</sup> Tc	6.02 h	IT			$\gamma$	0.142	100%
<sup>113m</sup> In	99.5 min	IT			$\gamma$	0.392	100%
<sup>123</sup> I	13.0 h	EC			$\gamma$	0.159	$\approx$ 100%
<sup>131</sup> I	8.040 d	$\beta^-$ s	0.248	7%	$\gamma$ s	0.364	85%
			0.607	93%		others	
			others				

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$^{129}\text{Cs}$	32.3 h	EC			$\gamma$ s	0.0400	35%
						0.372	32%
						0.411	25%
						others	
$^{137}\text{Cs}$	30.17 y	$\beta^-$ s	0.511	95%	$\gamma$	0.662	95%
			1.17	5%			
$^{140}\text{Ba}$	12.79 d	$\beta^-$	1.035	$\approx 100\%$	$\gamma$ s	0.030	25%
						0.044	65%
						0.537	24%
						others	
$^{198}\text{Au}$	2.696 d	$\beta^-$	1.161	$\approx 100\%$	$\gamma$	0.412	$\approx 100\%$
$^{197}\text{Hg}$	64.1 h	EC			$\gamma$	0.0733	100%
$^{210}\text{Po}$	138.38 d	$\alpha$	5.41	100%			
$^{226}\text{Ra}$	$1.60 \times 10^3$ y	$\alpha$ s	4.68	5%	$\gamma$	0.186	100%
			4.87	95%			
$^{235}\text{U}$	$7.038 \times 10^8$ y	$\alpha$	4.68	$\approx 100\%$	$\gamma$ s	numerous	<0.400%
$^{238}\text{U}$	$4.468 \times 10^9$ y	$\alpha$ s	4.22	23%	$\gamma$	0.050	23%
			4.27	77%			
$^{237}\text{Np}$	$2.14 \times 10^6$ y	$\alpha$ s	numerous		$\gamma$ s	numerous	<0.250%
			4.96 (max.)				
$^{239}\text{Pu}$	$2.41 \times 10^4$ y	$\alpha$ s	5.19	11%	$\gamma$ s	$7.5 \times 10^{-5}$	73%
			5.23	15%		0.013	15%
			5.24	73%		0.052	10%
						others	
$^{243}\text{Am}$	$7.37 \times 10^3$ y	$\alpha$ s	Max. 5.44		$\gamma$ s	0.075	
			5.37	88%		others	

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			5.32	11%			
			others				

**Table 1**