



International Atomic Energy Agency

INDC(GCP)-323/L

INDC

INTERNATIONAL NUCLEAR DATA COMMITTEE

Central Scientific Research Institute
on Information and Techno-Economic Research
on Atomic Science and Technology

REACTION CROSS-SECTIONS INDUCED BY 14.5 MeV
AND BY Cf-252 AND U-235 FISSION SPECTRUM NEUTRONS

An Analytical Review
by A.B. Pashchenko

Translation of Report FEI-0236
by A. Lorenz

January 1991

IAEA NUCLEAR DATA SECTION, WAGRAMERSTRASSE 5, A-1400 VIENNA

Central Scientific Research Institute
on Information and Techno-Economic Research
on Atomic Science and Technology

REACTION CROSS-SECTIONS INDUCED BY 14.5 MeV
AND BY Cf-252 AND U-235 FISSION SPECTRUM NEUTRONS

An Analytical Review
by A.B. Pashchenko

Translation of Report FEI-0236
by A. Lorenz

January 1991

ABSTRACT

The analytical review "Reaction Cross-Sections induced by 14.5 MeV Neutrons and by Cf-252 and U-235 Fission Spectrum Neutrons" presents evaluated values of threshold activation reaction cross-sections for stable nuclides induced by 14.5 MeV neutrons and by Cf-252 and U-235 fission spectrum neutrons.

Reproduced by the IAEA in Austria
January 1991

91-00364

Table of Contents

Introduction	5
1. Reaction-Cross Sections induced by 14.5 MeV Neutrons	5
2. Description of the Tabulated Results	8
Bibliography	10
Tabulated Results	14

INTRODUCTION

In the course of the last few years there has been a growing need for 14 MeV neutron data in the development of thermonuclear reactors. Contrary to neutron energies encountered in fission reactors, a considerable fraction of neutrons in the proximity of a D-T fusion plasma is composed of neutrons in the 14 to 15 MeV range. As a result, the prediction of fusion reactor parameters, such as tritium breeding, the activation of reactor components, nuclear heating, etc., depends to a significant extent on the knowledge and accuracy of neutron induced reaction cross-sections in that neutron energy range.

In the consideration of construction materials for a projected fusion reactor, the following nuclear data are of interest:

- nuclear reaction cross-sections for 14 MeV neutrons;
- type and energy of particles emitted in nuclear reactions;
- type of decay, its energy and the half-life of the reaction products, and
- neutron induced activation cross-sections for neutron spectra characteristic of typical nuclear power plants.

1. REACTION CROSS-SECTIONS INDUCED BY 14.5 MEV NEUTRONS

Compilations of published experimental cross-section data induced by 14 MeV neutrons, and associated recommended cross-section data have been published in references [1-8].

The compilation presented in reference [1] consists of weight-averaged cross-section values based on all known experimental results which had been published before 1969; the authors of reference [2] excluded from their compilation those data which they considered doubtful.

Compilations presented in references [3-5], reflect the status of the experimental data which had been measured up until 1980; while the cross-sections considered in reference [4] include only those which had been measured using the activation method; references [3,5], as well as reference [1], include data for those reactions which result in stable reaction products.

In the subsequent work, reported in reference [7], the above listed compilations were critically analysed taking into account new experimental data which had been published in the intervening years. The data which the author of reference [7] includes in his recommendation consist of weight-averaged 14 MeV reaction cross-sections providing they are not in disagreement with results of recent experiments. In those cases where there were no new data, the author used recommended data published in references [3] and [4].

The following should be said regarding the analytical approach used in reference [7]:

- 1) The experimental data which were considered in reference [7] were measured in the neutron energy range of 14-15 MeV; however, the author recommends the data at an energy of 14.7 MeV, which he does not correct for the difference in energy; the explanation being that the energy dependence of the cross-section in the given energy interval was not given in most cases, and that such corrections were very minor.
- 2) The relative data measurements were not renormalized with respect to their dependence on new values of reference cross-sections used as standards, and were not analysed with regard to the decay schemes and half-lives.

The analysis of experimental results for a large number of nuclides [5] can lead to a number of conclusions [9] regarding the general status of the availability and quality of experimental threshold reaction cross-sections:

- 1) In general, measurements are performed using the activation method which leads to the formation of a residual radioactive nucleus with a given decay half-life. Less often, the coincidence method is used, particularly for those reactions which result in the emission of charged particles; these measurements, however, are usually less accurate. As a result, experimental information exists in most cases for reactions which have a "convenient" decay half-life.
- 2) Many measurements, particularly in the past, were performed with monoenergetic neutrons from cascade or electrostatic generators, which could accelerate protons and deuterons up to an energy of 3 MeV, using the $D(d,n)^3\text{He}$, $T(d,n)^4\text{He}$ and $T(p,n)^3\text{He}$ reactions. As a consequence of using the aforementioned methods of neutron generation, the following can be noted:
 - for a large number of isotopes there is an absence of experimental data in the neutron energy range of 6-12 MeV which are important in applied problems,
 - because of the low reaction cross-section values near the reaction threshold, which requires a high intensity of monoenergetic neutrons, the data in that energy region is very sparse and generally of bad quality.
 - and that most experimental data of varying quality are available in the 13 MeV to 15 MeV energy range.

- 3) In the last few years, new accelerators which can generate neutrons in the 6-12 MeV energy range for neutron data measurements have become available in the laboratories. Measurements for a number of isotopes in the energy range of interest have been performed at Chalk River (by D.S. Santry and J.P. Buttler), at Geel (by H. Liskien and A. Paulsen) at Los Alamos (by R.S.Preswood, B.P.Bayhurst, et al.) at the Argonne National Laboratory (by D.S. Smith and J.N. Meadows) and at Bruyere-le-Chatel (by J.Frehaut and J. Mochinski).

During the last few years new experiments have been performed which give the possibility to undertake more reliable cross-section evaluations near 14 MeV. The results obtained by the Japanese group have been most interesting. References [10-11] describe the systematic measurements of threshold reaction cross-sections for basic structural materials using a D-T neutron energy points ranging between 13.3 MeV to 15 MeV, of (n,p), nuclei having decay half-lives ranging from one minute to a year. As reported by the authors, the experimental error is less than $\pm 5\%$ for practically all measured data.

In view of these developments, time had come to make a new evaluation of 14 MeV cross-sections for the (n,p), (n, α), (n,d), (n,t), (n, ^3He), (n,2n), (n,n'p) and other threshold reactions. Such an evaluation was performed for all of the aforementioned threshold reactions in the 13 MeV to 15 MeV energy range on the basis of a compilation of all experimental data which had been published prior to January 1990. This compilation is based on the international computerized library of experimental data EXFOR, the bibliographic catalogue of neutron data publications CINDA [13], as well as more recent publications [10-12] and material presented at the September 1989 meeting at the Argonne National Laboratory in the United States [41]. All these measurements have resulted in a tremendously large number of experimental neutron nuclear data in the vicinity of 14 MeV [13]. However, in the evaluation process it became apparent that data from different authors exhibited discrepancies which exceeded the experimental errors quoted by these authors.

The main reason for the discrepancies of the experimental data is apparently due to the following:

- the difference in the experimental conditions of the various experimental groups (e.g. the method used to measure the induced activity of the sample, the characteristics of the neutron field, the method used to monitor the neutron flux);
- the differences in the cross-section values used as standards in the evaluation of relative measurements;
- the differences in the nuclear data, such as the gamma ray yield, decay half-life and purity of the sample.

The experimental information that is needed by the evaluator to take all factors listed above into consideration is not always given in publications and in the EXFOR compilation. Also,

because of the large volume of data, such work becomes very time consuming, particularly in view of the large number of reactions involved. In view of these difficulties, only those measured data which were considered by the evaluator to be the more reliable were used in this critical analysis. As a result, preference was given to those experiments which used enriched isotopic samples, semi-conductor detectors, and to those whose results fell within the limits of the experimental uncertainty. Also excluded from consideration were data which differed substantially from the results obtained by other authors.

The analysis of the experimental data showed that a large fraction of the measured cross-sections was measured on 100-500 KeV deuteron accelerators using neutrons from the D-T reaction. Under these conditions the energy range of the emitted neutrons in line with the deuteron beam varies from 14.5 MeV to 15.8 MeV, and from 14.0 MeV to 14.2 MeV at an angle of 90°.

The evaluated threshold reaction cross-sections tabulated below are given for a neutron energy of 14.5 MeV. The experimental data were extrapolated to this energy on the basis of the energy dependence of the cross-section of the analyzed reaction using either theoretical calculations or information given in reference [5].

2. DESCRIPTION OF TABULATED RESULTS

Values of the cross-sections at an energy of 14.5 MeV, as well as cross-sections averaged over the spontaneous fission spectrum of ²⁵²Cf and over the thermal fission spectrum of ²³⁵U are tabulated below. Also listed in the Table are the residual nuclei for each reaction, the reaction energy, and the type of decay and decay half-life for all cases in which the reaction results in the production of a radioactive nuclide.

Unless indicated in the Table, all cross-section values are for the total cross-section. Partial cross-sections which lead to the formation of a specific state of the residual nucleus, as in a reaction leading to the formation of an isomeric or ground state, are designated by an asterisk. Accordingly, the ground and metastable states of residual nuclei are identified by the letters g and m respectively.

Reaction cross-sections are given for all stable nuclides. The abundances of the individual isotopes are taken from reference [17], and the reaction energies from reference [18]. The derivation of the recommended cross-section values at 14.5 MeV is based on the work presented in references [1-16]. In those cases where there were no experimental data, the recommended values were derived from systematics based on the number of protons and neutrons in the given nucleus [3]. Cross-section values derived on the basis of existing experimental data are given with their root-mean-square errors. Errors are not given when the experimental data were not deemed to be reliable, or when the cross-sections were derived from systematics.

The evaluated results of integral experiments aimed at the determination of the ²⁵²Cf and ²³⁵U fission spectrum averaged

cross-sections, were determined in reference [19] on the basis of data published in references [20-28] and [22, 29-31] respectively. These evaluated data are given in the Table with their root-mean-square errors. In the absence of integral experimental data, recommended values were obtained by integrating the excitation functions of the given reaction with the corresponding neutron fission spectrum. The ^{252}Cf and ^{235}U fission spectra used in these calculations were those evaluated by Grundl and Eisenhauer at the National Bureau of Standards, USA, and given in references [34] and [35] respectively. In the case of ^{235}U , results published by Pearlstein [36] and Calamand [30] were also used.

The decay data of all of the radioactive residual nuclei, namely the half-lives, the types of decay and their relative probabilities, were obtained from the computerized file of evaluated nuclear structure data ENSDF [37] which is maintained by the National Nuclear Data Center at the Brookhaven National Laboratory in the USA. The ENSDF file is composed of experimental data [38] for nuclei of mass numbers ranging from $A=45$ to 263, and experimental results published in Nuclear Physics for nuclei for $A<45$. For those nuclides that were not included in ENSDF, data were taken from reference [39].

TABLE CONTENTS

The identification of the target nuclei and their natural isotopic abundances are given in the first two columns; the nuclides are listed in the order of ascending atomic number Z , and in the order of their mass number A within each Z .

The nuclear reactions are listed in the third column; the asterisk indicates that the cross-section for this reaction is a partial cross-section.

The residual nucleus is given in the fourth column. The letters m or g indicate whether the residual nucleus is in a metastable or ground state respectively; if there is more than one metastable state, they are designated by the symbols m_1 , m_2 , etc.

The half-lives of the radioactive residual nuclei are given in the fifth column. The uncertainty in the half-life is given in parentheses; thus $3.14(2)\text{y}$ is equivalent to (3.14 ± 0.02) years.

The modes of decay of the radioactive nuclei and their relative probabilities (if they are known) are given in the sixth column; these are listed in the order of their decreasing probabilities from left to right. If there is no competing decay mode, the decay probability is not indicated. The various decay modes used in this Table are as follows:

β^-	beta decay
ϵ	electron capture ϵ or $\epsilon+\beta'$ or β' decay
IT	isomeric transition (by γ transition or electron conversion)

n, p, α	emitted neutron, proton or alpha particle
SF	spontaneous fission
β^-n , β^-p , $\beta^-\alpha$	emission of delayed n, p, α ,... accompanying beta decay
ϵp , $\epsilon\alpha$,...,ESF	emission of delayed p, α ,..., or spontaneous fission accompanying electron capture or β^- decay

The reaction energy, given in MeV, is listed in the seventh column. The cross-section values in millibarns at 14.5 MeV are given in the eighth column. The symbols used in this column have the following meaning: F - a graphical representation of this reaction will be given in reference [40]; C - the cross section is derived from systematics on the basis of the number of protons and neutrons in the target nucleus. Reaction cross-sections averaged over the ^{235}U and ^{252}Cf fission spectra are given in columns nine and ten. The symbol P indicates that the given value was obtained by integrating the recommended excitation function will be published in reference [40] with the fission spectrum, and symbol C indicates that the values are taken from systematics published in reference [30].

BIBLIOGRAPHY

- [1] CUZZOCREA, P., PERILLO, E., NOTARRIGO, S., Nuovo Cim. 4A (1971) 251.
- [2] EDER, G., WINKLER, G., HILLE, P., Z.Physik 253 (1972) 335.
- [3] BYCHKOV, V.M., MANOKHIN, V.N., PASHCHENKO, A.B., PLYASKIN, V.I., "Threshold cross-sections for the (n,p), (n, α) and (n,2n) reactions", Reports on Nuclear Science and Technology. Ser. Nuclear Constants. TsNIIatominform. (1979) Vol. 32 p.28, Vol.33 p. 51. (in Russian).
- [4] QUAIM, S.M., "14 MeV neutron activation cross-sections", Handbook of Spectroscopy, Vol.3, CRC Press, Boca Raton, FL (1981) 141.
- [5] BYCHKOV, V.M., MANOKHIN, V.N., PASHCHENKO, A.B., PLYASKIN, V.I., Neutron Induced Threshold Reaction Cross-Sections. Moscow, Energoatomizdat, Moscow (1982). (in Russian).
- [6] BOEDY, Z., CSIKAI, J., "Data for 14 MeV Neutron Activation Analysis", Handbook on Nuclear Activation Data, IAEA, Vienna (1987) 261-303.
- [7] FORREST, R.A., Systematics of Neutron-Induced Threshold Reactions with Charged Products at about 14.5 MeV. Rep. AERE-R- 12419, AERA Harwell, U.K.

- [8] BYCHKOV, V.M., NASSYROVA, S.M., PASHCHENKO, A.B., et al., "File of nuclear-physical data for a generalized comparison method for neutron activation data analysis", Reports on Nuclear Science and Technology. Ser. Nuclear Constants. TsNIIatoinform. Vol. 4 (1988) 14-17. (in Russian).
- [9] VLASSOV, M.F., FABRY, A., McELROY, W.W., KHALIL, N.A., Status of Neutron Cross-sections for Reactor Dosimetry. IAEA, Vienna, Rep. INDC(NDS)-84 (1977).
- [10] IKEDA, Y., KONNO, C., OISHI, K., et al., Activation Cross-Section Measurements for Fusion Reactor Structural Materials at Neutron Energies from 13.3 to 15.0 MeV Using the FNS Facility. Rep. JAERI-1312 (1988) Japan.
- [11] IKEDA, Y., KONNO, C., NAKAMURA, T., et al., "Systematic Measurement of Neutron Activation Cross-sections in the Energy Range from 13.3 to 15.0 MeV Using the FNS Facility", (Proc. Int. Conf., Mito, Japan). (1988) 257.
- [12] KATON, T., KAWADE, K., YAMAMOTO, H., Measurement of Activation Cross-sections. Rep. JAERI-M-89-083 (1989), Japan.
- [13] INTERNATIONAL ATOMIC ENERGY AGENCY, The Index to Literature on Microscopic Neutron Data. CINDA-A (1935-1976) Vols.1 and 2. (1983), CINDA-83 Suppl. (1983), CINDA-84 (1984), CINDA-87 (1987), IAEA, Vienna.
- [14] MANOKHIN, V.N., PASHCHENKO, A.B., PLYASKIN, A.B., et al., "Activation Cross-sections Induced by Fast Neutrons", Handbook on Nuclear Activation Data, IAEA Technical Report Series No.273, IAEA, Vienna (1987) 305-411. (in Russian).
- [15] TSUKADA, K., Table of Nuclear Reactions and Subsequent Radioactive Decay Induced by 14 MeV Neutrons, Rep. JAERI-1252 (1977) Japan.
- [16] McLANE, V., DUNFORD, C.L., ROSE, P.F., "Neutron Cross Sections", Vol.2, Neutron Cross-section Curves, National Nuclear Data Center, Brookhaven National Laboratory, Upton N.Y., Academic Press, New York (1988).
- [17] HOLDEN, N.E., MARTIN, R.L., BARNES, I.L., Isotopic Composition of the Elements 1983, Pure Appl.Chem. 56 (1984) 675.
- [18] GOVE, N.B., WAPSTRA, A.H., Nucl.Data Tables 11 (1972) 127.
- [19] PASHCHENKO, A.B., Activation Reaction Cross-sections Averaged over the Cf-252 and U-235 Neutron Fission Spectra, Preprint FEI-2041 (1989). (in Russian).
- [20] MANHARDT, W., Nucl.Sci.Eng. 77 (1981) 40.
- [21] MANHARDT, W., "Californium-252 spectrum averaged neutron cross-sections", Handbook of Nuclear Activation Data, Technical Report Series No.273, IAEA, Vienna (1983) 413-437.

- [22] FABRY, A., McELROY, W.N., KELLOGG, L.S., et al., Review of Microscopic Integral Cross-section Data in Fundamental Reactor Dosimetry Benchmark Neutron Fields (Proc. Consultants Meeting, Vienna, 1976). Rep. IAEA-208, IAEA, Vienna, Vol.1 (1978) 233.
- [23] KIROUAC, G.J., EILAND, H.M., SLAVIC, C.J., An Irradiation Experimentation in Fast Reactors (Proc. Int. Conf. Jackson Hole, WY, 1973), Office of Scientific and Technical Information, US Dept. of Energy, Oak Ridge, TN, Rep. CONF-730910 (1973) 412.
- [24] MANHARDT, W., Measurements of Average Cross-sections with Regard to the High and Low Part of the Californium-252 Neutron Spectrum (Proc. Consultants Meeting, Vienna, 1976). Rep. IAEA-208, IAEA, Vienna, Vol.2 (1978) 227.
- [25] ZIJP, W.L., On the Consistency between Integral and Differential Cross-section Data. (Proc. Advisory Group Meeting on Nuclear Data for Reactor Dosimetry, Vienna, 1978). Rep. INDC(NDS)-103 IAEA, Vienna, Vol.2 (1979) 187.
- [26] DESZOE, Z., Csikai, J., Average Cross-sections for the ²⁵²Cf Neutron Spectrum (Proc. Advisory Group Meeting on Nuclear Data for Reactor Dosimetry, Vienna, 1978). Rep. INDC(NDS)-103, IAEA, Vienna (1979) 176.
- [27] PAUW, H., ATEN, A.H.W., J.Nucl.Energy 25 (1971) 457.
- [28] BUCZKO, W., BOEDY, Z.T., CSIKAI, J., et al., Average Cross-sections for the ²⁵²Cf Neutron Spectrum (Proc. Int. Symposium on Californium-252 Utilization, Paris, France, 1976).
- [29] FABRY, A., Rep. BLG-465 (1972).
- [30] CALAMAND, A., Cross-sections for Fission Neutron Spectrum Induced Reactions, IAEA, Vienna, Rep. INDC(NDS)-55 (1973).
- [31] ZIJP, W.L., On the Consistency between Integral and Differential Cross-section Data, Rep. ECN-56 (1979).
- [32] BRUGGEMAN, A., MANNHARDT, W., HOSTE, I., Average Cross-sections for the (n,p) and (n, α) Reactions on ¹⁹F and ²³Na in a Fission Neutron Spectrum, J.Inorg.Nucl.Chem 41 (1979) 445.
- [33] KOBAYASHI, K., KIMURA, I., NAKAZAWA, M., AKIYAMA, M., Fission Spectrum Averaged Cross-sections of some Threshold Reactions Measured with the Fast Reactor YAYOI, J.Nucl.Sci. and Technol. 13, 10 (1976) 531.
- [34] HEATON, H.T., II, GILLIAM, D.M., SPIEGEL, V., EISENHAEUER, C., GRUNDL, J.A., Fast Neutron Fission Cross-sections of U-233, U-238, Pu-239 (Proc. NEANDC/NEACRP Specialists' Meeting, Argonne, IL, 1976) (POENITZ, W.P., SMITH A.B., Eds.) Argonne National Lab. Rep. ANL-76-90 (1976) 333.
- [35] GRUNDL, J.A., EISENHAEUER, C.M., (Proc. 1st ASTM-EURATOM Symposium on Reactor Dosimetry, Petten, 1975) Rep. EUR-5667 Part 1 (1977) 425.

- [36] PEARLSTEIN, S., Nucl.Sci.Eng. 23 (1965) 327 and Nucl.Energy 27 (1973) 81.
- [37] NATIONAL NUCLEAR DATA CENTER, ENSDF the Evaluated Nuclear Structure Data File, maintained by the National Nuclear Data Center, Brookhaven National Laboratory, Upton, NY, 1987 Ed.
- [38] TULI, J.K., (Ed.), Nucl.Data Sheets B7-46 (1972-1985)
- [39] TULI, J.K., "Nuclear Properties", Handbook on Nuclear Activation Data, Technical Report Series No.273, IAEA, Vienna 1987) 3-27.
- [40] BYCHKOV, V.M ., MANOKHIN, V.N., PASHCHENKO, A.B., PLYASKIN, V.I., Cross-sections for Neutron Induced Threshold Reactions. Moscow, Energoatomizdat (1990). (in Russian).
- [41] OECD NUCLEAR ENERGY AGENCY, Proc. Neutron Activation Cross Sections for Fission and Fusion Energy Applications, Argonne National Laboratory, USA, September, 1989. (WAGNER, M., VONACH, H., Eds), Rep. NEANDC-259 'U' (1990).

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
1	¹ H	-	(n,2n)	¹ H	stable
3	⁶ Li	7.5(2)	(n,p)	⁶ He	0.8067(15) s
			(n,α)	³ H	12.33(6) y
			(n,2n)	³ Li	-
			(n,np)	³ He	-
			(n,nα)	³ H	stable
			(n,t)	⁴ He	stable
3	⁷ Li	92.5(2)	(n,2n)	⁶ Li	stable
			(n,np)	⁶ He	0.8067(15) s
			(n,nα)	³ H	12.33(6) y
			(n,d)	⁶ He	0.8067(15) s
			(n,t)	³ He	-
			(n,3n)	³ Li	-
4	⁹ Be	100	(n,2nα)	³ H	stable
			(n,p)	⁹ Li	stable
			(n,α)	⁶ He	0.8067(15) s
			(n,2n)	⁹ Be	-
5	¹⁰ B	19.9(2)	(n,t)	⁷ Li	stable
			(n,p)	¹⁰ Be	1.6x10 ⁴ (2) y
			(n,2n)	¹⁰ B	-
			(n,t)	⁹ Be	-
5	¹¹ B	80.1(2)	(n,np)	¹⁰ B	stable
			(n,p)	¹¹ Be	13.81(8) s
			(n,α)	⁷ Li	0.838(6) s
			(n,2n)	¹¹ B	stable
5	¹¹ B	80.1(2)	(n,t)	⁹ Be	stable
			(n,2n)	¹¹ B	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
-	-	185	5.59 P	6.79
β ⁻	-2.73	8.6±2 F	4.30 P	4.70 P
β ⁻	4.78	25±3	-	-
p,α	-3.7	72±5 F	0.166 P	0.267 P
n,α	-4.65	170	-	-
-	-1.47	400	-	-
-	4.785	25±3	-	-
-	-7.25	55±5 F	0.37 C	-
β ⁻	-10.0	105	-	-
β ⁻	-2.47	340	-	-
β ⁻	-7.76	10	-	-
n,α	-3.42	55	-	-
p,α	-12.92	0.2	-	-
-	-8.72	33	-	-
-	-12.836	<4	<10 ⁻³ C	-
β ⁻	-0.6022	10±1	32.8±3.8	-
2α	-1.665	524±25 F	144±6	155 P
-	-10.439	20	-	-
β ⁻	-0.2266	3.5±0.5 F	-	-
p2α	-8.4352	23.6±2 F	0.18 C	-
2α	0.2318	94±20 F	24.4 P	0.265 P
-	-6.59	75	-	-
β ⁻ , β ⁻ α 3.1%	-10.726	3.3±0.7	<10 ⁻³ C	-
β ⁻ 2α	-6.633	30.5±3 F	0.14±0.07	-
-	-11.456	19	0.008 C	-
-	-9.559	15	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
6	¹¹ C	98.90(3)	(n,p)	¹¹ B	0.0202(2) s
			(n,α)	⁹ Be	stable
			(n,2n)	¹¹ C	20.385(20) m
			(n,na)	⁹ Be	-
6	¹³ C	1.10(3)	(n,p)	¹³ B	0.01736(16) s
			(n,α)	¹⁰ B	1.6x10 ⁴ (2) y
			(n,2n)	¹² C	stable
			(n,t)	¹¹ B	stable
7	¹⁴ N	99.634(9)	(n,p)	¹⁴ C	5730(40) y
			(n,α)	¹¹ B	stable
			(n,2n)	¹³ N	9.965(4) m
			(n,d)	¹³ C	stable
			(n,t)	¹² C	stable
			(n,np)	¹³ C	stable
			(n,2α)	⁷ Li	stable
7	¹⁵ N	0.366(9)	(n,p)	¹⁵ C	2.449(5) s
			(n,α)	¹² B	0.0202(2) s
			(n,2n)	¹⁴ N	stable
8	¹⁶ O	99.762(15)	(n,p)	¹⁶ N	7.13(2) s
			(n,α)	¹³ C	stable
			(n,2n)	¹⁵ O	122.24(16) s
			(n,d)	¹⁵ N	stable
			(n,np)	¹⁵ N	stable
8	¹⁷ O	0.038(3)	(n,p)	¹⁷ N	4.173(4) s
			(n,α)	¹⁴ C	5730(40) y
			(n,2n)	¹⁶ O	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻ , β ⁻ 3α 1.58%	-12.588	0.19 F	2.26x10 ⁻¹ P	7.66x10 ⁻¹ P
-	-5.7016	80±20	0.37 C	-
E	-18.723	0	(4.2±1.4)10 ⁻⁷	-
2α	-7.37	190	-	-
β ⁻ , β ⁻ n 0.28%	-12.654	-	<10 ⁻³ C	-
β ⁻	-3.836	130	3.3 C	-
-	-4.946	-	10 C	-
-	-12.421	6,1	-	-
β ⁻	0.626	80±15	-	-
-	-0.157	125±5 F	91.3 P	93.9 P
E	-10.554	7.3±1 F	9.8x10 ⁻¹ P	2.38x10 ⁻³ P
-	-5.326	49	-	-
-	-4.015	29	-	-
-	-7.55	46±13	-	-
-	-2.62	32	-	-
β ⁻	-8.989	16±4	0.001 C	-
β ⁻ , β ⁻ 3α 1.58%	-7.622	18	0.012 C	-
-	-10.834	-	0.024 C	-
β ⁻ , β ⁻ α 0.0012%	-9.638	41±3 F	0.019±0.001	0.0407
-	-2.215	103±20 F	11.7 P	13.3 P
E	-15.669	0	(5.3±2.4)10 ⁻⁴	-
-	-9.903	150	-	-
-	-12.11	15	-	-
β ⁻ , β ⁻ n 95%	-7.896	35	(8.6±0.8)10 ⁻⁴	-
β ⁻	1.189	250	-	-
-	-4.142	-	31 C	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
8	¹⁶ O	0.200(12)	(n,p)	¹⁶ N	0.624(12) s
			(n,α)	¹⁵ C	2.449(5) s
			(n,2n)	¹⁷ O	stable
9	¹⁹ F	100	(n,p)	¹⁹ O	26.91(8) s
			(n,α)	¹⁶ N	7.13(2) s
			(n,2n)	¹⁸ F	109.77(5) m
			(n,t)	¹⁷ O	stable
10	²⁰ Ne	90.51(9)	(n,p)	²⁰ F	11.00(2) s
			(n,α)	¹⁷ O	stable
			(n,2n)	¹⁹ Ne	17.22(2) s
10	²¹ Ne	0.27(2)	(n,p)	²¹ F	4.32(3) s
			(n,α)	¹⁸ O	stable
			(n,2n)	²⁰ Ne	stable
10	²² Ne	9.22(9)	(n,p)	²² F	4.23(4) s
			(n,α)	¹⁹ O	26.91(8) s
			(n,2n)	²¹ Ne	stable
11	²³ Na	100	(n,p)	²³ Ne	37.24(12) s
			(n,α)	²⁰ F	11.00(2) s
			(n,2n)	²² Na	2.602(2) y
			(n,np)	²² Ne	stable
12	²⁴ Mg	78.99(3)	(n,p)	²⁴ Na	15.02(7) h
			(n,α)	²¹ Ne	stable
			(n,2n)	²³ Mg	11.317(11) s
12	²⁵ Mg	10(1)	(n,p)	²⁵ Na	59.6(7) s
			(n,α)	²² Ne	stable
			(n,2n)	²⁴ Mg	stable
			(n,np)	²⁴ Na	15.02(7) h

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-13.274	-	<10 ⁻¹ C	-
β ⁻	-5.009	-	0.42 C	-
-	-8.0472	-	0.56 C	-
β ⁻	-4.036	20±2 F	0.83±0.02	1.58 P
β ⁻ , β ⁻ α	0.0012±	33±5 F	15.1±0.2	16.8 P
E	-10.431	47.5±3 F	(7.3±0.7)10 ⁻¹	0.063
-	-7.557	10	-	-
β ⁻	-6.244	92	0.078 C	-
-	-0.588	14 F	12 C	-
E	-16.866	0	10 ⁻¹ C	-
β ⁻	-4.903	-	0.05 C	-
-	0.698	-	26 C	-
-	-6.761	-	2.5 C	-
β ⁻	-10.07	-	3x10 ⁻¹ C	-
β ⁻	-5.711	-	0.056 C	-
-	-10.366	-	0.064 C	-
β ⁻	-3.596	44±4 F	1.43±0.02	1.88 P
β ⁻	-3.866	150±10 F	0.53±0.02	0.898 P
E	-12.418	33.5±3 F	(2.2±0.2)10 ⁻¹	0.013 P
-	-8.79	18	-	-
β ⁻	-4.732	186±15 F	1.50±0.06	1.998±0.048
-	-2.553	63	1.8 C	-
E	-16.531	0	0.002	-
β ⁻	-3.053	55±5 F	3.2±1.6	-
-	0.480	100	14 C	-
-	-7.332	-	1.6 C	-
β ⁻	-	17.6±2	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
12	²⁴ Mg	11.01(2)	(n,p)	²⁴ Na	1.072(9) s
			(n,α)	²³ Ne	37.24(12) s
			(n,2n)	²³ Mg	stable
13	²⁷ Al	100	(n,p)	²⁷ Mg	9.462(11) m
			(n,α)	²⁴ Na	15.02(7) h
			(n,2n)	²⁶ Al	7.2(3)x10 ³ y
			(n,2n)*	^{26m} Al	6.345(3) s
			(n,np)	²⁶ Mg	stable
14	²⁸ Si	92.23(1)	(n,p)	²⁸ Al	2.2406(5) m
			(n,α)	²⁵ Mg	stable
			(n,2n)	²⁷ Si	4.16(2) s
			(n,np)	²⁷ Al	stable
14	²⁹ Si	4.67(1)	(n,p)	²⁹ Al	6.56(6) m
			(n,α)	²⁶ Mg	stable
			(n,2n)	²⁸ Si	stable
			(n,np)	²⁸ Al	2.2406(5) m
14	³⁰ Si	3.1(1)	(n,p)	³⁰ Al	3.60(6) s
			(n,α)	²⁷ Mg	9.462(11) m
			(n,2n)	²⁹ Si	stable
15	³¹ P	100	(n,p)	³¹ Si	2.62(1) h
			(n,α)	²⁸ Al	2.2406(5) m
			(n,2n)	³⁰ P	2.498(4) m
			(n,d)	²⁹ Si	stable
			(n,He ³)	²⁸ Al	6.56(6) m
			(n,np)	³⁰ Si	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-7.92	25±5	5x10 ⁻³ C	-
β ⁻	-5.417	75±10 F	0.027 C	-
-	-11.094	-	0.036 C	-
β ⁻	-1.828	74±5 F	3.95±0.20	4.89
β ⁻	-3.132	118±5 F	0.706±0.028	1.02
E	-13.058	7	5x10 ⁻³ C	-
E	-	0.12±0.5 F	-	-
-	-8.27	50	-	-
β ⁻	-3.860	260±25 F	6.4±0.8	10.4 P
-	-2.653	13 F	0.56 C	-
E	-17.177	0	10 ⁻³ C	-
-	-11.59	27	-	-
β ⁻	-2.898	115±15	3.3±0.2	-
-	-0.0331	F	7.9 C	-
-	-8.474	400±100	0.59 C	-
β ⁻	-12.3337	20±3	-	-
β ⁻	-7.76	-	5x10 ⁻³ C	-
β ⁻	-4.20	87±20	0.155±0.020	-
-	-10.61	-	7x10 ⁻³ C	-
β ⁻	-0.709	83±5 F	35.5±2.7	35.2 P
β ⁻	-1.944	110±10 F	1.9±0.6	2.74 P
E	-12.307	12.5±3 F	1.07x10 ⁻³	2.99x10 ⁻³ P
-	-5.073	15	-	-
β ⁻	-13.086	0.013	-	-
-	-7.30	100	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
16	³² S	95.02(9)	(n,p)	³¹ P	14.26(4) d
			(n,α)	³¹ Si	stable
			(n,2n)	³¹ Si	2.62(1) h
			(n,t)	³⁴ P	2.498(4) m
			(n,np)	³¹ P	stable
16	³³ S	0.75(1)	(n,p)	³¹ P	25.34(12) d
			(n,α)	³⁴ Si	stable
			(n,2n)	³² S	stable
16	³⁴ S	4.21(8)	(n,p)	³³ P	12.43(8) s
			(n,α)	³¹ Si	2.62(1) h
			(n,2n)	³³ S	stable
16	³⁶ S	0.02(1)	(n,p)	³⁶ P	5.9 s
			(n,α)	³³ Si	6.11(21) s
			(n,2n)	³⁵ S	87.51(12) d
17	³⁵ Cl	75.77(5)	(n,p)	³⁵ S	87.51(12) d
			(n,α)	³¹ P	14.26(4) d
			(n,2n)	³⁴ Cl	1.5262(25) s
			(n,2n)*	³⁴ Cl	32.23(14) m
17	³⁷ Cl	24.23(5)	(n,p)	³⁷ S	5.05(2) s
			(n,α)	³⁶ P	12.43(8) s
			(n,2n)	³⁶ Cl	3.01(2)x10 ³ y
18	³⁶ Ar	0.337(3)	(n,p)	³⁶ Cl	3.01(2)x10 ³ y
			(n,α)	³³ S	stable
			(n,2n)	³⁵ Ar	1.775(4) s
18	³⁸ Ar	0.063(1)	(n,p)	³⁸ Cl	37.24(5) m
			(n,α)	³⁵ S	87.51(12) d
			(n,2n)	³⁷ Ar	35.04(4) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-0.928	230±10 F	66.8±3.7	72.7
-	1.526	68±10 F	44.7 P	48.5 P
β ⁻	-15.088	0 F	0.45x10 ⁻³ P	1.57x10 ⁻³ P
E	-12.689	0 F	9.3x10 ⁻⁴ P	2.98x10 ⁻³ P
-	-8.86	78	-	-
β ⁻	0.534	-	76±15	-
-	3.492	-	41 C	-
-	-8.643	-	0.011	-
β ⁻	-4.32	73±10 F	0.43±0.05	-
β ⁻	-1.335	134±25 F	2.2±2	3.23 P
-	-11.415	160	0.013	-
β ⁻	-10.4	50	10 ⁻³ C	-
β ⁻	-4.2	15	0.029 C	-
β ⁻	-9.892	20	0.17 C	-
β ⁻	0.615	110±10	78±23	-
β ⁻	0.938	117±10 F	8.8±4.6	13.1 P
E	-12.646	9±1 F	0.77x10 ⁻³ P	2.19x10 ⁻³ P
E 53.1%, IT 46.9%	-	8.5±1 F	1.26x10 ⁻¹ P	1.4x10 ⁻³ P
β ⁻	-4.072	28±3 F	0.38±0.19	-
β ⁻	-1.29	30.5±5 F	1.2 C	-
β ⁻ 98.1%, E 1.9%	10.311	350	0.065	-
β ⁻ 98.1%, E 1.9%	0.0738	-	320 C	-
-	2.002	-	12 C	-
E	-15.25	-	8x10 ⁻³ C	-
β ⁻	-4.132	100±20	0.54 C	-
β ⁻	-0.222	-	2.9 C	-
E	-11.839	-	0.025 C	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
18	⁴⁰ Ar	99.60(3)	(n,p)	⁴⁰ Cl	1.35(2) m
			(n,α)	³⁷ S	5.05(2) m
			(n,2n)	³⁹ Ar	269(3) y
			(n,np)	³⁹ Cl	55.6(2) m
19	³⁹ K	93.2581(30)	(n,p)	³⁹ Ar	269(3) y
			(n,α)	³⁶ Cl	3.012x10 ⁵ y
			(n,2n)	³⁸ K	7.636(18) m
			(n,2n)*	³⁸ K	0.9246(15) s
			(n,2n)*	³⁸ K	7.636(18) m
			(n,np)	³⁸ Ar	stable
			(n,nα)	³⁵ Cl	stable
19	⁴¹ K	6.7302(30)	(n,p)	⁴¹ Ar	1.827(7) h
			(n,α)	³⁷ Cl	37.24(5) m
			(n,2n)	⁴⁰ K	1.277(8)x10 ⁵ y
			(n,He ³)	³⁷ Cl	55.6(2) m
20	⁴⁰ Ca	96.941(13)	(n,p)	⁴⁰ K	1.277(8)x10 ⁵ y
			(n,α)	³⁷ Ar	35.04(4) d
			(n,2n)	³⁹ Ca	0.8596(14) s
			(n,t)	³⁸ K	7.636(18) m
			(n,np)	³⁹ K	stable
			(n,nα)	³⁸ Ar	stable
			(n,He ³)	³⁸ Ar	stable
20	⁴² Ca	0.647(3)	(n,p)	⁴² K	12.360(3) h
			(n,α)	³⁹ Ar	269(3) y
			(n,2n)	⁴¹ Ca	1.03(4)x10 ⁵ y

Decay Mode	React. Energy (MeV)	Cross-sections (mb)			
		14 MeV	U-235 spectrum	Cf-252 spectrum	
β ⁻	-6.72	18	0.01 C	-	
β ⁻	-2.486	11.3±3 F	0.11 C	-	
β ⁻	-9.871	570	0.15	-	
β ⁻	-12.51	1.7	-	-	
β ⁻	0.217	179±60 F	83.8 P	88.7 P	
β ⁻ 98.1%, E 1.9%	1.363	115±30 F	8.0±0.3	6.81 P	
E	-13.085	4±1 F	0.35x10 ⁻³ P	1.04x10 ⁻³ P	
E	-	2.0±0.4	-	-	
E	-	2.44±0.27	-	-	
-	-6.38	180	-	-	
-	-7.22	30	-	-	
β ⁻	-1.71	43±5 F	2.1±0.2	2.76 P	
β ⁻	-0.111	33.5±0.2F	0.76±0.05	0.76 P	
β ⁻ 89.3%, E 10.7%	-10.096	400	0.16 C	-	
β ⁻	-12.616	(6±3)x10 ⁻³	-	-	
β ⁻ 89.3%, E 10.7%	-0.529	470±30	77 C	-	
E	1.748	320	13±6	-	
E	-15.634	0	3x10 ⁻⁵	-	
E	-12.933	0.027	-	-	
-	-8.33	200	-	-	
-	-7.04	23	-	-	
-	-6.9913	≥ 0.2	-	-	
β ⁻	-2.734	172.5±10.F	3.58 P	4.58 P	
β ⁻	0.349	50	2.7 C	-	
E	-11.473	150 C	0.04 C	-	

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
20	⁴⁰ Ca	0.135(3)	(n,p)	⁴⁰ K	22.3(1) h
			(n,α)	⁴⁰ Ar	stable
			(n,2n)	⁴¹ Ca	stable
			(n,d)	⁴¹ K	12.360(3) h
			(n,np)	⁴¹ K	12.360(3) h
20	⁴² Ca	2.086(5)	(n,p)	⁴² K	22.13(19) m
			(n,α)	⁴² Ar	1.827(7) h
			(n,2n)	⁴³ Ca	stable
			(n,np)	⁴³ K	22.3(1) h
			(n,d)	⁴³ K	22.3(1) h
20	⁴⁴ Ca	0.004(3)	(n,p)	⁴⁴ K	107(10) s
			(n,α)	⁴⁴ Ar	5.37(6) m
			(n,2n)	⁴⁶ Ca	163.8(18) d
20	⁴⁶ Ca	0.187(3)	(n,p)	⁴⁶ K	6.9(2) s
			(n,α)	⁴⁶ Ar	21.48(15) s
			(n,2n)	⁴⁸ Ca	4.535(4) d
21	⁴⁵ Sc	100	(n,p)	⁴⁵ Ca	163.8(18) d
			(n,α)	⁴⁵ K	12.360(3) h
			(n,2n)	⁴⁶ Sc	3.927(8) h
			(n,2n)*	^{46m} Sc	58.6(1) d
			(n,2n)*	^{46g} Sc	3.927(8) h
			(n,He ³)	⁴⁵ K	22.3(1) h
(n,2p)	⁴⁵ K	22.13(19) m			
22	⁴⁸ Ti	8.00(1)	(n,p)	⁴⁸ Sc	83.83(2) d
			(n,α)	⁴⁸ Ca	stable
			(n,2n)	⁴⁸ Ti	3.08(1) h
			(n,t)	⁴⁸ Sc	3.927(8) h

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-1.035	92±10	2.3 C	-
-	2.287	37 C	10 C	-
-	-7.933	400 C	1.5 C	-
β ⁻	-8.44	1.3	-	-
β ⁻	-10.67	20	-	-
β ⁻	-4.876	39±4 F	0.075	0.119 P
β ⁻	-2.751	27.1±0.2 F	0.061±0.009	0.0952 P
-	-11.136	600 C	0.050	-
β ⁻	-12.171	2.37±0.40	-	-
β ⁻	-9.946	3.5±0.2	-	-
β ⁻	-6.93	11.5 C	5×10 ⁻¹ C	-
β ⁻	-5.92	5 C	3×10 ⁻¹ C	-
β ⁻	-10.404	900 C	0.13 C	-
β ⁻	-10.67	3.7 C	< 10 ⁻³ C	-
β ⁻	0.14	1.6 C	< 10 ⁻³ C	-
β ⁻	-9.951	767±75	0.36±0.04	-
β ⁻	0.526	58±6 F	15±12	15.6 P
β ⁻	-0.395	55±5 F	0.182±0.012	0.618 P
E	-11.321	293±20 F	0.041 P	0.103 P
IT 98.8%, E 1.2%	-	118±15 F	0.012 P	0.032 P
E	-	175±15	-	-
β ⁻	-11.341	(8.6±4)×10 ⁻³	-	-
β ⁻	-9.65	0.21	-	-
β ⁻	-1.585	242±30 F	11.6±0.4	14.2
-	-0.080	91 C	0.29	-
E	-13.197	39.4±5 F	(7.8±0.9)10 ⁻³	0.0107 P
β ⁻	-13.190	0.123±0.025	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
22	⁴⁷ Ti	7.3(1)	(n,p)	⁴⁷ Sc	3.345(3) d
			(n,α)	⁴⁴ Ca	stable
			(n,2n)	⁴⁶ Ti	stable
			(n,np)	⁴⁶ Sc	83.83(2) d
			(n,d)	⁴⁶ Sc	83.83(2) d
22	⁴⁸ Ti	73.8(1)	(n,p)	⁴⁸ Sc	43.7(1) h
			(n,α)	⁴⁵ Ca	163.8(18) d
			(n,2n)	⁴⁷ Ti	stable
			(n,np)	⁴⁷ Sc	3.345(3) d
			(n,d)	⁴⁷ Sc	3.345(3) d
22	⁴⁹ Ti	5.5(1)	(n,p)	⁴⁹ Sc	57.4 m
			(n,α)	⁴⁶ Ca	stable
			(n,2n)	⁴⁸ Ti	stable
			(n,np)	⁴⁸ Sc	43.7(1) h
			(n,d)	⁴⁸ Sc	43.7(1) h
22	⁵⁰ Ti	5.4(1)	(n,p)	⁵⁰ Sc	1.71(8) m
			(n,p)*	⁵⁰ Sc	1.71(8) h
			(n,α)	⁴⁷ Ga	4.535(4) d
			(n,2n)	⁴⁹ Ti	stable
			(n,d)	⁴⁹ Sc	57.4 m
23	⁵¹ V	0.25(2)	(n,p)	⁵¹ Ti	stable
			(n,α)	⁴⁸ Sc	3.345(3) d
			(n,2n)	⁵¹ V	330(15) d
			(n,t)	⁴⁸ Ti	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	0.182	129.5±8 F	17.7±0.6	19.4
-	2.181	47 C	1.4	-
-	-8.875	340 C	0.48	-
β ⁻	-10.46	53.5±5	0.012	-
β ⁻	-8.2354	60±7	-	-
β ⁻	-3.208	60±3 F	0.302±0.010	0.428
β ⁻	-2.033	31±8	0.013±0.006	-
-	-11.628	550 C	0.016	-
β ⁻	-11.45	12.6±2	0.0013	-
β ⁻	-9.2213	11.5±1	-	-
β ⁻	-1.223	29.5±5 F	0.049	0.606 P
-	0.228	13.5 C	0.033	-
-	-8.143	740 C	2.6	-
β ⁻	-11.351	5.7±1	-	-
β ⁻	-9.127	7±1	-	-
β ⁻	-6.106	13.5±2 F	0.0089 P	0.0168 P
β ⁻	-	12±2	-	-
β ⁻	-3.444	9±1	(4.6±2.3)10 ⁻¹	-
-	-10.948	930 C	0.079 C	-
β ⁻	-9.946	3.0±0.8	-	-
-	2.999	58 C	29	-
β ⁻	0.759	28 C	0.22	-
E	-9.332	510 C	0.29	-
-	-7.6098	(77±20)10 ⁻³	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
23	⁵¹ V	99.75(2)	(n,p)	⁵¹ Ti	5.76(1) m
			(n, α)	⁴⁸ Sc	43.7(1) h
			(n,2n)	⁵⁰ V	stable
			(n,n α)	⁴⁷ Ti	stable
			(n,He ³)	⁴⁸ Sc	57.4 m
24	⁵⁴ Cr	4.345(9)	(n,p)	⁵⁴ V	stable
			(n, α)	⁴⁷ Ti	stable
			(n,2n)	⁴⁹ Cr	42.09(15) m
			(n,t)	⁴⁴ V	15.974(3) d
			(n,np)	⁴⁹ V	330(15) d
			(n,d)	⁴⁹ V	330(15) d
24	⁵² Cr	83.789(12)	(n,p)	⁵² V	3.75(1) m
			(n, α)	⁴⁹ Ti	stable
			(n,2n)	⁵¹ Cr	27.704(4) d
			(n,np)	⁵¹ V	stable
24	⁵³ Cr	9.501(11)	(n,p)	⁵³ V	1.61(4) m
			(n, α)	⁵⁰ Ti	stable
			(n,2n)	⁵² Cr	stable
			(n,np)	⁵² V	3.75(1) m
			(n,d)	⁵² V	3.75(1) m
24	⁵⁴ Cr	2.365(5)	(n,p)	⁵⁴ V	49.8(5) s
			(n, α)	⁵¹ Ti	5.76(1) m
			(n,2n)	⁵³ Cr	stable
			(n,d)	⁵³ V	1.61(4) m

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β^-	-1.676	33 \pm 3 F	0.503 \pm 0.024	0.718
β^-	-2.055	16.5 \pm 2 F	.0241 \pm .0090	0.0430
-	-11.052	660 \pm 50	0.21	-
-	-10.29	2	8.7 \times 10 ⁻⁵	-
β^-	-12.505	\pm 0.188	-	-
-	-0.257	300 \pm 50	63	-
-	0.320	120 \pm 10	0.62	-
E	-12.94	22.8 \pm 4 F	(6 \pm 1)10 ⁻³	5.0 \times 10 ⁻³ P
E	-12.664	0.066	-	-
E	-9.59	150 \pm 20	0.04	-
E	-7.364	405 \pm 65	-	-
β^-	-3.196	78 \pm 10 F	1.09 \pm 0.08	1.12 P
-	-1.211	35 \pm 3	0.083	-
E	-12.041	315 \pm 30	0.034	0.0877 P
-	-10.5	30	0.005	-
β^-	-2.64	40 \pm 3	0.62	-
-	1.797	45 \pm 4	0.29	-
-	-7.941	700 C	1.6	-
β^-	-11.45	7	0.001	-
β^-	-8.9114	8 \pm 1	-	-
β^-	-6.22	15 \pm 3	0.0072	-
β^-	-1.546	14 \pm 2	0.021	-
-	-9.72	860 C	0.31	-
β^-	-10.136	1.8 \pm 0.4	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
25	⁵⁵ Mn	100	(n,p)	⁵⁵ Cr	3.497(3) m
			(n,α)	⁵¹ V	3.75(1) m
			(n,2n)	⁵⁴ Mn	312.5(5) d
			(n,He ³)	⁵³ V	1.61(4) m
			(n,t)	⁵³ Cr	stable
26	⁵⁴ Fe	5.8(1)	(n,p)	⁵⁴ Mn	312.5(5) d
			(n,α)	⁵¹ Cr	27.704(4) d
			(n,2n)	⁵³ Fe	8.51(2) m
			(n,np)	⁵³ Mn	3.7(4)×10 ⁶ y
			(n,t)	⁵² Mn	5.591(3) d
26	⁵⁶ Fe	91.72(30)	(n,p)	⁵⁶ Mn	2.5785(6) h
			(n,α)	⁵³ Cr	stable
			(n,2n)	⁵⁵ Fe	2.68 y
			(n,t)	⁵⁴ Mn	312.5(5) d
			(n,np)	⁵⁵ Mn	stable
26	⁵⁷ Fe	2.2(1)	(n,p)	⁵⁷ Mn	1.45 m
			(n,α)	⁵⁴ Cr	stable
			(n,2n)	⁵⁶ Fe	stable
			(n,np)	⁵⁶ Mn	2.5785(6) h
			(n,d)	⁵⁶ Mn	2.5785(6) h
26	⁵⁸ Fe	0.28(1)	(n,p)	⁵⁸ Mn	65.3(7) s
			(n,p)*	^{58m} Mn	3(1) s
			(n,p)*	^{58s} Mn	65.3(7) s
			(n,α)	⁵⁵ Cr	3.497(3) m
			(n,2n)	⁵⁷ Fe	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-1.806	45±10	1.2	-
β ⁻	-0.626	29±2 F	0.11±0.03	-
E	-10.224	809±35 F	0.244±0.015	0.408
β ⁻	-12.709	0.8±0.3	-	-
-	-9.3049	0.987±0.148	-	-
E	0.088	295±30 F	80.5±2.3	87.3
E	0.841	85±15 F	0.6±0.2	0.887 P
E	-13.382	7±2 F	.0050±.0025	3.92×10 ⁻³ P
E	-8.85	110	0.12	-
E	-12.425	0.121±.030	-	-
β ⁻	-2.918	110±10 F	1.09±0.04	1.47
-	0.321	40 C	0.397±0.12	-
E	-11.203	540±40 F	0.078 P	0.189 P
E	11.931	(46±12)10 ⁻³	-	-
-	-10.19	35	0.0051	-
β ⁻	-1.78	80±10	1.5	-
-	2.395	23.5 C	0.54	-
-	-7.646	630 C	2.2	-
β ⁻	-10.56	15.2±3	0.0025	-
β ⁻	-8.3397	11.0±2.4	-	-
β ⁻	-5.32	20±3	0.051	-
β ⁻	-	7±2	-	-
β ⁻	-	13±2	-	-
β ⁻	-1.387	14 C	0.01	-
-	-10.043	800 C	0.2	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life	Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
								14 MeV	U-235 spectrum	Cf-252 spectrum
27	⁵⁷ Co	100	(n,p)	⁵⁶ Fe	44.496(7) d	β ⁻	-0.783	46.5±10 F	1.41±0.05	1.69
			(n,α)	⁵⁶ Mn	2.5785(6) h	β ⁻	0.320	32.5±2 F	0.161±0.007	0.222
			(n,2n)	⁵⁸ Co	70.916(15) d	E	-10.46	748±50 F	0.202±0.006	0.406
			(n,2n)*	⁵⁸ Co	9.15(10) h	IT	-	498	-	-
			(n,2n)*	⁵⁸ Co	70.916(15) d	E	-	250±30	-	-
			(n,He ³)	⁵⁷ Mn	1.45 m	β ⁻	-11.47	0.0047±0.0022	-	-
			(n,t)	⁵⁷ Fe	stable	-	-8.9306	0.482±0.123	-	-
28	⁵⁸ Ni	68.27(1)	(n,p)	⁵⁸ Co	70.916(15) d	E	0.395	310±25 F	108.5±5.4	118
			(n,p)*	⁵⁸ Co	9.15 h	IT	-	175±20	35.4±2.2	-
			(n,α)	⁵⁵ Fe	2.68 y	E	2.89	120±15	3.0±0.9	-
			(n,2n)	⁵⁷ Ni	36.08(9) h	E	-12.203	34±2 F	0.00419±0.00022	8.97x10 ⁻³
			(n,d)	⁵⁷ Co	270.9(6) d	E	-5.9526	18±5	-	-
			(n,t)	⁵⁶ Co	78.76(12) d	E	-11.073	0.090±0.020	-	-
			(n,np)	⁵⁷ Co	270.9(6) d	E	-8.18	627±35	0.21	-
			(n,nα)	⁵⁴ Fe	stable	-	-6.39	30	1.4x10 ⁻³	-
28	⁶⁰ Ni	26.10(1)	(n,p)	⁶⁰ Co	5.271(1) y	β ⁻	-2.041	137±15 F	2.3±0.4	2.39
			(n,p)*	⁶⁰ Co	10.47(4) m	IT 99.75%, β ⁻ 0.25%	-	95±10	2.1±0.3	-
			(n,α)	⁵⁷ Fe	stable	-	1.351	48.4 C	0.21	-
			(n,2n)	⁵⁹ Ni	7.5(13)x10 ⁴ y	E	-11.388	400 C	0.038	-
			(n,t)	⁵⁸ Co	70.916(15) d	E	-11.511	0.054±0.018	-	-
			(n,np)	⁵⁹ Co	stable	-	-9.53	68	7.1x10 ⁻³	-
28	⁶¹ Ni	1.13(1)	(n,p)	⁶¹ Co	1.650(5) h	β ⁻	-0.525	95±10	1.4±0.2	-
			(n,α)	⁵⁸ Fe	stable	-	3.575	29.5 C	5.5	-
			(n,2n)	⁶¹ Ni	stable	-	-7.819	580 C	2.3	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
28	⁶⁴ Ni	3.59(1)	(n,p)	⁶⁴ Co	1.50(4) m
			(n,p)*	⁶² Co	13.91(5) m
			(n,p)*	⁶¹ Co	1.50(4) m
			(n,α)	⁶⁰ Fe	44.496(7) d
			(n,2n)	⁶¹ Ni	stable
			(n,np)	⁶¹ Co	1.650(5) h
			(n,d)	⁶¹ Co	1.650(5) h
28	⁶⁵ Ni	0.91(1)	(n,p)	⁶⁴ Co	0.30(3) s
			(n,α)	⁶⁰ Fe	5.98(6) m
			(n,2n)	⁶³ Ni	100.1(20) y
			(n,d)	⁶³ Co	27.4 s
29	⁶³ Cu	69.17(2)	(n,p)	⁶³ Ni	100.1(20) y
			(n,α)	⁶⁰ Co	5.271(1) y
			(n,α)*	⁶⁰ Co	10.47(4) m
			(n,2n)	⁶² Cu	9.74(2) m
			(n,He ³)	⁶¹ Co	1.650(5) h
29	⁶⁴ Cu	30.83(2)	(n,p)	⁶⁴ Ni	2.520(2) h
			(n,α)	⁶¹ Co	1.50(4) m
			(n,α)*	⁶² Co	13.91(5) m
			(n,2n)	⁶⁴ Cu	12.701(2) h
			(n,nα)	⁶¹ Co	1.650(5) h
30	⁶⁶ Zn	48.6(3)	(n,p)	⁶⁶ Cu	12.701(2) h
			(n,α)	⁶⁶ Ni	stable
			(n,2n)	⁶⁵ Zn	38.1(3) m
			(n,t)	⁶² Cu	9.74(2) m
30	⁶⁷ Zn	27.9(2)	(n,p)	⁶⁷ Cu	5.10(2) m
			(n,α)	⁶⁵ Ni	100.1(20) y

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-4.44	37±5	0.19	-
β ⁻ , IT < 1%	-	17±3	-	-
β ⁻	-	20±3	-	-
β ⁻	-0.435	21±3	0.09±0.07	0.052 P
-	-10.957	750 C	0.17	-
β ⁻	-11.12	3.6	1.5x10 ⁻¹	-
β ⁻	-8.897	7.3±1.4	-	-
β ⁻	-6.220	5±1	0.027	-
β ⁻	-2.43	5.2±1.2	4.9x10 ⁻¹	-
β ⁻	-9.66	1060 C	0.5	-
β ⁻	-10.311	3.5±0.7	-	-
β ⁻	0.716	120±30	9.8	-
β ⁻	1.715	45±8 F	0.500±0.056	0.69
IT 99.75%, β ⁰ 0.25%	-	25	-	-
E	-10.854	551±30 F	0.122±0.012	0.187
β ⁻	-9.528	(3.8±1.9)10 ⁻¹	-	-
β ⁻	-1.349	19.7±3 F	0.48±0.08	0.701 P
β ⁻	-0.090	13 C	0.39	-
β ⁻ , IT < 1%	-	1.9±0.6	-	-
E 62.9%, β ⁻ 37.1%	-9.905	968±20 F	0.1 P	0.706 P
β ⁻	-6.76	1.7±0.3	6.3x10 ⁻¹	-
E 62.9%, β ⁻ 37.1%	0.208	176±20 F	29.9±1.6	40.5
-	3.867	57.5 C	1.1	-
E	-11.856	178±15 F	0.0175 P	0.0465 P
E	-10.08	(78±16)10 ⁻³	-	-
β ⁻	-1.852	66±5 F	0.62±0.11	1.16 P
β ⁻	2.274	30 C	0.28	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
30	⁶⁶ Zn	27.9(2)	(n,2n)	⁶⁵ Zn	243.9(1) d
30	⁶⁷ Zn	4.1(1)	(n,p)	⁶⁷ Cu	61.92(9) h
			(n,α)	⁶⁶ Ni	stable
			(n,2n)	⁶⁶ Zn	stable
			(n,d)	⁶⁶ Cu	5.10(2) m
30	⁶⁸ Zn	18.8(4)	(n,p)	⁶⁸ Cu	31(1) s
			(n,p)*	⁶⁸ Cu	3.75(5) m
			(n,p)*	⁶⁹ Cu	31(1) s
			(n,α)	⁶⁸ Ni	2.52 h
			(n,2n)	⁶⁷ Zn	stable
			(n,d)	⁶⁷ Cu	61.92(9) h
30	⁷⁰ Zn	0.6(1)	(n,p)	⁷⁰ Cu	4.5(1) s
			(n,α)	⁶⁹ Ni	21(1) s
			(n,2n)	⁶⁹ Zn	55.6(16) m
			(n,2n)*	⁷⁰ Zn	13.76(2) h
			(n,nα)	⁶⁸ Ni	54.6(4) h
31	⁶⁹ Ga	60.1(2)	(n,p)	⁶⁹ Zn	55.6(16) m
			(n,p)*	⁷⁰ Zn	13.76(2) h
			(n,α)	⁶⁸ Cu	5.10(2) m
			(n,2n)	⁶⁸ Ga	68.1(3) m
31	⁷¹ Ga	39.9(2)	(n,p)	⁷¹ Zn	2.45(10) m
			(n,p)*	⁷¹ Zn	3.94(5) h
			(n,p)*	⁷¹ Zn	2.45(10) m
			(n,α)	⁶⁹ Cu	31(1) s
			(n,2n)	⁷⁰ Ga	21.15(5) m
			(n,He ³)	⁶⁹ Cu	3.0(1) m
			(n,nα)	⁶⁷ Cu	61.92(9) h

Decay Mode	React. Energy (MeV)	Cross Sections (mb)			
		14 MeV	U-235 spectrum	Cf-252 spectrum	
E	-11.052	690±60 F	0.123 P	0.286 P	
β ⁻	0.208	45±5	1.07±0.04	-	
-	4.879	14.8 C	0.74	-	
-	-7.054	870 C	2.5	-	
β ⁻	-6.681	7.8±3	-	-	
β ⁻	-3.800	14±5	(15.6±2.5)10 ⁻³	-	
IT 86%, β ⁻ 14%	-	5±1	-	-	
β ⁻	-	9±2	-	-	
β ⁻	0.776	11.6±2 F	0.074±0.006	-	
-	-10.199	1030 C	0.35	-	
β ⁻	-7.766	2.1±0.3	-	-	
β ⁻	-6.3	8.7 C	6.7x10 ⁻³	-	
β ⁻	-0.71	4.3 C	5.5x10 ⁻³	-	
β ⁻	-9.215	1200±120	0.55	-	
IT 99.97%, β ⁻ 0.03%	-	448±29	-	-	
β ⁻	-5.91	0.56±0.10	2.7x10 ⁻⁴	-	
β ⁻	-0.124	34±3	1.5 C	-	
IT 99.97%, β ⁻ 0.03%	-	25±2 F	0.496±0.073	-	
β ⁻	2.584	18±2	0.2	-	
E	-10.31	945±50 F	0.237 P	0.522 P	
β ⁻	-2.023	17±3	0.067	-	
β ⁻	-	11±1	-	-	
β ⁻	-	6±1	-	-	
β ⁻	0.93	60±4	0.04	-	
β ⁻ 99.59%, E 0.41%	-9.304	1146±70 F	0.648 P	0.0128 P	
β ⁻	-11.060	0.066±0.02	-	-	
β ⁻	-5.26	2.5±0.5	7.7x10 ⁻⁴	-	

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life	Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
								14 MeV	U-235 spectrum	Cf-252 spectrum
32	⁷⁰ Ge	20.5(5)	(n,p)	⁷⁰ Ga	21.15(5) m	β^- 99.59%, E 0.41%	-0.871	77±10	1.3	-
			(n, α)	⁶⁷ Zn	stable	-	2.964	28 C	0.39	-
			(n,2n)	⁶⁹ Ge	39.05(10) h	E	-11.533	605±40 F	1.8±0.9	0.188 P
			(n,t)	⁶⁸ Ga	68.1(3) m	E	-10.353	(42±12)10 ⁻³	-	-
32	⁷² Ge	27.4(6)	(n,p)	⁷² Ga	14.10(1) h	β^-	-3.211	31±3	0.022±0.006	-
			(n, α)	⁶⁹ Zn	55.6(16) m	β^-	1.482	15±2	0.041	-
			(n, α)*	⁶⁸ Zn	13.76(2) h	IT 99.97%, β^- 0.03%	-	8.2±1	0.025±0.006	-
			(n,2n)	⁷¹ Ge	11.8(4) d	E	-10.749	970 C	0.15	-
32	⁷³ Ge	7.8(2)	(n,p)	⁷³ Ga	4.87(3) h	β^-	-0.77	22±3	0.35	-
			(n, α)	⁷⁰ Zn	stable	-	3.913	8.3 C	0.19	-
			(n,2n)	⁷¹ Ge	stable	-	-6.784	1120 C	4.9	-
32	⁷⁴ Ge	36.5(7)	(n,p)	⁷⁴ Ga	8.1(1) m	β^-	-4.72	11±2	0.47	-
			(n, α)	⁷¹ Zn	2.45(10) m	β^-	-0.443	6±1	4.8x10 ⁻¹	-
			(n, α)*	⁷¹ Zn	3.94(5) h	β^-	-	3.3±0.5	-	-
			(n,2n)	⁷³ Ge	stable	-	-10.201	1220 C	0.17	-
32	⁷⁶ Ge	7.8(2)	(n,p)	⁷⁶ Ga	32.6(6) s	β^-	-5.94	3.0±1.5	1.4x10 ⁻³	-
			(n, α)	⁷³ Zn	23.5(10) s	β^-	-2.4	2.7 C	8.4x10 ⁻⁴	-
			(n,2n)	⁷⁵ Ge	82.78(4) m	β^-	-9.443	1148±120 F	0.69 P	0.0136 P
			(n,2n)*	⁷⁵ Ge	47.7(7) s	IT 99.97%, β^- 0.03%	-	730±100	-	-
			(n,n α)	⁷¹ Zn	46.5(1) h	β^-	-7.49	0.80±0.17	1x10 ⁻⁷	-
33	⁷⁵ As	100	(n,p)	⁷⁵ Ge	82.78(4) m	β^-	-0.406	19.2±2 F	0.45±0.15	0.301 P
			(n,p)*	⁷⁵ Ge	47.7(7) s	IT 99.97%, β^- 0.03%	-	18	-	-
			(n, α)	⁷¹ Ga	14.10(1) h	β^-	1.205	11.6±1	7.4x10 ⁻³ P	0.0135 P
			(n,2n)	⁷⁴ As	17.78(3) d	E 65.8%, β^- 34.2%	-10.243	1061±60 F	0.33±0.02	0.636 P
			(n,He ³)	⁷³ Ga	4.87(3) h	β^-	-10.15	0.00405±0.00220	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
34	⁷⁴ Se	0.9(1)	(n,p)	⁷⁴ As	17.78(3) d
			(n, α)	⁷¹ Ge	11.8(4) d
			(n,2n)	⁷³ Se	7.15(8) h
			(n,2n)*	⁷² Se	39.8(13) m
34	⁷⁶ Se	9.0(2)	(n,p)	⁷⁶ As	26.32(7) h
			(n, α)	⁷³ Ge	stable
			(n,2n)	⁷⁵ Se	119.770(10)
34	⁷⁷ Se	7.6(2)	(n,p)	⁷⁷ As	38.83(5) h
			(n, α)	⁷⁴ Ge	stable
			(n,2n)	⁷⁶ Se	stable
			(n,d)	⁷⁶ As	26.32(7) h
34	⁷⁸ Se	23.6(6)	(n,p)	⁷⁸ As	90.7(2) m
			(n, α)	⁷⁵ Ge	82.78(4) m
			(n,2n)	⁷⁷ Se	stable
			(n,2n)*	⁷⁷ Se	17.45(10) s
34	⁷⁹ Se	49.7(7)	(n,p)	⁷⁹ As	15.2(2) s
			(n, α)	⁷⁷ Ge	11.30(1) h
			(n, α)*	⁷⁷ Ge	11.30(1) h
			(n, α)*	⁷⁷ Ge	52.9(6) s
			(n,2n)	⁷⁹ Se	$\leq 6.5 \times 10^4$ y
			(n,2n)*	⁷⁸ Se	3.91(5) m
34	⁸¹ Se	9.2(5)	(n,p)	⁸¹ As	19 s
			(n, α)	⁷⁹ Ge	19.1(3) s
			(n,2n)	⁸¹ Se	18.5(1) m
			(n,2n)*	⁸⁰ Se	57.25(9) m

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
E 65.8%, β^- 34.2%	-0.572	147 \pm 30 F	6.6 \pm 3.3	-
E	3.336	34 C	0.29	-
E	-12.071	320 \pm 30 F	0.031 P	0.0812 P
IT 73%, E 27%	-	35	-	-
β^-	-2.186	55 \pm 5	0.18	-
-	1.685	15 C	0.043	-
E	-11.161	879 \pm 70 F	0.142 P	0.337 P
β^-	0.098	35 \pm 5	0.62	-
-	4.468	10.6 C	0.18	-
-	-7.418	1070 C	3.9	-
β^-	-7.3798	12.1 \pm 2.0	-	-
β^-	-3.49	18 \pm 4	0.027	-
β^-	0.461	7 \pm 1	6.6 $\times 10^{-3}$	-
-	-10.497	993 \pm 50 F	0.245 P	0.542 P
IT	-	800	-	-
β^-	-5.22	7.2 C	3.8 $\times 10^{-3}$	-
β^-	-0.950	6.6 \pm 2	1.2 $\times 10^{-3}$	-
β^-	-	0.6 \pm 0.3	-	-
β^- 79%, IT 21%	-	6.0 \pm 2	-	-
β^-	-9.896	1132 \pm 60 F	0.453 P	0.937 P
IT	-	200	-	-
β^-	-7.17	3.1 C	7.4 $\times 10^{-4}$	-
β^-	-2.55	1.9 C	1.2 $\times 10^{-4}$	-
β^-	-9.272	1050 \pm 50 F	1.03 P	1.92 P
IT, β^- 0.07%	-	900	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
35	⁷⁹ Br	50.69(5)	(n,p)	⁷⁹ Se	≤ 6.5x10 ⁴ y
			(n,p)*	⁷⁸ Se	3.91(5) m
			(n,α)	⁷⁶ As	26.32(7) h
			(n,2n)	⁷⁸ Br	6.46(4) m
35	⁸¹ Br	49.31(5)	(n,p)	⁸¹ Se	18.5(1) m
			(n,p)*	⁸⁰ Se	57.25(9) m
			(n,α)	⁷⁸ As	90.7(2) m
			(n,2n)	⁸⁰ Br	17.68(2) m
			(n,2n)*	⁸⁰ Br	4.42(1) h
			(n,He ³)	⁷⁹ As	9.01(15) m
36	⁷⁸ Kr	0.35(2)	(n,p)	⁷⁸ Br	6.46(4) m
			(n,α)	⁷⁶ Se	119.770(10) d
			(n,2n)	⁷⁷ Kr	74.4(6) m
36	⁸⁰ Kr	2.25(2)	(n,p)	⁸⁰ Br	17.68(2) m
			(n,α)	⁷⁸ Se	stable
			(n,2n)	⁷⁹ Kr	35.04(10) h
			(n,2n)*	⁷⁹ Kr	50(3) s
36	⁸² Kr	11.6(1)	(n,p)	⁸² Br	35.30(3) h
			(n,α)	⁸⁰ Se	≤ 6.5x10 ⁴ y
			(n,2n)	⁸¹ Kr	2.1(2)x10 ⁵ y
36	⁸³ Kr	11.5(1)	(n,p)	⁸³ Br	2.39(2) h
			(n,α)	⁸¹ Se	stable
			(n,2n)	⁸³ Kr	stable
36	⁸⁴ Kr	57.0(3)	(n,p)	⁸⁴ Br	31.80(8) m
			(n,α)	⁸² Se	18.5(1) m
			(n,2n)	⁸⁴ Kr	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	0.641	31 C	0.87	-
IT	-	10	-	-
β ⁻	1.859	12.7±1.5 F	0.031	-
E≥99.99%, β ⁻ ≤0.01%	-10.693	974±50 F	0.213 P	0.478 P
β ⁻	-0.805	21±5	0.024±0.005	-
IT, β ⁻ 0.07%	-	15±2	0.0145±0.004	-
β ⁻	0.430	5±2	4.2x10 ⁻¹	-
β ⁻ 91.7%, E 8.3%	-10.16	1026±30 F	0.303 P	0.652 P
IT	-	665±50 F	0.176 P	0.387 P
β ⁻	-11.140	≤ 11.5x10 ⁻¹	-	-
E≥99.99%, β ⁻ 0.01%	0.089	138 C	2.6	-
E	3.665	40 C	0.37	-
E	-11.981	245±20	0.048	-
β ⁻ 91.7%, E 8.3%	-1.228	57 C	0.38	-
-	2.352	19 C	0.052	-
E	-11.525	810±60	0.077	-
IT	-	415	-	-
β ⁻	-2.306	23±4	0.07	-
β ⁻	0.988	9.2 C	8.7x10 ⁻¹	-
E	-10.98	1150 C	0.21	-
β ⁻	-0.187	15.5 C	0.2	-
-	3.417	6.6 C	0.04	-
-	-7.467	1270 C	3.8	-
β ⁻	-3.92	8.0±1.5	9.3x10 ⁻¹	-
β ⁻	-0.400	4.7 C	1.5x10 ⁻⁴	-
-	-10.518	1290 C	0.33	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
36	⁸⁴ Kr	17.3(2)	(n,p)	⁸⁴ Br	55.0(8) s
			(n,α)	⁸¹ Se	22.5(2) m
			(n,2n)	⁸³ Kr	10.72(2) y
			(n,2n)*	^{83m} Kr	4.480(8) h
37	⁸⁵ Rb	72.165(13)	(n,p)	⁸⁵ Kr	10.72(2) y
			(n,p)*	^{85m} Kr	4.480(8) h
			(n,α)	⁸³ Br	35.30(3) h
			(n,2n)	⁸⁴ Rb	32.87(11) d
			(n,2n)*	^{84m} Rb	32.87(11) d
			(n,2n)*	⁸⁴ Rb	20.49(17) m
37	⁸⁶ Rb	27.835(13)	(n,p)	⁸⁶ Kr	76.3(5) m
			(n,α)	⁸⁴ Br	31.80(8) m
			(n,2n)	⁸⁵ Rb	18.66(2) d
			(n,2n)*	^{85m} Rb	18.66(2) d
			(n,2n)*	⁸⁵ Rb	1.017(3) m
38	⁸⁷ Sr	0.56(1)	(n,p)	⁸⁷ Rb	32.87(11) d
			(n,p)*	^{87m} Rb	20.49(17) m
			(n,α)	⁸⁴ Kr	2.1(2)×10 ⁵ y
			(n,2n)	⁸⁶ Sr	32.4(2) h
			(n,d)	⁸⁶ Rb	86.2(1) d
38	⁸⁸ Sr	9.86(1)	(n,p)	⁸⁸ Rb	18.66(2) d
			(n,α)	⁸⁶ Kr	stable
			(n,2n)	⁸⁷ Sr	64.84(3) d
			(n,2n)*	^{87m} Sr	67.66(7) m
			(n,t)	⁸⁸ Rb	32.87(11) d
38	⁸⁹ Sr	7.00(1)	(n,p)	⁸⁹ Rb	stable
			(n,α)	⁸⁶ Kr	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)			
		14 MeV	U-235 spectrum	Cf-252 spectrum	
β ⁻	-6.52	4.4 C	2.4×10 ⁻¹	-	
β ⁻	-2.175	0.53 C	1.8×10 ⁻⁴	-	
β ⁻	-9.86	1400 C	0.44	-	
β ⁻ 79%, IT 21%	-	350	-	-	
β ⁻	0.0955	18.3 C	0.26	-	
β ⁻ 79%, IT 21%	-	5.0±0.5	-	-	
β ⁻	0.991	5.9±1 F	5.3×10 ⁻³	-	
ε 96%, β ⁻ 4%	-10.6	1135±100 F	0.37±0.01	0.616 P	
ε 96%, β ⁻ 4%	-	500	-	-	
IT	-	635	-	-	
β ⁻	-3.110	10±2	0.023	-	
β ⁻	-1.210	4±1	2.2×10 ⁻¹	-	
β ⁻ , ε 0.005%	-9.926	1195±130 F	0.394 P	0.835 P	
β ⁻ , ε 0.005%	-	695	-	-	
IT>99.7%, β ⁻ <0.3%	-	500	-	-	
ε 96%, β ⁻ 4%	-0.104	96±8	0.7	-	
IT	-	47±7	-	-	
ε	2.69	22.6 C	0.058	-	
ε	-12.013	1054±50 F	0.103 P	0.264 P	
ε	-6.755	104±16	-	-	
β ⁻ , ε 0.005%	-0.989	44.5±2 F	0.11 P	-	
-	1.124	11.4 C	0.011	-	
ε	-11.485	1000±100	0.15	-	
IT 87.3%, ε 12.7%	-	340	-	-	
ε 69%, β ⁻ 4%	-11.635	-	-	-	
-	0.509	21.5 C	0.19	-	
-	3.214	8.2 C	0.068	-	

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
38	⁸⁶ Sr	7.00(1)	(n,2n)	⁸⁶ Sr	stable
38	⁸⁷ Sr	82.58(1)	(n,p)	⁸⁷ Rb	17.8(1) m
			(n,α)	⁸⁷ Kr	10.72(2) y
			(n,2n)	⁸⁷ Sr	stable
			(n,2n)*	⁸⁷ Sr	2.81(1) y
			(n,t)	⁸⁷ Rb	18.66(2) d
39	⁸⁹ Y	100	(n,p)	⁸⁹ Sr	50.55(9) d
			(n,α)	⁸⁹ Rb	18.66(2) d
			(n,α)*	⁸⁹ Rb	1.017(3) m
			(n,2n)	⁸⁹ Y	106.64(8) d
40	⁹⁰ Zr	45(2)	(n,p)	⁹⁰ Y	64.1(1) h
			(n,p)*	⁹⁰ Y	3.19(1) h
			(n,α)	⁹⁰ Sr	stable
			(n,α)*	⁹⁰ Sr	2.81(1) h
			(n,2n)	⁹⁰ Zr	78.43(8) h
			(n,2n)*	⁹⁰ Zr	4.18(1) m
			(n,2n)*	⁹⁰ Zr	78.43(8) h
			(n,t)	⁹⁰ Y	106.64(8) d
40	⁹¹ Zr	11.22(2)	(n,p)	⁹¹ Y	58.51(6) d
			(n,p)*	⁹¹ Y	49.71(4) m
			(n,α)	⁹¹ Sr	stable
			(n,2n)	⁹¹ Zr	stable
			(n,np)*	⁹¹ Y	3.19(1) h
			(n,d)	⁹¹ Y	64.1(1) h

Decay Mode	React. Energy (MeV)	Cross Sections (mb)			
		14 MeV	U-235 spectrum	Cf-252 spectrum	
-	-8.428	1200 C	2.5	-	
β ⁻	-4.522	15±2 F	3.8x10 ⁻³ P	-	
β ⁻	-0.788	6 C	5.9x10 ⁻³	-	
-	-11.113	1200 C	0.14	-	
IT 99.7%, E 0.03%	-	318±30 F	0.0451 P	-	
β ⁻ , E 0.005%	-12.048	(63±22)10 ⁻³	-	-	
β ⁻	-0.707	24.6±3 F	0.31±0.06	-	
β ⁻ , E 0.005%	0.699	5.4±1 F	8.3x10 ⁻³	-	
IT > 99.7%	-	2.5	-	-	
E	-11.468	966±100 F	0.156±0.011	0.319 P	
β ⁻	-1.506	45±3 F	0.38±0.02	0.497 P	
IT, β ⁻ 0.002%	-	12.36±1	-	-	
-	1.75	14 C	0.014	-	
IT 99.7%, E 0.3%	-	3.64±0.3	-	-	
E	-11.983	730±35	0.103±0.004	0.222±0.066	
IT 93.76%, E 6.24%	-	112.8	-	-	
E	-	618	-	-	
E	-11.352	0.041	-	-	
β ⁻	-0.763	32.5±3 F	0.13 C	-	
IT	-	17.9±1	-	-	
-	5.661	10.1 C	2.2 C	-	
-	-7.203	1200 C	5.5 C	-	
IT, β ⁻ 0.002%	-	1.82±0.3	-	-	
β ⁻	6.4842	6.2±1.5	-	-	

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
40	⁹⁰ Zr	17.15(1)	(n,p)	⁸⁹ Y	3.54(1) h
			(n,α)	⁸⁶ Sr	50.55(9) d
			(n,2n)	⁸⁹ Zr	stable
			(n,np)*	⁸⁹ Y	49.71(4) m
			(n,d)	⁸⁹ Y	58.51(6) d
			(n,t)	⁸⁹ Y	64.1(1) h
40	⁹¹ Zr	17.38(2)	(n,p)	⁹⁰ Y	18.7(1) m
			(n,α)	⁸⁷ Sr	9.52(6) h
			(n,2n)	⁸⁹ Zr	1.53(10)x10 ⁶ y
			(n,np)	⁹⁰ Y	0.82 s
			(n,d)	⁹⁰ Y	10.1(2) h
			(n,He ³)	⁸⁸ Sr	2.71(1) h
40	⁹² Zr	2.80(1)	(n,p)	⁹¹ Y	6.2(2) m
			(n,α)	⁸⁸ Sr	7.6(2) m
			(n,2n)	⁹⁰ Zr	64.02(4) d
			(n,He ³)	⁸⁹ Sr	75.1(7) s
41	⁹³ Nb	100	(n,p)	⁹² Zr	1.53(10)x10 ⁶ y
			(n,α)	⁸⁹ Y	64.1(1) h
			(n,α)*	⁸⁸ Y	3.19(1) h
			(n,2n)	⁹² Nb	3.5(3)x10 ⁷ y
			(n,2n)*	⁹¹ Nb	10.15(2) d
			(n,He ³)	⁹⁰ Y	58.51(6) d
			(n,t)	⁹² Zr	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-2.841	22±2	0.10 C	-
β ⁻	3.386	8.9±1 F	0.096 C	-
-	-8.635	1300 C	1.3 C	-
IT	-	1.07±0.30	-	-
β ⁻	-7.173	3.0±1.2	-	-
β ⁻	-8.8617	(26.5±7)10 ⁻¹	-	-
β ⁻	-4.22	8±1	0.011 C	-
β ⁻	2.067	4.8±0.5 F	0.015 C	-
β ⁻	-8.191	1360 C	2.1 C	-
IT	-	1.0±0.5	-	-
β ⁻	-8.074	2.4±0.2	-	-
β ⁻	-11.200	≤ 0.42	-	-
β ⁻	-6.02	4.0 C	9x10 ⁻³ C	-
β ⁻	0.17	1.1±0.2	9x10 ⁻³ C	-
β ⁻	-7.832	1500±90	3.1 C	-
β ⁻	-13.540	≤ 0.13±0.048	-	-
β ⁻	0.719	35 C	1.0 C	-
β ⁻	4.914	9.5±0.5 F	0.0974±0.003	-
IT, β ⁻ 0.002±	-	5.12±0.40	0.0267±0.017	-
E	-8.826	1375±70 F	1.09 P	2.07 P
E	-	482±20 F	0.475±0.032	0.766 P
β ⁻	-7.719	(3.1±1.5)10 ⁻¹	-	-
-	-6.192	(367±67)x10 ⁻¹	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
42	⁹² Mo	14.84(4)	(n,p)	⁹¹ Nb	3.5(3)x10 ⁷ y
			(n,p)*	^{92m} Nb	10.15(2) d
			(n,α)	⁸⁸ Zr	78.43(8) h
			(n,α)*	⁸⁹ Zr	78.43(8) h
			(n,α)*	⁹⁰ Zr	4.18(1) m
			(n,2n)	⁹¹ Mo	15.49(1) m
			(n,2n)*	^{91m} Mo	65.2(8) s
			(n,t)	⁹⁰ Nb	14.60(5) h
42	⁹⁴ Mo	9.25(2)	(n,p)*	^{93m} Nb	6.26(1) m
			(n,p)	⁹⁴ Nb	2.03(16)x10 ⁴ y
			(n,α)	⁹⁰ Zr	stable
			(n,2n)	⁹³ Mo	3.5(7)x10 ³ y
			(n,2n)*	^{93m} Mo	6.85(7) h
42	⁹⁶ Mo	15.92(4)	(n,p)	⁹⁵ Nb	34.97(3) d
			(n,p)*	^{96m} Nb	3.61(3) d
			(n,α)	⁹² Zr	stable
			(n,2n)	⁹⁵ Mo	stable
42	⁹⁸ Mo	16.68(4)	(n,p)	⁹⁷ Nb	23.35(5) h
			(n,α)	⁹³ Zr	1.53(10)x10 ⁴ y
			(n,2n)	⁹⁷ Mo	stable
			(n,np)	⁹⁷ Nb	34.97(3) d
			(n,np)*	^{98m} Nb	3.61(3) d
			(n,d)	⁹⁷ Nb	34.97(3) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
E	0.427	137 C	9.1 C	-
E	-	68±6	7.0±0.6	-
E	3.69	25.0±1.5	0.04±0.02	-
E	-	20±2	-	-
IT 93.76%, E 6.24%	-	5.0±0.5	-	-
E	-12.692	192±20 F	0.016 P	0.0426 P
IT 50.1%, E 49.9%	-	14.6±5	-	-
E	-11.036	(70±21)x10 ⁻¹	-	-
IT 99.5%, β ⁻ 0.5%	-	33.6±9	-	-
β ⁻	-1.263	61 C	0.73 C	-
-	5.13	16.6 C	0.54 C	-
E	-9.672	1000 C	0.435	-
IT 99.88%, E 0.12%	-	5.25±0.4	-	-
β ⁻	-0.142	42±2	0.14±0.01	-
IT 94.4%, β ⁻ 5.6%	-	7.76±0.70	-	-
-	6.39	12.3 C	3.4 C	-
-	-7.45	1140 C	3.45	-
β ⁻	-2.405	23.35±1.50	0.058±0.008	-
β ⁻	3.995	9.1 C	0.11 C	-
-	-9.154	1260 C	0.767	-
β ⁻	-9.2965	5.7±0.5	-	-
IT 94.4%, β ⁻ 5.6%	-	1.2±0.3	-	-
β ⁻	-7.0719	5.9±0.2	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
42	⁹⁵ Mo	9.55(2)	(n,p)	⁹⁵ Nb	72.1(7) m
			(n,p)*	^{95m} Nb	60(8) s
			(n,α)	⁹⁴ Zr	stable
			(n,2n)	⁹⁴ Mo	stable
			(n,np)	⁹⁴ Nb	23.35(5) h
			(n,d)	⁹⁴ Nb	23.35(5) h
42	⁹⁶ Mo	24.13(6)	(n,p)	⁹⁶ Nb	2.86(6) s
			(n,p)*	^{96m} Nb	51.3(4) m
			(n,α)	⁹⁵ Zr	64.02(4) d
			(n,2n)	⁹⁵ Mo	stable
			(n,np)	⁹⁵ Nb	72.1(7) m
			(n,np)	^{96m} Nb	3.61(3) d
42	⁹⁷ Mo	9.63(2)	(n,p)	⁹⁷ Nb	3.1(3) s
			(n,α)	⁹⁶ Zr	16.90(5) h
			(n,2n)	⁹⁶ Mo	66.0(2) h
43	⁹⁸ Tc	100	(n,p)	⁹⁸ Mo	66.0(2) h
			(n,α)	⁹⁷ Nb	23.35(5) h
			(n,2n)	⁹⁷ Tc	4.2(3) × 10 ⁶ y
			(n,nα)	⁹⁷ Nb	34.97(3) d
			(n,He ³)	⁹⁷ Nb	72.1(7) m
44	⁹⁹ Ru	5.52(5)	(n,p)	⁹⁹ Tc	4.28(6) d
			(n,p)*	^{99m} Tc	51.5(10) m
			(n,α)	⁹⁸ Mo	3.5(7) × 10 ³ y
			(n,2n)	⁹⁸ Ru	1.64(1) h
			(n,d)	⁹⁸ Tc	20.0(1) h

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-1.153	16.8±1.0	0.057 C	-
IT	-	4.4±0.8	-	-
-	5.34	6.8 C	0.84 C	-
-	-6.816	1350 C	6.10	-
β ⁻	-9.221	3.8±0.3	-	-
β ⁻	-6.996	3,6±0.2	-	-
β ⁻	-3.82	11±4	0.015 C	-
β ⁻	-	5.5±0.6	-	-
β ⁻	3.202	5.6±0.6	-	-
-	-8.642	1370 C	1.3	-
β ⁻	-9.796	1.84±0.2	-	-
IT 94.4%, β ⁻ 5.6%	-	1.05±0.8	-	-
β ⁻	-7.571	2.15±0.10	-	-
β ⁻	-5.22	5.2±1	0.002 C	-
β ⁻	2.394	2.8±0.3	0.012 C	-
β ⁻	-8.301	1420±150	1.85	-
β ⁻	-0.575	12±3	0.10 C	-
β ⁻	3.928	7±1	0.065 C	-
β ⁻	-8.966	1230±120	1.02	-
β ⁻	-2.966	1.3±0.2	-	-
β ⁻	-8.576	≤ 6.8 × 10 ⁻³	-	-
E	0.57	150±20	8.1 C	-
IT 98%, E 2%	-	62	-	-
E	6.383	36 C	1.7 C	-
E	-10.694	700±100	0.249	-
E	-5.125	535±90	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
44	¹⁰⁰ Ru	1.88(5)	(n,p)	¹⁰⁰ Tc	4.2(3)x10 ⁴ y
			(n,α)	⁹⁸ Mo	stable
			(n,2n)	⁹⁹ Ru	2.9(1) d
44	¹⁰¹ Ru	12.7(1)	(n,p)	¹⁰¹ Tc	2.13(5)x10 ⁵ y
			(n,p)*	^{100m} Tc	6.02(3) h
			(n,α)	⁹⁹ Mo	stable
			(n,2n)	¹⁰⁰ Ru	stable
44	¹⁰² Ru	12.6(1)	(n,p)	¹⁰² Tc	15.8(1) s
			(n,α)	⁹⁹ Mo	stable
			(n,2n)	¹⁰¹ Ru	stable
44	¹⁰³ Ru	17.0(1)	(n,p)	¹⁰³ Tc	14.2(1) m
			(n,α)	¹⁰¹ Mo	stable
			(n,2n)	¹⁰² Ru	stable
44	¹⁰⁴ Ru	31.6(2)	(n,p)	¹⁰⁴ Tc	5.28(15) s
			(n,p)*	^{103m} Tc	4.35(7) m
			(n,α)	¹⁰² Mo	66.0(2) h
			(n,2n)	¹⁰³ Ru	stable
44	¹⁰⁵ Ru	18.7(2)	(n,p)	¹⁰⁵ Tc	18.3(3) m
			(n,α)	¹⁰³ Mo	14.6(1) m
			(n,2n)	¹⁰⁴ Ru	39.26(2) d
45	¹⁰³ Rh	100	(n,p)	¹⁰³ Ru	39.26(2) d
			(n,α)	¹⁰³ Tc	15.8(1) s
			(n,2n)	¹⁰² Rh	2.9 y
			(n,2n)*	^{101m} Rh	207(3) d
			(n,2n)*	^{103m} Rh	2.9 y
			(n,He ³)	¹⁰¹ Tc	14.2(1) m
			(n,t)	¹⁰¹ Ru	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-0.92	82 C	0.87 C	-
-	5.137	19.6 C	0.27 C	-
E	-10.25	1050±100	0.264	-
β ⁻	0.49	55.4 C	0.45 C	-
IT, β ⁻	-	15	-	-
-	6.822	14.6 C	3.1 C	-
-	-7.468	1100 C	3.2	-
β ⁻	-2.59	37.5 C	0.069 C	-
-	3.965	11 C	0.057 C	-
-	-9.674	1220 C	0.493	-
β ⁻	-0.848	36±4	0.067 C	-
-	5.802	8.3 C	0.75 C	-
-	-6.805	1350 C	6.24	-
β ⁻	-3.72	17.3 C	0.012 C	-
β ⁻ =98%, IT =2%	-	5.7	-	-
β ⁻	2.502	5±1	0.007 C	-
-	-9.216	1390 C	0.802	-
β ⁻	-4.52	7.2±1	4x10 ⁻³ C	-
β ⁻	1.057	2.6±1	9x10 ⁻⁴ C	-
β ⁻	-8.912	1440±100	1.14	-
β ⁻	0.0198	16±1	0.107±0.006	-
β ⁻	3.48	11±2	0.016 C	-
E	-9.31	1325±100 F	0.765 P	1.51 P
E 75%, β ⁻ 20%, IT 5%	-	600	0.715	-
E	-	725	-	-
β ⁻	-8.55	(2.0±0.6)10 ⁻¹	-	-
-	-6.939	0.692±0.208	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
46	¹⁰¹ Pd	1.020(12)	(n,p)	¹⁰¹ Rh	2.9 y
			(n,α)	⁹⁹ Ru	stable
			(n,2n)	¹⁰¹ Pd	8.47(6) h
			(n,t)	¹⁰⁰ Rh	20.8(1) h
46	¹⁰² Pd	11.14(8)	(n,p)	¹⁰² Rh	42.3(4) s
			(n,α)	¹⁰¹ Ru	stable
			(n,2n)	¹⁰³ Pd	16.991(19) d
46	¹⁰³ Pd	22.33(8)	(n,p)	¹⁰³ Rh	35.36(6) h
			(n,α)	¹⁰¹ Rh	stable
			(n,2n)	¹⁰⁴ Pd	stable
			(n,p)*	¹⁰³ Rh	45 s
46	¹⁰⁴ Pd	27.33(5)	(n,p)	¹⁰⁴ Rh	29.80(8) s
			(n,p)*	¹⁰⁴ Rh	29.80(8) s
			(n,p)*	¹⁰³ Rh	130(2) m
			(n,α)	¹⁰³ Ru	39.26(2) d
			(n,2n)	¹⁰⁵ Pd	stable
46	¹⁰⁵ Pd	26.46(9)	(n,p)	¹⁰⁵ Rh	6.0(3) m
			(n,α)	¹⁰³ Ru	4.44(2) h
			(n,2n)	¹⁰⁷ Pd	6.5(3)×10 ⁴ y
			(n,2n)*	¹⁰⁷ Pd	21.3(5) s
			(n,d)	¹⁰⁷ Rh	21.7(4) m
46	¹⁰⁶ Pd	11.72(9)	(n,p)	¹⁰⁶ Rh	28.5(15) s
			(n,α)	¹⁰⁷ Ru	3.75(5) m
			(n,2n)	¹⁰⁹ Pd	13.7(1) h
			(n,2n)*	¹⁰⁹ Pd	4.69(1) m
			(n,2n)*	¹⁰⁹ Pd	13.7(1) h

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
E	-0.367	110 C	1.6 C	-
-	5.34	23 C	0.18 C	-
E	-10.587	1100±100	-	-
E	-9.214	(64±22)10 ⁻³	-	-
β ⁻ 99.55%, E 0.45%	-1.685	58±14	0.20 C	-
-	4.191	13 C	0.033 C	-
E	-10.02	1180 C	0.369	-
β ⁻	0.217	38±8	0.22 C	-
-	6.334	10 C	0.77 C	-
-	-7.073	1300 C	4.96	-
IT	-	23	-	-
β ⁻	-2.758	25±3	0.04 C	-
β ⁻	-	16±2	-	-
β ⁻	-	9±2	-	-
β ⁻	2.998	5.6±0.7	7×10 ⁻³ C	-
-	-9.561	1400 C	6.11×10 ⁻¹	-
β ⁻	-3.72	9±2	0.01 C	-
β ⁻	2.051	2.5±0.5	10 ⁻³ C	-
β ⁻	-9.225	1450 C	0.864	-
IT	-	500	-	-
β ⁻	-7.730	4.0±2.0	-	-
β ⁻	-4.62	5.5 C	0.002 C	-
β ⁻	1.02	2.7 C	4×10 ⁻⁴ C	-
β ⁻	-8.806	1850±120	1.3	-
IT	-	500	-	-
β ⁻	-	1350±100	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
47	¹⁰⁷ Ag	51.839(5)	(n,p)	¹⁰⁷ Pd	6.5(3)x10 ⁴ y
			(n,p)*	^{107m} Pd	21.3(5) s
			(n,α)	¹⁰⁴ Rh	42.3(4) s
			(n,2n)	¹⁰⁶ Ag	24.0(1) m
			(n,2n)*	^{106m} Ag	8.46(10) d
47	¹⁰⁹ Ag	48.161(5)	(n,p)	¹⁰⁹ Pd	13.7(1)h
			(n,p)*	^{109m} Pd	4.69(1) m
			(n,α)	¹⁰⁶ Rh	29.80(8) s
			(n,2n)	¹⁰⁹ Ag	2.37(1) m
			(n,2n)*	^{109m} Ag	127(21) y
			(n,He ³)	¹⁰⁷ Rh	21.7(4) m
48	¹⁰⁶ Cd	1.25(3)	(n,p)	¹⁰⁶ Ag	24.0(1) m
			(n,p)*	^{106m} Ag	8.46(10) d
			(n,α)	¹⁰³ Pd	16.991(19) d
			(n,2n)	¹⁰⁵ Cd	55.5(4) m
			(n,2n)*	^{105m} Cd	24 m
			(n,d)	¹⁰⁵ Ag	41.29(7) d
			(n,t)	¹⁰⁴ Ag	69.2(10) m
48	¹⁰⁸ Cd	0.89(1)	(n,p)	¹⁰⁸ Ag	2.37(1) m
			(n,α)	¹⁰⁵ Pd	stable
			(n,2n)	¹⁰⁷ Cd	6.50(2) h
48	¹¹⁰ Cd	12.49(9)	(n,p)	¹¹⁰ Ag	24.6(2) s
			(n,p)*	^{110m} Ag	249.76(4) d
			(n,α)	¹⁰⁷ Pd	6.5(3)x10 ⁴ y
			(n,2n)	¹⁰⁹ Cd	462.9(20) d
48	¹¹¹ Cd	12.80(6)	(n,p)	¹¹¹ Cd	7.45(1) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	0.747	41 C	0.47 C	-
IT	-	15	-	-
β ⁻ 99.55%, E 0.45%	4.182	10.8 C	0.025 C	-
E ≥ 99%, β ⁻ ≤ 1%	-9.551	1260±120	0.601	-
E	-	600	-	-
β ⁻	-0.333	14±3 F	0.095 C	-
IT	-	9.1	-	-
β ⁻	3.288	12.0±2.5	0.007 C	-
β ⁻ 97.15%, E 2.85%	-9.188	1440 C	0.880	-
E 91.3%, IT 8.7%	-	27	-	-
β ⁻	-	(10.5±5)10 ⁻¹	-	-
E ≥ 99%, β ⁻ ≤ 1%	0.581	148 C	3.3±0.3	-
E	-	76	-	-
E	5.98	100±40	0.14 C	-
E	-10.92	1350±200 F	0.154 P	-
-	-	876±90 F	0.132	0.325 P
E	-5.117	215±50	-	-
E	-8.697	(86.5±15)10 ⁻¹	-	-
β ⁻ 97.15%, E 2.85%	-0.86	70 C	0.51 C	-
-	4.812	15.4 C	0.039 C	-
E	-10.329	1290±150	0.285	-
β ⁻ 99.7%, E 0.3%	-2.108	27±5	0.10±0.05	-
β ⁻ 98.64%, IT 1.36%	-	20	-	-
β ⁻	3.673	9.1 C	0.008 C	-
E	-9.879	1220±150	0.474	-
β ⁻	-0.2455	22.2±6 F	0.021	0.0369 P

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
48	¹¹¹ Cd	24.13(11)	(n,p)	¹¹¹ Ag	3.14(2) h
			(n,α)	¹⁰⁹ Pd	13.7(1) h
			(n,α)*	^{109m} Pd	4.69(1) m
			(n,2n)	¹¹¹ Cd	stable
			(n,2n)*	¹¹⁰ Cd	48.6(3) m
48	¹¹² Cd	12.22(6)	(n,p)	¹¹² Ag	5.37(5) h
			(n,α)	¹¹⁰ Pd	stable
			(n,2n)	¹¹² Cd	stable
48	¹¹⁴ Cd	28.73(21)	(n,p)	¹¹⁴ Ag	4.6(2) s
			(n,α)	¹¹² Pd	23.4(2) m
			(n,α)*	^{112m} Pd	5.5(1) h
			(n,2n)	¹¹³ Cd	9.3(19)x10 ¹⁵ y
			(n,2n)*	^{113m} Cd	13.7 y
			(n,t)	¹¹³ Ag	3.14(2) h
48	¹¹⁶ Cd	7.49(9)	(n,p)	¹¹⁶ Cd	2.68(1) m
			(n,α)	¹¹³ Pd	98 s
			(n,2n)	¹¹⁵ Cd	53.64(10) h
			(n,2n)*	^{115m} Cd	44.6(3) d
			(n,2n)*	¹¹⁵ Cd	53.46(10) h
49	¹¹³ In	4.3(2)	(n,p)	¹¹³ Cd	9.3(19)x10 ¹⁵ y
			(n,α)	¹¹⁰ Ag	24.6(2) s
			(n,2n)	¹¹² In	14.4(2) m
			(n,2n)*	^{112m} In	14.4(2) m
			(n,2n)*	¹¹² In	20.9(2) m
			(n,n')	^{113m} In	1.658(1) h

Decay Mode	React. Energy (MeV)	Cross-sections(mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-3.22	16±2	0.014 C	-
β ⁻	2.675	2.6±0.5 F	0.7x10 ⁻¹ P	-
IT	-	1.3	-	-
-	-9.397	1460 C	0.752	-
IT	-	700±50	0.42±0.06	-
β ⁻	-1.228	8±2	0.022 C	-
-	4.942	4.3 C	0.046 C	-
-	-6.54	1480 C	9.18	-
β ⁻	-4.22	10±2	0.003 C	-
β ⁻	1.66	0.65±0.10	5x10 ⁻⁴ C	-
IT 73%, β ⁻ 27%	-	0.13	-	-
β ⁻	-9.014	1500 C	1.07	-
β ⁻ 99.86%, IT 0.14%	-	860	-	-
β ⁻	-10.320	(36±8)10 ⁻¹	-	-
β ⁻	-5.52	2.5±0.3	5x10 ⁻⁴ C	-
β ⁻	0.19	0.5	10 ⁻⁴ C	-
β ⁻	-8.696	1578±100 F	2.07	3.87 P
β ⁻	-	800±75	-	-
β ⁻	-	778±75	-	-
β ⁻	0.486	27 C	0.24 C	-
β ⁻ 99.7%, E 0.03%	3.76	7.7 C	7x10 ⁻³ C	-
E 56%, β ⁻ 44%	-9.424	1600±100 F	0.767 P	1.54 P
E 56%, β ⁻ 44%	-	300±30	-	-
IT	-	1300±100	-	-
IT	-	-	-	162.7±2.5

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
49	¹¹⁵ In	95.7(2)	(n,p)	¹¹⁵ Cd	53.46(10) h
			(n,p)*	^{115m} Cd	44.6(3) d
			(n,α)	¹¹² Ag	3.14(2) h
			(n,2n)	¹¹⁴ In	71.9(1) s
			(n,2n)*	^{114m} In	49.51(1) d
			(n,He ³)	¹¹³ Ag	5.37(5) h
			(n,n')	^{115m} In	4.486(4) h
50	¹¹² Sn	0.97(1)	(n,p)	¹¹² In	14.4(2) m
			(n,α)	¹⁰⁹ Cd	462.9(20) d
			(n,2n)	¹¹¹ Sn	35.3(8) m
			(n,d)	¹¹¹ In	2.83(1) d
			(n,t)	¹¹⁰ In	69.1(5) m
50	¹¹⁴ Sn	0.65(1)	(n,p)	¹¹⁴ In	71.9(1) s
			(n,p)*	^{114m} In	49.51(1) d
			(n,α)	¹¹¹ Cd	stable
			(n,2n)	¹¹³ Sn	115.09(4) d
			(n,2n)*	^{113m} Sn	21.4(4) m
50	¹¹⁵ Sn	0.36(1)	(n,p)	¹¹⁵ In	4.41(25)x10 ¹⁴ y
			(n,α)	¹¹² Cd	stable
			(n,2n)	¹¹⁴ Sn	stable
50	¹¹⁶ Sn	14.53(11)	(n,p)	¹¹⁶ In	14.01(3) s
			(n,p)*	^{116m} In	54.15(6) m
			(n,α)	¹¹³ Cd	9.3(19)x10 ¹⁵ y
			(n,2n)	¹¹⁵ Sn	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	0.668	15±5	0.041 C	-
β ⁻	-	7	-	-
β ⁻	2.68	2.5±0.5	10 ⁻¹ C	-
β ⁻ 99.5%, E 0.5%	-9.029	1710±80 F	1.13 P	2.169 P
IT 95%, β ⁻ 5%	-	1262±100 F	0.761	1.551 P
β ⁻	-9.34	0.007	-	-
IT 95%, β ⁻ 5%	-	-	190.3±7.3	198.1±2.6
E 56%, β ⁻ 44%	0.124	94.7 C	1.7 C	-
E	5.539	17.9 C	0.046 C	-
E	-10.802	1500±280	0.245 P	0.557 P
E	-5.286	168±59	-	-
E	-9.110	(77.5±13)10 ⁻¹	-	-
β ⁻ 99.5%, E 0.5%	-1.198	45.5 C	0.22 C	-
IT 95,7%, E 4.3%	-	18.6±5	-	-
-	4.334	10.8 C	0.01 C	-
E	-10.32	1105±50	0.305	-
IT 91.1%, E 8.9%	-	1050	-	-
β ⁻	0.296	31.7 C	0.13 C	-
-	6.196	8.4 C	0.15 C	-
-	-7.534	1450 C	3.59	-
β ⁻ >99.94%, E<0.06%	-2,491	22±2	0.031 C	-
β ⁻	-	9.7±0.9	-	-
β ⁻	3.169	6.6 C	0.002 C	-
-	-9.566	1470 C	0.635	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
50	¹¹⁷ Sn	7.68(7)	(n,p)	¹¹⁷ In	43.8(7) m
			(n,p)*	^{117m} In	116.5(7) m
			(n,p)*	^{117a} In	43.8(7) m
			(n,α)	¹¹⁴ Cd	stable
			(n,2n)	¹¹⁶ Sn	stable
			(n,np)*	^{116m} In	54.15(6) m
50	¹¹⁸ Sn	24.22(11)	(n,p)	¹¹⁸ In	5.0(3) s
			(n,p)*	^{118m} In	4.45(5) m
			(n,α)	¹¹⁵ Cd	53.46(10) h
			(n,2n)	¹¹⁷ Sn	stable
			(n,2n)*	^{117m} Sn	13.61(4) d
50	¹¹⁹ Sn	8.58(4)	(n,p)	¹¹⁹ In	2.4(1) m
			(n,p)*	^{119m} In	18.0(3) m
			(n,α)	¹¹⁶ Cd	stable
			(n,2n)	¹¹⁸ Sn	stable
50	¹²⁰ Sn	32.59(10)	(n,p)	¹²⁰ In	3.08(8) s
			(n,α)	¹¹⁷ Cd	2.49(4) h
			(n,α)*	^{117m} Cd	3.36(5) h
			(n,α)*	^{117a} Cd	2.49(4) h
			(n,2n)	¹¹⁹ Sn	stable
50	¹²¹ Sn		(n,2n)	¹²⁰ Sn	stable
50	¹²² Sn	4.63(3)	(n,p)	¹²² In	10.0(5) s
			(n,α)	¹¹⁹ Cd	2.69(2) m
			(n,2n)	¹²¹ Sn	27.06(4) h
50	¹²⁴ Sn	5.79(5)	(n,p)	¹²⁴ In	3.17(5) s
			(n,α)	¹²¹ Cd	13.5(3) s
			(n,2n)	¹²³ Sn	129.2(4) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-0.681	16±4	0.036 C	-
β ⁻ 52.9%, IT 47.1%	-	5.3±0.6	-	-
β ⁻	-	10.7±0.7	-	-
-	5.268	5.2 C	0.041 C	-
-	-6.942	1500 C	6.35	-
β ⁻	-	1.14±0.3	-	-
β ⁻	-3.42	9±3	0.008 C	-
β ⁻	-	6	-	-
β ⁻	2.089	0.94±0.10 F	2.4×10 ⁻⁴ P	7×10 ⁻⁴ P
-	-9.327	1520 C	0.817	-
IT	-	790±45	-	-
β ⁻	-1.565	10±2	0.009 C	-
β ⁻ 97.5%, IT 2.5%	-	3	-	-
-	4.3	3.3 C	0.015 C	-
-	-6.485	1540 C	9.84	-
β ⁻	-4.82	4.3±0.7	0.001 C	-
β ⁻	0.96	0.4	10 ⁻⁴ C	-
β ⁻	-	0.19±0.05	-	-
β ⁻	-	0.202±0.080	-	-
-	-9.104	1560 C	1.03	-
-	?	-	0.89 P	-
β ⁻	-5.92	2.7 C	2×10 ⁻⁴ C	-
β ⁻	-0.08	1.7 C	< 10 ⁻³ C	-
β ⁻	-8.805	1600 C	1.39	-
β ⁻	-6.62	1.3 C	10 ⁻⁴ C	-
β ⁻	-1.98	1.1 C	< 10 ⁻³ C	-
β ⁻	-8.493	1630 C	1.84	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
50	¹¹⁴ Sn	5.79(5)	(n,2n)*	¹¹³ Sn	40.08(7) m
51	¹¹⁵ Sb	57.3(9)	(n,p)	¹¹⁵ Sn	27.06(4) h
			(n,α)	¹¹⁴ In	5.0(3) s
			(n,2n)	¹¹⁴ Sb	15.89(4) m
			(n,2n)*	¹¹⁰ Sb	5.76(2) d
			(n,2n)*	¹¹⁰ Sb	15.89(4) m
51	¹¹⁵ Sb	42.7(9)	(n,p)	¹¹⁵ Sn	129.2(4) d
			(n,α)	¹¹⁴ In	3.08(8) s
			(n,2n)	¹¹⁵ Sb	2.70(1) d
			(n,2n)*	¹¹² Sb	4.2(2) m
52	¹¹⁶ Te	0.096(2)	(n,p)	¹¹⁶ Sb	15.89(4) m
			(n,α)	¹¹⁷ Sn	stable
			(n,2n)	¹¹⁵ Te	16.05(5) h
52	¹¹⁶ Te	2.60(10)	(n,p)	¹¹⁶ Sb	2.70(1) d
			(n,α)	¹¹⁶ Sn	stable
			(n,2n)	¹²¹ Te	16.78(35) d
			(n,2n)*	¹¹⁸ Te	154(7) d
			(n,2n)*	¹²¹ Te	16.78(35) d
52	¹²³ Te	0.908(3)	(n,p)	¹²³ Sb	stable
			(n,α)	¹²⁴ Sn	stable
			(n,2n)	¹²³ Te	stable
52	¹²⁴ Te	4.816(8)	(n,p)	¹²⁴ Sb	60.20(3) d
			(n,p)*	¹²⁴ Sb	93(5) s
			(n,α)	¹²¹ Sn	27.06(4) h
			(n,2n)	¹²³ Te	1.3x10 ¹¹ y
			(n,2n)*	¹²³ Te	119.7(1) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-	546±30	-	-
β ⁻	0.395	9.1 C	0.16 C	-
β ⁻	3.51	3.6 C	4x10 ⁻⁴ C	-
E	-9.248	1500±100 F	0.846 P	1.75 P
E	-	530±50	-	-
E	-	1050±100	-	-
β ⁻	-0.628	4.6±1.5	0.032 C	-
β ⁻	1.92	2.3 C	3x10 ⁻⁴ C	-
β ⁻ 97.62%, E 2.38%	-8.965	1420±140 F	1.05 P	1.998 P
IT	-	1000	-	-
E	-0.206	30.6 C	0.86 C	-
-	6.637	7.8 C	0.13 C	-
E	-10.286	1300±130	0.326	-
β ⁻ 97.62%, E 2.38%	1.196	12±2	0.17 C	-
-	5.404	4.9 C	0.024 C	-
E	-9.79	1550±100	0.417	-
IT 88.6%, E 11.4%	-	850±70	-	-
E	-	700±70	-	-
-	0.84	10.7 C	0.25 C	-
-	7.579	4 C	0.56 C	-
-	-6.93	1560 C	6.45	-
β ⁻	-2.117	9±2	0.044 C	-
IT 75%, β ⁻ 25%	-	4.5	-	-
β ⁻	4.335	3.2 C	0.006 C	-
E	-9.424	1570 C	0.771	-
IT	-	850±75	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
52	¹¹³ Te	7.14(1)	(n,p)	¹¹³ Sb	2.73(3) y
			(n,α)	¹¹² Sn	stable
			(n,2n)	¹¹⁴ Te	stable
52	¹¹⁴ Te	18.95(1)	(n,p)	¹¹⁴ Sb	12.4(1) d
			(n,α)	¹¹³ Sn	129.2(4) d
			(n,α)*	^{113m} Sn	40.08(7) m
			(n,2n)	¹¹⁵ Te	stable
52	¹¹⁵ Te	31.69(2)	(n,p)	¹¹⁵ Sb	9.01(3) h
			(n,p)*	^{115m} Sb	10.4(2) m
			(n,α)	¹¹⁵ Sn	9.64(3) d
			(n,α)*	^{115m} Sn	9.52(5) m
			(n,2n)	¹¹⁷ Te	9.35(7) h
			(n,2n)*	^{117m} Te	109(2) d
			(n,2n)*	^{115m} Te	9.35(7) h
			(n,d)	¹¹⁷ Sb	3.85(5) d
52	¹¹⁶ Te	33.80(2)	(n,p)	¹¹⁶ Sb	38.4 m
			(n,p)*	^{116m} Sb	6.3(2) m
			(n,α)	¹¹⁷ Sn	2.10(4) h
			(n,2n)	¹¹⁸ Te	69.6(2) m
			(n,2n)*	^{118m} Te	33.6(1) d
			(n,d)	¹¹⁸ Sb	17.7 m
			(n,He ³)	¹¹⁸ Sn	59.1(5) m
53	¹¹⁷ I	100	(n,p)	¹¹⁷ Te	9.35(7) h
			(n,p)*	^{117m} Te	109(2) d
			(n,p)*	^{117f} Te	9.35(7) h
			(n,α)	¹¹⁴ Sb	60.20(3) d
			(n,2n)	¹¹⁴ I	13.02(7) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	0.018	5.4 C	0.078 C	-
-	6.555	2.6 C	0.13 C	-
-	-6.585		8.95	-
β ⁻	-2.95	5±1	0.013 C	-
β ⁻	3.39	2.1±0.6	0.001 C	-
β ⁻	-	0.6	-	-
-	-9.109	1620 C	1.05	-
β ⁻	-3.5	2.4±0.4	0.006 C	-
β ⁻ 96.4%, IT 3.6%	-	1.0±0.2	-	-
β ⁻	2.548	1.1±0.3	4x10 ⁻⁴ C	-
β ⁻	-	0.4	-	-
β ⁻	-8.772	1690±130	1.37	-
IT 97.6%, β ⁻ 2.4%	-	940	-	-
β ⁻	-	720±60	-	-
β ⁻	-7.346	0.65±0.20	-	-
β ⁻	-4.22	1.8±0.3	0.002 C	-
β ⁻	-	0.6	-	-
β ⁻	1.810	0.4±0.1	2x10 ⁻⁴ C	-
β ⁻	-8.413	1700±120	1.80	2.257 P
IT 64%, β ⁻ 36%	-	100	-	-
β ⁻	-7.819	0.65±0.2	-	-
β ⁻	-10.797	0.014±0.008	-	-
β ⁻	0.09	9±3 F	0.068 C	-
IT 97.6%, β ⁻ 2.4%	-	6±2	0.013±0.001	-
β ⁻	-	-	0.009±0.0005	-
β ⁻	4.279	1.4±0.2 F	0.003 C	-
E 56.3%, β ⁻ 43.7%	-9.139	1496±100 F	1.050±0.065	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
54	¹¹⁴ Xe	0.10(1)	(n,p)	¹¹⁴ I	4.18(2) d
			(n,α)	¹¹¹ Te	16.78(35) d
			(n,2n)	¹¹³ Xe	2.08(2) h
54	¹¹⁶ Xe	0.09(1)	(n,p)	¹¹⁶ I	13.02(7) d
			(n,α)	¹¹³ Te	1.3x10 ¹³ y
			(n,2n)	¹¹⁵ Xe	16.9(2) h
			(n,2n)*	^{115m} Xe	57(1) s
54	¹¹⁸ Xe	1.91(3)	(n,p)	¹¹⁸ I	24.99(2) m
			(n,α)	¹¹⁵ Te	stable
			(n,2n)	¹¹⁷ Xe	36.4(1) d
			(n,2n)*	^{117m} Xe	69.2(9) s
54	¹¹⁹ Xe	26.4(6)	(n,p)	¹¹⁹ I	1.57(4)x10 ⁷ y
			(n,α)	¹¹⁶ Te	stable
			(n,2n)	¹²⁰ Xe	stable
54	¹²⁰ Xe	4.1(1)	(n,p)	¹²⁰ I	12.36(1) h
			(n,α)	¹¹⁷ Te	9.35(7) h
			(n,2n)	¹¹⁹ Xe	stable
54	¹²¹ Xe	21.2(4)	(n,p)	¹²¹ I	8.04(1) d
			(n,α)	¹¹⁸ Te	> 8x10 ¹⁴ y
			(n,2n)	¹²⁰ Xe	stable
54	¹²² Xe	26.9(5)	(n,p)	¹²² I	2.30(3) h
			(n,α)	¹¹⁹ Te	69.6(2) m
			(n,2n)	¹²¹ Xe	stable
			(n,2n)*	^{121m} Xe	11.9(1) d
54	¹²⁴ Xe	10.4(2)	(n,p)	¹²⁴ I	52.6(4) m
			(n,α)	¹²¹ Te	25.0(1) m
			(n,2n)	¹²³ Xe	5.245(6) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
E	0.69	42.2 C	2.5 C	-
E	6.79	9.2 C	0.076 C	-
E	-10.23	1200±100	0.34 C	-
E 56.3%, β ⁻ 43.7%	-0.468	21.1 C	0.42 C	-
E	5.644	5.9 C	0.018 C	-
E	-10.09	1400±100	0.352	-
IT	-	700	-	-
β ⁻ 93.1%, E 6.9%	-1.342	10.7 C	0.11 C	-
-	4.184	3.8 C	6x10 ⁻¹ C	-
E	-9.614	1550±150	0.623	-
IT	-	840	-	-
β ⁻	0.592	7.6 C	0.12 C	-
-	7.018	3.1 C	0.12 C	-
-	-6.905	1600 C	6.61	-
β ⁻	-2.21	9±2	0.029 C	-
β ⁻	4.055	2.5 C	2x10 ⁻¹ C	-
-	-9.258	1630 C	0.843	-
β ⁻	-0.188	6±1	0.038 C	-
2β ⁻	6.222	2 C	0.044 C	-
-	-6.606	1650 C	8.36	-
β ⁻	-2.798	3.0±0.5	0.012 C	-
β ⁻	3.372	1.7 C	7x10 ⁻⁴	-
-	-8.936	1670 C	1.068	-
IT	-	770	-	-
β ⁻	-3.37	2.0±0.5	5x10 ⁻¹ C	-
β ⁻	2.715	1.1 C	3x10 ⁻⁴ C	-
β ⁻	-8.535	1700±170	1.52	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
54	¹³⁴ Xe	10.4(2)	(n,2n)*	^{133m} Xe	2.188(8) d
54	¹³⁶ Xe	8.9(1)	(n,p)	¹³⁶ I	84(1) s
			(n,α)	¹³² Te	12.45(28) m
			(n,2n)	¹³⁵ Xe	9.09(1) h
			(n,2n)*	^{133m} Xe	15.29(3) m
55	¹³³ Cs	100	(n,p)	¹³³ Xe	5.245(6) d
			(n,p)*	^{133m} Xe	2.188(8) d
			(n,α)	¹³⁰ I	12.36(1) h
			(n,α)*	^{130m} I	9.0(1) m
			(n,2n)	¹³² Cs	6.475(10) d
			(n,d)	¹³² Xe	stable
			(n,He ³)	¹³¹ I	8.04(1) d
56	¹³⁶ Ba	0.106(2)	(n,p)	¹³⁶ Cs	29.2 m
			(n,α)	¹³⁷ Xe	36.4(1) d
			(n,2n)	¹²⁹ Ba	2.23(11) h
56	¹³⁷ Ba	0.101(2)	(n,p)	¹³⁷ Cs	6.475(10) d
			(n,α)	¹³⁹ Xe	stable
			(n,2n)	¹³⁴ Ba	11.8(2) d
56	¹³⁴ Ba	2.417(27)	(n,p)	¹³⁴ Cs	2.062(5) y
			(n,α)	¹³¹ Xe	stable
			(n,2n)	¹³³ Ba	10.74(5) y
			(n,2n)*	^{133m} Ba	38.9(1) h
56	¹³⁵ Ba	6.592(18)	(n,p)	¹³⁵ Cs	3x10 ⁶ y
			(n,p)*	^{135m} Cs	53(2) m
			(n,α)	¹³² Xe	stable
			(n,2n)	¹³⁴ Ba	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
IT	-	665	-	-
β ⁻	-6.22	0.7 C	10 ⁻¹ C	-
β ⁻	2.12	0.8 C	10 ⁻¹ C	-
β ⁻	-7.992	1750±100	2.88	-
IT, β ⁻ 0.004%	-	750	-	-
β ⁻	0.355	11.3±2 F	0.081 C	-
IT	-	4.8±0.8	-	-
β ⁻	4.448	1.3±0.3 F	0.0030±0.0008	-
IT 83%, β ⁻ 17%	-	0.54±0.08	-	-
E 98%, β ⁻ 2%	-8.979	1603±100 F	1.043 P	2.02 P
-	-3.87	0.9	-	-
β ⁻	-7.503	(3.05±0.5)10 ⁻³	-	-
E 98.4%, β ⁻ 1.6%	0.3418	29.3 C	1.0 C	-
E	6.667	6.9 C	0.033 C	-
E	-10.22	1550 C	0.366	-
E 98%, β ⁻ 2%	-0.489	15.0 C	0.28 C	-
-	5.89	4.5 C	0.012 C	-
E	-9.803	1600±100	0.668	-
β ⁻ , E 0.0003%	-1.276	7.7 C	0.084 C	-
-	5.096	3 C	4x10 ⁻³ C	-
E	-9.464	1640 C	0.847	-
IT 99.99%, E 0.01%	-	820±65	-	-
β ⁻	0.573	5.6 C	0.095 C	-
IT	-	0.297±0.035	-	-
-	7.057	2.5 C	0.06 C	-
-	-6.975	1675 C	4.9	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
56	¹³⁶ Ba	7.854(39)	(n,p)	¹³⁶ Cs	13.16(3) d
			(n,α)	¹³³ Xe	5.245(6) d
			(n,2n)	¹³⁵ Ba	stable
			(n,2n)*	^{135m} Ba	28.7(2) h
56	¹³⁷ Ba	11.23(4)	(n,p)	¹³⁷ Cs	30.17 y
			(n,α)	¹³⁴ Xe	stable
			(n,2n)	¹³⁶ Ba	stable
			(n,np)	¹³⁶ Cs	13.16(3) d
56	¹³⁸ Ba	71.70(7)	(n,p)	¹³⁸ Cs	32.2(1) m
			(n,α)	¹³⁵ Xe	9.09(1) h
			(n,α)*	^{135m} Xe	15.29(3) m
			(n,2n)	¹³⁷ Ba	stable
			(n,2n)*	^{137m} Ba	2.5513(7) m
57	¹³⁸ La	0.09(1)	(n,p)	¹³⁸ Ba	stable
			(n,α)	¹³⁵ Cs	3x10 ⁶ y
			(n,2n)	¹³⁷ La	6(2)x10 ⁴ y
57	¹³⁹ La	99.91(1)	(n,p)	¹³⁹ Ba	84.63(34) m
			(n,α)	¹³⁶ Cs	13.16(3) d
			(n,2n)	¹³⁸ La	1.28(12)x10 ¹¹ y
58	¹³⁶ Ce	0.19(1)	(n,p)	¹³⁶ La	9.87(3) m
			(n,α)	¹³³ Ba	10.74(5) y
			(n,2n)	¹³⁵ Ce	17.6 h
58	¹³⁸ Ce	0.25(1)	(n,p)	¹³⁸ La	1.28(12)x10 ¹¹ y
			(n,α)	¹³⁵ Ba	stable
			(n,2n)	¹³⁷ Ce	9.0(3) h
			(n,2n)*	^{137m} Ce	34.4(3) h

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-1.765	6.2±1.1	0.04 C	-
β ⁻	4.403	2 C	1.5x10 ⁻¹ C	-
-	-9.107	1690 C	0.828	-
IT	-	920±75	-	-
β ⁻	-0.391	2.9 C	0.022 C	-
-	6.036	1.7 C	0.015 C	-
-	-6.902	1710 C	6.43	-
β ⁻	-	8.60±0.25	-	-
β ⁻	-4.62	2.8±0.2	5x10 ⁻⁴ C	-
β ⁻	3.875	2.16±0.2	0.0019±0.0003	-
IT, β ⁻ 0.004%	-	0.55	-	-
-	-8.612	1720 C	1.71	-
IT	-	890±50	2.4±0.3	-
-	2.577	4.8 C	25 C	-
β ⁻	6.826	2.2	0.03 C	-
E	-7.32	1700	5.03	-
β ⁻	-1.478	4.8±0.4	4x10 ⁻¹ C	-
β ⁻	4.817	1.8±0.3	2x10 ⁻¹ C	-
E 66.7%, β ⁻ 33.3%	-8.778	1710 C	1.40	-
E	0.35	20.9 C	0.8 C	-
E	6.757	5.3 C	0.019 C	-
E	-10.10	1600±140	0.457	-
E 66.7%, β ⁻ 33.3%	-0.274	10.9 C	0.28 C	-
-	5.979	3.6 C	7x10 ⁻¹ C	-
E	-9.57	1900±200	0.703	-
IT 99.22%, E 0.78%	-	970±90	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life	Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
								14 MeV	U-235 spectrum	Cf-252 spectrum
58	¹⁴⁰ Ce	88.48(10)	(n,p)	¹⁴⁰ La	40.272(7) h	β ⁻	-2.984	6.5±0.5	5x10 ⁻³ C	-
			(n,α)*	¹³⁷ Ba	2.5513(7) m	IT	5.338	11.5±1 F	3x10 ⁻³ C	-
			(n,2n)	¹³⁸ Ce	137.66(13) d	E	-9.203	1963±70 F	1.38 P	2.61 P
			(n,2n)*	¹³⁹ Ce	56.4(5) s	IT	-	963±100 F	0.46 P	0.928 P
			(n,2n)*	¹³⁹ Ce	137.66(13) d	E	-	1000±100	-	-
58	¹⁴¹ Ce	11.08(10)	(n,p)	¹⁴¹ La	91.1(5) m	β ⁻	-3.735	4±1	2x10 ⁻³ C	-
			(n,α)	¹³⁷ Ba	84.63(34) m	β ⁻	6.085	5.5±1	8x10 ⁻³ C	-
			(n,2n)	¹⁴¹ Ce	32.501(5) d	β ⁻	-7.16	1900±70 F	7.55 P	11.66 P
			(n,d)	¹⁴¹ La	3.92(3) h	β ⁻	-6.582	1.3±0.2	-	-
			(n,He ³)	¹⁴⁰ Ba	12.746(10) d	β ⁻	-8.107	(3.3±1.3)10 ⁻³	-	-
59	¹⁴¹ Pr	100	(n,p)	¹⁴¹ Ce	32.501(5) d	β ⁻	0.201	9±1	0.035 C	-
			(n,α)	¹³⁸ La	1.28(12)x10 ¹¹ y	E 66.7%, β ⁻ 33.3%	6.146	3.2 C	7x10 ⁻³ C	-
			(n,2n)	¹⁴⁰ Pr	3.39(1) m	E	-9.397	1660±200 F	1.16 P	2.23 P
			(n,t)	¹³⁹ Ce	137.66(13) d	E	-5.948	(137±31)10 ⁻³	-	-
60	¹⁴² Nd	27.13(10)	(n,p)	¹⁴² Pr	19.12(4) h	β ⁻ 99.98%, E0.02%	-1.381	14±2	0.042 C	-
			(n,α)	¹³⁹ Ce	137.66(13) d	E	6.642	7.1±0.8	0.01 C	-
			(n,2n)	¹⁴¹ Nd	2.49(3) h	E	-9.813	1770±120 F	0.657 P	1.362 P
			(n,2n)*	¹⁴¹ Nd	62.4(9) s	IT 99.97%, E 0.03%	-	550±50	-	-
			(n,2n)*	¹⁴¹ Nd	2.49(3) h	E	-	1220±120	-	-
60	¹⁴³ Nd	12.18(5)	(n,p)	¹⁴³ Pr	13.58(3) d	β ⁻	-0.15	12±2	0.017 C	-
			(n,α)	¹⁴⁰ Ce	stable	-	9.719	3.5 C	0.71 C	-
			(n,2n)	¹⁴² Nd	stable	-	-6.125	1720 C	15.2	-
60	¹⁴⁴ Nd	23.80(10)	(n,p)	¹⁴⁴ Pr	17.28(5) m	β ⁻	-2.214	8.11 C	0.013 C	-
			(n,α)	¹⁴¹ Ce	32.501(5) d	β ⁻	7.330	2.9 C	0.027 C	-
			(n,2n)	¹⁴³ Nd	stable	-	-7.817	1750±120	3.63	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
60	¹⁴³ Nd	8.30(5)	(n,p)	¹⁴³ Pr	5.98(2) h
			(n,α)	¹⁴¹ Ce	> 5x10 ¹⁴ y
			(n,2n)	¹⁴⁴ Nd	2.1(4)x10 ¹¹ y
60	¹⁴⁴ Nd	17.19(8)	(n,p)	¹⁴⁴ Pr	24.15(18) m
			(n,α)	¹⁴³ Ce	33.0(2) h
			(n,2n)	¹⁴⁵ Nd	> 6x10 ¹⁴ y
60	¹⁴⁵ Nd	5.76(3)	(n,p)	¹⁴⁵ Pr	2.27(4) m
			(n,α)	¹⁴³ Ce	2.98(15) m
			(n,2n)	¹⁴⁷ Nd	10.98(1) d
60	¹⁴⁶ Nd	5.64(3)	(n,p)	¹⁴⁶ Pr	6.19(16) s
			(n,α)	¹⁴⁷ Ce	56.4(12) s
			(n,2n)	¹⁴⁸ Nd	1.725(7) h
62	¹⁴⁸ Sm	3.1(1)	(n,p)	¹⁴⁸ Pm	363(4) d
			(n,α)	¹⁴⁶ Nd	2.49(3) h
			(n,2n)	¹⁴⁹ Sm	8.83(1) m
			(n,2n)*	¹⁴⁸ Sm	66(2) s
			(n,2n)*	¹⁴⁹ Sm	8.83(1) m
62	¹⁴⁷ Sm	15.0(2)	(n,p)	¹⁴⁷ Pm	2.6234(2) y
			(n,α)	¹⁴⁴ Nd	2.1(4)x10 ¹⁵ y
			(n,2n)	¹⁴⁸ Sm	1.03(5)x10 ¹ y
62	¹⁴⁸ Sm	11.3(1)	(n,p)	¹⁴⁸ Pm	5.370(9) d
			(n,p)*	¹⁴⁸ Pm	41.29(11) d
			(n,α)	¹⁴⁶ Nd	> 6x10 ¹⁴ y
			(n,2n)	¹⁴⁷ Sm	1.06(2)x10 ¹¹ y
62	¹⁴⁹ Sm	13.8(1)	(n,p)	¹⁴⁹ Pm	53.08(5) h
			(n,α)	¹⁴⁶ Nd	stable
			(n,2n)	¹⁴⁸ Sm	7(3)x10 ¹⁵ y

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-1.023	5.92 C	5x10 ⁻¹ C	-
-	8.729	2.4 C	0.2 C	-
α	-5.76	1760 C	22.5	-
β ⁻	-3.3	4.7±0.6	2x10 ⁻³ C	-
β ⁻	6.342	4.4±0.5	6x10 ⁻³ C	-
α	-7.565	1861±150 F	5.23 P	8.52 P
β ⁻	-4.12	3.5±0.8	8x10 ⁻⁴ C	-
β ⁻	5.37	1.4 C	2x10 ⁻³ C	-
β ⁻	-7.324	1829±150 F	6.43 P	10.25 P
β ⁻	-4.22	1.2 C	6x10 ⁻⁴ C	-
β ⁻	4.21	1 C	3x10 ⁻⁴ C	-
β ⁻	-7.357	1900±150 F	7.22 P	11.33 P
E	0.22	40.3 C	0.39 C	-
E	7.918	7.2 C	0.031 C	-
E	-10.554	1700±120 F	0.386 P	0.85 P
IT 99.76%, E 0.24%	-	600±100	-	-
E	-	1100±120	-	-
β ⁻	0.558	15.6 C	0.048 C	-
α	10.114	4.1 C	0.63 C	-
α	-6.373	1740 C	13.5	-
β ⁻	-1.683	10±1	0.023 C	-
β ⁻ 95.4%, IT 4.6%	-	5.8±0.8	-	-
α	7.734	3.4 C	0.024 C	-
α	-8.141	1789±150 F	3.43 P	5.83 P
β ⁻	-0.289	8,3 C	0.013 C	-
-	9.426	2.8 C	0.2 C	-
α	-5.873	1780 C	20.9	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
62	¹⁵⁰ Sm	7.4(1)	(n,p)	¹⁵⁰ Pm	2.68(2) h
			(n,α)	¹⁴⁷ Nd	10.98(1) d
			(n,2n)	¹⁴⁹ Sm	> 2x10 ¹⁵ y
62	¹⁵² Sm	26.7(2)	(n,p)	¹⁵² Pm	4.1(1) m
			(n,α)	¹⁴⁹ Nd	1.725(7) h
			(n,2n)	¹⁵¹ Sm	90(6) y
62	¹⁵⁴ Sm	22.7(2)	(n,p)	¹⁵⁴ Pm	1.7(2) m
			(n,α)	¹⁵¹ Nd	12.44(7) m
			(n,2n)	¹⁵³ Sm	46.7(1) h
63	¹⁵¹ Eu	47.8(5)	(n,p)	¹⁵¹ Sm	90(6) y
			(n,α)	¹⁴⁹ Pm	5.370(9) d
			(n,2n)	¹⁵⁰ Eu	12.62(10) h
63	¹⁵³ Eu	52.2(5)	(n,p)	¹⁵³ Sm	46.7(1) h
			(n,α)	¹⁵⁰ Pm	2.68(2) h
			(n,2n)	¹⁵² Eu	13.33(4) y
			(n,2n)*	^{152m1} Eu	9.32(1) h
			(n,2n)*	^{152m2} Eu	96(1) m
64	¹⁵² Gd	0.20(1)	(n,p)	¹⁵² Eu	13.33(4) y
			(n,α)	¹⁴⁹ Sm	> 2x10 ¹⁵ y
			(n,2n)	¹⁵¹ Gd	120(20) d
64	¹⁵⁴ Gd	2.18(3)	(n,p)	¹⁵⁴ Eu	8.8(1) y
			(n,α)	¹⁵¹ Sm	90(6) y
			(n,2n)	¹⁵³ Gd	241.6(2) d
64	¹⁵⁵ Gd	14.89(5)	(n,p)	¹⁵⁵ Eu	4.96(1) y
			(n,α)	¹⁵² Sm	stable
			(n,2n)	¹⁵⁴ Gd	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)			
		14 MeV	U-235 spectrum		Cf-252 spectrum
β ⁻	-2.72	7.2±1	5x10 ⁻³ C	-	
β ⁻	6.743	3.5±0.5	5x10 ⁻³ C	-	
α	-7.986	1803±150 P	3.67 P	6.18 P	
β ⁻	-2.62	3.7±0.4	5x10 ⁻³ C	-	
β ⁻	5.275	1.7±0.2	8x10 ⁻⁴ C	-	
β ⁻	-8.267	1855±150 P	2.46	4.34 P	
β ⁻	-3.22	3.5±0.4	3x10 ⁻³ C	-	
β ⁻	4.095	0.9±0.1	10 ⁻⁴ C	-	
β ⁻	-7.978	1885±130 P	4.09 P	6.83 P	
β ⁻	0.706	9.9 C	0.049 C	-	
β ⁻	7.869	3.1 C	0.021 C	-	
β ⁻ 89%, E 11%	-7.982	1800±100	3.55	-	
β ⁻	-0.02	6±1	0.015 C	-	
β ⁻	5.83	2.2±0.3	10 ⁻³ C	-	
E 72.08%, β ⁻ 27.92%	-8.555	1950±200	2.15	-	
β ⁻ 72%, E 28%	-	500±100	-	-	
IT	-	70	-	-	
E 72.08%, β ⁻ 27.92%	-1.045	-	0.05 C	-	
α	8.074	4 C	0.018 C	-	
E, αw	-8.597	1800±200	2.14	-	
β ⁻ 99.98%, E 0.02%	-1.296	8.6 C	0.038 C	-	
β ⁻	6.509	2.8 C	2x10 ⁻³ C	-	
E	-8.657	1900±150	2.02	-	
β ⁻	0.538	6.3 C	0.032 C	-	
-	8.331	2.3 C	0.024 C	-	
-	-6.446	1850±100	12.9	-	

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
64	¹⁵⁶ Gd	20.47(4)	(n,p)	¹⁵⁶ Eu	15.19(6) d
			(n,α)	¹⁵³ Sm	46.7(1) h
			(n,2n)	¹⁵⁵ Gd	stable
64	¹⁵⁷ Gd	15.65(3)	(n,p)	¹⁵⁷ Eu	15.15(4) h
			(n,α)	¹⁵⁴ Sm	stable
			(n,2n)	¹⁵⁶ Gd	stable
64	¹⁵⁸ Gd	24.84(12)	(n,p)	¹⁵⁸ Eu	44(4) m
			(n,α)	¹⁵⁵ Sm	22.1(2) m
			(n,2n)	¹⁵⁷ Gd	stable
64	¹⁵⁹ Gd	21.86(4)	(n,p)	¹⁵⁹ Eu	44(4) s
			(n,α)	¹⁵⁶ Sm	8.0(5) m
			(n,2n)	¹⁵⁸ Gd	18.56(8) h
65	¹⁵⁹ Tb	100	(n,p)	¹⁵⁹ Gd	18.56(8) h
			(n,α)	¹⁵⁶ Eu	15.19(6) d
			(n,2n)	¹⁵⁸ Tb	150(30) y
			(n,2n)*	^{158a} Tb	10.5(2) s
			(n,He ³)	¹⁵⁷ Eu	15.15(4) h
66	¹⁵⁶ Dy	0.06(1)	(n,p)	¹⁵⁶ Tb	5.34(9) d
			(n,α)	¹⁵³ Gd	241.6(2) d
			(n,2n)	¹⁵⁵ Dy	10.0(3) h
66	¹⁵⁷ Dy	0.10(1)	(n,p)	¹⁵⁷ Tb	150(3) y
			(n,α)	¹⁵⁴ Gd	stable
			(n,2n)	¹⁵⁶ Dy	8.1(1) h
66	¹⁵⁸ Dy	2.34(5)	(n,p)	¹⁵⁸ Tb	72.3(2) d
			(n,α)	¹⁵⁵ Gd	stable
			(n,2n)	¹⁵⁷ Dy	144.4(2) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-1.67	4.7 C	0.021 C	-
β ⁻	5.666	2 C	6x10 ⁻³ C	-
-	-8.531	1800±100	2.21	-
β ⁻	-0.578	5.4±1.1	6x10 ⁻³ C	-
-	7.277	1.7 C	6x10 ⁻³ C	-
-	-6.368	1850±100	14.4	-
β ⁻	-2.65	2.5 C	4x10 ⁻³ C	-
β ⁻	5.16	1.4 C	3x10 ⁻⁴ C	-
-	-7.931	1850±100	3.76	-
β ⁻	-3.62	1.4 C	9x10 ⁻⁴ C	-
β ⁻	3.5	1 C	< 10 ⁻⁴ C	-
β ⁻	-7.453	1800±120	6.12	-
β ⁻	-0.168	4.7±0.7	0.01 C	-
β ⁻	6.215	1.8 C	8x10 ⁻⁴ C	-
E 82%, β ⁻ 18%	-8.136	1800±120	3.02	-
IT	-	450±65	-	-
β ⁻	-6.903	(5.2±2.0)10 ⁻³	-	-
E	0.520	22.3 C	0.42 C	-
E	8.261	4.6 C	0.01 C	-
E	-9.442	1850±150	0.651	-
E 82%, β ⁻ 18%	-0.162	12.1 C	0.13 C	-
-	7.327	3.3 C	3x10 ⁻³ C	-
E	-9.061	1950±170	1.66	-
β ⁻	-1.052	7.0±1.2	0.039 C	-
-	6.819	2.3 C	10 ⁻³ C	-
E	-8.582	2000±200	2.11	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
66	¹⁶¹ Dy	18.9(1)	(n,p)	¹⁶¹ Tb	6.90 d
			(n,α)	¹⁵⁹ Gd	stable
			(n,2n)	¹⁶⁰ Dy	stable
66	¹⁶² Dy	25.5(2)	(n,p)	¹⁶² Tb	7.76(10) m
			(n,α)	¹⁵⁹ Gd	18.56(8) h
			(n,2n)	¹⁶¹ Dy	stable
66	¹⁶³ Dy	24.9(2)	(n,p)	¹⁶³ Tb	19.5(3) m
			(n,α)	¹⁶⁰ Gd	stable
			(n,2n)	¹⁶² Dy	stable
66	¹⁶⁴ Dy	28.2(2)	(n,p)	¹⁶⁴ Tb	3.0(1) m
			(n,α)	¹⁶¹ Gd	3.66(5) m
			(n,2n)	¹⁶³ Dy	stable
67	¹⁶⁵ Ho	100	(n,p)	¹⁶⁵ Dy	2.334(6) h
			(n,α)	¹⁶² Tb	7.76(10) m
			(n,2n)	¹⁶⁴ Ho	29(1) m
			(n,2n)*	¹⁶⁴ Ho	37.5(+15-5) m
68	¹⁶² Er	0.14(1)	(n,p)	¹⁶² Ho	15(1) m
			(n,α)	¹⁵⁹ Dy	144.4(2) d
			(n,2n)	¹⁶¹ Er	3.21(3) h
68	¹⁶⁴ Er	1.61(1)	(n,p)	¹⁶⁴ Ho	29(1) m
			(n,α)	¹⁶¹ Dy	stable
			(n,2n)	¹⁶³ Er	75.0(4) m
68	¹⁶⁶ Er	33.6(2)	(n,p)	¹⁶⁶ Ho	26.8(2) h
			(n,α)	¹⁶³ Dy	stable
			(n,2n)	¹⁶⁵ Er	10.36(4) h

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	0.200	5.6±0.5	0.016 C	-
-	8.299	2 C	0.012 C	-
-	-6.451	1900 C	13.3	-
β ⁻	-1.68	5±1	0.014 C	-
β ⁻	6.049	2.1±0.2	5x10 ⁻⁴ C	-
-	-8.195	1910 C	2.99	-
β ⁻	-0.900	3±1	3x10 ⁻³ C	-
-	7.229	1.4 C	3x10 ⁻³ C	-
-	-6.272	1930 C	16.0	-
β ⁻	-2.56	2.8±0.5	3x10 ⁻³ C	-
β ⁻	5.207	1.2 C	2x10 ⁻⁴ C	-
-	-7.655	1950 C	4.88	-
β ⁻	-0.513	3.2 C	4x10 ⁻³ C	-
β ⁻	6.460	1.5 C	6x10 ⁻⁴ C	-
E 58%, β ⁻ 42%	-7.989	2000±200	3.49	-
IT	-	1200±200	-	-
E	0.464	17.1 C	0.23 C	-
E	8.486	3.8 C	8x10 ⁻³ C	-
E	-9.21	1900±130	1.22	-
E 58%, β ⁻ 42%	-0.18	9.4 C	0.083 C	-
-	7.756	2.7 C	3x10 ⁻³ C	-
E	-8.856	1820±150	1.78	-
β ⁻	-1.077	4.5±0.7	0.022 C	-
-	7.094	2 C	10 ⁻³ C	-
E	-8.474	2000±150	2.25	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
68	¹⁶¹ Er	22.95(13)	(n,p)	¹⁶¹ Ho	3.1(1) h
			(n,α)	¹⁶⁴ Dy	stable
			(n,2n)	¹⁶⁶ Er	stable
68	¹⁶⁶ Er	26.8(2)	(n,p)	¹⁶⁶ Ho	3.0(1) m
			(n,α)	¹⁶⁵ Dy	2.334(6) h
			(n,2n)	¹⁶⁷ Er	stable
			(n,2n)*	^{167m} Er	2.28(3) s
68	¹⁷⁰ Er	14.9(1)	(n,p)	¹⁷⁰ Ho	43 s
			(n,α)	¹⁶⁷ Dy	6.2 m
			(n,2n)	¹⁶⁹ Er	9.40(2) d
			(n,d)	¹⁶⁹ Ho	4.7(1) m
			(n,t)	¹⁶⁸ Ho	3.0(1) m
69	¹⁶⁹ Tm	100	(n,p)	¹⁶⁹ Er	9.40(2) d
			(n,α)	¹⁶⁶ Ho	26.80(2) h
			(n,2n)	¹⁶⁸ Tm	93.1(1) d
			(n,He ³)	¹⁶⁷ Ho	3.1(1) h
70	¹⁶⁸ Yb	0.13(1)	(n,p)	¹⁶⁸ Tm	93.1(1) d
			(n,α)	¹⁶⁵ Er	10.36(4) h
			(n,2n)	¹⁶⁷ Yb	17.5(2) m
70	¹⁷⁰ Yb	3.05(5)	(n,p)	¹⁷⁰ Tm	128.6(3) d
			(n,α)	¹⁶⁷ Er	stable
			(n,2n)	¹⁶⁹ Yb	32.022(8) d
70	¹⁷¹ Yb	14.3(2)	(n,p)	¹⁷¹ Tm	1.92(1) y
			(n,α)	¹⁶⁸ Er	stable
			(n,2n)	¹⁷⁰ Yb	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-0.188	3.4±0.4	6x10 ⁻³ C	-
-	8.312	1.7 C	6x10 ⁻³ C	-
-	-6.436	1950 C	13.8	-
β ⁻	-1.99	2.5±1	6x10 ⁻³ C	-
β ⁻	6.256	1.4 C	4x10 ⁻⁴ C	-
-	-7.771	1970 C	4.39	-
IT	-	600±120	-	-
β ⁻	-2.92	1.8±0.5	2x10 ⁻³ C	-
β ⁻	4.58	1 C	10 ⁻⁴ C	-
β ⁻	-7.263	1930±130	7.07	-
β ⁻	-6.410	0.19±0.03	-	-
β ⁻	-6.770	(12.7±3.2)10 ⁻³	-	-
β ⁻	0.431	4.6 C	0.014 C	-
β ⁻	7.44	1.8 C	10 ⁻³ C	-
ε, β ⁻ ?	-8.06	2071±100 F	3.75 P	6.43 P
β ⁻	-5.812	(7.50±3.75)10 ⁻³	-	-
ε, β ⁻ ?	0.5	13.3 C	0.18 C	-
ε	8.599	3.1 C	5x10 ⁻³ C	-
ε	-9.055	1920±150	1.53	-
β ⁻ 99.85%, ε 0.15%	-0.816	7.4 C	0.063 C	-
-	8.174	2.3 C	3x10 ⁻³ C	-
ε	-8.469	1940±150	2.23	-
β ⁻	0.686	5.5 C	0.016 C	-
-	9.328	2 C	0.013 C	-
-	-6.617	1970 C	10.3	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
70	¹⁷³ Yb	21.9(3)	(n,p)	¹⁷² Tm	63.6(2) h
			(n,α)	¹⁶⁹ Er	9.40(2) d
			(n,2n)	¹⁷¹ Yb	stable
70	¹⁷³ Yb	16.12(18)	(n,p)	¹⁷² Tm	8.24(8) h
			(n,α)	¹⁷⁰ Er	stable
			(n,2n)	¹⁷² Yb	stable
70	¹⁷⁴ Yb	31.8(4)	(n,p)	¹⁷⁴ Tm	5.4(1) m
			(n,α)	¹⁷¹ Er	7.52(3) h
			(n,2n)	¹⁷³ Yb	stable
70	¹⁷⁶ Yb	12.7(1)	(n,p)	¹⁷⁶ Tm	1.9(1) m
			(n,α)	¹⁷³ Er	1.4(1) m
			(n,2n)	¹⁷⁵ Yb	4.19(1) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-1.088	4.2 C	0.017 C	-
β ⁻	7.307	1.7 C	7x10 ⁻¹ C	-
-	-8.024	1990 C	3.11	-
β ⁻	-0.538	3.1 C	2x10 ⁻³ C	-
-	8.202	1.4 C	3x10 ⁻³ C	-
-	-6.368	2000 C	12.8	-
β ⁻	-2.28	3.5±1.0	3x10 ⁻³ C	-
β ⁻	6.414	1.2±0.2	2x10 ⁻⁴ C	-
-	-7.469	2020 C	5.67	-
β ⁻	-3.36	1.3 C	5x10 ⁻⁴ C	-
β ⁻	5.58	0.9 C	10 ⁻⁴ C	-
β ⁻	-6.876	2150±230	11.8	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
71	¹⁷⁵ Lu	97.41(2)	(n,p)	¹⁷⁵ Yb	4.19(1) d
			(n,α)	¹⁷³ Tm	63.6(2) h
			(n,2n)	¹⁷⁴ Lu	3.31(5) y
			(n,2n)*	^{174m} Lu	142(2) d
			(n,2n)*	^{174m} Lu	3.31(5) y
71	¹⁷⁶ Lu	2.59(2)	(n,p)	¹⁷⁶ Yb	stable
			(n,α)	¹⁷³ Tm	8.24(8) h
			(n,2n)	¹⁷⁵ Lu	stable
72	¹⁷⁶ Hf	0.162(2)	(n,p)	¹⁷⁶ Lu	3.31(5) y
			(n,α)	¹⁷¹ Yb	stable
			(n,2n)	¹⁷³ Hf	23.6 h
72	¹⁷⁷ Hf	5.206(4)	(n,p)	¹⁷⁶ Lu	3.60(16)×10 ¹⁰ y
			(n,α)	¹⁷³ Yb	stable
			(n,2n)	¹⁷⁵ Hf	70(2) d
72	¹⁷⁷ Hf	18.606(3)	(n,p)	¹⁷⁷ Lu	6.71(1) d
			(n,α)	¹⁷⁴ Yb	stable
			(n,2n)	¹⁷⁶ Hf	stable
72	¹⁷⁸ Hf	27.297(3)	(n,p)	¹⁷⁸ Lu	28.4(2) m
			(n,α)	¹⁷⁵ Yb	4.19(1) d
			(n,2n)	¹⁷⁷ Hf	stable
72	¹⁷⁸ Hf	13.629(5)	(n,p)	¹⁷⁸ Lu	4.59(6) h
			(n,α)	¹⁷⁶ Yb	stable
			(n,2n)	¹⁷⁸ Hf	stable
			(n,2n)*	^{178m} Hf	4.0(2) s
72	¹⁸⁰ Hf	35.100(6)	(n,p)	¹⁸⁰ Lu	5.7(1) m
			(n,α)	¹⁷⁷ Yb	1.9(1) h
			(n,2n)	¹⁷⁸ Hf	stable

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	0.314	3.7±0.5	8×10 ⁻³ C	-
β ⁻	7.867	1.6 C	10 ⁻³ C	-
E	-7.659	2030±200 F	5.03 P	8.38 P
IT 99.35%, E 0.65%	-	550±50	-	-
E	-	1480±100	-	-
-	0.897	2.8 C	0.33 C	-
β ⁻	8.491	2.3±0.6	3×10 ⁻³ C	-
-	-6.293	2040 C	16.9	-
E	0.584	10.5 C	0.16 C	-
-	9.174	2.7 C	5×10 ⁻³ C	-
E	-8.59	1900±150	2.2 C	-
β ⁻	-0.406	5.9 C	0.036 C	-
-	8.623	2 C	2×10 ⁻³ C	-
E	-8.089	2050±150	3.17	-
β ⁻	0.285	4.5 C	7×10 ⁻³ C	-
-	9.712	1.7 C	0.011 C	-
-	-6.381	2030 C	14.5	-
β ⁻	-1.470	3.4 C	7×10 ⁻³ C	-
β ⁻	7.905	1.5 C	9×10 ⁻⁴ C	-
-	-7.626	2050 C	5.11	-
β ⁻	-0.57	2.5 C	2×10 ⁻³ C	-
-	8.681	1.3 C	3×10 ⁻³ C	-
-	-6.099	2060 C	19.6	-
IT	-	900	-	-
β ⁻	-2.52	1.9 C	10 ⁻³ C	-
β ⁻	6.856	1.1 C	2×10 ⁻⁴ C	-
-	-7.388	2080 C	6.88	-

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
72	¹⁸⁰ Hf	35.100(6)	(n,2n)*	¹⁸⁰ Hf	18.68(6) s
73	¹⁸⁰ Ta	0.012(2)	(n,p)	¹⁸⁰ Hf	stable
			(n,α)	¹⁷⁷ Lu	6.71(1) d
			(n,2n)	¹⁷⁹ Ta	664.9(42) d
73	¹⁸¹ Ta	99.988(2)	(n,p)	¹⁸¹ Hf	42.39(6) d
			(n,α)	¹⁷⁸ Lu	28.4(2) m
			(n,2n)	¹⁸⁰ Ta	8.1(1) h
			(n,2n)*	¹⁸⁰ Ta	> 1.2x10 ¹⁵ y
			(n,He ³)	¹⁷⁹ Lu	4.59(6) h
74	¹⁸⁰ W	0.13(3)	(n,p)	¹⁸⁰ Ta	8.1(1) h
			(n,α)	¹⁷⁷ Hf	stable
			(n,2n)	¹⁷⁹ W	37.5(5) m
			(n,2n)*	¹⁷⁹ W	6.4 m
74	¹⁸² W	26.3(2)	(n,p)	¹⁸² Ta	114.5 d
			(n,p)*	¹⁸² Ta	15.84(10) m
			(n,α)	¹⁷⁹ Hf	stable
			(n,α)*	¹⁷⁹ Hf	18.68(6) s
			(n,2n)	¹⁸¹ W	120.98(12) d
74	¹⁸³ W	14.3(1)	(n,p)	¹⁸³ Ta	5.1(1) d
			(n,α)	¹⁸⁰ Hf	stable
			(n,α)*	¹⁸⁰ Hf	5.5(1) h
			(n,2n)	¹⁸² W	stable
			(n,np)	¹⁸² Ta	114.5 d
			(n,d)	¹⁸² Ta	114.5 d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
IT	-	600±100	-	-
-	1.709	4.0 C	0.72 C	-
β ⁻	9.178	1.6 C	4x10 ⁻³ C	-
E	-6.58	2060 C	10.7	-
β ⁻	-0.240	4.5±0.5 F	1.05x10 ⁻³	0.0023 P
β ⁻	7.41	1.4 C	3x10 ⁻⁴ C	-
E87%, β ⁻ 13%	-7.644	2090±100 F	5.21 P	8.61 P
E, β ⁻	-	1310±80 F	2.77 P	4.56 P
β ⁻	-6.56	(3.2±1.45)10 ⁻³	-	-
E 87%, β ⁻ 13%	-0.03	9 C	0.049 C	-
-	8.86	2.3 C	0.002 C	-
E	-8.49	1900±170	2.5 C	-
IT 99.8%, E 0.2%	-	490±50	-	-
β ⁻	-1.022	6.0±0.5	(4.0±0.7)10 ⁻³	-
IT	-	0.12±0.02	-	-
-	7.889	1.7 C	3x10 ⁻⁴ C	-
IT	-	0.12±0.02	-	-
E	-8.054	2150±120	3.91	-
β ⁻	-0.286	4.1±0.5	2x10 ⁻³ C	-
-	9.085	1.5 C	2x10 ⁻³ C	-
IT	-	0.22±0.03	-	-
-	-6.191	1900±150	18.5	-
β ⁻	-7.2132	1.3±0.5	-	-
β ⁻	-4.9885	1.3±0.5	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
74	¹⁸⁴ W	30.67(15)	(n,p)	¹⁸⁴ Ta	8.7(1) h
			(n,p)*	^{184m} Ta	?
			(n,α)	¹⁸¹ Hf	42.39(6) d
			(n,2n)	¹⁸³ W	stable
			(n,2n)*	^{183m} W	5.15(3) s
			(n,np)	¹⁸³ Ta	5.1(1) d
			(n,d)	¹⁸³ Ta	5.1(1) d
74	¹⁸⁶ W	28.6(2)	(n,p)	¹⁸⁶ Ta	10.5(5) m
			(n,α)	¹⁸³ Hf	64(1) m
			(n,2n)	¹⁸⁵ W	75.1(3) d
			(n,2n)*	^{185m} W	1.67(3) m
			(n,np)	¹⁸⁵ Ta	49(2) m
			(n,d)	¹⁸⁵ Ta	49(2) m
75	¹⁸⁵ Re	37.40(2)	(n,p)	¹⁸⁵ W	75.1(3) d
			(n,α)	¹⁸¹ Ta	114.5 d
			(n,2n)	¹⁸⁴ Re	38.0(5) d
			(n,2n)*	^{184m} Re	165(5) d
			(n,He ³)	¹⁸³ Ta	5.1(1) d
75	¹⁸⁷ Re	62.60(2)	(n,p)	¹⁸⁷ W	23.9(1) h
			(n,α)	¹⁸⁴ Ta	8.7(1) h
			(n,2n)	¹⁸⁶ Re	90.64(9) h
			(n,He ³)	¹⁸⁵ Ta	49(2) m
76	¹⁸⁸ Os	0.02(1)	(n,p)	¹⁸⁸ Re	38.0(5) d
			(n,α)	¹⁸⁴ W	120.98(12) d
			(n,2n)	¹⁸⁷ Os	13.0(5) h
			(n,2n)*	^{187m} Os	9.9(3) h
			(n,2n)*	¹⁸⁸ Os	13.0(5) h

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-2.248	4.0±1.0	2x10 ⁻³ C	-
IT	-	2.65±0.20	-	-
β ⁻	7.369	1.2±0.2	(2.0±0.5)10 ⁻⁴	-
-	7.411	2000±150	6.55	-
IT	-	1600	-	-
β ⁻	-7.697	0.7±0.2	-	-
β ⁻	-5.472	0.65±0.15	-	-
β ⁻	-3.12	1.7±0.5	4x10 ⁻⁴ C	-
β ⁻	6.391	0.55±0.07	< 10 ⁻⁴ C	-
β ⁻	7.202	1900±150	10.0±0.7	-
IT	-	600±60	-	-
β ⁻	-8.380	0.25±0.05	-	-
β ⁻	-6.150	0.43±0.08	-	-
β ⁻	0.353	4.3 C	6x10 ⁻³ C	-
β ⁻	8.276	1.6 C	6x10 ⁻⁴ C	-
E	-7.79	1900 C	4.6±0.4	-
IT 74.7%, E 25.3%	-	260	0.62±0.05	-
β ⁻	-5.375	(4±3)10 ⁻³	-	-
β ⁻	-0.529	4.3±0.5	2x10 ⁻³ C	-
β ⁻	7.102	1.2 C	10 ⁻⁴ C	-
β ⁻ 93.5%, E 6.5%	-7.371	1700±200	10±6	-
β ⁻	-6.6	0.004±0.003	-	-
E	0.68	11.9 C	0.02 C	-
E	9.714	2.6 C	3x10 ⁻³ C	-
E	-8.86	2000±150	1.8 C	-
E 89%, IT 11%	-	500±100	-	-
E	-	1500±100	-	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
76	¹⁸⁶ Os	1.58(10)	(n,p)	¹⁸⁶ Re	90.64(9) h
			(n,α)	¹⁸³ W	stable
			(n,2n)	¹⁸⁵ Os	93.6(5) d
76	¹⁸⁷ Os	1.6(1)	(n,p)	¹⁸⁷ Re	5(2)×10 ¹⁶ y
			(n,α)	¹⁸⁴ W	> 3×10 ¹⁷ y
			(n,2n)	¹⁸⁶ Os	2.0(11)×10 ¹¹ y
76	¹⁸⁸ Os	13.3(2)	(n,p)	¹⁸⁸ Re	16.98(2) h
			(n,α)	¹⁸⁵ W	75.1(3) d
			(n,2n)	¹⁸⁷ Os	stable
76	¹⁸⁹ Os	16.1(3)	(n,p)	¹⁸⁹ Re	23.3 h
			(n,α)	¹⁸⁶ W	stable
			(n,2n)	¹⁸⁸ Os	stable
76	¹⁹⁰ Os	26.4(4)	(n,p)	¹⁹⁰ Re	3.1(3) m
			(n,α)	¹⁸⁷ W	23.9(1) h
			(n,2n)	¹⁸⁹ Os	stable
76	¹⁹² Os	41.0(3)	(n,p)	¹⁹² Re	16(1) s
			(n,α)	¹⁸⁹ W	11.5(3) m
			(n,2n)	¹⁹¹ Os	15.4(1) d
			(n,2n)*	¹⁹⁰ Os	13.10(5) h
			(n,2n)*	¹⁹¹ Os	15.4(1) d
77	¹⁹¹ Ir	37.3(5)	(n,p)	¹⁹¹ Os	15.4(1) d
			(n,α)	¹⁸⁸ Re	16.98(2) h
			(n,2n)	¹⁸⁹ Ir	11.78(10) d
			(n,2n)*	¹⁸⁸ Ir	3.3(2) h
77	¹⁹³ Ir	62.7(5)	(n,p)	¹⁹³ Os	30.5(4) h
			(n,α)	¹⁹⁰ Re	3.1(3) m
			(n,2n)	¹⁹² Ir	73.831(8) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻ 93.5%, E 6.5%	-0.294	5.5±1.3	0.024 C	-
-	9.016	2 C	10 ⁻³ C	-
E	-8.27	2000±100	2.91	-
β ⁻	0.78	5.2 C	8×10 ⁻³ C	-
-	10.13	1.7 C	7×10 ⁻³ C	-
α	-6.297	2100 C	16.9	-
β ⁻	-1.336	7±2	5×10 ⁻³ C	-
β ⁻	7.891	1.5 C	3×10 ⁻⁴ C	-
-	-7.989	2120 C	4.39	-
β ⁻	-0.228	5±2	2×10 ⁻³ C	-
-	9.169	1.3 C	2×10 ⁻³ C	-
-	-5.923	2140 C	21.1	-
β ⁻	-2.400	2.0±0.5	10 ⁻³ C	-
β ⁻	6.842	0.5±0.1	10 ⁻⁴ C	-
-	-7.793	2160 C	4.73	-
β ⁻	-3.19	1.3 C	3×10 ⁻⁴ C	-
β ⁻	5.24	-	< 10 ⁻⁴ C	-
β ⁻	-7.559	2200±150	5.40	-
IT	-	1000±200	-	-
β ⁻	-	1200±200	-	-
β ⁻	0.472	4.8±0.8	5×10 ⁻³ C	-
β ⁻	7.957	1.4 C	10 ⁻⁴ C	-
E	-8.12	1960±150 F	2.85 P	4.99 P
E 94.4%, IT 5.6%	-	370	-	-
β ⁻	-0.350	3.8±0.5	10 ⁻³ C	-
β ⁻	6.64	1.1 C	< 10 ⁻⁴ C	-
β ⁻ 95.4%, E 4.6%	-7.772	2048±150 F	3.90 P	6.63 P

Atomic Number	Nuclide	Abund. in %	Nuclear React.	Resid. Nucleus	Half-life
78	¹⁹⁴ Pt	0.01(1)	(n,p)	¹⁹⁴ Ir	11.78(10) d
			(n,α)	¹⁹⁷ Os	stable
			(n,2n)	¹⁹⁹ Pt	10.89(1) h
78	¹⁹⁵ Pt	0.79(5)	(n,p)	¹⁹⁵ Ir	73.831(8) d
			(n,α)	¹⁹⁸ Os	stable
			(n,2n)	¹⁹⁷ Pt	2.9(1) d
78	¹⁹⁶ Pt	32.9(5)	(n,p)	¹⁹⁶ Ir	19.15(3) h
			(n,α)	¹⁹⁹ Os	15.4(1) d
			(n,α)*	¹⁹⁸ Os	13.10(5) h
			(n,2n)	¹⁹⁷ Pt	50(9) y
78	¹⁹⁷ Pt	33.8(5)	(n,p)	¹⁹⁷ Ir	2.8 h
			(n,α)	²⁰⁰ Os	stable
			(n,2n)	¹⁹⁸ Pt	stable
78	¹⁹⁸ Pt	25.3(5)	(n,p)	¹⁹⁸ Ir	52(2) s
			(n,α)	²⁰¹ Os	30.5(4) h
			(n,2n)	¹⁹⁹ Pt	stable
			(n,2n)*	¹⁹⁷ Pt	4.02(1) d
78	¹⁹⁹ Pt	7.2(2)	(n,p)	¹⁹⁹ Ir	8(1) s
			(n,α)	²⁰² Os	6.5 m
			(n,2n)	²⁰⁰ Pt	18.3(3) h
			(n,2n)*	¹⁹⁷ Pt	94.4(8) m
			(n,2n)*	¹⁹⁹ Pt	18.3(3) h
79	¹⁹⁷ Au	100	(n,p)	¹⁹⁷ Pt	18.3(3) h
			(n,α)	¹⁹⁹ Ir	19.15(3) h
			(n,2n)	¹⁹⁸ Au	6.183(10) d
			(n,2n)*	¹⁹⁹ Au	9.7(1) h
			(n,2n)*	¹⁹⁷ Au	6.183(10) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
E	0.110	9.7 C	0.032 C	-
-	9.537	2.3 C	10 ⁻³ C	-
E	-8.81	2100 C	1.98	-
β ⁻ 95.4%, E 4.6%	-0.674	5.6 C	0.01 C	-
-	8.343	1.7 C	2x10 ⁻⁴ C	-
E	-8.656	2030±100	2.67	-
β ⁻	-1.457	4.0±0.5	3x10 ⁻³ C	-
β ⁻	7.276	1.3 C	10 ⁻⁴ C	-
IT	-	1.26	-	-
E	-8.367	2170 C	2.65	-
β ⁻	-0.153	2.0±0.5	2x10 ⁻³ C	-
-	8.711	1.1 C	4x10 ⁻⁴ C	-
-	-6.124	2190 C	18.5	-
β ⁻	-2.39	1.4±0.3	8x10 ⁻⁴ C	-
β ⁻	6.379	1.0 C	< 10 ⁻⁴ C	-
-	-7.921	2200 C	3.98	-
IT	-	460	-	-
β ⁻	-3.62	1.1 C	10 ⁻⁴ C	-
β ⁻	5.59	0.8 C	< 10 ⁻⁴ C	-
β ⁻	-7.563	1950±120	5.53	-
IT 96.7%, β ⁻ 3.3%	-	800±100	-	-
β ⁻	-	1150±100	-	-
β ⁻	0.036	2.1±0.2 F	2x10 ⁻³ C	-
β ⁻	6.979	0.35±0.05 F	< 10 ⁻⁴ C	-
E 92.5%, β ⁻ 7.5%	-8.08	2254±200 F	3.50±0.13	5.53±0.09
IT	-	230	-	-
E 92.5%, β ⁻ 7.5%	-	1900	100	-

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
79	¹⁹⁷ Au	100	(n,He ³)	¹⁹⁵ Ir	2.8 h
80	¹⁹⁶ Hg	0.14(10)	(n,p)	¹⁹⁶ Au	6.183(10) d
			(n,α)	¹⁹³ Pt	50(9) y
			(n,2n)	¹⁹⁵ Hg	9.5 h
80	¹⁹⁸ Hg	10.02(7)	(n,p)	¹⁹⁸ Au	2.696(2) d
			(n,α)	¹⁹⁵ Pt	stable
			(n,2n)	¹⁹⁷ Hg	64.1(1) h
80	¹⁹⁹ Hg	16.84(11)	(n,p)	¹⁹⁹ Au	3.139(7) d
			(n,α)	¹⁹⁶ Pt	stable
			(n,2n)	¹⁹⁸ Hg	stable
			(n,d)	¹⁹⁹ Au	2.696(2) d
80	²⁰⁰ Hg	23.13(11)	(n,p)	²⁰⁰ Au	48.4(3) m
			(n,α)	¹⁹⁷ Pt	18.3(3) h
			(n,2n)	¹⁹⁹ Hg	stable
80	²⁰¹ Hg	13.22(11)	(n,p)	²⁰¹ Au	26(1) m
			(n,α)	¹⁹⁸ Pt	stable
			(n,2n)	²⁰⁰ Hg	stable
80	²⁰² Hg	29.80(14)	(n,p)	²⁰² Au	28(2) s
			(n,α)	¹⁹⁹ Pt	30.8(4) m
			(n,2n)	²⁰¹ Hg	stable
80	²⁰⁴ Hg	6.85(5)	(n,p)	²⁰⁴ Au	40(3) s
			(n,α)	²⁰¹ Pt	2.5(1) m
			(n,2n)	²⁰³ Hg	46.60(2) d
81	²⁰³ Tl	29.524(9)	(n,p)	²⁰³ Hg	46.60(2) d
			(n,α)	²⁰⁰ Au	48.4(3) m
			(n,2n)	²⁰² Tl	12.23(2) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-6.170	≤ 0.023	-	-
E 92.5%, β ⁻ 7.5%	0.0983	8.0 C	0.024 C	-
E	8.248	2 C	3x10 ⁻⁴ C	-
E	-8.75	2050±180	1.72	-
β ⁻	-0.59	4.6±0.3	9x10 ⁻³ C	-
-	7.458	1.5 C	< 10 ⁻⁴ C	-
E	-8.3	2000±150	2.03	-
β ⁻	0.329	3.5±0.6	3x10 ⁻³ C	-
-	8.73	1.3 C	3x10 ⁻⁴ C	-
-	-6.649	2100 C	11.3	-
β ⁻	-5.0143	0.4±0.1	-	-
β ⁻	-1.420	3.6±1	3x10 ⁻³ C	-
β ⁻	6.552	1.2 C	10 ⁻⁴ C	-
-	-8.029	2120 C	3.49	-
β ⁻	0.72	1.8±0.3	5x10 ⁻⁴ C	-
-	7.89	1.0 C	< 10 ⁻⁴ C	-
-	-6.225	2140 C	16.5	-
β ⁻	-2.72	1.6 C	4x10 ⁻⁴ C	-
β ⁻	5.706	0.9 C	< 10 ⁻⁴ C	-
-	7.756	2160 C	4.45	-
β ⁻	-3.72	0.9 C	10 ⁻⁴ C	-
β ⁻	4.460	0.7 C	< 10 ⁻⁴ C	-
β ⁻	-7.491	2100±150	5.63	-
β ⁻	0.291	4.2±1.0	2x10 ⁻³ C	-
β ⁻	7.2	1.1 C	< 10 ⁻⁴ C	-
E	-7.72	2065±150 F	3.0±0.5	5.57 P

Atomic Number	Nuclide	Abund. in %	Nuclear Reaction	Resid. Nucleus	Half-life
81	²⁰³ Tl	70.476(9)	(n,p)	²⁰³ Hg	5.2(1) m
			(n,α)	²⁰² Au	28(2) s
			(n,2n)	²⁰⁴ Tl	3.78(2) y
			(n,t)	²⁰³ Hg	46.60(2) d
			(n,He ³)	²⁰³ Au	53(2) s
82	²⁰⁴ Pb	1.4(1)	(n,p)	²⁰⁴ Tl	3.78(2) y
			(n,α)	²⁰³ Hg	stable
			(n,2n)	²⁰³ Pb	51.88 h
			(n,2n)*	^{203m} Pb	0.48(2) s
			(n,t)	²⁰³ Tl	12.23(2) d
82	²⁰⁶ Pb	24.1(1)	(n,p)	²⁰⁶ Tl	4.20(2) m
			(n,α)	²⁰³ Hg	46.60(2) d
			(n,2n)	²⁰⁶ Pb	1.52(7)×10 ⁷ y
82	²⁰⁷ Pb	22.1(1)	(n,p)	²⁰⁷ Tl	4.77(2) m
			(n,α)	²⁰⁶ Hg	stable
			(n,2n)	²⁰⁶ Pb	stable
82	²⁰⁸ Pb	52.4(1)	(n,p)	²⁰⁸ Tl	3.053 m
			(n,α)	²⁰⁸ Hg	5.2(1) m
			(n,2n)	²⁰⁷ Pb	stable
			(n,2n)*	^{207m} Pb	0.796 s
83	²⁰⁹ Bi	100	(n,p)	²⁰⁹ Pb	3.253(14) h
			(n,α)	²⁰⁸ Tl	4.20(2) m
			(n,2n)	²⁰⁹ Bi	3.68(4)×10 ⁵ y
			(n,t)	²⁰⁷ Pb	stable
90	²³² Th	100	(n,2n)	²³¹ Th	25.52(1) h
92	²³⁸ U	99.2745(15)	(n,2n)	²³⁷ U	6.75(1) d

Decay Mode	React. Energy (MeV)	Cross-sections (mb)		
		14 MeV	U-235 spectrum	Cf-252 spectrum
β ⁻	-0.747	1.9±0.2	5×10 ⁻⁴ C	-
β ⁻	5.68	0.85 C	< 10 ⁻⁴ C	-
β ⁻ 97.45%, E 2.55%	-7.541	2006±200 F	5.61	6.71 P
β ⁻	-5.4234	(33±8)×10 ⁻³	-	-
β ⁻	-7.900	≤ 0.07	-	-
β ⁻ 97.45%, E 2.55%	0.0191	3.9 C	0.019 C	-
-	8.204	1.3 C	10 ⁻⁴ C	-
E	-8.401	2232±130 F	2.45±0.4	3.95 P
IT	-	1200	-	-
E	-5.875	(30±6)×10 ⁻³	-	-
β ⁻	-0.751	2.0±0.4	6×10 ⁻³ C	-
β ⁻	7.136	1.0±0.5	< 10 ⁻⁴ C	-
E	-8.081	2000±100	3.58	-
β ⁻	-0.65	1.6±0.3	5×10 ⁻⁴ C	-
-	7.887	0.9 C	< 10 ⁻⁴ C	-
-	-6.741	2000±100	11.1	-
β ⁻	-4.211	1.0±0.5	< 10 ⁻⁴ C	-
β ⁻	6.186	0.8 C	< 10 ⁻⁴ C	-
-	-7.368	2000±100	6.18	-
IT	-	1282 F	0.94	1.76 P
β ⁻	0.135	0.8±0.2	10 ⁻³ C	-
β ⁻	9.634	0.8±0.3	3×10 ⁻⁴ C	-
E	-7.453	2261±100 F	6.21 P	10.13 P
-	-2.6892	(284±47)10 ⁻³	-	-
β ⁻ , αw	-6.434	1259±50 F	15.7±0.7	23.41 P
β ⁻	-6.144	745±30 F	15.7±0.8	20.99 P