

5 Man-Made Radioisotopes

5.1 Activation Products

Content of this subsection: Cs-134, Sb-124, Sb-122, Ag-110m, Ag-110, Ag-108m, Ag-108, As-74, Zn-65, Ni-63, Co-60, Fe-59, Co-58, Co-57, Mn-54, Cr-51, Sc-46, Na-22

isotope Reference Q_ϵ, Q_β MeV $t_{1/2}$	β^- , ϵ -decay $E_\epsilon, E_\beta^{max}, (\bar{E}_\beta)$ MeV	β^- , ϵ^- , IT- branch intens.** %	daughter-nuclide & E_γ γ -ray transition to final state in keV	E-list in I-order keV	γ - intens.* %
$^{134}_{55}\text{Cs}$	$\rightarrow \beta^- :$ $\rightarrow \epsilon :$	99.9997 ₁ $3.0 \cdot 10^{-4}$	$\beta^- : 100.01_{15}\%$ $\rightarrow ^{134}_{56}\text{Ba}$ $\rightarrow \gamma : 847.0_2^{E2} \rightarrow ^{134}_{54}\text{Xe}$	847.025 ₂₅	3.0 ₁₄ E-4
$^{134}_{55}\text{Cs}$ NDS:103,1,2004	$\rightarrow \beta^- :$ $\rightarrow \beta^- : 0.6581_4$ $\rightarrow \beta^- : 0.0888_4$	70.17 ₇ 27.27 ₃	$^{134}_{56}\text{Ba}$ $\rightarrow \gamma : 795.864^{int}, 604.721(\downarrow > 95\%) !$ $\rightarrow \gamma : 569.331^{int}, 795.86, 604.72 !$ $\gamma : 801.953^{int}, 563.25, 604.72 !$ $\gamma : 801.953, 1167.938$ $\gamma : 1365.185, 604.72$	604.721 ₄ 795.864 ₄ 569.331 ₃ 801.953 ₄ 563.246 ₅ 1365.185 ₇	97.62 ₁₁ 85.46 ₆ 15.373 ₁₇ 8.688 ₁₆ 8.338 ₁₄ 3.017 ₈
$Q_\epsilon = 1.2333_8$	$\rightarrow \beta^- : 1.4540_4$	≈ 0	$\rightarrow \gamma : 563.246^{int}, 604.72$	1167.968 ₅	1.790 ₅
$Q_\beta = 2.0587_4$ 2.0652 ₄ y	$\rightarrow \beta^- :$ (0.15752 ₇)	2.499 ₉	$\rightarrow \gamma : 475.365, 1167.968$ $\gamma : 1038.610, 604.72$ $\rightarrow X : \Sigma K_\alpha$ $\rightarrow X : K_{\alpha_1}$ $\rightarrow X : K_{\alpha_2}$ $\rightarrow X : \Sigma K_\beta$ $\rightarrow X : K_{\beta_1}$ $\rightarrow X : K_{\beta_2}$ $\rightarrow X : K_{\beta_3}$ $\rightarrow X : \Sigma L$	475.365 ₂ 1038.610 ₇ 32.061 32.194 31.817 36.648 36.378 37.255 36.304 4.7	0.990 ₃ 0.690 0.434 ₁₀ 0.238 ₆ 0.155 0.0803 ₁₈ 0.0254 ₆ 0.0416 ₉ 0.095
! intensive decay cascades: all photons de-excites via 604.72 (or 1167.97) level to ground state. For activity determination the sample should be in >7cm distance to the detector end-cap; see also explanations to Ho-166m, page 89					
Possible Σ energies (in keV): 604.72 + 795.86 = 1400.59, 604.72 + 569.33 = 1274.06, 604.72 + 801.95 = 1406.67, 795.86 + 569.33 = 1365.20					
$^{int=228}\text{Ac}(562.50, .87\%), ^{234}\text{Pa}(569.5, .02\%), ^{207}\text{Bi}(569.70, 97.74\%)$					
$^{int=57}\text{Co}(570.09, .0158\%), ^{228}\text{Ac}(794.95, 4.25\%), ^{129}\text{Te}(802.10, .192\%)$					
$^{65}_{30}\text{Zn}$ NDS:111,2425,2010	$\rightarrow \epsilon/\beta^+ : .3301_3$ $\rightarrow \epsilon :$ ANNIHILATION SE/DE	$\epsilon^- : 100\%$ 48.00/1.421 ₇ 50.04 \rightarrow \rightarrow	data set completely $\rightarrow ^{65}_{29}\text{Cu}$ $\rightarrow \gamma : 1115.539^{pcd} (0.26 \text{ ps})$ $\gamma : 344.95^{int}, 770.6$ $\rightarrow \gamma : 511.00 (2\gamma\text{-rays})$ 604.54/93.54 $\rightarrow X : \Sigma K$ $\rightarrow X : \Sigma K_\alpha$ $\rightarrow X : K_{\alpha_1}$ $\rightarrow X : K_{\alpha_2}$ $\rightarrow X : \Sigma K_\beta$ $\rightarrow X : \Sigma L$	1115.539 ₂ 511.00 344.95 ₂₀ 770.6 ₂ 8.15 8.04 8.048 8.028 8.905 0.93	50.04 ₁₀ 2.842 ₁₄ 0.00253 ₁₈ 0.00268 ₂₂ 38.3 34.2 22.6 ₁₀ 11.6 ₅ 4.08 ₁₄ 1.24 ₅
$Q_\epsilon = 1.3521_3$ 243.93 ₉ d	$\alpha_t^{1115} = 1.85 \cdot 10^{-4}$ $\alpha_K^{1115} = 1.66 \cdot 10^{-4}$				
$^{int=133}\text{I}(345.43, 0.104\%), ^{59}\text{Fe}(344.8, 0.27\%)$					
$^{63}_{28}\text{Ni}$ $Q_\beta = .066945_5$ 100.2 ₁₅ y	NDS:92,147,2001 $\rightarrow \beta^- : 0.066945_5$ (0.017425 ₆)	$\beta^- : 100\%$ 100	$\rightarrow ^{63}_{29}\text{Cu}, ^{62}\text{Ni}(n,\gamma)^{63}\text{Ni}, ^{62}\text{Ni}:3.59\%$ NO γ -RAYS OBSERVED		