874

JAERI 1252

NEANDC(J)-52/AL
INDC(JAP)-38/G

Table of Nuclear Reactions and Subsequent Radioactive Decays Induced by 14-MeV Neutrons

September 1977

日本原子力研究所
Japan Atomic Energy Research Institute

JAERI 1252

JAERI レポート

この報告書は、日本原子力研究所で行なわれた研究および技術の成果を研究成果編集委員会の審査を経て、不定期に刊行しているものです.

研究成果編集委員会

委員長　山　本　賢　三（理事）

委　　員

赤石　　準（保健物理）	佐々木吉方（研究炉管理部）
朝岡　卓見（原子炉工学部）	佐藤　一男（安全解析部）
天野　　恕（環境安全研究部）	田川　博章（原子炉化学部）
石塚　　信（動力試験炉部）	田中　正俊（核融合研究部）
伊藤　太郎（企 画 室）	長崎　隆吉（燃料工学部）
大内　信平（材料試験炉部）	能沢　正雄（安全工学部）
大森　栄一（技術情報部）	浜口　由和（物 理 部）
岡下　　宏（原子炉化学部）	原田吉之助（物 理 部）
小幡　行雄（核融合研究部）	平田　実穂（動力炉開発・安全性研究管理部）
栗山　　将（開発試験場）	武久　正昭（研 究 部）

入手（資料交換による），複製などのお問合わせは，日本原子力研究所技術情報部（〒319-11 茨城県那珂郡東海村）あて，お申しこみください．なお，このほかに財団法人原子力弘済会情報サービス事業部（茨城県那珂郡東海村日本原子力研究所内）で複写による実費頒布をおこなっております．

JAERI Report

Published by the Japan Atomic Energy Research Institute

Board of Editors

Kenzo Yamamoto (Chief Editor)

Jun Akaishi	Mitsuho Hirata	Masao Nozawa	Yoshikata Sasaki
Hiroshi Amano	Makoto Ishizuka	Yukio Obata	Kazuo Sato
Takumi Asaoka	Taro Ito	Hiroshi Okashita	Masaaki Takehisa
Yoshikazu Hamaguchi	Isamu Kuriyama	Eiichi Ohmori	Hiroaki Tagawa
Kichinosuke Harada	Ryukichi Nagasaki	Shinpei Ouchi	Masatoshi Tanaka

Inquiries about the availability of reports and their reproduction should be addressed to the Division of Technical Information, Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, Japan.

編集兼発行　日本原子力研究所
印　　刷　三美印刷株式会社

Table of Nuclear Reactions and Subsequent Radioactive Decays Induced by 14-MeV Neutrons

Kineo TSUKADA

Division of Physics, Tokai Research Establishment,
Japan Atomic Energy Research Institute
Tokai-mura, Naka-gun, Ibaraki-ken

Received May 9, 1977

Compilation of the data on nuclear reactions and subsequent radioactive decays induced by 14-MeV neutrons is presented in tabular form for most of the isotopes available in nature and for some of the artificially-produced isotopes, including the following items:

Nuclide (isotopic abundance), type of nuclear reaction, reaction $\boldsymbol{Q}$-value, reaction product, type of decay, decay $\boldsymbol{Q}$-value, half-life of reaction product, decay product, maximum reaction cross section, neutron energy for maximum cross section, reaction cross section for 14 MeV neutrons, saturated radioactivity induced by irradiation of a neutron flux of 1 n/cm^{2}sec for a mol of atoms, and reference for the cross section.

The mass number dependence of (n, γ), $(n, 2n)$, (n, p), (n, d), (n, t), $(n, {}^3He)$ and (n, α) reaction cross sections for 14-MeV neutrons is given in figures to show general trends of the cross sections.

Keywords: Nuclear Data Compilatin, 14-MeV Neutrons, Neutron-induced Nuclear Reactions, Reaction $\boldsymbol{Q}$-velue, Reaction Product, Type of Decay, Decay $\boldsymbol{Q}$-value, Half-life, Decay Product, Cross Section, Saturated Radioactivity.

14 MeV 中性子による核反応および引きつづき起る放射性崩壊データ表

塚 田 甲 子 男

日本原子力研究所東海研究所物理部

1977 年 5 月 9 日 受理

天然に入手可能な多くのアイソトープおよび若干の人工的アイソトープの 14 MeV 中性子による核反応およびそれによって生ずる放射性崩壊のデータが収集されている．表に収められている項目は下記の通りである．

核種（天然に存在する割合），核反応型，核反応Q値，核反応生成核，崩壊型式，崩壊Q値，半減期，崩壊生成核，最大反応断面積，反応断面積が最大となる中性子エネルギー，14 MeV 中性子に対する反応断面積，1 mol の原子を 1 n/cm^{2}sec の中性子束で照射した後の飽和放射能および文献．

一般的傾向を見るために，14 MeV 中性子に対する (n, γ)，$(n, 2n)$，(n, p)，(n, d)，(n, t)，$(n, {}^3He)$ および (n, α) 反応断面積と質量数の関係を図示してある．

1. Introduction

One of the most important factors to be considered in choosing structual materials for design of a possible nuclear fusion reactor is the nuclear reactions by 14 MeV neutrons and subsequent radioactive decays. The nuclear data of interest from this view point are:

(1) Nuclear reaction cross sections by 14 MeV neutrons, and also by degraded neutrons due to slowing-down in the materials,

(2) Type of the particle and its kinetic energy emitted from the nuclear reaction, and

(3) Type of decay, decay energy and half-life of the reaction product.

In this report, these data are compiled for most of the isotopes available in nature and also for some of the artificial isotopes. The intensity of the saturated radioactivity induced by irradiation of a neutron flux of 1 n/cm^2 sec for a mol of atoms is also tabulated. From these data it is easy to estimate the radiation level due to the residual radioactivities after some period of irradiation and cooling. These data are also useful for the activation analysis by using the 14 MeV neutrons. Some of these data have been compiled in JAERI-M 6354 (1976)[61].

2. Nuclear Reaction Cross Section

Reaction cross sections by 14 MeV neutrons have hitherto been reported in a large number of published papers. The discrepancies among the reported data are, however, very large and in some cases much larger than the errors quoted by the authors of the papers. The cross sections, sometimes, fluctuate by an order of magnitude or larger. It is very difficult to evaluate these cross sections, because the origins of the discrepancies are not clear in most cases. One of the origins may be ambiguity in decay scheme of the products. In the present compilation, plural numbers of the data if available are presented for some cases, being quoted from the papers of experiments, compilations, evaulations and/or theoretical estimations. In the section of References, titles of the papers and the above classification are shown for information. Figures in the table are limited to one or two significant digits in most cases, and any error of the cross section is not quoted.

Most of the cross sections have been measured by using the D-T neutrons from accelerators of 100-500 keV. In this case neutron energies range from 14.5 to 15.8 MeV at forward angle, and from 14.0 to 14.2 MeV at 90°. Energy dependence of the data between 14 and 15 MeV is neglected in the present compilation considering the scattering of the reported values.

One more remark which should be added is that, since in many measurements the activation method is adopted, the sum of the reported cross sections to the ground state and to the isomeric states is not necessarily equal to the total cross section of the reaction.

Type of reactions induced by the 14-MeV neutrons are mostly (n, γ), (n, n'), $(n, 2n)$, (n, p), (n, d), (n, np), (n, t), $(n, {}^3He)$, (n, α) and $(n, n\alpha)$ in addition to the elastic scattering which is excluded in the present compilation.

The (n, γ), $(n, 2n)$, (n, p), (n, d) and (n, t), $(n, {}^3He)$ and (n, α) reaction cross sections for each isotope are plotted with mass number A in **Figs. 1** through **6**, respectively. Symbols in the figures designate respective isotopes, and, plural data for the same nuclide are plotted in the figures when

they are available. In **Fig. 1** the isotopic symbol with prime means the case of (n, γ^*) reaction which leads to isomeric states. In **Figs. 2, 3** and **6**, the isotopes with abundance of more than about 30% are shown by concentric circles, and a group of points for the same element are connected to one another with a solid line and labeled by the isotopic symbol. Here the maximum values of the data are chosen for the connection in most cases.

The general tendencies of the cross sections with the mass number and/or the neutron energy are as follows.

(1) The (n, γ) reaction cross sections at 14 MeV have a tendency to increase from 0.1 to 10 mb with mass number A as seen in **Fig. 1**. The cross sections seem to be depressed around neutron-magic nuclei, though scattering of the data is too large to draw any definite conclusion.

(2) The (n, n') reaction cross sections become flat above a few MeV, and their magnitudes are of about one barn.

(3) The $(n, 2n)$ reaction cross sections become maximum around 14 MeV, and their magnitude amounts to a few barns. They generally increase with mass number A, and within the same element they rapidly increase with A except for heavy nuclei as seen in **Fig. 2**.

(4) The (n, p) and (n, α) reaction cross sections are less than those of the $(n, 2n)$ reactions except for light nuclei. They decrease with A, and within the same element they rapidly decrease with A as seen in **Figs. 3** and **6**. The (n, α) reaction cross sections are smaller than those of the (n, p) reactions by a factor of 2.5. Both cross sections approximately vary with A, atomic number Z, and neutron number N as in the followings[27] :

$$\sigma(n, p) = 0.73\, \sigma_n \exp\{-33\,(N-Z)/A\}, \tag{1}$$

and

$$\sigma(n, \alpha) = 0.29\, \sigma_n \exp\{-33\,(N-Z)/A\}. \tag{2}$$

$$(Z \geq 20)$$

Here,

$$\sigma_n = \pi r_0^2\,(A^{1/3}+1)^2,$$

with

$$r_0 = 1.4 \times 10^{-13}\text{cm}.$$

Eq. (1) is reported[27] to predict $\sigma(n, p)$ within the limits of 20—30%. Disagreement between the observed values and the calculations by a factor of 1.5−2 is observed in only 10% of the cases. The situation for Eq. (2) is nearly the same.

(5) The (n, d), (n, t) and $(n, {}^3He)$ reaction cross sections generally decrease with A as seen in **Figs. 4** and **5**. The following $(N-Z)/A$ dependence of the (n, t) reaction cross sections has been proposed for the medium and heavy target nuclei by Qaim *et al.*,[65] though the dependence of the (n, t) reactions is significantly weaker than those of the (n, p) and (n, α) reactions.

$$\sigma(n, t) = 0.74 \times 10^{-4} \sigma_n \exp\{-10\,(N-Z)/A\}. \tag{3}$$

The cross sections of the (n, d) reactions are about ten times as large as those of the (n, t) reactions.

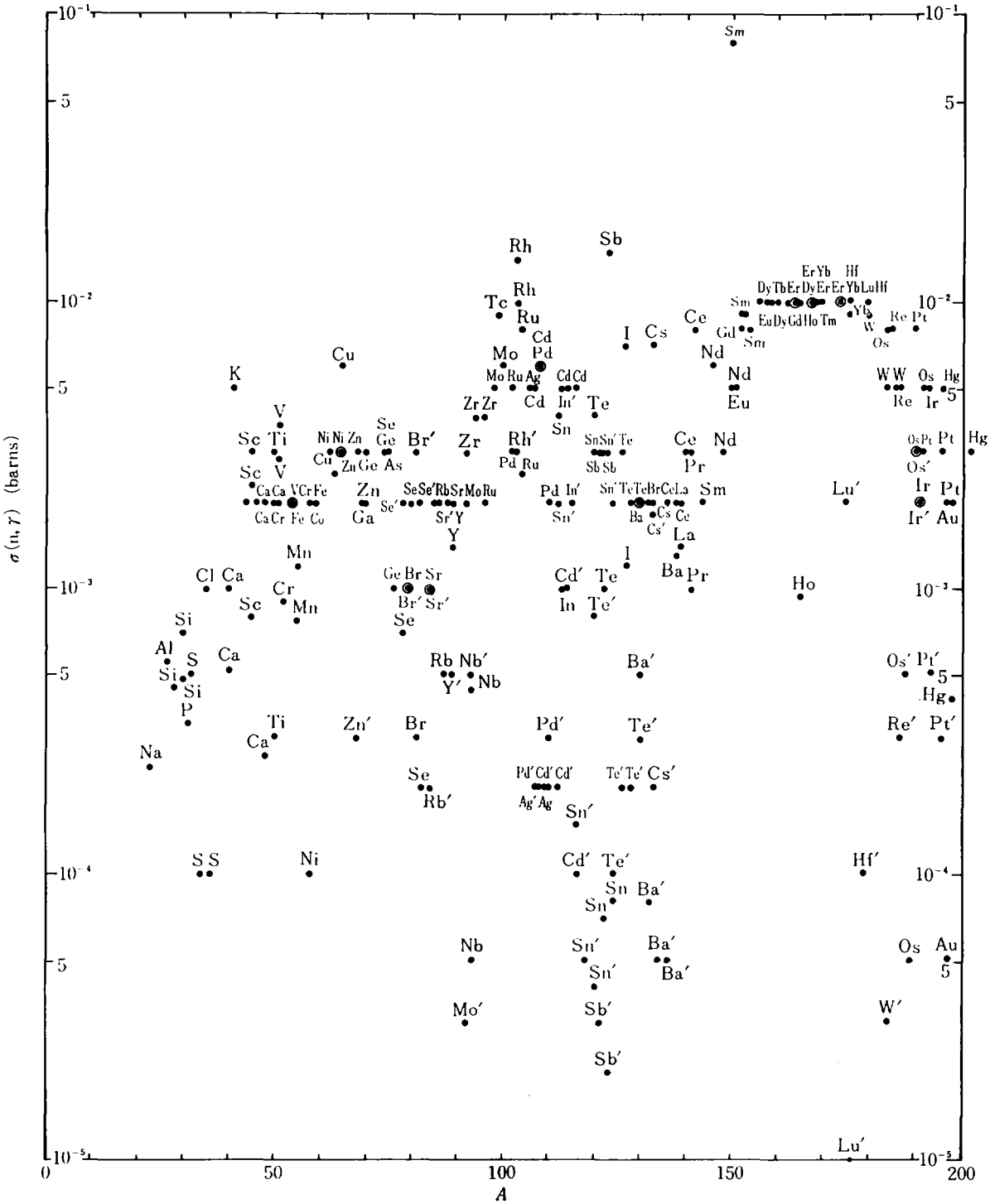

Fig. 1 $\sigma(n,\gamma)$ vs. A

Symbols in the figure designate respective isotopes, and plural data for the same nuclide are plotted when they are available. The symbol with prime means the case of (n,γ^*) reaction which leads to the isomeric states. If the masses and cross sections coincide between two elements, respectively, they are shown by concentric circles.

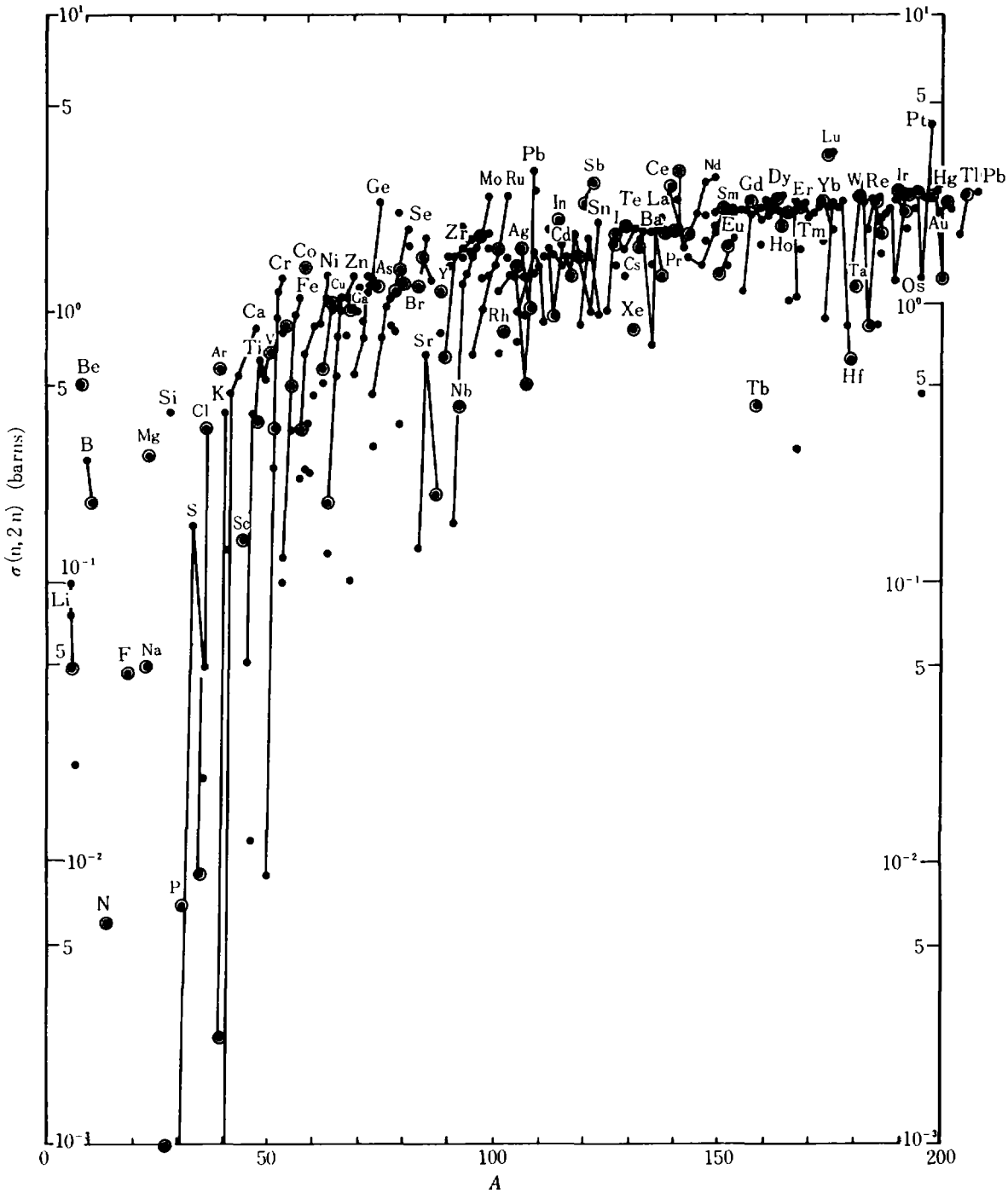

Fig. 2 $\sigma(n, 2n)$ vs. A

Symbols in the figure designate respective isotopes, and plural data for the same nuclide are plotted when they are available. The isotopes with abundance of more than about 30% are shown by concentric circles, and points for the same element are connected to one another by a solid line and labeled by the isotopic symbol. Here the maximum values among the data are chosen for the connection in most cases.

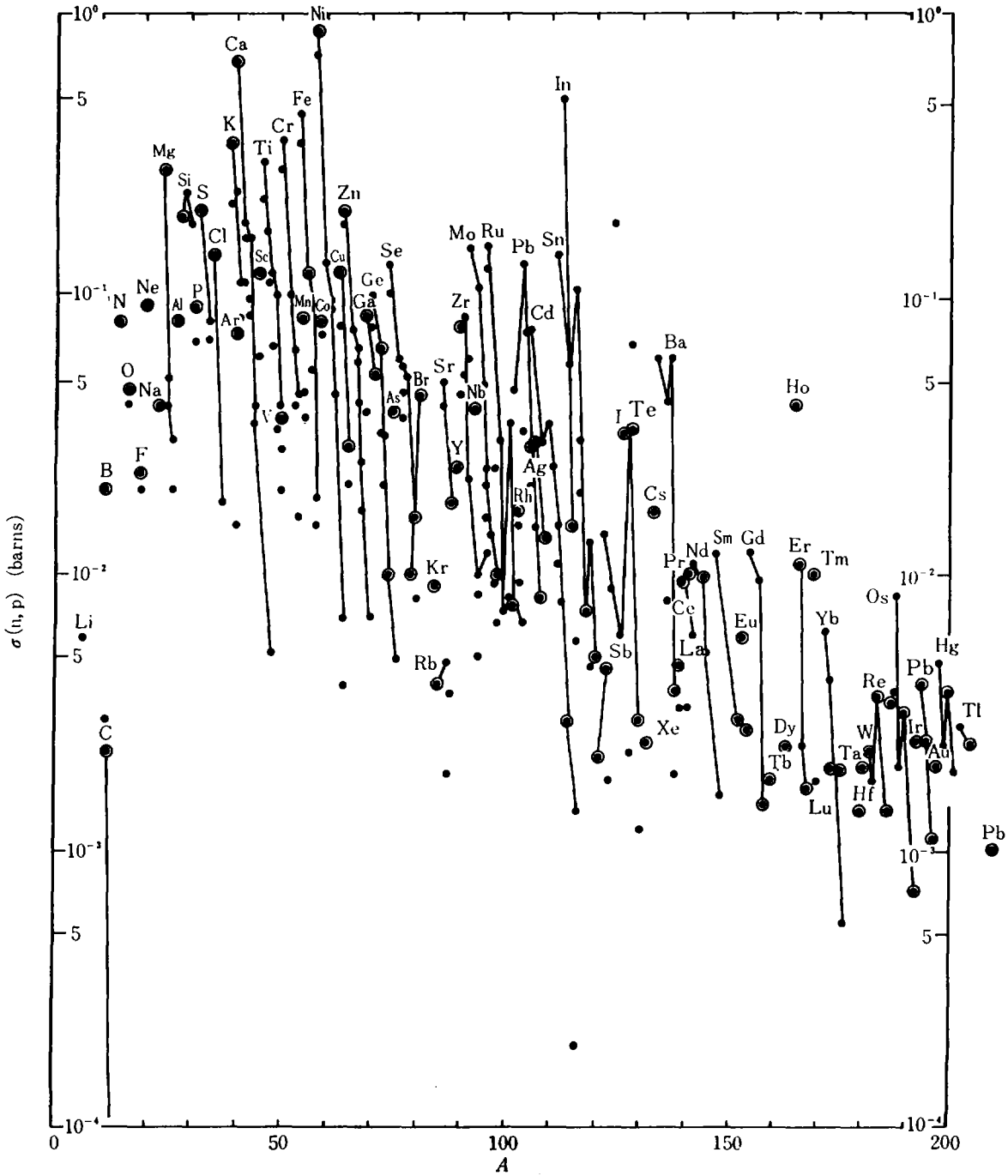

Fig. 3 $\sigma(n, p)$ vs. A

The explanation of the figure is the same as in Fig. 2.

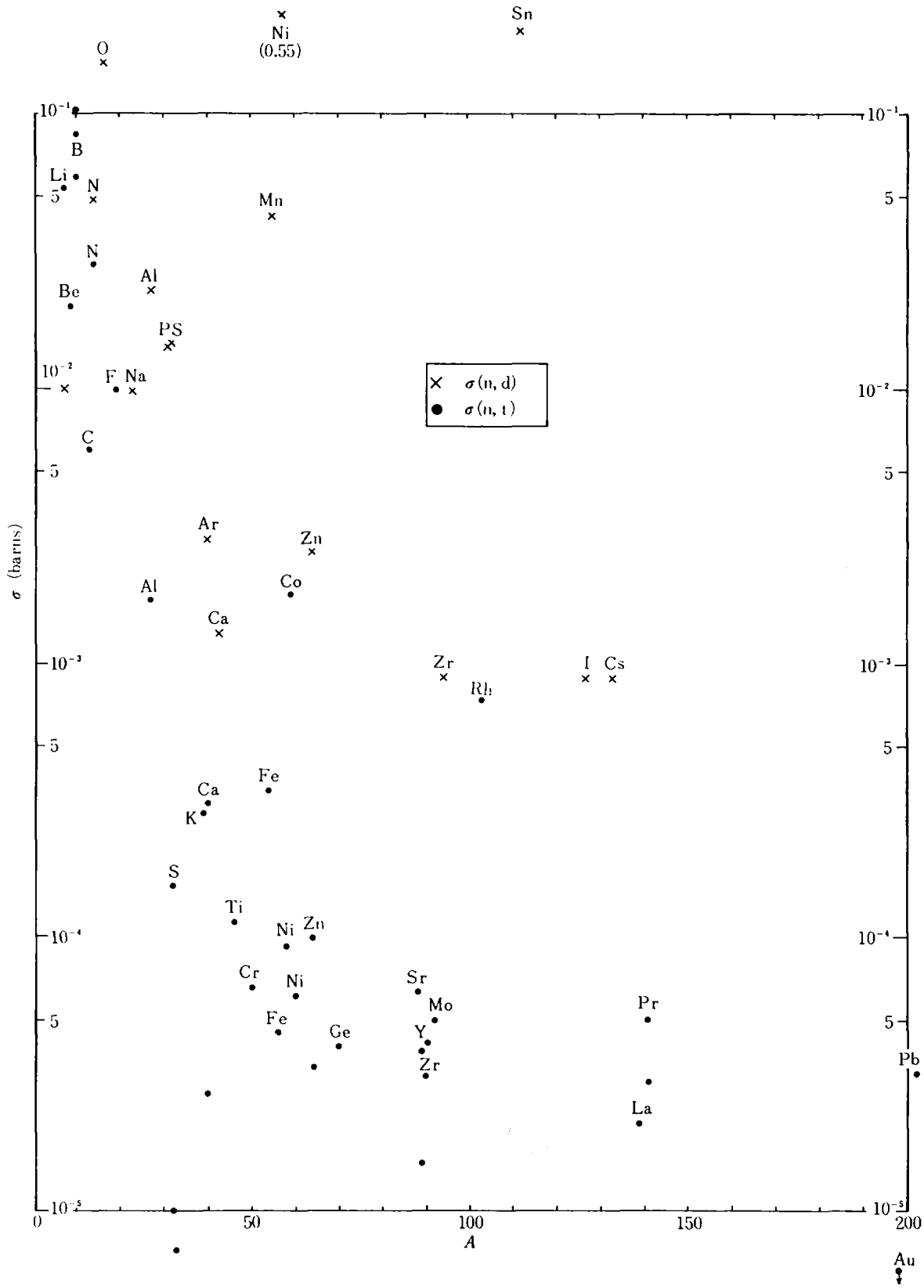

Fig. 4 $\sigma(n, d)$ and $\sigma(n, t)$ vs. A

Symbols in the figure designate respective isotopes, and plural data for the same nuclide are plotted when they are available.

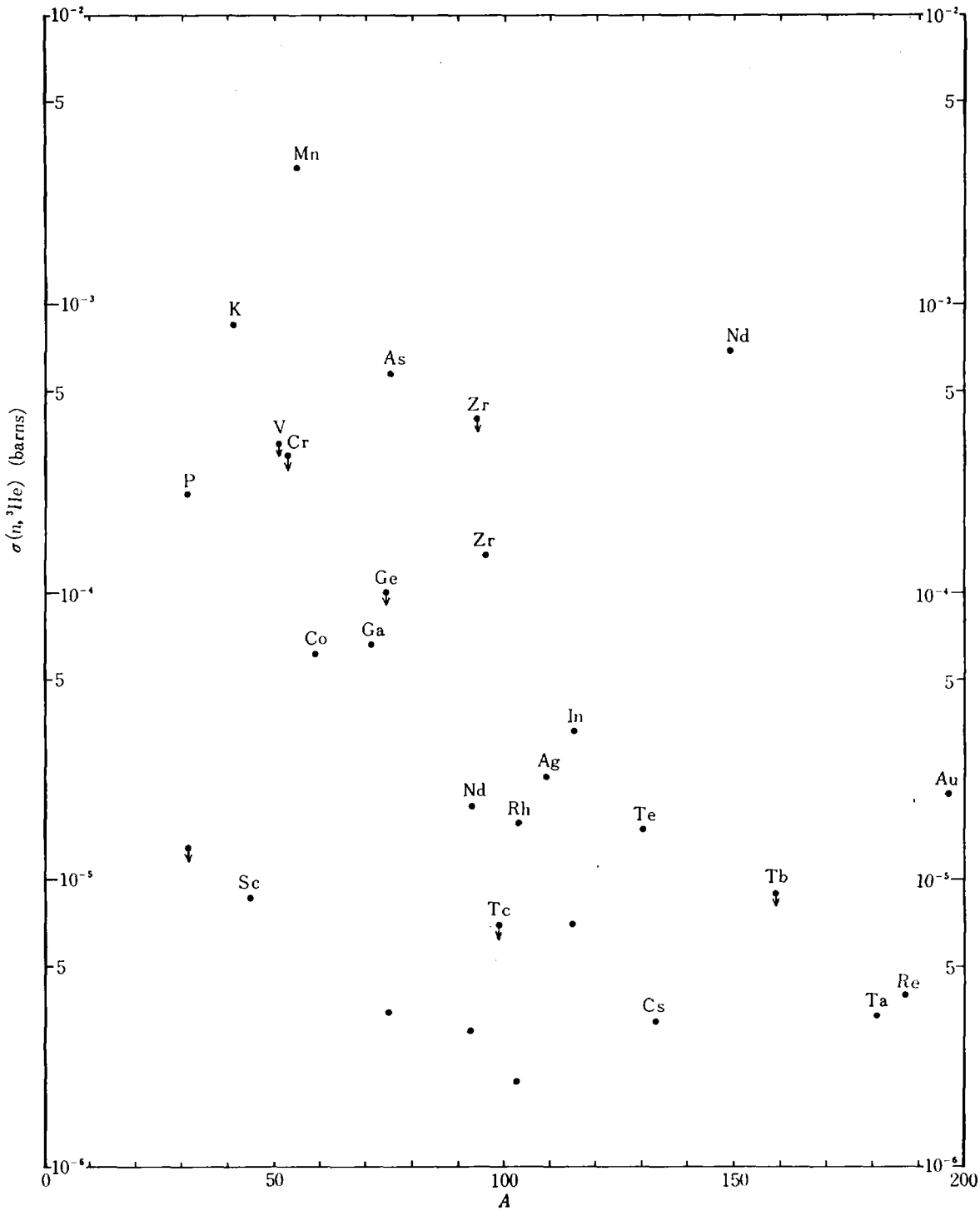

Fig. 5 $\sigma(n, {}^3He)$ vs. A

Symbols in the figure designate respective isotopes, and plural data for the same nuclide are plotted when they are available. The point with arrow directed downward showes upper limit value.

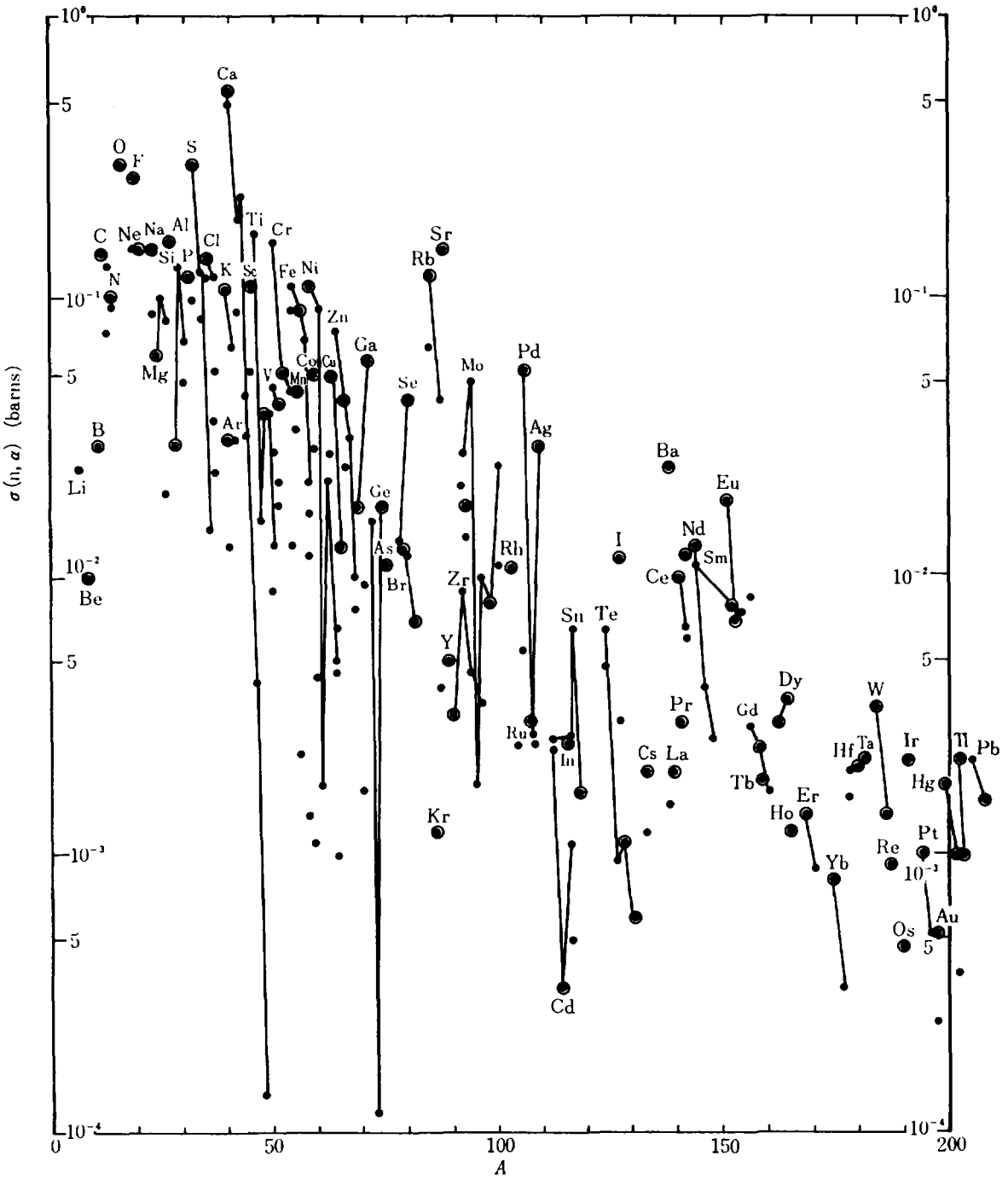

Fig. 6 $\sigma(n, \alpha)$ vs. A

The explanation of the figure is the same as in Fig. 2.

3. Nuclear-reaction Q-value and Kinetic Energy of an Emitted Particle

The relation between the reaction Q-value in the third column of the table and the kinetic energy E of an emitted particle is given in the classical approximation[84] as follows.

$$E=\frac{m_n m}{(m+M)^2}\{(\eta+\cos^2\theta)^{1/2}+\cos\theta\}^2 E_n. \tag{4}$$

Here,

$$\eta=\frac{(m+M)M}{m_n m}(1-m_n/M+Q/E_n),$$

m_n : neutron mass,
M : mass of the residual nucleus,
m : mass of the emitted particle,
E_n : incident neutron energy, and
θ : outgoing angle of the emitted particle in laboratory system.

If m_n and $m \ll M$ and $\theta=90°$,

$$E=(Q+E_n)-m/M\{Q+(1+m_n/m)E_n\}. \tag{5}$$

The forward threshold energy[84] of the reaction is

$$E_{\text{thres}}=(1+m_n/M_t)(-Q), \tag{6}$$

if the Q-value is negative,
where
M_t : mass of a target nucleus.

4. Induced Radioactivity of a Reaction Product

Radioactivity R of a reaction product induced by a neutron flux F after irradiation time T is given as follows, if decrease rate of number of target atoms ($Fe^{-\sigma N_0}$) is neglected.

$$\begin{aligned} R&=\lambda\int_0^T FN_0\sigma e^{-\lambda(T-t)}dt \\ &=FN_0\sigma(1-e^{-\lambda T}) \\ &=FN_0\sigma(1-e^{-0.693T/t_{1/2}}). \end{aligned} \tag{7}$$

Here,

σ : relevant reaction cross section of a nucleus,
λ : decay constant of the product,
$t_{1/2}$: half life of the product, $\lambda=0.693/t_{1/2}$, and
N_0 : number of the relevant nuclei per cm^2.

In the case of appreciable decrease of the atoms due to the flux, a term $-F^2\sigma e^{-\sigma N_0}\{T-1/\lambda(1-e^{-\lambda T})\}$ should be added to the right side of Eq. (7). If a mol of the atoms are irradiated by a neutron flux of 1 n/cm^2 sec,

$$R\,(\text{curie/mol})=16.28\times10^{-15}\ \sigma(1-e^{-0.693T/t_{1/2}}). \tag{8}$$

(σ in mb)

This formula reduces to

$$R\,(\text{curie/mol})=16.28\times10^{-15}\ \sigma \quad \text{for } t_{1/2}\ll T \qquad (\sigma \text{ in mb})$$

$$=R_{\text{saturated}}, \tag{9}$$

and

$$R\,(\text{curie/mol})=3.74\ \sigma/t_{1/2} \quad \text{for } t_{1/2}\gg T \tag{10}$$

$$(\sigma \text{ in mb and } t_{1/2} \text{ in year})$$

$$=0.693\,R_{\text{saturated}}\ T/t_{1/2}.$$

For the case of serial decays, the first and second product nuclei decay as $e^{-\lambda_1 t}$ and $\frac{\lambda_1}{\lambda_2-\lambda_1}\times(e^{-\lambda_1 t}-e^{-\lambda_2 t})$, respectively. Then, in the case of irradiation of the neutron flux of 1 n/cm^2 sec for a mol of atoms,

$$R_1=R$$

and

$$R_2=16.28\times10^{-15}\sigma\left(1-\frac{\lambda_2}{\lambda_2-\lambda_1}e^{-\lambda_1 T}+\frac{\lambda_1}{\lambda_2-\lambda_1}e^{-\lambda_2 T}\right). \tag{11}$$

Here,

λ_1 : decay constant of the first product,

λ_2 : decay constant of the second product,

R_1 : radioactivity of the first product, and

R_2 : radioactivity of the second product.

5. Explanation of the Table

From the left to the right of the table, the following items are tabulated.

Nuclide (Isotopic abundance) : the natural abundance is quoted from ref. 32.

Type of nuclear reaction :

Reaction Q-value (MeV) : quoted from ref. 4 and ref. 33 except for Li, Q-values of which are quoted from ref. 12 and ref. 10.

Reaction product : suffixes g and m designate ground and metastable states, respectively.

Type of decay : the reaction product leads to the decay product via **IT** (isomeric transition), β^- decay, β^+ decay and/or **EC** (electron capture) (ref. 3 and ref. 34).

Decay Q-value (MeV) : level energy for **IT**, maximum energy for β^- decay, and Q-value of electron capture for β^+ decay and/or **EC** (ref. 3 and ref. 34).

Half-life : quoted mainly from ref. 3 and ref. 34.

Decay product : including the successive decay products, if they exist. Number in parentheses shows the half-life of the second decay product (ref. 3).

Maximum reaction cross section (barns) : plus or minus sign denotes the cross section increasing or decreasing with energy around 14 MeV, respectively.

Neutron energy for the maximum cross section (MeV) : "thermal" means thermal neutron energy

Reaction cross section σ for the 14-MeV neutrons (barns) :

Saturated radioactivity (curie/mol.unit flux) : induced after irradiation of a mol of the atoms by the 14-MeV neutron flux of 1 n/cm^{2}sec, which is given by Eq. 9.

Reference : for reaction cross section for the 14-MeV neutrons and, also, for the maximum reaction cross sections in parentheses.

References

1) (evaluation) Alley W.E. and Lessler R.M.: Neutron Activation Cross Sections, Nucl. Data Tables, 11, 8-9 (1973).
2) (compilation) Schett A., *et al.*: Threshold Reaction Neutron Cross Sections, EANDC-95 (1974).
3) Lederer C.M., Hollander J.H. and Perlman I.: Table of Isotopes, 2nd ed. (John Wiley & Sons, INC., 1967).
4) Gove N.B. and Wapstra: A.H.: Nuclear-Reaction Q-values, Nucl. Data Tables, 11, 2-3 (1972).
5) (compilation) Stehn J.R., *et al.*: Neutron Cross Section, BNL-325, 2nd ed., Supple. No. 2 (1964-6).
6) (compilation) Hughes D.J. and Schwartz R.B.: Neutron Cross Sections, BNL-325, 2nd ed. (1958).
7) (compilation) Borman M., Neuert H. and Scobel W.: Handbook on Nuclear Activation Cross-Section, Tech. Report Series, No. 156 (IAEA, 1974) p. 87.
8) (semiempirical) Pearlstein S.: Analysis of $(n, 2n)$ Cross Sections for Medium and Heavy Mass Nuclei, *Nucl. Sci. Eng.*, **23**, 238 (1965).
9) (experiment) Mather D.S. and Pain L.F.: Measurement of $(n, 2n)$ and $(n, 3n)$ Cross Sections at 14 MeV Incident Energy, AWRE 0-47/69 (1969).
10) (evaluation) Pendlebury E.D.: Neutron Cross Sections of Li-7 in the Energy Range 0.001 eV-15 MeV, AWRE 0-61/64 (1964).
11) (evaluation) Conlon T.W.: Neutron Cross Sections for ^{7}Li in the Energy Range 10 keV to 15 MeV, AERE-R 7166 (1972).
12) (evaluation) Pendlebury E.D.: Neutron Cross Sections of Li-6 in the Energy Range 0.001eV-15 MeV, AWRE 0-60/64 (1964).
13) (experiment relative to ^{32}S$(n, p)^{32}$P) Santry D.C. and Butler J.P.: Excitation Curve for the Reactions of Fast Neutrons with Zinc, *Can. J. Phys.*, **50**, 2536 (1972).
14) (evaluation) Sher R.: Neutron Cross Section in Zirconium, BNL-666 (1961).
15) (compilation) Jeki L.: On the Recommended Value of $(n, 2n)$ Cross Sections, KFKI-73-68 (1973).
16) (experiment) Jaskola M., *et al.*: The Excitation Function of the ^{29}Si$(n, \alpha_0)^{26}$Mg Reaction for Neutron Energies Around 14 MeV, *Nucl. Phys.*, **79**, 108 (1966).
17) (experiment) Spira C. and Robson J.M.: Individual Transitions in (n, α) Reactions at 14.6 MeV, *Nucl. Phys.*, **A127**, 81 (1969).
18) (experiment) Aitken J.H. and Dixon W.R.: The Ge$^{73}(n, \alpha)$Zn^{70} Reaction at 14 MeV Observed in a Lithium Drifted Germanium Detector, *Nucl. Phys.*, **67**, 395 (1965).
19) (evaluation) Gardner D.G. and Yu Y.: Trends in Nuclear Reaction Cross Sections, (III) The (n, α) Reaction Induced by 14.5 MeV Neutrons for Elements in the Range $6 \leqq Z \leqq 30$, *Nucl. Phys.*, **60**, 49 (1964).
20) (evaluation) Gardner D.G. and Rosenblum S.: Trends in Nuclear Reaction Cross Section, (IV) Recalculated (n, p) Cross Sections for 14.5 MeV Neutrons of Nuclei in the Range $6 \leqq Z \leqq 50$, *Nucl. Phys.*, **A96**, 121 (1967).
21) (experiment) Yu Y. and Gardner D.G.: Cross Secions of Some Reactions of Ar, Ti, Ni, Cd and Pb with 14.1 MeV Neutrons, *Nucl. Phys.*, **A98**, 451 (1967).
22) (experiment) Lu, W., Rana Kumar N. and Fink R.W.: Activation Cross Sections for (n, p), $[(n, np)+(n, pn)+(n, d)]$, and (n, α) Reactions in the Region of $Z=40$ to 58 at 14.4 MeV, *Phys. Rev.*, **C 1**, 358 (1970).
23) (evaluation) Bödy Z.T. and Csikai J.: Recommended Values of $(n, 2n)$ Cross-Section at 14.7 MeV, *Atomic Energy Review*, **11**, 153 (1973).
24) (compilation and semiempirical) Csikai J., *et al.*: Nuclear Data for Neutron Activation Analysis, *Atomic Energy Review*, **7**, 93 (1969).
25) (experiment) Hankla A.K., Fink R.W. and Hamilton J.H.: Neutron Activation Cross Sections at 14.4 MeV for Some Naturally Occuring Heavy Elements in the Region $76<Z<82$, *Nucl. Phys.*, **A180**, 157

(1972).

26) (semiempirical) Chatterjee A.: Shell Effects in 14 MeV (n, p) Reactions, *Nucl. Phys.*, **60**, 273 (1964).

27) (semiempirical) Levkovskii V.N.: Cross Sections of (n, p) and (n, α) Reactions at a Neutron Energy 14–15 MeV, *Sov. J. Nucl. Phys.*, **18**, 361 (1974).

28) (experiment) Cuzzocrea P., *et al.*: Activation Cross Section of Mo Isotopes for 14.1 MeV Neutrons, *Nucl. Phys.*, **A103**, 616 (1967).

29) (experiment) Vonack H.K., *et al.*: Progress Report on Nuclear Data Research in the Euratom Community, EANDC(E)-89 (1968) p. 37.

30) (experiment) Tuurnala T. and Pursiheimo V.: Activation Cross Sections of Yb Isotopes for (n, p) and (n, α) Reactions at 14.5 MeV, *Physica Scripta*, **5**, 183 (1972).

31) (evaluation) estimated from results of the experiment by Cuzzocrea P., *et al.*: α-Particles from (n, α) Reactions In Mo Isotopes at $E_n \simeq 15$ MeV, *Nucl. Phys.*, **55**, 364 (1964).

32) ed. by Gray D.E., *et al.*: American Institute of Physics Handbook (MacGraw-Hill Book Co., 1957).

33) Ashley V.J. and Catron H.C.: Tables of Nuclear Reaction Q-values, UCRL-5419 (1959).

34) ed. by Nuclear Data Group: Nuclear Level Schemes A=45 through A=257 from Nuclear Data Sheets (Academic Press, INC, 1973).

35) (evaluation) Howerton R., Smith A., Guenther P. and Whalen J.: Evaluated Neutronic Cross Section File for Niobium, ANL/NDM-6 (1974).

36) (compilation and semiempirical) Facchini F., *et al.*: Statistical Model Analysis of (n, α) Reactions, (III) Cross-Section of (n, α) Reaction Induced by 14 MeV Neutron, *Nucl. Phys.*, **51**, 460 (1964).

37) (experiment) Meason J.L., *et al.* and Ganapathy R., *et al.*: Annual Progress Report to the USAEC by the Univ. of Arkansas, Dep. of Chem., ORO-3235-12 (1967) p. 22 and p. 24.

38) (compilation) Mughabghab S.F., *et al.*: Neutron Cross Sections, BNL-325, 3rd ed., Vol. 1 (1973).

39) (experiment) Coates M.S., Hunt G.J. and Uttley C.A.: Neutron Standard Reference Data (IAEA, 1974) p. 129.

40) (evaluation) Young P.G.: An Evaluation of the Neutron and Gamma-ray Production Cross Section for Nitrogen, LA-4725 (1972).

41) (evaluation) Ottenwitte E.H., *et al.*: An Evaluation of Tantalum-181 and Tantalum-182 for the ENDF/B Data File, AI-AEC-12990 (1971).

42) (evaluation) Takahashi H.: Evaluation of the Neutron and Gamma-ray Cross-sections for ^{55}Mn, BNL-50442 (1974).

43) (evaluation) Straker E.A. and McGregor B.J.: A Calculation of Gamma-ray Production and Transport in Liquid Nitrogen, ORNL-TM-3635 (1972).

44) (experiment) Csikai G.: Fast Neutron Induced Reactions, *acta phys. slov.*, **25**, 88 (1975).

45) (experiment) Brown G., *et al.*: A Study of Protons Emitted from Aluminium, Iron and Rhodium on Bombardment with Neutrons of 13.2 MeV, *Phil. Mag.*, **2**, 785 (1957).

46) (evaluation) Smith D.L.: Evaluation of the In-115 (n, n') In-115m Reaction for the ENDF/B-V Dosimetry File, ANL/NDM-26 (1976).

47) (experiment) Breunlich W., Stengel G. and Vonach H.: Bestimmung von (n, $n'\gamma$)-Querschnitten für 14.4 MeV-Neutronen im Massebereich A=46−88, *Z. Naturforsch.*, **26a**, 451 (1971).

48) (experiment) Fern C., Gibbons D. and Olive G.: The Formation of Y^{89m} by 14 MeV Neutron Irradiation of Zirconium, AERE-R 5009 (1965).

49) (experiment) Petö G., *et al.*: Radioactive Capture Cross Sections for 14.7 MeV Neutrons, *acta phys. slov.*, **25**, 185 (1975).

50) (evaluation) Foster D.G., Jr. and Young P.G.: A Preliminary Evaluation of the Neutron and Photon-Production Cross Section of Oxygen, LA-4780 (1972).

51) (evaluation) Penny S.K. and Owen L.W.: A Re-evaluation of Vanadium Neutron and Gamma-ray Production Cross Sections, ORNL-TM-4007 (1972).

52) (compilation) Chatterjee A.: Proton, Deuteron and Triton Reaction Cross Sections for 14-MeV Neutrons, Nucleonics, (August, 1965) p. 112.

53) (evaluation) Philis C., *et al.*: Evaluated (n, p) Cross Sections of ^{46}Ti, ^{47}Ti and ^{48}Ti, ANL/NDM-27 (1977).

54) (experiment) Dikšič M., Strohal P. and Slaus I.: $(n, {}^3He)$ and (n, t) Reaction Cross-Sections at 14 MeV, *J. Inorg. Nucl. Chem.*, **36**, 477 (1974).

55) (experiment) Qaim S.M., Wölfle R. and Stöcklin G.: Radiochemical Investigation of Fast Neutron-induced Lowyield Nuclear Reactions, *J. Radio., Chem.* **21**, 395 (1974).

56) (experiment) Qaim S.M.: A Study of $(n, {}^3He)$ Reactions at 14.6 MeV on Medium and Heavy Mass Nuclei, *J. Inorg. Nucl. Chem.*, **36**, 239 (1974).

57) (compilation) Nagy A.Z., Csöke A. and Szabó E.: Two-dimensional (T, E_γ) Mapping of Shot-lived Nuclides, *J. Radio, Chem.*, **7**, 365 (1971).

58) (experiment) Budnar M., *et al.*: Measurements of 14 MeV Neutron Radiative Capture γ-ray Spectra and Integrated Cross Sections in Sc, Y. Pr and Ho, INDC (YUG)-5/L (1977).

59) (experiment) Colli L., *et al.*: The (n, d) Pick-up Reaction on $f_{7/2}$ Proton Shell Nuclei, *Nucl. Phys.*, **46**, 73 (1963).

60) (experiment) Qaim S.M., Wölfle R. and Stöcklin G.: Fast Neutron Induced $[(n, t)+(n, n't)]$ Reaction Cross-sections in the Medium and Heavy Mass Regions, *J. Inorg. Nucl. Chem.*, **36**, 3639 (1974).

61) (compilation) Tsukada K.: Nuclear Reactions and Subsequent Radioactive Decays Induced by 14-MeV Neutrons, JAERI-M 6354 (1976).

62) (experiment) Bauer R.W., Anderson J.D. and Christensen L.J.: Scattering of 14 MeV Neutrons from Nitrogen and Oxygen, *Nucl. Phys.*, **47**, 241 (1963).

63) (experiment) Jeronymo J.M.F., *et al.*: Absolute Cross-sections for Some (n, p), (n, α) and $(n, 2n)$ Reactions, *Nucl. Phys.*, **47**, 157 (1963).

64) (experiment) Aldefeld B.: Untersuchung einiger Kernreaktionen, die durch Neutronen des Energiebereichs von 12.6 MeV bis 18.2 MeV in NaI ausgelöst werden, *Nucl. Phys.*, **A145**, 569 (1970).

65) (experiment) Qaim S.M. and Stöcklin G.: Investigation of (n, t) Reactions at 14.6 MeV and an Analysis of Some Systematic Trends in the Cross-section Data, *Nucl. Phys.*, **A257**, 233 (1976).

66) (evaluation) Otter J.M., *et al.*: Evaluated Neutron Cross Sections for Copper-63, Copper-65 and Natural Copper, AI-AEC-12741 (1968).

67) (compilation) Miljanic D. and Valkovic V.: The (n, d) Reactions on Light Nuclei, *Nucl. Phys.*, **A176**, 110 (1971).

68) (experiment) Alder J.C. and Vaucher B.: Scattering of 14.1 MeV Neutrons form ^{11}B, *Nucl. Phys.*, **A147**, 657 (1970).

69) (experiment) Scobel W.: Wirkungsquerschnitt der Reaktion ^{9}Be$(n, d)^8$Li zwischen 16.3 and 18.7 MeV, *Z. Naturforsch.*, **24a**, 289 (1969).

70) (experiment) Alvar K.R.: Proton Energy and Angular Distributions from (n, p) and (n, np) Reactions, *Nucl. Phys.*, **A195**, 289 (1972).

71) (evaluation) Tobias M.: Review on the Cross Sections of the Isotopes ^{6}Li and ^{7}Li as Tabulated on the ENDF/B Version III Files, ORNL-TM-3859 (1972).

72) (evaluation) Young P.G. and Foster D.G., Jr: A Preliminary Evaluation of the Neutron and Photon-Production Cross Sections for Aluminium, LA-4726 (1972).

73) (compilation) Leppämäki H. and Kantele J.: Table of Cross Sections of Some Reactions Induced by 14-15 MeV Neutrons, UJ-RR 3 (1970).

74) (experiment) Csikai J., *et al.*: Radiative Capture Cross Sections for 14.7 MeV Neutrons, *Nucl. Phys.*, **A95**, 229 (1967).

75) (experiment) Cvelbar f., Hudoklin A. and Potokar M.: Comparison between the Activation Cross Sections and Integrated Cross Sections for the Radiative Capture of 14 MeV Neutrons, *Nucl. Phys.*, **A158**, 251 (1970).

76) (experiment) Decowski P., Grochulski W. and Marcinkowski A.: On the Role of γ-decay of Unbound Nuclear States in Nucleon-induced Reactions, *Nucl. Phys.*, **A194**, 380 (1972).

77) (experiment) Augustyniak W., Herman M. and Marcinkowski A.: Cross Section for the (n, n'), (n, p)

and (n, $2n$) Reactions on ^{107}Ag and ^{109}Ag Isotopes, *Nucl. Phys.*, **A247**, 231 (1975).

78) (experiment) Wagner R.R. and Peck R.A., Jr.: The ^{32}S(n, d)^{31}P and ^{34}S(n, d)^{33}P Reactions at 14 MeV, *Nucl. Phys.*, **A110**, 81 (1968).

79) (experiment) Khan N.A., Mubarakmand S. and Ahmad M.: Aspects of α-emission from the Bombardment of ^{58}Ni with 14.7 MeV Neutrons, *Nucl. Phys.*, **A202**, 123 (1973).

80) (experiment) Struwe W. and Winkler G.: Measurement of (n, p) Cross Sections on Isotopes of Cd, Sn and Te for 14 MeV Neutrons, *Nucl. Phys.*, **A222**, 605 (1973).

81) (experiment) Grin G.S., *et al*: ^{12}C(n, n), (n, n') and (n, n')3α Reactions at 14.1 MeV, *Helv. Phys. Acta*, **42**, 990 (1969).

82) (experiment) Alford W.L., *et al.*: Evidence for an Isomeric States of ^{90}Y, *Phys. Rev.*, **123**, 1365 (1961).

83) (experiment) Qaim S.M. and Stöcklin G.L.: A Systematic Investigation of (n, t) Reactions at 14–15 MeV on Medium and Heavy Mass Nuclei, *J. Inorg. Nucl. Chem.*, **35**, 19 (1973).

84) ed. Marion J.B. and Fowler J.L.: Fast Neutron Physics, Part I (Interscience Pub., INC., 1960) Chap. I.B., Appendix, p. 68.

85) (experiment) Bormann M., *et al.*: Über die Wirkungsquerschnitte einiger n, $n\alpha$-Reactionen für Neutronenenergien zwischen 12 und 19 MeV, *Zeit. f. Phys.*, **166**, 477 (1962).

86) (experiment) Qaim S.M.: Activation Cross-section for Some 14.8 MeV Neutron-induced Nuclear Reaction on Cesium: Isomer Ratio of ^{134}Cs, ^{133}Xe and ^{130}I, *J. Inorg. Nucl. Chem.*, **32**, 1799 (1970).

87) (experiment) Qaim S.M. and Graca C.: Neutron Activation Cross Sections at 14.7 MeV for Isotopes of Tungsten, *Nucl. Phys.*, **A242**, 317 (1975).

88) (experiment) Bormann M., *et al.*: Untersuchung von (n, $2n$) Anregungsfunktionen, *Nucl. Phys.*, **A115**, 309 (1968).

89) (experiment) Curzio G. and Sona P.: Isomeric (n, $2n$) Cross-section Ratios and Spin Cut-Off Parameter Calculations, *Nuovo Cimento*, LIVB, 319 (1968).

90) (experiment) Husain L. and Kuroda P.K.: 14.8 MeV Neutron Activation Cross Sections for Chromiun, *J. Inorg. Nucl. Chem.*, **29**, 2665 (1967).

91) (experiment) Husain L., Bari A. and Kuroda P. K.: 14.8 MeV Neutron Cross-sections for (n, ^3He) and Other Rare Nuclear Reactions on ^{103}Rh, *J. Inorg. Nucl. Chem.*, **30**, 3145 (1968).

92) (evaluation) Simons R.L. and McElroy W.N.: Evaluated Reference Cross Section Library, BNWL-1312 (1970).

93) (experiment) Biró T., *et al.*: Investigations of (n, t) Cross Sections at 14.7 MeV, *J. Inorg. Nucl. Chem.*, **37**, 1583 (1975).

94) (experiment) Levkovskiĭ V.N. and Artemév O.I.: Cross Sections of the Reactions (n, p) and (n, α) at a Neutron Energy 14.8 MeV, *Soviet J. Nucl. Phys.*, **13**, 529 (1971).

95) (compilation) Hermsdorf D., *et al.*: Eine Physikalisch Begründete Parametrisierumgsmöglichkeit für Spektren und Wirkungsquerschnitt der Unelastischen Wechselwirkung Schnellen Neutronen mit Atomkern, *Kernenergie*, **16**, 252 (1973).

96) (compilation) Garver D.I. and Kinsey R.R.: Neutron Cross Sections, BNL-325, 3rd ed., Vol. II Curves (1976).

97) (experiment) Valkonen M.: Studies of 14MeV Neutron Activation Cross Sections with Special Reference to the Capture Reaction, JU-RR-76/1 (1976).

98) (experiment) Molla N. I. and Qaim S. M.: A Systematic Study of (n, p) Reactions at 14. 7MeV, *Nucl. phys.*, **A283**, 269 (1977).

99) (experiment) Augustyniak W., *et al.*: Cross Sections for the (n, $2n$) Reaction on ^{102}Pd, ^{110}Pd, ^{112}Cd and ^{192}Os, *Nucl. Phys.*, **A285**, 145 (1977).

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{6}Li (7.52%)	(n, γ)	7.25	^{7}Li					0.045	thermal			(5)
	(n, n'γ)	−2.18	^{6}Li					+		0.020		12
	(n, 2n)	−3.70	^{5}Li	p	1.967	10^{-21}s	α			0.078		9
								+		0.1		5
	(n, p)	−2.73	^{6}He	β^-	3.51	0.8s	^{6}Li	0.038	4	0.008	130	7, 12
	(n, α)	4.78	t	β^-	0.019	12.3y	^{3}He	3	0.25	0.025	407	5
	(n, np)	−4.65	^{5}He	n	0.957		^{4}He			0.17		73
	(n, nα)	−1.47	d					0.68	6.0	0.40		12
										0.3		5
	nonelastic	——	——					0.78	5.0	0.53		12
^{7}Li (92.48%)	(n, γ)	2.03	^{8}Li	β^- (n	16.002 −2.032)	0.84s	^{8}Be→2α (2×10^{-16}s)	0.035	thermal			(5)
	(n, n'γ)	−0.48	^{7}Li					0.29	4.5	0.08		(10, 11), 71
		total n'								0.42		71
	(n, 2n)	−7.25	^{6}Li					+		0.049		9
										0.022		10
	(n, 3n)	−12.92	^{5}Li	p	1.967	10^{-21}s	α	+		0.0002		9
	(n, d)	−7.76	^{6}He	β^-	3.51	0.8s	^{6}Li	+		0.01	160	5, 10, 71
	(n, t)	−3.42	^{5}He	n	0.957		^{4}He			0.055		73
	(n, np)	−10.0	^{6}He	β^-	3.51	0.8s	^{6}Li			0.105	1710	73
	(n, nα)	−2.47	t	β^-	0.019	12.3y	^{3}He	0.45	8	0.34	8500	5, 10, 11, 71
	(n, 2np)	−11.91	^{6}He	n	0.957		α					
	(n, 2nα)	−8.72	d					+		0.033		10
	nonelastic	——	——					flat >8		0.47		10

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{9}Be (100%)	(n, γ)	6.81	^{10}Be	β^-	0.555	2.7×10^{6}y	^{10}B	0.01	thermal	1×10^{-6}	0.02	1
	(n, 2n)	−1.66	^{8}Be	α	0.095	2×10^{-16}s	α	0.6	6	0.5	8100	5
	(n, p)	−12.83	^{9}Li	β^-	13.61	0.17s	^{9}Be^{g} ^{9}Be→^{8}Be+n			<0.004	<65	7
	(n, d)	−14.66	^{8}Li	β^-	16.002	0.84s	^{8}Be^{excit}→2α	+		0.006 at 18.5 MeV		69
	(n, t)	−10.44	^{7}Li					+		0.02		1, 93
	(n, α)	−0.60	^{6}He	β^-	3.510	0.8s	^{6}Li	0.11	3	0.01	160	7
	nonelastic	—	—					6	~4	0.5		96
^{10}B (18.5%)	(n, γ)	11.45	^{11}B					0.5	thermal			(38)
	(n, 2n)	−8.44	^{9}B	p	0.185	8×10^{-19}s	^{8}Be→2α			0.027		9
	(n, p)	0.23	^{10}Be	β^-	0.555	2.5×10^{6}y	^{10}B			0.003 b/sr at 15°		52
	(n, d)	−4.36(g)	^{9}Be$^{g+2.43\,MeV}$							0.014 b/sr (σ_{max}) at 20°		67
	(n, t)	0.23	^{8}Be	α	0.095	2×10^{-16}s	α			0.102	1660	ref. in 93
										0.060	977	
										0.085	1380	
	(n, $\alpha_0+\alpha_1$)	2.79 for α_0	^{7}Li					3837	thermal			(38)
	(n, $\alpha_1\gamma$)		^{7}Li^{excit}		0.4774			0.056 at 100 keV				(39)
	(n, np)	−6.59	^{9}Be							0.075		73
	(n, nd)	−6.03	^{8}Be	α	0.095	2×10^{-16}s	α			0.004 b/sr at 15°		52
	nonelastic	—	—							0.56		96
^{11}B (81.5%)	(n, γ)	3.37	^{12}B	β^- (n	13.370 −3.369)	0.0203s	^{12}C	0.0055	thermal			(38)
	(n, n′)	total	—							0.19		68
	(n, 2n)	−11.46	^{10}B							0.019		9
	(n, p)	−10.73	^{11}Be	β^-	11.51	13.65s	^{11}B			0.03	490	7

										0.003	49	5
	(n, d)	−9.00	$^{10}Be^{g}$	β^-	0.555	2.5×10^6y	^{10}B			0.0021 b/sr (σ_{max}) at 20°		67
	(n, t)	−9.56	^{9}Be	(n	−1.665		^{8}Be)	+		0.015		1
	(n, α)	−6.63	^{8}Li	β^- (n	16.002 −2.032)	0.84s	$^{8}Be\rightarrow2\alpha$	0.03	~14	0.03	490	7
	nonelastic	—	—							0.46		68
^{11}C	(n, p)	2.76	^{11}B							0.88		20
	(n, α)	11.35	^{8}Be	α	0.095	2×10^{-16}s	α			0.23		19
^{12}C (98.89%)	(n, γ)	4.95	^{13}C					0.0034	thermal			(5)
	(n, n′)	total	—							0.33		81
	(n, 2n)	−18.72	^{11}C	β^+	1.981	20.3m	^{11}B	0.018	33	0	0	5, 7
	(n, p)	−12.59	^{12}B	(β^- n	13.370 −3.369	0.0203s —	^{12}C ^{11}B			0.023		20
								0.018	18	0.002		7
	(n, α)	−5.70	^{9}Be					0.08	8.1	0.062		5
	(n, α^*)		$^{9}Be^{excit}$	n	0.768	—	$^{8}Be\rightarrow2\alpha$			0.082		5
	(n, nα)	−7.37	^{8}Be	all process to (3α+n)						0.19		81
	nonelastic	—	—							0.6		96
^{13}C (1.108%)	(n, γ)	8.18	^{14}C	β^-	0.156	5730y	^{14}N	0.001	thermal	1×10^{-10}	0	1
	(n, p)	−12.65	^{13}B	β^-	13.437	0.019s	^{13}C			0	0	20
	(n, t)	−12.42	^{11}B							0.0061		96
	(n, α)	−3.84	^{10}Be	β^-	0.555	2.7×10^6y	^{10}B	flat >10		0.13	2120	1
										0.075	1220	19
^{13}N	(n, p)	3.00	^{13}C							0.078		20
	(n, α)	−1.06	^{10}B							0.11		19

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{14}N (99.63%)	(n, γ)	10.83	^{15}N					0.075	thermal			(5)
	(n, n′)	total	—							0.40		43
	(n, 2n)	−10.55	^{13}N	β^+ p	2.221 −1.944	10m —	^{13}C ^{12}C	0.018	18	0.006 0.003~6		5 7
	(n, p)	0.63	^{14}C	β^-	0.156	5730y	^{14}N	1.81	thermal	0.08	1300	5, 7
										0.032	521	20
	(n, d)	—	^{13}C							0.049		43
	(n, d_0)	−5.33	$^{13}C^g$							0.020		40
	(n, t)	—	^{12}C							0.029		43
	(n, t_0)	−4.01	$^{12}C^g$							0.0065		40
	(n, t_1)	−8.45	$^{12}C^{4.439MeV\ level}$							0.021		40
	(n, α)	−0.16	^{11}B					2	1.4	0.1		6
										0.092		19
	(n, np)	−7.55	^{13}C							0.046		73
	(n, 2α)	−2.62	^{7}Li							0.032		43
	nonelastic	—	—							0.72		62
										0.64		43
^{15}N (0.365%)	(n, n′)	—	—									
	(n, p)	−8.99	^{15}C	β^-	9.773	2.4s	^{15}N			0.0031	51	20
	(n, d)	−7.98	$^{14}C^g$	β^-	0.1561	5730y	^{14}N			0.0033b/sr (σ_{max}) at 20°		67
	(n, α)	−7.63	^{12}B	β^-	13.370	0.0203s	^{12}C $^{8}Be+\alpha$			0.018	293	19
^{16}N	(n, p)		^{16}C	β^-	8.00	0.74s	$^{16}N^{excit}\rightarrow^{15}N$ (7.2s)			0.016	260	96
										0.0022	35	20
	(n, α)	−5.24	^{13}B	β^-	13.437	0.019s	^{13}C			0.20	3260	19
^{15}O	(n, p)	3.54	^{15}N							0.90		20

	(n, α)	8.50	^{12}C							1.05		19
^{16}O (99.76%)	(n, γ)	4.14	^{17}O					1.78×10^{-4}	thermal			(38)
	(n, γ*)		^{17}O^{excit}	n	−4.142		^{16}O					
	(n, n′)	total	——						~14	0.46 (0.26)		50
	(n, 2n)	−15.67	^{15}O	β^+	2.760	124s		0.018	32	0	0	5
	(n, p)	−9.64	^{16}N	β^-	10.422	7.2s		0.045	13.5	0.04	650	7
								0.08	12	0.046	749	20
	(n, d)	−9.90	^{15}N					0.16	13~14	0.15		50
	(n, α)	−2.22	^{13}C					0.35	16	0.3		5
	(n, np)	−12.11	^{15}N					+(peak 80mb at 11.8 MeV)		0.015		73
	(n, n$\alpha\gamma$)	−11.59 E_γ=4.439MeV	^{12}N	β^+	17.36	0.0110s	^{12}C ^{8}Be+α	0.15	18	0.020	326	50
	nonelastic	——	——							0.73		62
										0.65		50
								+		0.8		96
^{17}O (0.037%)	(n, p)	−8.00	^{17}N	β^-	8.68	4.13s	^{17}O			0.035	570	20
	(n, α)	1.82	^{14}C	β^-	0.1561	5730y	^{14}N			0.25	4070	19
^{18}O (0.204%)	(n, γ)	3.96	^{19}O	β^-	4.819	29s	^{19}F			6×10^{-5} at 1MeV		96
^{18}F	(n, p)	−13.27	^{18}N	β^-	13.9	0.63s	^{18}O$^{excit}\rightarrow^{18}$O^g (2ps)			0.65	1060	20
	(n, α)	−5.04	^{15}C	β^-	9.773	2.4s	^{15}N			0.13	2120	19
^{19}F (100%)	(n, γ)	6.60	^{20}F	β^-	7.030	11.4s	^{20}Ne	0.0098	thermal			(5)
	(n, n′)	——								0.99		73
	(n, 2n)	−10.43	^{18}F	β^+, EC	1.655	109.7m	^{18}O	0.1	18	0.047	765	7
	(n, 2n*)		^{18}F^m			138ns				0.0027	44	7
	(n, p)	−4.04	^{19}O	β^-	4.819	29s	^{19}F$^m\rightarrow^{19}$F (87ns)	0.045	9	0.02	320	7
								0.07	7.5	0.023	374	20
	(n, d)	−5.77	^{18}O							0.024 b/sr at 0°		52

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{19}F (100%)	(n, t)	−7.56	^{17}O							0.010		ref. in 55
	(n, α)	−1.52	^{16}N	β^-	0.422	7.2s	^{16}O	0.2~0.3	6	0.015	244	5, 7
										0.027	439	19
	nonelastic	—	—							0.83		96
^{20}F	(n, p)		^{20}O	[β^-]	3.81	14s	$^{20}F^{excit} \rightarrow {}^{20}F^{g} \rightarrow {}^{20}Ne$ (11.4s)			0.015	244	20
	(n, α)	−2.34	^{17}N	β^-	8.68	4.16s	^{17}O			0.0091	148	19
^{20}Ne (90.92%)	(n, p)	−6.24	^{20}F	β^-	7.030	11.4s	^{20}Ne			0.092	1500	20
	(n, α)	−0.59	^{17}O							0.15		19
^{22}Na	(n, p)	3.62	^{22}Ne							0.15		20
	(n, α)	1.92	^{19}F							0.31		19
^{23}Na (100%)	(n, γ)	6.96	^{24}Na	β^-	5.515	15h	^{24}Mg			3.5×10^{-4}	5.7	92
								0.13	thermal	2.4×10^{-4}	3.9	(5), 74
	(n, γ*)		$^{24}Na^{m}$	IT β^-	0.473 5.988	20ms	$^{24}Na^{g} \rightarrow {}^{24}Mg$ (15h) ^{24}Mg	0.40	thermal	$<10^{-4}$	<1.6	5
	(n, 2n)	−12.42	^{22}Na	β^+, EC	2.843	2.6y	^{22}Ne	~0.1	~19	0.025	407	1
										0.043	700	23
	(n, p)	−3.60	^{23}Ne	β^-	4.380	37.6s	^{23}Na	~0.1	~10	0.04	50	7, 20
	(n, d)	−6.57	^{22}Ne					—		0.010		64
	(n, α)	−3.87	^{20}F	β^-	7.030	11.4s	^{20}Ne	~0.2	~14	0.12	1950	7
										0.088	1430	19
	(n, np)	−8.79	^{22}Ne							0.018		73
										~0.020		52
	(n, nd)	−10.50	^{19}F					+		0.12 at 18MeV		64
^{24}Na	(n, p)	−1.67	^{24}Ne	β^-	2.47	3.38m	$^{24}Na^{m} \rightarrow {}^{24}Na^{g} \rightarrow {}^{24}Mg$ (0.20s) (15.0h)			0.036	586	20

	(n, α)	−2.77	^{21}F	β^-	5.68	4.4s	^{21}Ne			0.051	830	19
^{24}Mg (78.6%)	(n, γ)	7.33	^{25}Mg							2.5×10^{-4} at 4MeV		96
	(n, n′)	1.37	^{24}Mg^m	IT	1.368	0.9ps	^{24}Mg	~0.7	~4	0.55	9000	5
	(n, 2n)	−16.53	^{23}Mg	β^+	4.056	12.1s	^{23}Na			0.18	2900	29
	(n, p)	−4.73	^{24}Na	β^-	5.515	15.0h	^{24}Mg	0.22	13.5	0.20	3200	2, 7
	(n, p*)		^{24}Na^m	IT β^-	0.473 5.988	20ms	^{24}Na$^g\rightarrow^{24}$Mg^g (15h) ^{24}Mg^g	0.20	14	0.20	3300	7
	(n, α)	−2.55	^{21}Ne							0.063	103	19
^{25}Mg (10.11%)	(n, 2n)	−7.33	^{24}Mg									
	(n, p)	−3.05	^{25}Na	β^-	3.83	60s	^{25}Mg			0.04	651	5
										0.05	814	7, 20
	(n, α)	0.48	^{22}Ne	β^+, EC	2.843	2.6y	^{22}Ne			0.10	1630	19
^{26}Mg (11.17%)	(n, γ)	6.44	^{27}Mg	β^-	2.614	9.5m	^{27}Al$^m\rightarrow^{27}$Al^g (0.02ns)	0.027	thermal	2×10^{-4}	3.3	1, (6)
	(n, 2n)	−11.09	^{25}Mg									
	(n, p)	−7.92	^{26}Na	β^-	8.5	1.0s	^{26}Mg$^m\rightarrow^{26}$Mg^g (0.4ps)			0.02	330	5, 20
										0.03	490	7
	(n, α)	−5.42	^{23}Ne	β^-	4.380	37.6s	^{23}Na	−		0.084	1370	7
										0.015	244	19
^{26}Al	(n, p)	4.80	^{26}Mg							0.26		20
	(n, α)	2.95	^{23}Na							0.54		19
^{27}Al (100%)	(n, γ)	7.73	^{28}Al	β^-	4.635	2.31s	^{28}Si$^m\rightarrow^{28}$Si^g (0.5ps)	0.235	thermal	5.6×10^{-4}	9.1	5, 74
	(n, n′)	total	——							0.52		72
										0.83		95
	(n, 2n)	−13.06	^{26}Al	β^+, EC	4.003	7.4×10^5y	^{26}Mg$^m\rightarrow^{26}$Mg (0.4ps)	+		0.007	110	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{27}Al (100%)	(n, p)	−1.83	^{27}Mg	β^-	2.614	9.5m	$^{27}Al^m \rightarrow {}^{27}Al^g$	0.10	12.0	0.08	1300	2, 7, 20, 92
										0.055	900	45
	(n, d)	−6.02	^{26}Mg					0.032	16	0.023		72
	(n, t)	−10.88	^{25}Mg					+		0.003 at 16MeV		72
										0.00173		93
	(n, α)	−3.13	^{24}Na	β^-	5.515	15.0h	^{24}Mg	0.12	13.5	0.12	1950	2, 7, 92
										0.10	1630	63
	(n, α^*)		$^{24}Na^m$	IT β^-	0.473 5.988	20ms	$^{24}Na^g \rightarrow {}^{24}Mg^g$ (0.02s) $^{24}Mg^g$			0.04	651	5
	(n, nα)	−10.09	^{23}Na					+		0.05 at 16MeV		72
	(n, np)	−8.27	^{26}Mg							0.05		5
	total n emission	—	—					0.83	8~11	0.72		72
	total p emission	—	—							0.19		70
	nonelastic	—	—					1.1	15	1.0		96
^{28}Al	(n, p)	−1.06	^{28}Mg							0.046		20
	(n, α)	−1.81	^{25}Na	β^-	3.83	60s	^{25}Mg			0.074	1200	19
^{28}Si (92.27%)	(n, γ)	8.47	^{29}Si							4.5×10^{-4}		75
	(n, 2n)	−17.18	^{27}Si	β^+	4.810	4.2s	^{27}Al			0	0	5
	(n, p)	−3.86	^{28}Al	β^-	4.635	2.31m	$^{28}Si^m \rightarrow {}^{28}Si$ (0.5ps)	0.4	10	0.19	3100	1, 7, 20
										0.18	2900	63
	(n, α)	−2.65	^{25}Mg					~0.2	~8	0.013		5
	(n, $\alpha+\alpha^*$)		^{25}Mg					~0.3	~8	0.03		5
	(n, np)	−11.59	^{27}Al							0.027		73
^{29}Si (4.68%)	(n, 2n)	−8.47	^{28}Si							0.40±0.10 (fluctuation)		16

	(n, p)	−2.90	^{29}Al	β^-	3.68	6.6m	^{29}Si	0.39	9	0.23	3700	1
										0.13	2100	7, 20
	(n, α)	−0.03	^{26}Mg							0.13		19
	(n, 2p)	−14.63	^{28}Mg	β^-	1.836	21h	^{28}Al$^{excit}\rightarrow^{28}$Al$^{g}\rightarrow^{28}$Si (2.3ns)(2.31m)			$<5\times10^{-4}$	<8.1	73
^{30}Si (3.09%)	(n, γ)	6.59	^{31}Si	β^-	1.48	2.62h	^{31}P	0.11	thermal	4.8×10^{-4}	7.8	(6), 74
										7×10^{-4}	11	1
	(n, 2n)	−10.61	^{29}Si									
	(n, p*)	(−7.76)	^{30}Al^{m}	IT		72s	^{30}Al$^{g}\rightarrow^{30}$Si (3.3s)			0.18	2900	5
	(n, α)	−4.20	^{27}Mg	β^-	2.614	9.5m	^{27}Al$^{m}\rightarrow^{27}$Al^{g} (0.02ns)			0.07	113	7
										0.050	810	19
^{31}P (100%)	(n, γ)	7.94	^{32}P	β^-	1.710	14.3d	^{32}S	0.19	thermal	3.4×10^{-4}	5.5	(5), 74
										1×10^{-6}	0.02	1
	(n, n′)	—	—							0.92		95
	(n, 2n)	−12.31	^{30}P	β^+	4.24	2.50m	^{30}Si	+		0.007	110	1
										0.011	180	23
	(n, p)	−0.71	^{31}Si	β^-	1.48	2.62h	^{31}P	0.14	8	0.09	1460	2
										0.067	1090	20
	(n, d)	−5.07	^{30}Si							0.0145		52
	(n, ^{3}He)	−13.08	^{29}Al	β^-	3.68	6.6m	^{29}Si$^{excit}\rightarrow^{29}$Si^{g} (0.1ps)			2.22×10^{-4}	3.6	54
										$\leq1.3\times10^{-5}$	≤0.21	56
	(n, α)	−1.94	^{28}Al	β^-	4.635	2.31m	^{28}Si$^{m}\rightarrow^{28}$Si^{g} (0.5ps)	1.4	11	0.12	2000	1, 27
										0.11	1800	7
								1.5	11			(19)
	(n, np)	−7.30	^{30}Si							0.1		5
	nonelastic	—	—							0.95		96

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{32}S (95.018%)	(n, γ)	8.63	^{33}S							5.0×10^{-4}		75
	(n, 2n)	−15.09	^{31}S	β^+	5.44	2.7s	^{31}P			4×10^{-4} at 16 MeV		5
	(n, p)	−0.93	^{32}P	β^-	1.710	14.3d	^{32}S	0.4	11	0.20	3300	7, 20
	(n, d)	−6.64	$^{31}P_g$							0.015		78
	(n, t)	−12.69	^{30}P	β^+	4.24	2.50m	^{30}Si	+		1.54×10^{-4}	2.5	54
										1×10^{-5}	0.2	5
										7.2×10^{-6}	0.12	83
	(n, α)	1.53	^{29}Si					~0.25	~4	0.10		5
										0.31		19
	(n, np)	−8.86	^{31}P							0.078		73
	total p emission	—	—							0.400		79
	nonelastic for S	—	—					~1.2	~10	1.1		96
^{34}S (4.125%)	(n, γ)	6.99	^{35}S	β^-	0.1678	88d	^{35}Cl	0.26	thermal	1×10^{-4}	1.6	1, (6)
	(n, 2n)	−11.41	^{33}S							0.16		8
	(n, p)	−4.32	^{34}P	β^-	5.1	12.4s	^{34}S	−		0.08	1300	7
										0.069	1120	20
	(n, α)	−1.33	^{31}Si	β^-	1.48	2.62h	^{31}P	+		0.125	2030	1
										0.085	1380	19
^{36}S (0.017%)	(n, γ)	4.31	^{37}S	β^-	4.8	5.06m	^{37}Cl	0.3	thermal	1×10^{-4}	1.6	1
	(n, 2n)	−9.89	^{35}S	β^-	0.1674	88d	^{35}Cl			0.02	320	1
										0.050	810	20
	(n, p)		^{36}P							0.050		20
	(n, α)	−4.69	^{33}Si							0.015		19
^{35}Cl (75.4%)	(n, γ)	8.58	^{36}Cl	β^- EC, β^+	0.712 1.14	3.1×10^5y	^{36}Ar ^{36}S	30	thermal	0.001	16	1, (6)

	(n, 2n)	−12.65	^{34}Cl	β^+	5.482	1.57s	^{34}S	0.05	19	0.005	81	7
	(n, 2n*)		^{34}Cl^m	β^+ IT	5.627 0.145	32.0m	^{34}S$^m \rightarrow ^{34}$S^g (32.0m) ^{34}Cl$^g \rightarrow ^{34}$S^g (1.56s)	+		0.005	81	1
	(n, p)	0.62	^{35}S	β^-	0.1674	88d	^{35}Cl	0.5	thermal	0.14	2280	1, 20
	(n, α)	0.94	^{32}P	β^-	1.710	14.3d	^{32}S	$<5\times10^{-5}$	thermal	0.12	1940	1, 27
										0.14	2280	19
^{36}Ar (0.337%)	(n, p)	0.07	^{36}Cl	β^- (EC, β^+)	0.712 1.14	3.1×10^5y	^{36}Ar ^{36}S			0.60	9770	20
	(n, α)	2.00	^{33}S							0.30		19
^{38}Ar (0.063%)	(n, p)	−4.13	^{38}Cl	β^-	4.91	37.3m	^{38}Ar			0.075, 0.11		96
										0.14		20
	(n, α)	−0.22	^{35}S	β^-	0.1674	88d	^{35}Cl			0.11	1790	19
^{37}Cl (24.6%)	(n, γ)	10.31	^{38}Cl	β^-	4.91	37.5m	^{38}Ar	0.56	thermal	1×10^{-7}	0	1, (6)
	(n, 2n)	−8.58	^{36}Cl	β^- β^+, EC	0.712 1.14	3.1×10^5y	^{36}Ar ^{36}S	+		0.35	5700	1
	(n, p)	1.93	^{37}S	β^-	4.8	5.06m	^{37}Cl	±		0.018	292	1
										0.02	320	7
	(n, α)	2.46	^{34}P	β^-	5.1	12.4s	^{34}S	−		0.12	1950	7
										0.055	891	19
										0.024	389	20
										0.036	583	27
^{40}Ar (99.6%)	(n, γ)	6.09	^{41}Ar	β^-	2.491	1.83h	^{41}K			0.001 at 1MeV		96
	(n, 2n)	−9.87	^{39}Ar	β^-	0.565	269y	^{39}K			0.57	9300	8
	(n, p)	−6.72	^{40}Cl	β^-	7.5	1.4m	^{40}Ar			0.018	290	7
										0.072	1170	20
	(n, d)	−10.29	^{39}Cl	β^-	3.44	55.5m	^{39}Ar$\rightarrow^{39}$K (269y)			0.0029	47	96
	(n, α)	−2.49	^{37}S	β^-	4.8	5.06m	^{37}Cl	−		0.013	210	7, 26
										0.031	502	21
	(n, np)	−12.51	^{39}Cl	β^-	3.44	55.5m	^{39}Ar$\rightarrow^{39}$K (269y)			0.0017	28	96

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{39}K (93.08%)	(n, γ)	7.80	^{40}K	β^-, EC, β^+	1.314 1.505	1.26×10^9y	^{40}Ca ^{40}Ar	~3	thermal	9×10^{-5}	1.5	1, (6)
	(n, 2n)	−13.09	^{38}K	β^+, EC	5.93	7.71m	$^{38}Ar^{excit}\rightarrow{}^{38}Ar^g$	~0.025	~20	0.002	33	7
										0.0047	76	97
										0.0035	57	1
	(n, 2n*)	−13.09	$^{38}K^m$	β^+	6.06	0.95s	$^{38}Ar^g$	0.012	2.1	8×10^{-4}	13	7
	(n, p)	0.22	^{39}Ar	β^-	0.565	2.69×10^2y	^{39}K		flat >18	0.35	5700	1
										0.21	3420	20
	(n, t)	−9.74	^{37}Ar	EC	0.814	35d	^{37}Cl			1.84×10^{-4}	3.0	93, 96
	(n, α)	1.36	^{36}Cl	β^-, β^+, EC	0.712 1.14	3.1×10^5y	^{36}Ar ^{36}S	0.16	8	0.11	1800	1, 19
										0.08	1300	7
	(n, 2α)	−8.99	^{32}P	β^-	1.710	14.3d	^{32}S			1.27×10^{-4}	2.1	96
	(n, np)	−6.38	^{38}Ar							0.18		5
	(n, nα)	−7.22	^{35}Cl							0.03		5, 85
^{41}K (6.91%)	(n, γ)	7.53	^{42}K	β^-	3.52	12.4h	^{42}Ca	1	thermal	0.005	81	1
	(n, 2n)	−10.10	^{40}K	β^-, β^+	1.314 1.505	1.26×10^9y	^{40}Ca ^{40}Ar	+		0.4	6500	1
	(n, 2n*)		$^{40}K^m$			294ns				0.036		7
	(n, p)	−1.71	^{41}Ar	β^-	2.491	1.83h	^{41}K	0.09	10	0.08	1300	1
										0.11	1780	20
									~10	0.05	810	7
	(n, ^{3}He)	−12.60	^{39}Cl	β^-	3.44	66m	$^{39}Ar\rightarrow{}^{39}K$ (269y)			8.48×10^{-4}	13.8	54
	(n, α)	−0.11	^{38}Cl	β^-	4.91	37.3m	^{38}Ar	0.033	12	0.031	502	1, 27
										0.067	1090	19
^{40}Ca (96.97%)	(n, γ)	8.36	^{41}Ca	EC	0.427	8×10^4y	^{41}K			5.2×10^{-4}	8.5	75
								2	thermal	0.001	16	1

	(n, 2n)	−15.63	^{39}Ca	β^+	6.50	0.87s	^{39}K					
	(n, p)	−0.53	^{40}K	β^- β^+	1.314 1.505	1.3×10^9y	^{40}Ca ^{40}Ar	0.75	12	0.68	11000	1
										0.23	3700	20
	(n, t)	−12.94	^{38}K	β^+, EC	5.93	7.71m	^{38}Ar$^{excit}\rightarrow{}^{38}$Ar^g			2.7×10^{-5}	0.44	55, 83
										3.1×10^{-4}	5.1	54
	(n, α)	1.75	^{37}Ar	EC	0.814	35.1d	^{37}Cl	0.8	10	0.5	8140	1
										0.55	8950	19
	(n, np)	−8.33	^{39}K							0.20		5
	(n, nα)	−7.04	^{36}Ar							0.023		96
	nonelastic	——	——							1.3		96
^{42}Ca (0.64%)	(n, 2n)	−11.47	^{41}Ca	EC	0.427	7.7×10^4y	^{41}K	+		0.13	2100	1
	(n, p)	−2.73	^{42}K	β^-	3.52	12.4h	^{42}Ca	0.17	12	0.16	2600	1
										0.11	1800	15
										0.18	2930	27
	(n, α)	0.35	^{39}Ar	β^-	0.565	2.7×10^2y	^{39}K	+		0.09	1500	1
										0.30	4900	19
^{43}Ca (0.145%)	(n, 2n)	−7.93	^{42}Ca							0.47		15
	(n, p)	−1.04	^{43}K	β^-	1.82	22.4h	^{43}Ca	0.16	14	0.16	2590	1
										0.097	1570	7, 27
										0.085	1380	20
	(n, d)	−8.44	^{42}K	β^-	3.52	12.4h	^{42}Ca			0.0013	21	96
	(n, α)	2.29	^{40}Ar							0.23		19
	(n, np)	−10.67	^{42}K	β^-	3.52	12.4h	^{42}Ca	+		0.02	330	1
^{44}Ca (2.06%)	(n, γ)	7.41	^{45}Ca	β^-	0.252	165d	^{45}Sc	0.67	thermal	0.002	33	1, (6)
	(n, 2n)	−11.14	^{43}Ca							0.54		15
										0.4		8
	(n, p)	−4.88	^{44}K	β^-	5.2	22m	^{44}Ca	0.041	12	0.035	569	1, 20
										0.040	651	27
										0.046	750	98

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{44}Ca (2.06%)	(n, α)	−2.75	^{41}Ar	β^-	2.491	1.83h	^{41}K	+		0.045	732	1, 19
										0.032	518	7, 27
^{46}Ca (0.0033%)	(n, γ)	7.28	^{47}Ca	β^-	1.979	4.53d	^{47}Sc→^{47}Ti (3.43d)	0.5	thermal	0.002	33	1
	(n, 2n)	−10.40	^{45}Ca	β^-	0.252	1.65×10^2d	^{45}Sc	+		0.65	10600	1, 15
	(n, α)		^{43}Ar							0.0042		19
^{48}Ca (0.0185%)	(n, γ)	5.14	^{49}Ca	β^-	5.26	8.8m	^{49}Sc→^{49}Ti (57.5m)	1	thermal	0.002	33	1
										2.6×10^{-4}	4.2	74
	(n, 2n)	−9.95	^{47}Ca	β^-	1.979	4.53d	^{47}Sc→^{47}Ti (3.43d)	+		0.8	13000	1
	(n, p)	−10.67	^{48}K							0.0052		20
	(n, α)		^{45}Ar							0.00014		19
^{45}Sc (100%)	(n, γ)	8.77	^{46}Sc	β^-	2.367	83.9d	^{46}Ti^{excit}→^{46}Ti^{g}	25	thermal	8×10^{-4}	13	58
										0.003	49	5
										0.0023	38	74
	(n, 2n)	−11.32	^{44}Sc	β^+, EC	3.647	3.92h	^{44}Ca	~0.32	~18	0.14	2270	1, 7
	(n, 2n*)		^{44}Sc^{m}	IT	0.271	2.44d	^{44}Sc^{g}→^{44}Ca (3.92h)	~0.19	~18	0.11	1780	1, 7
	(n, p)	0.53	^{45}Ca	β^-	0.252	1.65×10^2d	^{45}Sc	0.11	8	0.06	980	1, 27
										0.05	810	7
										0.12	1980	20
	(n, ^{3}He)	−11.59	^{43}K	β^-	1.82	22.0h	^{43}Ca			8.6×10^{-6}	0.14	55, 56
	(n, α)	−0.40	^{42}K	β^-	3.52	12.4h	^{42}Ca	0.055	14	0.055	895	1, 7, 27
										0.11	1780	19
	(n, 2p)	−9.65	^{44}K	β^-	5.2	22.0m	^{44}Ca			2.1×10^{-4}	3.4	96
^{46}Ti (7.95%)	(n, n'γ)	−0.8894 1st (2$^+$) level	^{46}Ti							0.602	9800	47

	(n, 2n)	−13.20	^{45}Ti	β^+, EC	2.509	3.09h	^{45}Sc	+		0.02	326	1
										0.01	163	7
										0.051	830	23
	(n, p)	−1.58	^{46}Sc	β^-	2.367	84d	^{46}Ti$^{excit}\rightarrow^{46}$Ti^g (4ps)	0.3	15	0.3	4900	2, 7, 92
								0.27	12	0.25	4080	53
										0.166	2700	98
										0.22	3580	20, 27
	(n, p*)	−1.73	^{44}Sc^m	IT	2.507	18.7s	^{46}Sc$^g\rightarrow^{46}$Ti (83.9d)			0.048	780	98
	(n, t)	−13.19	^{44}Sc^g	EC	3.647	4.0h	^{44}Ca			1.15×10^{-4}	1.87	65
	(n, t*)	−13.46	^{44}Sc^m	EC	3.918	2.44d	^{44}Sc$^g\rightarrow^{44}$Ca (4.0h)			$<2\times10^{-5}$	<0.3	65
	(n, α)	−0.08	^{43}Ca							0.17		19
^{47}Ti (7.75%)	(n, 2n)	−8.88	^{46}Ti							0.39		15
	(n, p)	0.18	^{47}Sc	β^-	0.600	3.43d	^{47}Ti	+		0.11	1780	2, 7, 27, 98
								0.14	11	0.12	1950	53
										0.17	2750	20
	(n, α*)	(2.18)	^{44}Ca^{excit}	IT	1.156	4ps	^{44}Ca			0.0016	26	17
	(n, np)	−10.46	^{46}Sc	β^- (β^+, EC)	2.367 1.38	84d	^{46}Ti$^{excit}\rightarrow^{46}$Ti^g (4ps)	+		0.03	488	1
^{48}Ti (73.45%)	(n, γ)	8.14	^{49}Ti					0.0083	thermal			(6)
	(n, n'γ)	−0.98 1st (2^+) level	^{48}Ti							0.591		47
	(n, 2n)	−11.63	^{47}Ti							0.37		8, 15
	(n, p)	−3.21	^{48}Sc	β^-	3.98	44h	^{48}Ti$^{excit}\rightarrow^{48}$Ti^g	0.065	14	0.065	1050	2, 27
										0.6	10000	7
										0.12	1950	20, 92
										0.053	860	98
								0.063	14	0.063	1030	53
	(n, α)	−2.03	^{45}Ca	β^-	0.252	165d	^{45}Sc			0.039	635	21, 27
	(n, np)	−11.45	^{47}Sc	β^-	0.600	3.43d	^{47}Ti	+		0.01	162	1
^{49}Ti (5.51%)	(n, γ)	10.95	^{50}Ti					0.0019	thermal			(6)
	(n, 2n)	−8.14	^{48}Ti							0.61		15

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{49}Ti (5.51%)	(n, p)	−1.22	^{49}Sc	β^-	2.008	57.5m	^{49}Ti	0.033	15	0.033	535	1, 27
										0.03	490	7
										0.023	374	98
										0.10	1600	20
	(n, α)	0.23	^{46}Ca							0.039	640	19
	(n, np)	−11.35	^{48}Sc	β^-	3.98	1.83d	^{48}Ti$^{excit}\rightarrow^{48}$Ti^{g} (3ps)	+		0.005	81	1
^{50}Ti (5.34%)	(n, γ)	6.38	^{51}Ti	β^-	2.46	5.8m	^{51}V$^{excit}\rightarrow^{51}$V^{g} (0.2ns)	0.004	thermal	0.003	49	5
										3×10^{-4}	5	74
	(n, n′γ)	−1.55 1st (2+) level	^{50}Ti							0.488		47
	(n, 2n)	−10.95	^{49}Ti							0.54		15
	(n, p)	−6.11	^{50}Sc	β^-	6.5	1.72m	^{50}Ti$^{excit}\rightarrow^{50}$Ti^{g} (0.7ps)	±		0.02	324	1, 7, 27
										0.012	195	98
										0.040	648	20
	(n, α)	−3.44	^{47}Ca	β^-	1.979	4.53d	^{47}Sc$\rightarrow^{47}$Ti (3.43d)	+		0.009	145	1, 21
										0.013	210	17, 27
	(n, 2p)	−17.22	^{49}Ca	β^-	5.26	8.8m	^{49}Sc$\rightarrow^{49}$Ti (57.5m)			2×10^{-4} at 14.7MeV?		96
^{50}V (0.24%)	(n, 2n)	−9.33	^{49}V	EC	0.60	330d	^{49}Ti	+		0.54	8790	1
										0.074	1200	20
	(n, p)	2.99	^{50}Ti							0.074		20
	(n, α)	0.76	^{47}Sc	β^-	0.600	3.43d	^{47}Ti	+		0.028	454	1
										0.048	778	19
^{51}V (99.76%)	(n, γ)	7.31	^{52}V	β^-	3.97	3.76m	^{52}Cr$^{excit}\rightarrow^{52}$Cr^{g} (0.7ps)	4.9 (0.001	thermal 3)	0.002	33	1, (5), 97
										2.7×10^{-4}	4.4	75
										3.7×10^{-4}	6.0	74
	(n, n_1′)	−0.319	^{51}V							0.006		51
	(n, n_2′)	−0.929	^{51}V							0.006		51

	(n, n′)	total	^{51}V							0.60		51, 95
	(n, 2n)	−11.05	^{50}V	β^- / EC	1.033 2.215	6×10^{15}y	^{50}Cr→^{50}Cr^g (6ps) ^{50}Ti→^{50}Ti^g (0.7ps)	+		0.65	10600	1
										0.47	7650	15
	(n, p)	−1.68	^{51}Ti	β^-	2.46	5.8m	^{51}V^{excit}→^{51}V^g (0.2ns)	0.037	13	0.036	583	1, 7, 27
										0.033	536	98
										0.028	454	20
	(n, d)	−5.82	^{50}Ti							4.8×10^{-4} b/sr at 15°		ref. in 59
	(n, ^{3}He)	−12.60	^{49}Sc	β^-	2.008	57.5m	^{49}Ti			$<3.3\times10^{-4}$	<5.4	73
	(n, α)	−2.06	^{48}Sc	β^-	3.98	1.83d	^{48}Ti^{excit}→^{48}Ti^g (3ps)	0.035	17	0.022	356	1, 5, 7
										0.042	680	19
										0.018	292	27
	(n, nα)	−10.29	^{47}Sc	β^-	0.600	3.43d	^{47}Ti	+		0.002	33	1
										0.005	81	85
^{52}V	(n, p)		^{52}Ti							0.018		20
	(n, α)	0.67	^{49}Sc	β^-	2.008	57.5m	^{49}Ti			0.055	895	19
^{50}Cr (4.31%)	(n, γ)	9.26	^{51}Cr	EC	0.752	27.8d	^{51}V	13.5	thermal	0.002	33	1, (6)
	(n, n′)	——								0.74		73
	(n, 2n)	−12.94	^{49}Cr	β^+, (EC)	2.56	42m	^{49}V→^{49}Ti (330d)	0.09	20	0.009	146	7, 17
										0.024	390	97
										0.029	470	23
	(n, p)	−0.26	^{50}V	β^- / EC	1.033 2.215	6×10^{15}y	^{50}Cr^m→^{50}Cr^g (6ps) ^{50}Ti^m→^{50}Ti^g (0.7ps)			0.36	5860	20
										0.28	4560	27
	(n, t)	−12.86	^{48}V	EC, β^+	4.013	16.2d	^{48}Ti			6.6×10^{-5}	1.1	55, 83
	(n, α)	0.32	^{47}Ti							0.16		19
	(n, np)	−9.59	^{49}V	EC	0.60	330d	^{49}Ti	+		0.15	2440	1
^{51}Cr	(n, p)	1.53	^{51}V							0.29		20
	(n, α)	2.70	^{48}Ti							0.16		19

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{52}Cr (83.76%)	(n, γ)	7.94	^{54}Cr							9.0×10^{-4}		75
	(n, n'γ)	−1.4336 1st (2^+) level	^{52}Cr					~1.0	~3	0.724		47
	(n, 2n)	−12.04	^{51}Cr	EC	0.752	27.8d	^{51}V	0.50	18	0.25	4070	1
										0.27	4400	7
										0.35	5700	23
										0.28	4500	88
	(n, p)	−3.20	^{52}V	β^-	3.97	3.77m	$^{52}Cr^m \rightarrow {}^{52}Cr^g$ (0.7ps)	0.13	11	0.10	1620	20, 27, 97
										0.080	1300	98
										0.12	1950	7, 90
	(n, d)	−8.29	^{51}V							0.0011 b/sr at 14°		52
	(n, α)	−1.21	^{49}Ti							0.054		19
	(n, np)	−10.5	^{51}V							<0.012		52
^{53}Cr (9.55%)	(n, 2n)	−7.94	^{52}Cr							1.05		15
										0.85		8
	(n, p)	−2.64	^{53}V	β^-	3.4	2.0m	$^{53}Cr^{excit} \rightarrow {}^{53}Cr^g$	+		0.04	648	1, 97
										0.044	715	90
										0.048	780	98
										0.064	1050	20
	(n, ^3He)	−12.42	^{51}Ti	β^-	2.46	5.8m	^{51}V			$<3\times10^{-4}$	<4.9	73
	(n, α)	1.80	^{50}Ti							0.095		19
	(n, np)	−11.15	^{52}V	β^-	3.97	3.76m	^{52}Cr			0.0071	116	90
^{54}Cr (2.38%)	(n, γ)	6.26	^{55}Cr	β^-	2.59	3.5m	^{55}Mn	0.38	thermal	0.002	33	1, (6)
	(n, 2n)	−9.72	^{53}Cr							1.19		15
										0.76		8
	(n, p)	−6.22	^{54}V	β^-	7.3	55s	$^{54}Cr^{excit} \rightarrow {}^{54}Cr^g$ (12ps)			0.016	259	20, 97
										0.0135	220	90
										0.018	293	98

										0.044	720	27
	(n, d)	−10.14	^{53}V	β^-	3.5	2.0m	^{53}Cr			4.8×10^{-4} b/sr at 15°		ref. in 59
	(n, α)	−1.55	^{51}Ti	β^-	2.46	5.8m	^{51}V$^{excit}\rightarrow^{51}$V^{g} (0.2ns)	+		0.013	211	1, 27, 90
										0.007	111	97
										0.047	765	19
										0.0125	204	90
^{54}Mn	(n, p)	2.16	^{54}Cr							0.15		20
	(n, α)	2.27	^{51}V							0.059		19
^{55}Mn (100%)	(n, γ)	7.27	^{56}Mn	β^-	3.702	2.576h	^{56}Fe	13	thermal	7.6×10^{-4}	12	(5), 42
										0.0012	20	74
	(n, n′)	——								0.355		95
	(n, 2n)	−10.22	^{54}Mn	EC (β^-)	1.379 0.69	303d	^{54}Cr$^{excit}\rightarrow^{54}$Cr^{g} (12ps)	1.0	17	0.8	13000	2
										0.9	15000	7
										0.84	13700	23
	(n, p)	−1.81	^{55}Cr	β^-	2.59	3.5m	^{55}Mn	0.090	15	0.083	1340	1
										0.04	650	7
										0.036	583	27
	(n, d)	−5.82	^{54}Cr							0.043		42
										3.5×10^{-4} b/sr at 14°		52
										1.4×10^{-4} b/sr at 15°		59
	(n, ^{3}He)	−12.702	^{53}V	β^-	3.5	2.0m	^{53}Cr			0.003	49	42
										8.0×10^{-4}	13	54
	(n, α)	−0.63	^{52}V	β^-	3.97	3.77m	^{52}Cr$^{excit}\rightarrow^{52}$Cr^{g} (0.7ps)	0.034	14	0.034	551	1, 7, 27
										0.046	745	19
	(n, np)	−8.06	^{54}Cr							<0.008 b/sr at 15°		52
	(n, t)+ (n, n′t)	——	——							0.0049 at 22.5 MeV		60

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{55}Mn (100%)	(n, 2p)		^{54}V	β^-	7.3	55s	^{54}Cr$^{excit}\rightarrow^{54}$Cr^g (12ps)			2×10^{-4}	3	96
	nonelastic	—	—							1.6 at 8 MeV		96
^{56}Mn	(n, p)		^{56}Cr	β^-	1.6	5.9m	^{56}Mn$\rightarrow^{56}$Fe (2.576h)			0.033	537	20
	(n, α)		^{53}V	β^-	3.5	2.0m	^{53}Cr			0.041	667	19
^{54}Fe (5.84%)	(n, γ)	9.30	^{55}Fe	EC	0.232	2.6y	^{55}Mn	2.5	thermal	0.002	33	1, (6)
	(n, n'γ)	−1.409 1st (2$^+$) level	^{54}Fe							0.480		47
	(n, n')	—	^{54}Fe							0.600		96
	(n, 2n)	−13.38	^{53}Fe	β^+, (EC)	3.98	8.5m	^{53}Mn$\rightarrow^{53}$Cr (2×10^6y)	~0.08	18	0.01	162	1, 7
										0.014	227	23
	(n, p)	0.09	^{54}Mn	EC	1.379	303d	^{54}Cr$^m\rightarrow^{54}$Cr^g (12ps)	0.55	9	0.35	5700	2, 7, 27, 92
										0.44	7160	20
	(n, t)	−12.43	^{52}Mn	EC, β^+	4.708	5.7d	^{52}Cr$^m\rightarrow^{52}$Cr^g (0.7ps)	+		5×10^{-5}	0.81	1
										1.0×10^{-5}	0.16	83
	(n, t*)		^{52}Mn^m	β^+, (EC)	5.091	21m	^{52}Cr$^m\rightarrow^{52}$Cr^g (0.7ps)	+		4×10^{-4}	6.5	1, 54
										9.5×10^{-5}	1.5	83
	(n, α)	0.84	^{51}Cr	EC	0.752	27.8d	^{51}V	+		0.09	1470	1, 7
										0.11	1790	19, 27
	(n, np)	−8.85	^{53}Mn	EC	0.598	2×10^6y	^{53}Cr	+		0.11	1790	1
^{55}Fe	(n, p)	1.00	^{55}Mn							0.23		20
	(n, α)	3.58	^{52}Cr							0.16		19
^{56}Fe (91.68%)	(n, γ)	7.65	^{57}Fe					~2.7	thermal			(6)
	(n, n'γ)	−0.8469 1st (2$^+$) level	^{56}Fe							0.584		47
	(n, n')	—	^{56}Fe							0.950		96

	(n, 2n)	−11.20	^{55}Fe	EC	0.232	2.6y	^{55}Mn	+		0.34	5540	1
										0.49	7980	23
	(n, p)	−2.92	^{56}Mn	β^-	3.702	2.58h	^{56}Fe	0.12	13.5	0.12	1940	2, 20, 27, 45, 85, 92
										0.098	1590	98
										0.11	1800	7
	(n, d)	−7.97	^{55}Mn							5.1×10^{-4} b/sr at 15°		ref. in 59
	(n, t)	−11.93	^{54}Mn	EC	1.379	303d	^{54}Cr$^{1st}\rightarrow^{54}$Cr^{g}			4.5×10^{-5}	0.73	65
	(n, α)	0.32	^{53}Cr							0.0023		17
										0.09		19
	(n, np)	−10.19	^{55}Mn							0.035		73
	nonelastic	——	——							~1.3		96
^{57}Fe (2.17%)	(n, 2n)	−7.65	^{56}Fe							0.87		15
	(n, p)	−1.78	^{57}Mn	β^-	2.7	1.7m	^{57}Fe	0.10	15	0.09	1460	1
										0.054	875	20, 27, 98
	(n, α)	2.40	^{54}Cr							0.070		19
	(n, np)	−10.56	^{56}Mn	β^-	3.702	2.58h	^{56}Fe	+		0.004	64	1
										0.0061		52
^{58}Fe (0.31%)	(n, γ)	6.59	^{59}Fe	β^-	1.573	46d	^{59}Co	0.98	thermal	0.002	33	1, (6)
	(n, 2n)	−10.04	^{57}Fe							1.0		15
	(n, p)	−5.32	^{58}Mn	β^-	6.5	1.1m	^{58}Fe	+		0.015	243	1
										0.007	111	98
										0.019	308	20
	(n, α)	−1.39	^{55}Cr	β^-	2.59	3.5m	^{55}Mn	+		0.012	194	1
										0.017	275	19
										0.022	356	27
^{58}Co	(n, p)	3.09	^{58}Fe							0.14		20
	(n, α)	3.54	^{55}Mn							0.081		19

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{59}Co (100%)	(n, γ)	7.49	^{60}Co	β^-	2.819	5.26y	^{60}Ni$^{excit}\rightarrow^{60}$Ni^g (10.7ps)	20	thermal	0.003	49	1
	(n, n′)	—	^{59}Co							0.78		95
	(n, 2n)	−10.46	^{58}Co	EC, β^+ (β^-)	2.309 0.39	71d	^{58}Fe	+		0.25	4070	1
										0.508	8270	63
										0.65	10600	7
	(n, 2n*)		^{58}Co^m	IT	0.025	9h	^{58}Co$^g\rightarrow^{58}$Fe (71.3d)	+		0.38	6160	1
								0.85	~18	0.42	6840	7
	(n, p)	−0.78	^{59}Fe	β^-	1.573	45d	^{59}Co	±	4	0.08	1300	1
										0.534	8700	63
										0.072	1170	20, 27
										0.06	980	7
	(n, d)	−5.18	^{58}Fe							1.5×10^{-4} b/sr at 15°		ref. in 59
	(n, t)	−8.93	^{57}Fe					+		0.0018		1
	(n, ^{3}He)	−11.61	^{57}Mn	β^-	2.7	1.7m	^{57}Fe			6.2×10^{-5}	1.0	54
	(n, α)	0.32	^{56}Mn	β^-	3.702	2.58h	^{56}Fe	0.029	14	0.029	470	2, 7, 27
										0.065	1060	93
										0.053	860	19
										0.026	420	63, 92
										0.0011	18	17
	total p emission	—	—							0.10		70
	nonelastic	—	—							1.4		96
^{60}Co	(n, p)		^{60}Fe	[β^-]	0.14	3×10^5y	^{60}Co$^m\rightarrow^{60}$Co$^g\rightarrow^{60}$Ni (10.5m) (5.26y)			0.028	456	20
	(n, α)	1.44	^{57}Mn	β^-	2.7	1.7m	^{57}Fe			0.019	309	19

^{57}Ni	(n, p)	4.02	^{57}Co	EC	0.837	270d	^{57}Fe			0.60	9770	20
	(n, α)	5.54	^{54}Fe							0.30		19
^{58}Ni (67.76%)	(n, γ)	9.00	^{59}Ni	EC	1.073	8×10^{4}y	^{59}Co	~4.4	thermal	1×10^{-4}	1.6	1, (6)
	(n, n'γ)	−1.45 1st (2^+) level	^{58}Ni							0.218		47
	(n, n')	——	——							0.36		96
	(n, 2n)	−12.20	^{57}Ni	EC, β^+	3.24	36h	^{57}Co→^{57}Fe (270d)	+		0.023	373	1, 7
										0.039		63
										0.034		23
	(n, p)	0.39	^{58}Co	EC, β^+	2.309	71d	^{58}Fe	0.65	8	0.45	7330	1, 7, 92
										0.122	1980	63
	(n, p*)		^{58}Co^{m}	IT	0.025	9.0h	^{58}Co^{g}→^{58}Fe (71.3d)	0.41	11	0.37	6000	1
										0.19	3100	7
	(n, d)	−5.95	^{57}Co	EC	0.837	270d	^{57}Fe	0.55	14	0.55	8950	1
	(n, t)	11.08	^{56}Co	EC, β^+	4.57	77d	^{56}Fe^{excit}→^{56}Fe^{g} (7ps)			9.2×10^{-5}	1.5	65
	(n, ^{3}He)	−6.47	^{56}Fe									
	(n, α)	2.89	^{55}Fe	EC	0.232	2.6y	^{55}Mn	0.11	12	0.11	1790	2
										0.0014	23	17
	(n, α*)		^{55}Fe^{excit}	IT	1.322 1.412		^{55}Fe^{g}→^{55}Mn (2.6y)			0.0044	72	17
	(n, np)	−8.18	^{57}Co	EC	0.837	270d	^{57}Fe	+		0.24	3910	1
										0.32	5200	73
	(n, nα)	−6.39	^{54}Fe							0.030		96
										0.036		79
	total p emission	——	——							0.42		70
^{59}Ni	(n, p)	1.86	^{59}Co							0.26		20
	(n, α)	5.09	^{56}Fe							0.23		19

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{60}Ni (26.16%)	(n, n'γ)	−1.3325 1st (2^+) level	^{60}Ni							0.515		47
	(n, 2n)	−11.39	^{59}Ni	EC	1.07	8×10^4y	^{59}Co	+		0.24	3910	1
										0.36	5900	15
	(n, p)	−2.04	^{60}Co	β^-	2.819	5.26y	^{60}Ni	0.14	13	0.13	2120	1, 7, 92
										0.112	1820	98
	(n, p*)		^{60}Co^m	IT (β^-)	0.0586	10.5m	^{60}Co$^g\rightarrow^{60}$Ni (5.3y)	0.014	13	0.013	211	1
										0.095	1540	98
										0.03	500	7
	(n, d)	−7.31	^{59}Co							0.0019 b/sr at 15°		ref. in 59
	(n, t)	−11.51	^{58}Co	EC, β^+	2.309	71.3d	^{58}Fe			6.1×10^{-5}	1.0	65
	(n, α)	1.35	^{57}Fe							0.0043		17
										0.091		19
	(n, np)	−9.53	^{59}Co							0.068		73
^{61}Ni (1.25%)	(n, 2n)	−7.82	^{60}Ni							0.46		15
										0.80		8
	(n, p)	−0.53	^{61}Co	β^-	1.29	99m	^{61}Ni			0.096	1560	27, 98
										0.088	1430	19
	(n, α)	3.57	^{58}Fe							0.0007		17
	(n, α*)		^{58}Fe^{excit}	IT	0.810	7ps	^{58}Fe^g			0.0011	18	17
	(n, np)	−9.86	^{60}Co	β^-	2.819	5.26y	^{60}Ni$^{excit}\rightarrow^{60}$Ni^g (0.7ps)	+		0.0033	54	1
	(n, np*)		^{60}Co^m	IT (β^-)	0.0586	10.5m	^{60}Co$^g\rightarrow^{60}$Ni (5.3y)	+		0.0033	54	1
^{62}Ni (3.66%)	(n, γ)	6.84	^{63}Ni	β^-	0.062	92y	^{63}Cu	20	thermal	0.003	49	1
	(n, 2n)	−10.60	^{61}Ni							0.81		15
	(n, p)	−4.44	^{62}Co	β^-	5.22	13.9m	^{62}Ni	0.022	14	0.022	356	1, 98
	(n, p*)		^{62}Co^m	β^-		1.6m	^{62}Ni	0.022	14	0.022	356	1
	(n, α)	−0.44	^{59}Fe	β^-	1.573	45d	^{59}Co	+		0.017	277	1, 27

										0.022	358	19, 21
	(n, np)	−11.12	^{61}Co	β^-	1.29	99m	^{61}Ni$^{excit}\rightarrow^{61}$Ni^{g} (5.2ns)	+		0.0036	58	1
^{64}Ni (1.16%)	(n, γ)	6.10	^{65}Ni	β^-	2.13	2.56h	^{65}Cu	1.6	thermal	0.003	49	1, (6)
	(n, 2n)	−9.66	^{63}Ni	β^-	0.062	92y	^{63}Cu	+		1.0	16300	1
										1.2	19600	15
	(n, p)	−6.22	^{64}Co			7.8m		+		0.002	32	1
										0.005	81	7
	(n, p*)		^{64}Co^{m}			2.0m			32.4	0.002	32	1
	(n, α)	−2.43	^{61}Fe	β^-	3.8	6.0m	^{61}Co→^{61}Ni (99m)	+		0.001	16	1
										0.0045	73	19
										0.005	81	7, 27
	(n, np)	−12.54	^{63}Co	β^-	3.6	52s	^{63}Ni→^{63}Cu (92y)	+		0.0035	56	1
^{63}Cu (69.1%)	(n, γ)	7.92	^{64}Cu	β^- β^+, EC	0.573 1.678	12.8h	^{64}Zn ^{64}Ni	44	thermal	0.004 0.0025	65 40	92 6
	(n, n′)	—								0.650		96
	(n, 2n)	−10.85	^{62}Cu	β^+, EC	3.98	9.8m	^{62}Ni	1.0	19	0.5	8100	2, 7, 85
										0.535	8700	97
										0.56	9120	23
	(n, p)	0.72	^{63}Ni	β^-	0.067	92y	^{63}Cu	0.12	14	0.12	1950	1, 27, 98
										0.077	1250	20
	(n, ^{3}He)	−9.51	^{61}Co	β^-	1.29	1.65h	^{61}Ni$^{m}\rightarrow^{61}$Ni^{g} (5.2ns)	+		0.0016	26	1
										1.13×10^{-4}	1.8	54
	(n, α)	1.72	^{60}Co	β^-	2.819	5.26y	^{60}Ni	0.050	11	0.038	619	2, 7, 27, 92
										0.0028	46	17
	(n, α*)		^{60}Co^{m}	IT (β^-)	0.0586 2.877	10.5m	^{60}Co$^{g}\rightarrow^{60}$Ni (5.26y)	0.027	12	0.025	405	1
	(n, np)	−6.12	^{62}Ni							0.15		5

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{65}Cu (30.9%)	(n, γ)	7.07	^{66}Cu	β^-	2.63	5.1m	^{66}Zn	2	thermal	0.006	97	6
	(n, n′)	——								0.380		76
	(n, 2n)	−9.90	^{64}Cu	β^- β^+, EC	0.573 1.678	12.9h	^{64}Zn ^{64}Ni	1.1	18	0.9	14600	2
										0.97	15700	23
	(n, p)	−1.35	^{65}Ni	β^-	2.13	2.56h	^{65}Cu	0.021	14	0.021	340	1, 66
										0.027	430	98
										0.029	470	20, 27
	(n, ^{3}He)	−12.26	^{63}Co	β^-	3.6	52s	^{63}Ni→^{63}Cu (92y)			~0.001	~16	5
	(n, α)	−0.09	^{62}Co	β^-	5.22	13.9m	^{62}Ni	+		0.011	178	1
								0.038	14	0.038	620	66
	(n, α^*)		^{63}Co^m	β^-	~5	1.6m	^{62}Ni	+		0.0018	29	1
	(n, nα)	−6.77	^{61}Co	β^-	1.29	1.65h	^{61}Ni	+		0.0018	29	1
										0.006		85
^{64}Zn (48.39%)	(n, γ)	7.98	^{65}Zn	EC, β^+	1.35	245d	^{65}Cu	0.5	thermal	0.003	49	1
	(n, n′γ)	−0.992 1st (2^+) level	^{64}Zn							0.451		47
	(n, 2n)	−11.86	^{63}Zn	β^+, EC	3.366	38m	^{63}Cu	0.4	18	0.125	2030	1, 7
										0.191	3100	23, 97
	(n, p)	0.21	^{64}Cu	β^- EC, β^+	0.573 1.678	12.8h	^{64}Zn ^{64}Ni	0.29	11.5	0.018	293	13, 27
										0.160	2450	98
										0.20	3240	20
										0.211	3420	97
	(n, d)	−5.48	^{63}Cu							0.0026		96
	(n, t)	−10.21	^{62}Cu	β^+, (EC)	3.94	9.76m	^{62}Ni			1.0×10^{-4}	1.6	55, 96
										3.4×10^{-5}	0.54	54
	(n, α)	3.87	^{61}Ni							0.0066		17
										0.077		19
	(n, np)	−7.71	^{63}Cu							0.4		5

^{66}Zn (27.81%)	(n, n′γ)	−1.039 1st (2⁺) level	^{66}Zn							0.673		47
	(n, 2n)	−11.05	^{65}Zn	EC, β^+	1.35	245d	^{65}Cu	+		0.53	8630	1
										0.74	12000	23
										0.8	13000	7
	(n, p)	−1.85	^{66}Cu	β^-	2.63	5.1m	^{66}Zn	0.076	13	0.076	1230	1, 7, 27, 97
										0.072	1170	98
										0.078	1260	5, 20
	(n, α)	2.27	^{63}Ni	β^-	0.067	92y	^{63}Cu	+		0.043	700	1
										0.025	407	19
	(n, np)	−8.92	^{65}Cu							0.05		5
^{67}Zn (4.11%)	(n, 2n)	−7.05	^{66}Zn							0.91		15
										1.0		8
	(n, p)	0.21	^{67}Cu	β^-	0.57	59h	^{67}Zn	0.58	14	0.058	940	1
										0.065	1050	20
										0.140	2280	97
										0.042	680	27
	(n, α)	4.88	^{64}Ni							0.032		19
	(n, np)	−8.91	^{66}Cu	β^-	2.63	5.1m	^{66}Zn	+		0.01	162	1
^{68}Zn (18.56%)	(n, γ)	6.48	^{69}Zn	β^-	0.90	57m	^{69}Ga	0.1	thermal	0.003	48	1
								1.0	thermal			(5)
	(n, γ*)		^{69}Zn^m	IT	0.439	13.8h	^{69}Zn$^g \rightarrow ^{69}$Ga^g (245d)	0.01	thermal	3×10^{-4}	5	1
								0.1	thermal			(5)
	(n, n′γ)	−1.078 1st (2⁺) level	^{68}Zn							0.440		47
	(n, 2n)	−10.20	^{67}Zn							1.0		15
										0.73		8
	(n, p)	−3.80	^{68}Cu	β^-	4.6	30s	^{68}Zn			0.025	405	5, 20
										0.011	179	97
										0.017	275	27
										0.0098	159	98
	(n, α)	0.78	^{65}Ni	β^-	2.13	2.56h	^{64}Cu	+		0.010	162	13, 27, 97

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{68}Zn (18.56%)	(n, α)	0.78	^{65}Ni	β^-	2.13	2.56h	^{65}Cu			0.0078	126	19
	(n, np)	−9.99	^{67}Cu	β^-	0.57	59h	^{67}Zn	+		5×10^{-4}	8	1
^{70}Zn (0.62%)	(n, γ)	5.84	^{71}Zn	β^-	2.61	2.4m	^{71}Ga	0.1	thermal	0.002	32	1, 5
	(n, 2n)	−9.22	^{69}Zn	β^-	0.901	57m	^{69}Ga	+		0.3	4860	1
										1.3	21100	7
	(n, 2n*)		^{69}Zn^m	IT	0.439	13.8h	^{69}Zn$^g\rightarrow^{69}$Ga^g (57m)			0.9	14600	1
								0.61	18	0.57	9280	13
	(n, p)	−5.067	^{70}Cu							0.0070		20
	(n, α)	−0.71	^{67}Ni	β^-	4.1	50s	^{67}Cu$\rightarrow^{67}$Zn (59h)	+		0.0095	154	1
										0.0017	27	19
	(n, nα)	−5.93	^{66}Ni	β^-	0.20	55h	^{66}Cu$\rightarrow^{66}$Zn (51m)	+		8×10^{-4}	13	1
										8.9×10^{-4}		73
^{69}Ga (60.2%)	(n, γ)	7.65	^{70}Ga	β^- (β^+, EC)	1.66 0.653	21.1m	^{70}Ge	2	thermal	0.002	32	1, 5
	(n, 2n)	−10.31	^{68}Ga	β^+, EC	2.920	68.3m	^{68}Zn	1.2	17	0.9	14600	1, 7
										0.82	13300	97
										0.10	1620	23
	(n, p)	−0.12	^{69}Zn	β^-	0.901	57m	^{69}Ga	0.046	12	0.043	697	1
										0.017	275	7
										0.036	583	27
	(n, p*)		^{69}Zn^m	IT	0.439	13.8h	^{69}Zn$^g\rightarrow^{69}$Ga^g (57m)	0.046	12	0.043	696	1, 85
										0.026	422	98
										0.021	340	7
	(n, α)	2.58	^{66}Cu	β^-	2.63	5.1m	^{66}Zn			0.018	292	7, 27
^{71}Ga (39.8%)	(n, γ)	6.52	^{72}Ga	β^-	4.00	14.1h	^{72}Ge	5	thermal	0.002	32	1, 5
	(n, 2n)	−9.30	^{70}Ga	β^- (β^+, EC)	1.66 0.653	21.1m	^{70}Ge	+		0.9	14600	1

										1.1	17800	23
	(n, p)	−2.02	^{71}Zn	β^-	2.61	2.4m	^{71}Ga	0.033	13	0.032	518	1
										0.008	130	98
										0.005	81	7
	(n, p*)	−2.15	^{71}Zn^m	β^-	2.9	4.0h	^{71}Ga	0.021	13	0.020	324	1
										0.0125	203	98
										0.01	162	7
	(n, ^{3}He)	−11.04	^{59}Cu	β^+, (EC)	4.8	3m (81s?)	^{59}Ni→^{59}Co (8×10^4y)			6.6×10^{-5}	1.1	54
	(n, α)	0.93	^{68}Cu	β^-	4.6	30s	^{68}Zn			0.06	972	7
	(n, nα)	−5.26	^{67}Cu	β^-	0.57	59h	^{67}Zn	+		0.004	64	1
^{70}Ge (20.55%)	(n, γ)	7.42	^{71}Ge	EC	0.23	11.4d	^{71}Ga	3.4	thermal	0.003	48	1, 5
	(n, n'γ)	−1.040 1st (2$^+$) level	^{70}Ge							0.80		47
	(n, 2n)	−11.53	^{69}Ge	EC, β^+	2.225	38h	^{69}Ga	0.9	18	0.54	8750	1, 7
										0.575	9350	97
										0.65	10500	23
	(n, p)	−0.87	^{70}Ga	β^- (β^+, EC)	1.66 0.653	21.1m	^{70}Ge	0.17	10	0.10	1620	1, 20
										0.077	1250	27
	(n, t)	−10.48	^{68}Ge	β^+, EC	2.920	68m	^{68}Zn			4×10^{-5}	0.7	55, 83
^{72}Ge (27.37%)	(n, n'γ)	−0.835 1st (2$^+$) level	^{72}Ge							0.42		47
	(n, 2n)	−10.75	^{71}Ge	EC	0.234	11.4d	^{71}Ga	+		0.73	11800	1
										0.84	13600	15
	(n, p)	−3.21	^{72}Ga	β^-	4.00	14.1h	^{72}Ge	0.068	13	0.065	1050	1
										0.031	553	98
										0.04	650	7, 27
										0.042	682	97
	(n, α)	1.48	^{69}Zn	β^-	0.901	57m	^{69}Ga^g	0.008	14	0.008	130	1
	(n, α*)		^{69}Zn^m	IT	0.439	13.8h	^{69}Zn^g→^{69}Ga^g (57m)	0.008	14	0.008	130	1
										0.011	179	97
^{73}Ge (7.76%)	(n, 2n)	−6.78	^{72}Ge							1.2		8
										1.05		15

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{73}Ge (7.76%)	(n, p)	−0.77	^{73}Ga	β^-	1.55	4.9h	^{73}Ge^m→^{73}Ge^g (0.53s)			0.02	320	7, 27
										0.027	439	98
										0.030	486	20
										0.016	260	97
	(n, α)	3.91	^{70}Zn							0.00012		18
^{74}Ge (36.74%)	(n, γ)	6.49	^{75}Ge	β^-	1.20	82.0m	^{75}As	0.5	thermal	0.003	48	1, 5
	(n, n′γ)	−0.5960 1st (2$^+$) level	^{74}Ge							0.477		47
	(n, 2n)	−10.20	^{73}Ge							1.13		15
	(n, p)	−4.72	^{74}Ga	β^-	5.5	7.9m	^{74}Ge			0.01	162	7, 20, 27
										0.012	195	97
	(n, ^{3}He)	−12.15	^{72}Zn	β^-	0.45	46.5h	^{72}Ga→^{72}Ge (14.1h)			$<1\times10^{-4}$	<1.6	73
	(n, α)	−0.44	^{71}Zn	β^-	2.61	2.4m	^{71}Ga	+		0.015	243	1
	(n, α*)		^{71}Zn^m	β^-	2.91	4.0h	^{71}Ga	+		0.0035	56	1
										0.020	325	97
	(n, np)	−10.87	^{73}Ga	β^-	1.55	4.9h	^{73}Ge^m→^{73}Ge^g (0.53s)			6.7×10^{-4}	11	96
^{76}Ge (7.67%)	(n, γ)	6.02	^{77}Ge	β^-	2.75	1.3h	^{77}As→^{77}Se (38.7h)	0.1	thermal	0.001	16	1, 5
	(n, n′γ)	−0.5632 1st (2$^+$) level	^{76}Ge							0.204		47
	(n, 2n)	−9.44	^{75}Ge	β^-	1.20	82m	^{75}As	1.3	15	1.2	19400	1, 7
	(n, 2n*)		^{75}Ge^m	IT	0.139	48s	^{75}Ge^g→^{75}As (82m)	1.1	15	1.0	16200	7
	(n, p)	−5.94	^{76}Ga	β^-	~7	32s	^{76}Ge			0.0049	79.4	20
										0.0031	50.4	97
	(n, nα)	−7.51	^{72}Zn	β^-	0.45	46.5h	^{72}Ga→^{72}Ge (14.1h)	+		7×10^{-4}	11.3	1
										0.0010	16	96
^{75}As (100%)	(n, γ)	7.33	^{76}As	β^- (β^+, EC)	2.97 0.92	26.5h	^{76}Se	5	thermal	0.003	48	1, 6
	(n, n′γ)	——	^{75}As^m	IT	0.304	17ms	^{75}As			0.13	2110	5, 57
	(n, 2n)	−10.24	^{74}As	(β^+, EC / β^-)	2.564 1.36	17.9d	^{74}Ge ^{74}Se	1.2	17	1.1	17900	1, 7

										1.02	16600	88
										1.11	18100	23
	(n, p)	−0.41	^{75}Ge	β^-	1.20	82m	^{75}As	0.02	14	0.02	324	1, 7, 27
										0.029	472	98
	(n, p*)		^{75}Ge^m	IT	0.139	48s	^{75}Ge$^g \rightarrow ^{75}$As (82m)	0.02	14	0.018	291	7
	(n, ^{3}He)	−10.148	^{73}Ga	β^-	1.35	4.9h	^{73}Ge$^m \rightarrow ^{73}$Ge^g (0.53s)			5.78×10^{-4}	9.4	54
										3.5×10^{-6}	0.06	55, 56
	(n, α)	1.20	^{72}Ga	β^-	4.00	14.1h	^{72}Ge	0.012	15	0.011	178	1, 7, 27
	(n, 2p)	−11.62	^{74}Ga	β^-	5.60	7.9m	^{74}Ge			0.51	8300	96
^{74}Se (0.87%)	(n, γ)	8.02	^{75}Se	EC	0.865	120d	^{75}As	30	thermal	0.003	48	1, 6
	(n, 2n)	−12.07	^{73}Se	EC, β^+	2.75	7.1h	^{73}As$\rightarrow^{73}$Ge$^m\rightarrow^{73}$Ge^g (80.3d) (0.53s)	~0.6	~18	0.26	4210	1, 7
	(n, 2n*)		^{73}Se^m	EC, β^+	2.8	42m	^{73}As$\rightarrow^{73}$Ge$^m\rightarrow^{73}$Ge^g (80.3d) (0.53s)	+		0.035	569	1
										0.2	3240	7
	(n, p)	−0.57	^{74}As	(β^+, EC / β^-)	2.564 / 1.36	17.9d	^{74}Ge / ^{74}Se	0.1	~14	0.1	1600	1, 7
										0.13	2090	20, 27, 98
^{76}Se (9.02%)	(n, n'γ)	−0.5593 1st (2^+) level	^{76}Se							0.483		47
	(n, 2n)	−11.16	^{75}Se	EC	0.865	120d	^{75}As	+		0.73	5970	1
	(n, p)	−2.19	^{76}As	β^- (β^+, EC)	2.97 / 0.92	26.5h	^{76}Se	0.06	14	0.06	970	1
										0.059	960	20, 27
										0.075	1220	98
^{77}Se (7.58%)	(n, 2n)	−7.42	^{76}Se							0.93		15
	(n, p)	0.10	^{77}As	β^-	0.68	38.7h	^{77}Se			0.04	650	7
										0.055	891	20
										0.036	583	27, 98

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{78}Se (23.52%)	(n, γ)	6.98	^{79}Se	β^-	0.154	6.5×10^4y	^{79}Br	0.06	thermal	7×10^{-4}	11	1
	(n, γ*)		^{79}Se^m	IT	0.096	3.9m	^{79}Se$^g\rightarrow^{79}$Br^g ($\leq6.5\times10^4$y)	0.4	thermal	0.002	32	1, 5
	(n, n'γ)	−0.6142 1st (2$^+$) level	^{78}Se							0.617		47
	(n, 2n*)	(−10.50)	^{77}Se^m	IT	0.161	17.5s	^{77}Se	1.2	16	0.8	13000	7
										1.0	16200	15
	(n, p)	−3.49	^{78}As	β^-	4.3	91m	^{78}Se			0.021	340	1, 27
										0.017	276	98
										0.031	502	20
	(n, p*)		^{78}As^m			6m		+		8×10^{-4}	13	1
	(n, α)	0.46	^{75}Ge	β^-	1.20	82m	^{75}As	+		0.006	97	1
	(n, α*)	0.46	^{75}Ge^m	IT	0.139	48s	^{75}Ge$^g\rightarrow^{75}$As (82m)			0.0076	123	7
^{80}Se (49.82%)	(n, γ)	6.70	^{81}Se	β^-	1.58	1.86m	^{81}Br	0.53	thermal	0.002	32	1, 5
	(n, n'γ)	−0.6662 1st (2$^+$) level	^{80}Se							0.444		47
	(n, 2n)	−9.90	^{79}Se	β^-	0.154	6.5×10^4y	^{79}Br^g	+		0.27	4400	1
										1.2	19500	15
	(n, 2n*)		^{79}Se^m	IT	0.096	3.9m	^{79}Se$^g\rightarrow^{79}$Br^g (6.5×10^4y)	+		0.09	1460	1
								1.4	15	0.8	13000	7
	(n, p)	−5.22	^{80}As	β^-	6.0	15.3s	^{80}Se			0.016	259	7
										0.0081	131	20
	(n, α)	−0.95	^{77}Ge	β^-	2.75	1.3h	^{77}As$\rightarrow^{77}$Se (38.7h)	+		0.037	599	1
										0.006	97	7
	(n, α*)		^{77}Ge^m	IT / β^-	0.159 / 2.91	54s	^{77}Ge$^g\rightarrow^{77}$As$\rightarrow^{77}$Se; ^{77}As$\rightarrow^{77}$Se (38.7h)			0.006	97	7
	(n, d) + (n, np)	−9.23 −11.5	^{79}As	β^-	2.2	9.0m	^{79}Se$^m\rightarrow^{79}$Se$^g\rightarrow^{79}$Br^g (3.9m) ($\leq6.5\times10^4$y)			$<8\times10^{-4}$	<13	52

^{82}Se (9.19%)	(n, γ)	5.93	^{83}Se	β⁻	3.6	25m	^{83}Br→^{83}Kr^{m}→^{83}Kr^{g} (2.41h) (1.9h)	0.004	thermal	2×10^{-4}	6	1
	(n, γ*)		^{83}Se^{m}	β⁻	3.82	70s	^{83}Br→^{83}Kr^{m}→^{83}Kr^{g} (24.1h) (1.9h)	0.05	thermal	0.002	32	1
	(n, 2n)	−9.27	^{81}Se	β⁻	1.58	18.6m	^{81}Br	+		0.09	1460	1
										0.3	4860	7
	(n, 2n*)		^{81}Se^{m}	IT	0.103	57m	^{81}Se^{g}→^{81}Br (18.6m)	+		1.45	23500	1
^{79}Br (50.52%)	(n, γ)	7.88	^{80}Br	(EC, β⁺) β⁻	1.871 2.01	17.6m	^{80}Se ^{80}Kr	10	thermal	0.001	16	1, 5
	(n, γ*)		^{80}Br^{m}	IT	0.086	4.38h	^{80}Br^{g} (17.6m) ↗ ^{80}Se ↘ ^{80}Kr	2.7	thermal	0.001	16	1, 5
	(n, 2n)	−10.69	^{78}Br	(β⁻) β⁺, EC	0.70 3.57	6.5m	^{76}Kr ^{78}Se			0.77	12500	1
										0.90	14600	7
										0.955	15500	97
										1.07	17400	23
	(n, p*)	(0.64)	^{79}Se^{m}	IT	0.096	3.9m	^{79}Se^{g}→^{79}Br^{g} ($\leq 6.5\times10^{6}$y)			0.01	160	7
	(n, α)	1.86	^{76}As	β⁻	2.97	26.5h	^{76}Se	0.0135	14.5	0.013	211	1, 7, 27
^{81}Br (49.48%)	(n, γ)	7.60	^{82}Br	β⁻	3.092	35.3h	^{82}Kr	0.26	thermal	3×10^{-4}	5	1, 5, 97
	(n, γ*)		^{82}Br^{m}	IT	0.046	6.1m	^{82}Br^{g}→^{82}Kr (35.34m)	3.0	thermal	0.003	50	1, 5
	(n, 2n)	−10.16	^{80}Br	(EC, β⁺) β⁻	1.87 2.01	17.6m	^{80}Se ^{80}Kr	+		0.44	7200	1, 89
	(n, 2n*)		^{80}Br^{m}	IT	0.086	4.38h	^{80}Br^{g} (17.6m) ↗ ^{80}Se ↘ ^{80}Kr	0.8	16	0.7	11000	1, 7, 89
	(n, p)	−0.81	^{81}Se	β⁻	1.58	18.6m	^{81}Br	+		0.022	360	1
	(n, p*)	−0.90	^{81}Se^{m}	IT	0.103	57m	^{81}Se^{g}→^{81}Br (18.6m)	+		0.022	360	1
										0.0153	249	98
	(n, α)	0.43	^{78}As	β⁻	4.3	91m	^{78}Se	+		0.007	110	1, 27
	(n, nα)	−6.48	^{77}As	β⁻	0.68	38.7h	^{77}Se	+		0.005	81	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{78}Kr (0.354%)	(n, 2n)	−11.98	^{77}Kr	β^+, EC	2.9	1.2h	^{77}Br→^{77}Se (57h)			0.245	3990	96
	(n, p)	0.09	^{78}Br	β^+, EC (β^-)	3.57 0.70	6.5m	^{78}Se ^{78}Kr			0.072	1170	20
^{80}Kr (2.27%)	(n, 2n)	−11.53	^{79}Kr^g	EC, β^+	1.62	34.9h	^{79}Br			0.810	13200	96
	(n, 2n*)		^{79}Kr^m	IT	0.127	55s	^{79}Kr^g→^{79}Br (34.9h)			0.415	6760	7
	(n, p*)	−1.23	^{80}Br^m	IT	0.086	4.4h	^{80}Br^g (17.6m) ↗^{80}Kr ↘^{80}Se			0.055	895	7
										0.037	602	20
^{84}Kr (56.9%)	(n, γ)	7.11	^{85}Kr	(IT), β^- β^-	0.97 0.67	4.4h 10.76y	^{85}Rb	0.10 ~0.06	thermal			(6)
	(n, 2n)	−10.52	^{83}Kr							1.1		15
	(n, p)	−3.92	^{84}Br	β^-	4.7	31.8m	^{84}Kr			0.009	150	7
										0.0073	118	20
^{82}Kr (11.56%)	(n, 2n)	−10.98	^{81}Kr^m	IT	0.190	13s	^{81}Kr^g→^{81}Br^g (2.1×10^5y)			0.160	2600	7
	(n, p)	−2.31	^{82}Br^g	β^-	3.092	35.4h	^{82}Kr^{excit}→^{82}Kr^g			0.023	374	96
^{86}Kr (17.37%)	(n, 2n)	−9.86	^{85}Kr	β^-	0.67	10.76y	^{85}Rb			1.3	21200	15
	(n, 2n*)		^{85}Kr^m	(β^- IT)	0.97 0.305	4.4h	^{85}Rb^m→^{85}Rb ^{85}Kr^g→^{85}Rb (10y)			0.35	5700	7
	(n, α)	−2.18	^{83}Se	β^-	3.6	25m	^{83}Br→^{83}Kr^m→^{83}Kr (2.41h) (1.86h)			0.0012	19	7
^{85}Rb (72.15%)	(n, γ)	8.65	^{86}Rb	β^- (EC)	1.78 0.54	18.7d	^{86}Sr	2	5×10^{-4}	0.002	32	1, 6
	(n, γ*)		^{86}Rb^m	IT	0.56	1.04m	^{86}Rb^g→^{86}Sr (18d)	0.2	5×10^{-4}	2×10^{-4}	3	1
	(n, 2n)	−10.48	^{84}Rb	(EC, β^+ β^-)	2.680 0.886	33d	^{84}Kr ^{84}Sr	~1.2	16	1.0	16300	7
										0.7	11000	1
										0.62	10100	88

	(n, 2n*)		$^{84}Rb^{m}$	IT	0.464	20m	$^{84}Rb^{g}$ (33d) $\nearrow^{84}Kr$ $\searrow^{84}Sr$	+		0.7	11000	1
										0.34	5500	88
								0.5	18	0.35		7
	(n, p*)	−0.20	$^{85}Kr^{m}$	β^- / IT	0.97 / 0.3050	4.4h	^{85}Rb $^{85}Kr^{g}\rightarrow^{85}Rb$ (10y)	0.005	15.5	0.004	64	7
										0.0047	76	98
	(n, α)	0.99	^{82}Br	β^- (EC)	3.092 / 0.09	35.3h	^{82}Kr	+		0.06	970	1
								0.01	18	0.007	113	7, 27
	(n, α*)		$^{82}Br^{m}$	IT (β^-)	0.046 / 3.138	6.1m	$^{82}Br^{g}\rightarrow^{82}Kr$ (35h)	+		0.06	972	1
^{87}Rb (27.85%)	(n, γ)	6.08	^{88}Rb	β^-	5.2	17.8m	^{88}Sr	0.12	thermal	5×10^{-4}	8	1, 6
	(n, 2n)	−9.93	^{86}Rb	β^- (EC)	1.78 / 0.54	18.7d	^{86}Sr	+		0.58	9440	1
								1.2	16	1.1	17900	7
	(n, 2n*)		$^{86}Rb^{m}$	IT	0.56	1.04m	$^{86}Rb^{g}\rightarrow^{86}Sr$ (18d)	+		0.58	9400	1
	(n, p)	−3.11	^{87}Kr	β^-	3.89	76m	$^{87}Rb\rightarrow^{87}Sr^{g}$ (5×10^{10}y)	+		0.0048	78	1
										0.012	195	98
										0.0019	30	20
	(n, α)	−1.21	^{84}Br	β^-	4.7	31.8m	^{84}Kr	+		0.023	373	1
										0.002	32	7
	(n, α*)		$^{84}Br^{m}$	β^-	~0.5	6m	^{84}Kr	+		0.023	373	1
										0.002	32	7
	(n, nα)	−8.00	^{83}Br	β^-	0.97	2.41h	$^{83}Kr^{m}\rightarrow^{83}Kr^{g}$ (1.9h)	+		0.0012	19	1
^{84}Sr (0.56%)	(n, γ)	8.53	^{85}Sr	EC	1.11	64d	^{85}Rb	0.4	thermal	0.001	16	1, 5
	(n, γ*)		$^{85}Sr^{m}$	IT / EC	0.237 / 1.34	70m	$^{85}Sr^{g}\rightarrow^{85}Rb$ (64d) ^{85}Rb	0.65	thermal	0.001	16	1, 5
	(n, 2n)	−12.01	^{83}Sr	EC, β^+	2.21	32.4h	$^{83}Rb\rightarrow^{83}Kr$ (83d)	+		0.13	2110	1
								1.5	18	0.9	15000	7
	(n, p)	−0.10	^{84}Rb	FC, β^+ / β^-	2.680 / 0.886	34.5d	^{84}Kr ^{84}Sr			0.096	1560	98
	(n, p*)	−0.57	$^{84}Rb^{m}$	IT	0.464	21m	$^{84}Rb^{g}$ (34.5d) $\nearrow^{84}Kr$ $\searrow^{84}Sr$			0.047	764	98

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{86}Sr (9.86%)	(n, γ*)	(8.43)	^{87}Sr^{m}	IT	0.388	2.83h	^{87}Sr	0.8	thermal	0.002	32	1, 5
	(n, 2n)	−11.49	^{85}Sr	EC	1.11	64d	^{85}Rb	+		0.34	5500	1
								0.75	17	0.55	8900	7
	(n, 2n*)		^{85}Sr^{m}	IT EC	0.237 1.34	70m	^{85}Sr$^{g}\rightarrow^{85}$Rb (64d) ^{85}Rb	+		0.34	5510	1
												7
	(n, p)	−0.99	^{86}Rb	β^-	1.78	18.66d	^{86}Sr	+		0.02	324	1
										0.044	716	98
										0.04	650	7
	(n, p*)		^{86}Rb^{m}	IT	0.56	1.04m	^{86}Rb$^{g}\rightarrow^{86}$Sr (18.66d)	+		0.02	324	1
										0.009	146	7
^{87}Sr (7.02%)	(n, n′)	——	^{87}Sr^{m}	IT	0.388	2.8y	^{87}Sr	0.33	5	0.1	1620	1
^{88}Sr (82.56%)	(n, γ)	6.36	^{89}Sr	β^-	1.463	52d	^{89}Y^{g}	1	thermal	0.002	32	1
								0.005	thermal			(6)
	(n, n′γ)	−1.8362 1st (2^+) level	^{88}Sr							0.84		47
	(n, 2n*)	(−11.11)	^{87}Sr^{m}	IT (EC)	0.388	2.83h	^{87}Sr ^{87}Rb$\rightarrow^{87}$Sr (5×10^{10}y)	0.28	17	0.20	3240	1, 7
	(n, p)	−4.52	^{88}Rb	β^-	5.2	17.8m	^{88}Sr	+		0.018	299	1, 7, 27
										0.0135	220	98
										0.0037	60	20
	(n, t)	−12.05	^{86}Rb	β^-	1.78	18.7d	^{86}Sr			6.3×10^{-5}	1.0	65
	(n, α)	−0.79	^{85}Kr	β^-	0.67	10.8y	^{85}Rb^{g}	+		0.2	3300	1
										0.087	1420	36
	(n, α*)		^{85}Kr^{m}	IT	0.305	4.4h	^{85}Kr$^{g}\rightarrow^{85}$Rb (10y)	+		0.065	1050	1
^{89}Y (100%)	(n, γ)	6.86	^{90}Y	β^-	2.27	64h	^{90}Zr^{g}	1.28	thermal	0.002	32	1
										0.0014	24	58, 74

	(n, γ*)		$^{90}Y^{m}$	IT	0.685	3.1h	$^{90}Y^{g}\rightarrow^{90}Zr$ (64h)	0.001	thermal	5×10^{-4}	8	1
	(n, n′γ)	−0.91	$^{89}Y^{m}$	IT	0.91	16.1s	$^{89}Y^{g}$			0.40	6510	57, 76
										0.497	8090	73
	(n, 2n)	−11.47	^{88}Y	EC, β^{+}	3.621	108d	^{88}Sr	1.2	17	0.75	12200	1, 7
										1.06	17300	23
	(n, p)	−0.71	^{89}Sr	β^{-}	1.463	52d	$^{89}Y^{g}$	0.023	14.5	0.023	374	1, 7
										0.026	422	20, 27
	(n, t*)	−10.20	$^{87}Sr^{m}$	IT (EC)	0.388	2.83h	$^{87}Sr^{g}$ $^{87}Rb^{g}\rightarrow^{87}Sr^{g}$ (5×10^{10}y)			3.8×10^{-6}	0.06	83
										1.5×10^{-6}	0.02	54
	(n, α)	0.70	^{86}Rb	β^{-} (EC)	1.78 0.54	18.7d	^{86}Sr	+		0.0025	40	1
										0.0035	57	7
	(n, α*)		$^{86}Rb^{m}$	IT	0.56	1.04m	$^{86}Rb^{g}\rightarrow^{86}Sr$ (18d)	+		0.0025	40	1
	(n, 2p)	−11.59	^{88}Rb	β^{-}	5.2	17.8m	^{88}Sr			4×10^{-4}	6.5	96
	nonelastic	—	—							≤1.05		76
^{89}Zr	(n, p)	3.64	^{89}Y							0.46		20
^{90}Zr (51.46%)	(n, γ)	7.20	^{91}Zr					0.064	4.5×10^{-3}			(5)
	(n, 2n)	−11.98	^{89}Zr	EC, β^{+}	2.834	78.4h	$^{89}Y^{m}\rightarrow^{89}Y$ (16s)	1.2	18	0.56	9120	1, 7
	(n, 2n*)		$^{89}Zr^{m}$	IT (EC, β^{+})	0.588 3.41	4.18m	$^{89}Zr^{g}\rightarrow^{89}Y$ (78h) ^{89}Y	+		0.06	980	1
	(n, p)	−1.51	^{90}Y	β^{-}	2.27	64.2h	$^{90}Zr^{g}$	+		0.033	535	1
										0.045	730	7
	(n, p*)		$^{90}Y^{m}$	IT	0.685	3.1h	$^{90}Y^{g}\rightarrow^{90}Zr$ (64h)	+		0.011	178	1
								flat		0.012	195	7, 82
	(n, t)	−11.38	^{88}Y	EC, β^{+}	3.621	108d	$^{88}Sr^{excit}\rightarrow^{88}Sr^{g}$			3.1×10^{-5}	0.50	55
										4.1×10^{-5}	0.67	65
	(n, α*)	(1.75)	$^{87}Sr^{m}$	IT	0.388	2.8h	$^{87}Sr^{g}$	+		0.0032	92	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{90}Zr (51.46%)	(n, np)	−8.10	^{89}Y							0.041		73
	(n, np*)		$^{89}Y^{m}$	IT	0.91	16.1s	$^{89}Y^{g}$			0.027	440	48
^{91}Zr (11.23%)	(n, 2n)	−7.20	^{90}Zr							1.4		8, 14
										1.3		15
	(n, p)	−0.76	^{91}Y	β^-	1.545	59d	$^{91}Zr^{g}$			0.034	554	27
								+		0.05	810	1
	(n, p*)		$^{91}Y^{m}$	IT	0.551	50m	$^{91}Y^{g}\rightarrow{}^{91}Zr^{g}$ (58d)			0.05	810	1
										0.018	292	7
	(n, np)	−9	^{90}Y	β^-	2.27	64.2h	$^{90}Zr^{g}$	+		0.004	64	1
	(n, np*)		$^{91}Y^{m}$	IT	0.685	3.1h	$^{90}Y^{g}\rightarrow{}^{90}Zr^{g}$ (64h)	+		0.004	64	1
^{92}Zr (17.11%)	(n, γ)	6.76	^{93}Zr	β^-	0.090	1.5×10^{6}y	$^{93}Nb^{m}\rightarrow{}^{93}Nb^{g}$ (13.6y)	0.2	thermal	0.003	48	1
	(n, 2n)	−8.64	^{91}Zr							1.3		8
										1.4		14
										1.5		15
	(n, p)	−2.84	^{92}Y	β^-	3.63	3.53h	^{92}Zr			0.019	308	22, 27
								+		0.022	356	1
										0.024	389	20
	(n, α)	3.39	^{89}Sr	β^-	1.463	50.4d	$^{89}Y^{g}$	0.01	16	0.009	47	1, 7, 27
	(n, np)	−9.40	^{91}Y	β^-	1.545	59d	$^{91}Zr^{g}$	+		5×10^{-4}	8	1
	(n, np*)		$^{91}Y^{m}$	IT	0.551	50m	$^{91}Y^{g}\rightarrow{}^{91}Zr^{g}$ (58d)	+		0.002	33	1
^{94}Zr (17.40%)	(n, γ)	6.48	^{95}Zr	β^-	1.121	65d	$^{95}Nb\rightarrow{}^{95}Mo$ (35d)	0.08	thermal	0.004	85	1, 5
	(n, 2n)	−8.19	^{93}Zr	β^-	0.090	1.5×10^{6}y	$^{93}Nb^{m}\rightarrow{}^{93}Nb^{g}$ (13.6y)			1.4	22800	14

								+		1.5	24400	1
										1.8	29300	15
	(n, p)	−4.22	^{94}Y	β^-	5.0	20.3m	^{94}Zr	+		0.005	81	1
										0.0085	137	20
										0.01	162	7, 27
	(n, d)	−8.32	^{93}Y	β^-	2.89	10.2h	^{93}Zr→^{93}Nb^m→^{93}Nb^g (1.5×10^{6}y) (13.6y)			9×10^{-4}	15	96
	(n, ^{3}He)	−11.14	^{92}Sr	β^-	1.9	2.71h	^{92}Y→^{92}Zr (3.53h)			$<4\times10^{-4}$	<6.5	ref. in 56
	(n, α)	2.07	^{91}Sr	β^-	2.67	9.7h	^{91}Y→^{91}Zr (58d)	0.0065	16	0.0046	74	1, 7, 27
										0.0050	81	22
	(n, np)	−10.30	^{93}Y	β^-	2.89	10.2h	^{93}Zr→^{93}Nb^m→^{93}Nb^g (1.5×10^{6}y) (13.6y)	+		0	0	1
										$<8\times10^{-4}$	<13	73
^{96}Zr (2.80%)	(n, γ)	5.58	^{97}Zr	β^-	2.67	17h	^{97}Nb^m→^{97}Nb→^{97}Mo (1m) (72m)	0.05	thermal	0.004	65	1, 5
	(n, 2n)	−7.83	^{95}Zr	β^-	1.12	65d	^{95}Nb→^{95}Mo (35d)	1.3	14	1.6	26000	1, 14
										1.46	23800	23
	(n, p)	−6.02	^{96}Y	β^-	6.9	2.3m	^{96}Zr	+		0.012	194	1
	(n, ^{3}He)	−13.47	^{94}Sr	β^-	3.5	1.35m	^{94}Y→^{94}Zr (20.3m)			1.36×10^{-4}	2.21	54
	(n, α)	0.17	^{93}Sr	β^-	4.8	8m	^{93}Y→^{93}Zr→^{93}Nb^m (10.2h) →^{93}Nb^g	+		0.0035	57	1
										0.0026	42	27
	(n, nα)	−4.78	^{92}Nb	β^-	1.9	2.71h	^{92}Y→^{92}Zr (3.53h)			0.0026	42	96
^{92}Nb	(n, p)	2.72	^{72}Zr							0.44		20
	(n, 3n)		^{90}Nb	EC, β^+	6.11	14.6h	^{90}Zr^{excit}→^{90}Zr^g			0.18 at 19 Mev		35
	(n, pn)	−5.93	^{91}Zr							0.336		35

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{93}Nb (100%)	(n, γ)	7.23	^{94}Nb	β^-	2.06	2×10^4y	^{94}Mo	0.1	thermal	5×10^{-5}	0.8	1
										4.4×10^{-4}	7.2	73
	(n, γ*)		^{94}Nb^m	IT (β^-)	0.0407 2.10	6.3m	^{94}Nb$^g\to^{94}$Mo (2×10^4y) ^{94}Mo	1	thermal	5×10^{-4}	8	1
	(n, n')	—	^{93}Nb^m	IT	0.0304	13.6y	^{93}Nb^g	1.2	8	0.3	5000	1
										0.90	15000	95
	(n, 2n+2n*)	(−8.83)	^{92}Nb^{g+m}							1.24	20200	35
	(n, 2n*)		^{92}Nb^m	EC, β^+ (β^-)	2.15 0.49	10.16d	^{92}Zr	0.41	14	0.41	6640	1, 7
	(n, p)	0.72	^{93}Zr	β^-	0.090	1.5×10^6y	^{93}Nb$^m\to^{93}$Nb^g (13.6y)			0.040	651	26
								0.045	14	0.045	732	1
	(n, ^{3}He)	−7.72	^{91}Y^g	β^-	1.545	58.8d	^{91}Zr^g			3×10^{-6}	0.05	55
										3.1×10^{-6}	0.050	56
	(n, ^{3}He*)	−8.27	^{91}Y^m	IT	0.551	50.3m	^{91}Y$^g\to^{91}$Zr^g (58.8d)			1.79×10^{-5}	0.29	54
	(n, 2p)	−8.88	^{92}Y	β^-	3.63	3.53h	^{92}Zr			$<5\times10^{-4}$	<8	5
	(n, α)	4.91	^{90}Y	β^-	2.27	64.2h	^{90}Zr^g	0.009	15	0.009	146	1, 7, 27
	(n, α*)		^{90}Y^m	IT	0.685	3.1h	^{90}Y$^g\to^{90}$Zr^g (64h)	+		0.005	81	1, 22, 82
								0.01	15	0.006	98	7
	(n, t)+(n, nt)	—	—							0.0042 at 22.5 Mev		60
	(n, nα*)	(−1.95)	^{89}Y^m	IT	0.91	16s	^{89}Y^g			0.0025	40	5
	nonelastic	—	—							2.0		96
^{94}Nb	(n, p)	1.72	^{94}Zr							0.025		20
^{91}Mo	(n, p)	5.20	^{91}Nb	EC (EC)	1.2 1.1	62d long	^{91}Nb$^g\to^{91}$Zr ^{91}Zr			0.90	14700	20
^{92}Mo (15.86%)	(n, γ)	8.07	^{93}Mo	EC	0.42	>100y	^{93}Nb$^m\to^{93}$Nb^g (14y) ^{93}Nb^g (15%)	0.3	thermal	0.002	33	1

	(n, γ*)		$^{93}Mo^{m}$	IT	2.428	6.9h	$^{93}Mo^{g} \nearrow {}^{93}Nb^{g}$ $\searrow {}^{93}Nb^{m} \rightarrow {}^{93}Nb^{g}$ (>100y) (13.6y)	0.006	thermal	3×10^{-5}	0.48	1
	(n, 2n)	−12.69	^{91}Mo	β^{+}, (EC)	4.46	15.5m	$^{91}Nb \rightarrow {}^{91}Zr$ (long)	+		0.145	2350	1
										0.158	2560	28
										0.15	2400	57
								~1.0	~20	0.1	1600	7
	(n, 2n*)		$^{91}Mo^{m}$	EC, β^{+} IT	5.11 0.658	66s	$^{91}Nb \rightarrow {}^{91}Zr$ $^{91}Mo^{g} \rightarrow {}^{91}Nb \rightarrow {}^{91}Zr$ (15.5m) (long)	+		0.0145	235	1
	(n, p*)	(0.43)	$^{92}Nb^{m}$	EC, β^{+} (β^{-})	2.15 0.49	10.16d	^{92}Zr ^{92}Mo	+		0.06	972	1
										0.15	2430	20
	(n, t)	−11.26	^{90}Nb	EC, β^{+}	6.11	14.6h	^{90}Zr			5.0×10^{-5}	0.81	55, 83
	(n, α)	3.69	^{89}Zr	EC, β^{+}	2.834	78.4h	$^{89}Y^{m} \rightarrow {}^{89}Y^{g}$ (16s)	+		0.016	259	1
										0.019	308	22
	(n, α*)		$^{89}Zr^{m}$	IT EC, β^{+}	0.588 3.41	4.2m	$^{89}Zr^{g} \rightarrow {}^{89}Y^{m} \rightarrow {}^{89}Y^{g}$ (78.4h) $^{89}Y^{g}$	+		0.0054	87	1
										0.0094	152	22
	(n, np*)	(−7.47)	$^{91}Nb^{m}$	IT (EC)	0.1045 1.2	62d	$^{91}Nb^{g} \rightarrow {}^{91}Zr$ (long) ^{91}Zr	+		0.038	619	1
										0.112	1820	73
	(n, t)+(n, nt)	—	—							0.0041 at 22.5 MeV		60
^{93}Mo	(n, p)	1.26	^{93}Nb							0.095		20
^{94}Mo (9.12%)	(n, 2n)	−9.67	^{93}Mo	EC	0.42	>100y	$^{93}Nb^{m} \rightarrow {}^{93}Nb^{g}$ (13.6y) $^{93}Nb^{g}$	+		0.56	9120	1
	(n, 2n*)		$^{93}Mo^{m}$	IT	2.428	6.9h	$^{98}Mo^{g} \nearrow {}^{93}Nb^{m} \rightarrow {}^{93}Nb^{g}$ $\searrow {}^{93}Nb^{g}$ (>100y)	+		0.56	9120	1
										0.003	48	7
	(n, p)	−1.26	^{94}Nb	β^{-} (EC)	2.06 0.92	2×10^{4}y	^{94}Mo	+		0.0054	89	1
	(n, p*)		$^{94}Nb^{m}$	IT	0.0407	6.3m	$^{94}Nb^{g} \rightarrow {}^{94}Mo$ (2×10^{4}y)	+		0.0054	87	1
	(n, α)	5.13	^{91}Zr							(0.05)		31

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{95}Mo (15.70%)	(n, 2n)	−7.38	^{94}Mo							1.2		15
	(n, p)	−0.14	^{95}Nb	β^-	0.925	35d	^{95}Mo	+		0.024	390	1
	(n, p*)		^{95}Nb^m	IT	0.235	90h	^{95}Nb$^g \rightarrow ^{95}$Mo (35d)	+		0.024	390	1
	(n, α)	6.39	^{92}Zr							(0.0018)		31
	(n, np)	−8.64	^{94}Nb	β^-	2.06	2×10^4y	^{94}Mo	+		0.003	49	1
	(n, np*)		^{94}Nb^m	IT	0.0407	6.3m	^{94}Nb$^g \rightarrow ^{94}$Mo (2×10^4y)	+		0.0025	40	1
^{96}Mo (16.50%)	(n, 2n)	−9.15	^{95}Mo							1.4		15
	(n, p)	−2.41	^{96}Nb	β^-	3.15	23.4h	^{96}Mo			0.016	359	28
								+		0.024	389	1
										0.021	340	22, 27
	(n, α)	3.99	^{93}Zr	β^-	0.090	1.5×10^6y	^{93}Nb$^m \rightarrow ^{93}$Nb^g (13.6y) ^{93}Nb^g	+		0.01	160	1
	(n, np)	−9.30	^{95}Nb	β^-	0.925	35d	^{95}Mo	+		0.002	33	1
	(n, np*)		^{95}Nb^m	IT	0.235	90h	^{95}Nb$^g \rightarrow ^{95}$Mo (35d)	+		5×10^{-4}	8	1
^{97}Mo (9.45%)	(n, 2n)	−6.82	^{96}Mo							1.5		15
	(n, p)	−1.15	^{97}Nb	β^-	1.93	72m	^{97}Mo	+		0.07	1130	1
										0.016	260	7, 22, 27, 28
	(n, p*)		^{97}Nb^m	IT	0.747	1.0m	^{97}Nb$^g \rightarrow ^{97}$Mo (72m)	+		0.007	113	1
	(n, α)	5.37	^{94}Zr									
	(n, np)	−9.22	^{96}Nb	β^-	3.15	23.4h	^{96}Mo	+		8×10^{-4}	13	1
^{98}Mo (23.75%)	(n, γ)	5.92	^{99}Mo	β^-	1.37	67h	^{99}Tc$\rightarrow^{99}$Ru (2×10^5y)	4.0	1.2×10^{-4}	0.005	81	1, 5
	(n, 2n)	−8.64	^{97}Mo							1.66		15
	(n, p)	−3.82	^{98}Nb	β^-	4.6	51.5m	^{98}Mo			0.0067	109	28
								+		0.01	162	1

										0.0094	152	20
	(n, α)	3.20	^{95}Zr	β^-	1.121	65d	^{95}Nb$^g \to ^{95}$Mo (35d) ^{95}Nb$^m \to ^{95}$Nb$^g \to ^{95}$Mo (90h) (35d)			0.0081	132	22
	(n, np)	−9.44	^{97}Nb	β^-	1.93	72m	^{97}Mo	+		1×10^{-4}	1.6	1
	(n, np*)		^{97}Nb^m	IT	0.747	1m	^{97}Nb$^g \to ^{97}$Mo (72m)	+		1×10^{-4}	1.6	1
^{99}Mo	(n, p)		^{99}Nb	β^-	3.1	10s 2.4m	^{99}Mo$\to^{99}$Tc$\to^{99}$Ru (67h) (2.12×10^{5}y)			0.0075	122	20
^{100}Mo (9.62%)	(n, γ)	5.39	^{101}Mo	β^-	2.82	14.6m	^{101}Tc$\to^{101}$Ru (14m)	2.0	4×10^{-4}	0.006	97	1, 5
	(n, 2n)	−8.30	^{99}Mo	β^-	1.37	67h	^{99}Tc$\to^{99}$Ru (2×10^{5}y)	2.3	14	2.3	37300	1
										1.4	22800	7, 28
										1.7	27500	23
	(n, α)	2.39	^{97}Zr	β^-	2.67	17h	^{97}Nb$^g \to ^{97}$Mo (72m)	+		0.011	178	1
										0.025	405	7, 28
^{99}Tc	(n, γ)		^{100}Tc	β^-	3.4	17s	^{100}Ru			0.009	147	96
	(n, n'γ)		^{99}Tc	β^-	0.292	2.12×10^{5}y	^{99}Ru			0.0413	672	73
	(n, 2n)		^{98}Tc	β^-	1.7	1.5×10^{6}y	^{100}Ru$^{excit} \to ^{100}$Ru^g			1.23	20000	96
	(n, p)		^{99}Mo	β^-	1.37	67h	^{99}Tc$\to^{99}$Ru (2.12×10^{5}y)			0.0071	116	20
	(n, ^{3}He)		^{97}Nb	β^-	1.93	74m	^{97}Mo			$<7\times10^{-6}$	<0.11	55
	(n, α)		^{96}Nb	β^-	3.15	23.4h	^{96}Mo			0.002	33	73
	(n, 2p)		^{98}Nb	β^-	4.6	<2m 51m	^{98}Mo			1.4×10^{-4}	2.3	96
	(n, nα)		^{95}Nb	β^-	0.925	35d	^{95}Mo$^{excit} \to ^{95}$Mo^g			0.0011	18	96
^{96}Ru (5.7%)	(n, γ)	8.04	^{97}Ru	EC	1.2	2.9d	^{97}Tc$\to^{97}$Mo (2×10^{5}y)	0.2	thermal	0.002	32	1
	(n, 2n)	−10.69	^{95}Ru	EC, β^+	2.35	1.7h	^{95}Tc$^g \to ^{95}$Mo (20h)	1.0	17	0.63	10200	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{96}Ru (5.7%)	(n, 2n)	−10.69	^{95}Ru	EC, β^+	2.35	1.7h	^{95}Tc$^g \rightarrow ^{95}$Mo (20h)			0.75	15500	7
										0.64	10400	23
	(n, p)	0.57	^{96}Tc	EC (β^-)	2.9 0.2	4.3d	^{96}Mo	+		0.062	1000	1
										0.15	2430	7, 22, 27
	(n, p*)		^{96}Tc^m	IT	0.0344	52m	^{96}Tc$^g \rightarrow ^{96}$Mo (4.3d)	+		0.062	1000	1
	(n, np)	−7.35	^{95}Tc	EC	1.66	20h	^{95}Mo	+		0.45	7330	1
										0.48	7810	22
	(n, np*)		^{95}Tc^m	EC, β^+	1.70	61d	^{95}Mo	+		0.052	847	1, 22
^{98}Ru (2.2%)	(n, 2n)	−10.25	^{97}Ru	EC	1.2	2.9d	^{97}Tc$\rightarrow ^{97}$Mo (2×10^6y)	+		0.9	14600	1
										1.17	19000	23
	(n, p)	−0.92	^{98}Tc	β^- (EC, β^+)	1.7 1.6	1.5×10^6y	^{98}Ru ^{98}Mo			0.024	390	20
^{99}Ru (12.8%)	(n, p)	0.49	^{99}Tc	β^-	0.292	2.12×10^5y	^{99}Ru	+		0.015	243	1
	(n, p*)		^{99}Tc^m	IT	0.1427	6h	^{99}Tc$^g \rightarrow ^{99}$Ru (2×10^5y)	+		0.015	243	1
^{100}Ru (12.7%)	(n, 2n)	−9.67	^{99}Ru							1.2		15
	(n, p)	−2.59	^{100}Tc	β^- (EC)	3.4 0.3	17s	^{100}Ru			0.0074	120	20
										0.015	244	73
^{101}Ru (17.0%)	(n, 2n)	−6.81	^{100}Ru							1.3		15
	(n, p)	−0.85	^{101}Tc	β^-	1.63	14m	^{101}Ru	+		0.035	569	1
										0.0082	133	20
^{102}Ru (31.3%)	(n, γ)	6.23	^{103}Ru	β^-	0.74	39.6d	^{103}Rh$^m \rightarrow ^{103}$Rh (57m)	1.44	thermal	0.005	79	1, 6
	(n, 2n)	−9.22	^{101}Ru							1.5		15

	(n, p)	−3.72	^{102}Tc	β^-	4.4	5s	^{102}Ru			0.002	32	7
	(n, p*)		^{102}Tc^m	β^-	~4.6	4.5m	^{102}Ru	+		0.0057	92	1
	(n, α)	2.50	^{99}Mo	β^-	1.37	67h	^{99}Tc→^{99}Ru (2×10^5y)			0.0021	34	37
^{104}Ru (18.3%)	(n, γ)	5.91	^{105}Ru	β^-	1.87	4.44h	^{105}Rh→^{105}Pd	0.211	thermal	0.008	130	1, 5
										0.0025	41	73
	(n, 2n)	−8.91	^{103}Ru	β^-	0.74	39.6d	^{103}Rh	+		2.3	31400	1
										2.5	40700	73
								1.5	15	1.4	22700	7, 23
	(n, p)	−4.52	^{104}Tc	β^-	5.8	18m	^{104}Ru	+		0.0063	102	1
										0.0072	117	27
	(n, α)	1.06	^{101}Mo	β^-	2.82	14.6m	^{101}Tc→^{101}Ru (14m)	+		0.0025	40	1, 27
^{103}Rh (100%)	(n, γ)	7.00	^{104}Rh	β^- (EC)	2.47 1.15	43s	^{104}Pd ^{104}Ru	320	1.3×10^{-6}	0.010	162	5
										0.014	228	74
	(n, γ*)		^{104}Rh^m	IT (β^-)	0.1290 2.60	4.41m	^{104}Rh^g→^{104}Pd (43s) ^{104}Pd	30	1.3×10^{-6}	0.003	48	1
	(n, n′)	——	^{103}Rh^m	IT	0.0400	57m	^{103}Rh	1.4	6.5	0.3	4860	2
										0.20	3250	44
	(n, 2n)	−9.31	^{102}Rh	EC, β^+ β^-	2.32 1.15	206d	^{102}Ru ^{102}Pd	+		0.38	6190	1
								0.65	15	0.65	10600	7
	(n, 2n*)		^{102}Rh^m	EC, β^+ β^-	~2.32 ~1.15	2.9y	^{102}Ru ^{102}Pd	0.55	18	0.38	6190	1, 7
	(n, p)	0.02	^{103}Ru	β^-	0.74	39.6d	^{103}Rh	+		0.015	244	1
										0.011	179	45
										0.017	278	22, 27
										0.0093	152	20
	(n, d)	−4.05	^{102}Ru							>0.0089		52
	(n, t)	−6.94	^{101}Ru							7.3×10^{-4}		93

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{103}Rh (100%)	(n, ^{3}He)	−8.55	^{101}Tc	β^-	1.63	14m	^{101}Ru			1.6×10^{-5}	0.26	54
										2.0×10^{-6}	0.03	91
	(n, α)	3.48	^{100}Tc	β^-	3.4	17s	^{100}Ru			0.01	160	7, 27
	(n, 2p)	−9.93	^{102}Tc	β^-	4.4	5s 4.5m	^{102}Ru			3×10^{-5}	0.5	96
										7×10^{-6}	0.11	91
	(n, nα)	−3.11	^{99}Tc	β^-	0.292	2.12×10^5y	^{99}Ru			1.08×10^{-4}	1.76	73
	(n, nα^*)		^{99}Tc^m	IT β^-	0.1427 0.434	6.0h	^{99}Tc$^g\rightarrow^{99}$Ru ^{99}Ru			6.5×10^{-5}	1.06	91
^{102}Pd (0.8%)	(n, γ)	7.61	^{103}Pd	EC	0.56	17d	^{103}Rh$^m\rightarrow^{103}$Rh^g (57m)	4.8	thermal	0.003	49	1
	(n, 2n)	−10.59	^{101}Pd	EC, β^+	1.99	8.4h	^{101}Rh^m (4.5d) $\nearrow^{101}$Ru, $\searrow^{101}$Rh$^g\rightarrow^{101}$Ru	1.2	16	1.05	17000	1
								1.2	16	1.23	20000	99
										0.9	15000	7
										0.64	10400	23
	(n, p)	−0.37	^{102}Rh	β^- EC, β^+	1.15 2.32	2.9y 206d	^{102}Pd ^{102}Ru			0.046	749	20
^{104}Rd (9.3%)	(n, 2n)	−10.02	^{103}Pd	EC	0.56	17d	^{103}Rh$^m\rightarrow^{103}$Rh^g (57m)	+		1.3	21200	1
										1.1	17900	15
	(n, p)	−1.69	^{104}Rh	β^- (EC)	2.47 1.15	43s	^{104}Pd ^{104}Ru			0.003	48	7
										0.0027	43	94
	(n, p*)		^{104}Rh^m	IT	0.129	4.41m	^{104}Rh^g (43s) $\nearrow^{104}$Pd, $\searrow^{104}$Ru	0.13	14	0.13	2110	1
										0.03	490	7
										0.031	501	94
^{105}Pd (22.23%)	(n, 2n)	−7.07	^{104}Pd							1.2		15

	(n, p)	0.22	^{105}Rh	β^-	0.565	35.9h	^{105}Pd			0.05	810	7
										0.028	460	94
										0.037	600	22
	(n, p*)		^{105}Rh^m	IT	0.1294	45s	^{105}Rh$^g \rightarrow ^{105}$Pd (35.9h)			0.023	373	7
^{106}Pd (27.2%)	(n, γ)	6.54	^{107}Pd	β^-	0.035	7×10^6y	^{107}Ag^g	0.292	thermal			(5)
	(n, 2n)	−9.56	^{105}Pd							1.3		15
	(n, p)	−2.76	^{106}Rh	β^-	3.54	30s	^{106}Pd			0.016	259	7
										0.014	228	94
										0.024	389	22, 27
	(n, p*)		^{106}Rh^m	β^-	3.63	130m	^{106}Pd	+		0.0057	82	1
	(n, α)	3.00	^{103}Ru	β^-	0.74	39.5d	^{103}Rh			0.0056	91	7, 22
										0.0055	90	27
^{108}Pd (26.8%)	(n, γ)	6.15	^{109}Pd	β^-	1.115	13.5h	^{109}Ag	10	thermal	0.006	97	1
	(n, γ*)		^{109}Pd^m	IT	0.188	4.7m	^{109}Pd$^g \rightarrow ^{109}$Ag$^m \rightarrow ^{109}$Ag^g (13h) (40s)	0.3	thermal	2×10^{-4}	33	1
	(n, 2n*)	(−9.23)	^{107}Pd^m	IT	0.21	22s	^{107}Pb$^g \rightarrow ^{107}$Ag^g (7×10^6y)			0.5	8100	7
	(n, p)	−3.72	^{108}Rh	β^-	4.5	17s	^{108}Pd			0.008	130	7
										0.0083	134	22
	(n, d)	−7.73	^{107}Rh	β^-	1.51	22m	^{107}Pd$\rightarrow^{107}$Ag (7×10^6y)	+		0.0018	29	1
	(n, α)	2.05	^{105}Ru	β^-	1.87	4.44h	^{105}Rh$\rightarrow^{105}$Pd (4.44h)	+		0.0025	40	1
										0.0027	43	27
										0.0023	37	94
	(n, np)	−9.95	^{107}Rh	β^-	1.51	22m	^{107}Pd$\rightarrow^{107}$Ag (7×10^6y)	+		0.0035	56	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{110}Pd (13.5%)	(n, γ)	5.76	^{111}Pd	β^-	2.2	22m	^{111}Ag^m→^{111}Ag^g (74s)→^{111}Cd	0.3	thermal	0.002	33	1
	(n, γ*)		^{111}Pd^m	IT β^-	0.17 2.4	5.5h	^{111}Pd^g→^{111}Ag→^{111}Cd (22m) (7.5d) ^{111}Ag→^{111}Cd (7.5d)	0.03	thermal	3×10^{-4}	5	1
	(n, 2n)	−8.81	^{109}Pd	β^-	1.115	13.5h	^{109}Ag			1.9	30800	1
								1.5	14	1.46	23800	99
								1.8	17	1.5	24400	7
	(n, 2n*)		^{109}Pd^m	IT	0.188	4.7m	^{109}Pd^g→^{109}Ag (13h)			0.95	15400	1
								0.5	16	0.5	8100	7
										0.46	7500	99
	(n, α)	1.02	^{107}Ru	β^-	3.2	4.2m	^{107}Rh→^{107}Pd→^{107}Ag (22m) (7×10^6y)			0.014	227	7
										0.003	50	5
										0.0012	19	27
^{107}Ag (51.35%)	(n, γ)	7.27	^{108}Ag	(β^+, EC) β^-	1.92 1.64	2.42m	^{108}Pd ^{108}Cd	35	thermal	0.005	81	1, 5
	(n, γ*)		^{108}Ag^m	EC (IT)	2.03 0.110	>0.5y	^{108}Pd (90%) ^{108}Ag^g→^{108}Cd (2.42m)	1	thermal	2×10^{-4}	3.3	1
	(n, n′)	——	^{107}Ag^m	IT	0.0931	44.3s	^{107}Ag^g			0.312	5080	77
	(n, 2n)	−9.55	^{106}Ag	EC, β^+ (β^-)	2.96 0.19	24m	^{106}Pd	0.72	15	0.79	12900	1
										0.70	11400	97
										0.664	10800	77
										1.0	16200	7
	(n, 2n*)		^{106}Ag^m	EC, β^+ (β^-)	~3.3 ~0.5	8.4d	^{106}Pd	+		0.49	7940	1
										0.4	6500	7
	(n, p*)	(0.75)	^{107}Pd^m	IT	0.21	22s	^{107}Pd^g→^{107}Ag (7×10^6y)			0.015	243	7
										0.030	486	20
	(n, α)	4.18	^{104}Rh	β^- (EC)	2.47 1.15	43s	^{104}Pd	0.0035	~12	0.0030	49	18
	(n, nα*)	−2.82	^{103}Rh^m	IT	0.040	57m	^{103}Rh^g	+		0.0018	29	1

	(n, 3n)	−17.47	^{105}Ag	EC	1.3	40d	^{105}Pd			0.056 at 19.5 MeV	912	96
^{109}Ag (48.65%)	(n, γ*)	(6.81)	^{110}Ag^{m}	β⁻ (IT)	2.98 0.116	253d	^{110}Cd	3.5	thermal	2×10^{-4}	3.3	1, 5
	(n, n′)	——	^{109}Ag^{m}	IT	0.0877	40.0s	^{109}Ag^{g}			0.419	6820	77
	(n, 2n)	−9.19	^{108}Ag	(EC, β⁺ β⁻	1.92 1.64	2.42m	^{108}Pd ^{108}Cd	+		0.75	12200	7
										0.9	14600	1
										1.186	19300	77
	(n, 2n*)		^{108}Ag^{m}	EC (IT)	2.03 0.110	>5y	^{108}Pd ^{108}Ag$^{g}\rightarrow^{108}$Cd (2m)	+		0.027	439	1
	(n, p)	−0.33	^{109}Pd	β⁻	1.115	13.5h	^{109}Ag$^{m}\rightarrow^{109}$Ag^{g} (40s)	flat	around 17	0.0068	110	1
										0.013	220	7
	(n, p*)		^{109}Pd^{m}	IT	0.188	4.7m	^{109}Pd$^{g}\rightarrow^{109}$Ag (13h)	+		0.0068	110	1
										0.0091	150	77
	(n, ^{3}He)	−8.72	^{107}Rh	β⁻	1.51	21.7m	^{107}Pd→^{107}Ag (7×10^{6}y)			2.3×10^{-5}	0.37	54
	(n, α*)	(3.29)	^{106}Rn^{m}	β⁻	3.63	130m	^{106}Pd	+		0.023	374	1, 5
	(n, nα)	−3.30	^{105}Rh	β⁻	0.565	35.9h	^{105}Pd	+		5×10^{-4}	8	1
^{106}Cd (1.215%)	(n, γ)	7.93	^{107}Cd	EC, β⁺	1.417	6.5h	^{107}Ag$^{m}\rightarrow^{107}$Ag^{g} (44s)	1	thermal	0.005	81	1, 6
	(n, 2n)	−10.92	^{105}Cd	β⁺, EC	2.8	55m	^{105}Ag→^{105}Pd (40d)	1.3	16	0.9	15000	7
										0.7	11000	1
										1.36	*22100*	*88*
										0.89	14500	23
	(n, 2n*)		^{105}Cd					0.85	14	0.85		7
	(n, p)	0.58	^{106}Ag	EC, β⁺ (β⁻)	2.96 0.19	24m	^{106}Pd	+		0.038	616	1
								flat	~18	0.08	1300	7
	(n, p*)		^{106}Ag^{m}	EC, β⁺ (β⁻)	3.3 0.5	8.4d	^{106}Pd	+		0.038	616	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{108}Cd (0.875%)	(n, γ)	7.36	^{109}Cd	EC	0.168	453d	^{109}Ag$^{m}\rightarrow^{109}$Ag^{g} (40s)	2	thermal	0.006	98	1, 5
	(n, 2n)	−10.33	^{107}Cd	EC, β^{+}	1.417	6.5h	^{107}Ag$^{m}\rightarrow^{107}$Ag^{g} (44s)	+		1.2	19400	1
										0.50	8100	21
										0.87	14100	23
	(n, p)	−0.86	^{108}Ag	β^{-} (EC, β^{+})	1.62 1.92	2.42m	^{108}Cd ^{108}Pd			0.030	486	20
^{110}Cd (12.39%)	(n, γ*)	(6.98)	^{111}Cd^{m}	IT	0.396	48.6m	^{111}Cd^{g}	0.1	thermal	2×10^{-4}	3.3	1, 5
	(n, 2n)	−9.88	^{109}Cd	EC	0.17	453d	^{109}Ag$^{m}\rightarrow^{109}$Ag^{g} (40s)	+		1.45	23600	1
										1.32	21500	23
	(n, p)	−2.11	^{110}Ag	β^{-}	2.87	24.4s	^{110}Cd			0.008	130	7
										0.0173	281	80
										0.014	227	20
	(n, p*)		^{110}Ag^{m}	β^{-} (IT)	2.99 0.12	253d	^{110}Cd	+		0.02	320	1
										0.027	440	21
^{111}Cd (12.75%)	(n, n′)	——	^{111}Cd^{m}	IT	0.396	48.6m	^{111}Cd^{g}	0.33	4	0.15	2430	1
	(n, 2n)	−6.98	^{110}Cd							1.3	21100	15
	(n, p)	−0.25	^{111}Ag	β^{-}	1.05	7.5d	^{111}Cd	+		0.013	211	1
										0.014	227	21
										0.022	358	7
										0.016	259	20
	(n, p*)		^{111}Ag^{m}	IT	0.07	74s	^{111}Ag$\rightarrow^{111}$Cd (7.5d)	+		0.013	211	1
^{112}Cd (24.07%)	(n, γ*)	(6.54)	^{113}Cd^{m}	β^{-}	0.57	14y	^{113}In	5×10^{-2}	thermal	2×10^{-4}	3.3	1
	(n, 2n*)	(−9.40)	^{111}Cd^{m}	IT	0.396	48.6m	^{111}Cd^{g}	0.82	15	0.82	13300	1
								0.7	15	0.675	11000	99

	(n, p)	−3.22	^{112}Ag	β^-	4.01	3.2h	^{112}Cd	+		0.011	178	1, 21
										0.015	243	22, 27
	(n, α)	2.68	^{109}Pd	β^-	1.115	13.5h	^{109}Ag^m→^{109}Ag^g (40s)	+		0.0013	21	1
										0.0025	40	7, 21
	(n, α*)		^{109}Pd^m	IT	0.188	4.7m	^{109}Pd^g→^{109}Ag (13.47h)	+		0.0013	21	1
^{113}Cd (12.26%)	(n, n′)	——	^{113}Cd^m	β^-	0.57	14y	^{113}In	0.58	4	0.17	2770	1
	(n, 2n)	−6.54	^{112}Cd							1.5	24400	15
	(n, p)	−1.23	^{113}Ag	β^-	2.00	5.3h	^{113}Cd	+		0.008	130	1, 20, 21
										0.013	211	27
^{114}Cd (28.86%)	(n, γ)	6.15	^{115}Cd	β^-	1.45	53.5h	^{115}In^m→^{115}In^g→^{115}Sn (4.5h)(6×10^{14}y)	0.3	thermal	0.005	81	1, 5
	(n, γ*)		^{115}Cd^m	β^-	1.65	43d	^{115}In^g→^{115}Sn (6×10^{14}y)	0.14	thermal	0.001	16	1, 6
	(n, 2n*)	(−9.04)	^{113}Cd^m	β^-	0.57	14y	^{113}In	+		0.86	14000	1
	(n, p)	−4.22	^{114}Ag	β^-	4.6	4.5s	^{114}Cd			0.003	48	7, 20
										0.005	81	80
	(n, α)	1.66	^{111}Pd	β^-	2.2	22m	^{111}Ag^m→^{111}Ag^g→^{111}Cd (74s) (7.5d)	+		5×10^{-4}	8	1, 21
	(n, α*)		^{111}Pd^m	IT β^-	0.17 2.4	5.5h	^{111}Pd^g→^{111}Ag→^{111}Cd (22m) (7.5d) ^{111}Ag→^{111}Cd (7.5d)	+		1.3×10^{-4}	2.1	1
										2×10^{-4}	3.3	21
^{116}Cd (7.58%)	(n, γ)	5.77	^{117}Cd	β^-	2.52	2.4h	^{117}In→^{117}Sn (44m)	2	thermal	0.005	81	1, 6
	(n, γ*)		^{117}Cd^m	β^-	2.65	3.4h	^{117}In→^{117}Sn (44m)	0.05	thermal	1×10^{-4}	2	1
	(n, 2n)	−8.70	^{115}Cd	β^-	1.45	53.5h	^{115}In^m→^{115}In^g→^{115}Sn (4.5h) (44m)	0.83	14	0.83	13400	1
										0.86	14000	21
	(n, 2n*)		^{115}Cd^m	β^-	1.65	43d	^{115}In^g→^{115}Sn (6×10^{14}y)	0.83	15.5	0.82	13300	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{116}Cd (7.58%)	(n, 2n*)		^{115}Cd^{m}	β^-	1.65	43d	^{115}In$^{g}\rightarrow^{115}$Sn (6×10^{14}y)			0.73	11900	21
	(n, p)	−5.52	^{116}Ag	β^-	6.1	2.5m	^{116}Cd			0.005	81	7
										0.0014	22	20
										2×10^{-4}	3	21
	(n, α)	0.905	^{113}Pd	β^-	≈3.5	1.4m	^{113}Ag$\rightarrow^{113}$Cd (5.3h)			5×10^{-4}	8	21
										0.0011	17	27
^{113}In (4.23%)	(n, γ)	7.31	^{114}In	(EC, β^+) β^-	1.44 1.986	72s	^{114}Cd ^{114}Sn	3	thermal	0.001	16	1, 5
	(n, γ*)		^{114}In^{m}	IT (EC)	0.1916 1.63	50d	^{114}In$^{g}\rightarrow^{114}$Sn (72s) ^{114}Cd	8.1	thermal	0.003	49	1, 5
	(n, n′)	——	^{113}In^{m}	IT	0.393	100m	^{113}In^{g}	1	5	0.33	5350	1
	(n, 2n)	−9.42	^{112}In	(EC, β^+ β^-	2.59 0.66	14m	^{112}Cd ^{112}Sn			0.79	12800	1
								12	~15	0.2	3300	7, 89
	(n, 2n*)		^{112}In^{m}	IT	0.156	20.7m	^{112}In^{g} (72s) $\nearrow^{112}$Cd $\searrow^{112}$Sn			0.79	12800	1
								0.7	15	0.7	11000	7, 89
	(n, p)	0.49	^{113}Cd							0.51	8300	20
^{115}In (95.77%)	(n, γ*)	(6.78)	^{116}In^{m}	β^-	3.39	54m	^{116}Sn	157	thermal	0.002	33	1, 5
										0.0021	34	49
	(n, n′)	——	^{115}In^{m}	IT (β^-)	0.335 0.82	4.5h	^{115}In$^{g}\rightarrow^{115}$Sn (6×10^{14}y) ^{115}Sn (5%)	0.33	6	0.06	972	2, 46, 92
	(n, 2n)	−9.03	^{114}In	(EC, β^+) β	1.44 1.986	1.2m	^{114}Cd ^{114}Sn	0.38	14.5	0.38	6180	1, 7
	(n, 2n*)		^{114}In^{m}	IT (EC)	0.1916	50d	^{114}In$^{g}\rightarrow^{114}$Sn (6×10^{14}y) ^{114}Cd	1.55	14.5	1.5	24400	1, 7
	(n, p)	−0.67	^{115}Cd	β^-	1.45	53.5h	^{115}In$^{m}\rightarrow^{115}$In$^{g}\rightarrow^{115}$Sn (4.5h)(6×10^{14}y)	+		0.007	113	1

										0.015	244	7
	(n, p*)		$^{115}Cd^{m}$	β^-	1.65	43d	$^{115}In^{g} \rightarrow ^{115}Sn$ (6×10^{14}y)	+		0.007	110	1
	(n, ^{3}He)	−9.34	^{113}Ag	β^-	2.00	5.3h	$^{113}Cd \rightarrow ^{113}In$ ($>10^{15}$y)			3.3×10^{-5}	0.54	54
										$\leq7\times10^{-6}$	$\leq$0.11	56
	(n, α)	2.68	^{112}Ag	β^-	4	3.2h	^{112}Cd	+		0.0025	40	1, 27
	nonelastic	——	——							$\leq$2.0		76
^{112}Sn (0.95%)	(n, γ)	7.74	^{113}Sn	EC	1.02	115d	$^{113}In^{m} \rightarrow ^{113}In^{g}$ (100m)	0.9	thermal	0.004	65	1, 5
	(n, γ*)		$^{113}Sn^{m}$	IT (EC)	0.079 1.10	20m	$^{113}Sn^{g} \rightarrow ^{113}In$ (115d) $^{113}In^{g}$	0.4	thermal	0.002	33	1, 5
	(n, 2n)	−10.80	^{111}Sn	EC, β^+	2.52	35m	$^{111}In \rightarrow ^{111}Cd^{m} \rightarrow ^{111}Cd$ (2.81d) (48.6m)			1.35	21900	1
								13	16	1.11	18000	7, 88
										1.49	24300	23
	(n, p)	0.12	^{112}In	(EC, β^+ β^-	2.59 0.66	14m	^{112}Cd ^{112}Sn	+		0.12	1940	1
	(n, p*)		$^{112}In^{m}$	IT	0.156	20.7m	$^{112}In^{g}$ (14m) $\nearrow ^{112}Cd$ $\searrow ^{112}Sn$	+		0.12	1940	1
	(n, d)	−5.29	^{111}In	EC	1.1	2.81d	^{111}Cd			0.19	3090	96
	(n, α)	5.54	^{109}Cd	EC	0.16	453d	$^{109}Ag^{m} \rightarrow ^{109}Ag^{g}$ (40s)	+		0.0026	42	1
^{114}Sn (0.65%)	(n, 2n)	−10.32	^{113}Sn	EC	1.02	115d	$^{113}In^{m} \rightarrow ^{113}In^{g}$ (100m)	+		0.35	5700	1
										1.5	24400	7
										1.55	25200	23
	(n, 2n*)		$^{113}Sn^{m}$	IT (EC)	0.079 1.10	20m	$^{113}Sn^{g} \rightarrow ^{113}In$ (115d) $^{113}In^{g}$	+		1.05	17100	1
	(n, p)	−1.20	^{114}In	(EC, β^+) β^-	1.44 1.986	1.2m	^{114}Cd ^{114}Sn			0.058	944	20

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{116}Sn (14.24%)	(n, γ*)	(6.94)	^{117}Sn^{m}	IT	0.317	14d	^{117}Sn^{g}	0.006	thermal	1.5×10^{-4}	2.4	1, 6
	(n, 2n)	−9.57	^{115}Sn							1.3		15
	(n, p)	−2.49	^{116}In	β^-	3.33	14s	^{116}Sn			0.011	178	7
	(n, p*)		^{116}In^{m}	β^-	3.4	54m	^{116}Sn	+		0.0095	154	1
										0.011	179	80
	(n, α*)	(3.17)	^{113}Cd^{m}	β^-	0.27	14y	^{113}In	+		0.0027	44	1
^{117}Sn (7.57%)	(n, n′)	——	^{117}Sn^{m}	IT	0.317	14.0d	^{117}Sn			0.30	4880	76
	(n, 2n)	−6.94	^{116}Sn							1.4		15
	(n, p)	−0.68	^{117}In	β^-	1.47	44m	^{117}Sn	+		0.013	211	1
										0.016	259	22, 27
										0.0098	160	80
										0.024	389	20
	(n, p*)		^{117}In^{m}	β^- / IT	1.78 / 0.314	1.93h	^{117}Sn; ^{117}In$\rightarrow^{117}$Sn (44m)	+		0.0065	105	1
	(n, α)	5.27	^{114}Cd							0.0039	64	80
	nonelastic	——	——							$\leq$2.0		76
^{118}Sn (24.01%)	(n, γ*)	(6.49)	^{119}Sn^{m}	IT	0.089	250d	^{119}Sn^{g}	0.01	thermal	6×10^{-5}	1.0	1, 6
	(n, 2n*)	(−9.33)	^{117}Sn^{m}	IT	0.317	14d	^{117}Sn^{g}	+		1.2	19400	1
	(n, p*)	(−3.42)	^{118}In^{m}	β^-	4.3	4.4m	^{118}Sn	+		0.0075	122	1
										0.0054	88	80
	(n, α)	2.09	^{115}Cd	β^-	1.45	53.5h	^{115}In^{m} (4.50h) → ^{115}Sn^{g}; ^{115}In$^{g}\rightarrow^{115}$Sn^{g} (6×10^{14}y)	+		8.5×10^{-4}	13.8	1, 7
	(n, α*)		^{115}Cd^{m}	β^-	1.63	43d	^{115}In$^{g}\rightarrow^{115}$Sn^{g} (6×10^{14}y)	+		8.5×10^{-4}	13.8	1
										3×10^{-4}	5	7
	(n, np)	−10.01	^{117}In	β^-	1.47	44m	^{117}Sn	+		7.5×10^{-4}	12.2	1
	(n, np*)		^{117}In^{m}	IT / β^-	0.314 / 1.78	1.93h	^{117}In$^{g}\rightarrow^{117}$Sn (44m); ^{117}Sn	+		4×10^{-4}	6	1

^{119}Sn (8.58%)	(n, 2n)	−6.94	^{118}Sn							1.8		8
										1.6		15
	(n, p)	−1.57	^{119}In	β^-	2.5	2.1m	^{119}Sn	+		0.0065	105	1, 27
										0.003	49	7
	(n, p*)		^{119}In^m	β^- (IT)	2.8 0.30	18m	^{119}In$^g \rightarrow ^{119}$Sn (2.1m) (5%) ^{119}Sn	+		0.0065	105	1
										0.003	49	7
	(n, np*)	(−9.90)	^{118}In^m	β^-	4.3	4.4m	^{118}Sn	+		0.009	146	1
										0.005	81	5
^{120}Sn (32.97%)	(n, γ)	6.18	^{121}Sn	β^-	0.383	27h	^{121}Sb^g	0.14	thermal	0.003	49	1, 6
	(n, γ*)		^{121}Sn^m	β^-	0.45	76y	^{121}Sb$^m \rightarrow ^{121}$Sb^g (3.5ns)	0.001	thermal	4×10^{-5}	0.8	1, 6
	(n, 2n*)	(−9.10)	^{119}Sn^m	IT	0.089	250d	^{119}Sn^g	+		1.4	22800	1
	(n, p)	−4.82	^{120}In	β^-	5.3	46s	^{120}Sn			0.004	65	7, 27
										0.0031	51	80
	(n, p*)		^{120}In^m	β^-	5.6	3.2s	^{120}Sn			~0.001	~16	5
										0.0014	23	80
	(n, α)	0.96	^{117}Cd	β^-	2.52	2.4h 3.4h	^{117}In$\rightarrow^{117}$Sn (44m)					
^{122}Sn (4.71%)	(n, γ)	5.95	^{123}Sn	β^-	1.42	125	^{123}Sb	0.001	thermal	7×10^{-5}	1.1	1, 6
	(n, γ*)		^{123}Sn^m	β^-	1.45	40m	^{123}Sb	0.16	thermal	0.003	48	1, 6
	(n, 2n)	−8.80	^{121}Sn	β^-	0.383	27h	^{121}Sb	+		0.9	14600	1
	(n, 2n*)		^{121}Sn^m	β^-	0.45	76y	^{121}Sb	+		0.9	14600	1
	(n, p)	−5.92	^{122}In	β^-	6.7	7.5s	^{122}Sn			0.00106	17.3	80
^{124}Sn (5.98%)	(n, γ)	5.73	^{125}Sn	β^-	2.34	9.4d	^{125}Sb$\rightarrow^{125}$Te (2.7y)	0.004	thermal	8×10^{-5}	1.3	1, 6
	(n, γ*)		^{125}Sn^m	β^-	2.36	9.7m	^{125}Sb$\rightarrow^{125}$Tc (2.7y)	0.2	thermal	0.002	33	1, 6
	(n, 2n)	−8.49	^{123}Sn	β^-	1.42	125d	^{123}Sb	0.92	14	0.92	15000	1
	(n, 2n*)		^{123}Sn^m	β^-	1.45	40m	^{123}Sb	0.92	14	0.92	15000	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{121}Sb (57.25%)	(n, γ)	6.81	^{122}Sb	(EC, β^+) β^-	1.62 1.972	2.8d	^{122}Sn ^{122}Te	6.5	thermal	0.003	48	1, 5
	(n, γ*)		^{122}Sb^m	IT	0.162	4.2m	^{122}Sb^g (2.8d) $\nearrow$ ^{122}Sn $\searrow$ ^{122}Te	0.055	thermal	3×10^{-5}	0.5	1, 5
	(n, 2n)	−9.25	^{120}Sb	β^+, EC (β^-)	2.69 0.99	15.9m	^{120}Sn ^{120}Te	1.1	15	1.1	17800	1
										0.94	15300	88
	(n, 2n*)		^{120}Sb^m	EC	≈3.4	5.8d	^{120}Sn	+		1.1	17800	1
										0.61	9900	88
								0.7	17	0.5	8100	7
	(n, p)	0.40	^{121}Sn	β^-	0.383	27h	^{121}Sb			0.0022	35	7, 94
^{123}Sb (42.75%)	(n, γ)	6.47	^{124}Sb	β^- (EC)	2.916 0.65	60d	^{124}Te	3	thermal	0.003	49	1
										0.015	244	74
	(n, γ*)		^{124}Sb^m	(β^- IT	2.92 0.010	93s	^{124}Te ^{124}Sb^g (60d) $\rightarrow$ ^{124}Te	0.035	thermal	2×10^{-5}	0.32	1, 5
	(n, 2n)	−8.97	^{122}Sb	(EC, β^+) β^-	1.62 1.972	2.8d	^{122}Sn ^{122}Te	1.4	16	1.3	21100	1, 7
										0.92	15000	88
	(n, 2n*)		^{122}Sb^m	IT	0.162	4.2m	^{122}Sb^g (2.80d) $\nearrow$ ^{122}Sn $\searrow$ ^{122}Te	+		1.3	21100	1
										0.55	8950	88
										0.6	9700	7
	(n, p)	−0.63	^{123}Sn	β^-	1.42	125d	^{123}Sb			0.0046	75	27
										0.0028	46	94
										0.0018	29	7

^{120}Te (0.089%)	(n, γ)	7.26	^{121}Te	EC	1.29	17d	^{121}Sb	2.0	thermal	0.004	65	1, 5
	(n, γ*)		^{121}Te^{m}	IT EC, β^+	0.2939 1.58	154d	^{121}Te^{g} → ^{121}Sb (17d) ^{121}Sb	0.34	thermal	8×10^{-4}	13	1, 5
	(n, 2n)	−10.29	^{119}Te	EC, β^+	2.294	15.9h	^{119}Sb → ^{119}Sn (38h)	+		0.8	13000	1
	(n, 2n*)		^{119}Te^{m}	EC	2.5	4.7d	^{119}Sb → ^{119}Sn (38h)	+		0.8	13000	1
^{122}Te (2.46%)	(n, γ*)	(6.93)	^{123}Te^{m}	IT	0.2475	117d	^{123}Te^{g} → ^{123}Sb (1.2×10^{13}y)	1	thermal	0.001	16	1
	(n, 2n)	−9.79	^{121}Te	EC	1.29	17d	^{121}Sb	+		0.32	5200	1
										0.7	11000	7
	(n, 2n*)		^{121}Te^{m}	IT EC, (β^+)	0.2939 1.58	154d	^{121}Te^{g} → ^{121}Sb (17d) ^{121}Sb	+		1.3	21000	1
										0.7	11000	7
	(n, p)	−1.20	^{122}Sb	β^- (EC)	1.972 1.62	2.68d	^{122}Te ^{122}Sn			0.014	227	7, 27, 94
										0.0106	173	80
^{124}Te (4.61%)	(n, γ*)	(6.58)	^{125}Te^{m}	IT	0.1449	58d	^{125}Te^{g}	0.04	thermal	1×10^{-4}	1.6	1, 5
	(n, 2n*)	(−9.42)	^{123}Te^{m}	EC	0.06	117d	^{123}Te^{g}	+		0.87	14200	1
	(n, p)	−2.12	^{124}Sb	β^- (EC)	2.916 0.65	60 d	^{124}Te	+		0.14	2300	1, 5
										0.0080	130	80
										0.009	150	7, 27
	(n, p*)		^{124}Sb^{m}	IT β^-	0.010 2.92	1.55m	^{124}Sb^{g} → ^{124}Te (60d) ^{124}Te	+		0.0043	70	1, 5
										$<6\times10^{-4}$	<9.7	7
	(n, α)	4.34	^{121}Sn	β^-	0.383	27h	^{121}Sb	+		0.0032	52	1, 5
										7.6×10^{-4}	12.3	7
	(n, α*)		^{121}Sn^{m}	β^-	0.45	76y	^{121}Sb	+		0.0032	52	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curic}}{\text{mol. unit flux}}\right)$	Reference
^{126}Te (18.71%)	(n, γ)	6.30	^{127}Te	β^-	0.69	9.4h	^{127}I	0.9	thermal	0.003	49	1, 5
	(n, γ*)		^{127}Te^m	IT	0.0887	109d	^{127}Te$^g \rightarrow ^{127}$I (9.4h)	0.135	thermal	2×10^{-4}	3	1, 5
	(n, 2n*)	(−9.11)	^{125}Te^m	IT	0.1449	58d	^{125}Te^g	+		0.9	15000	1
	(n, p)	−2.95	^{126}Sb	β^-	3.7	12.4d	^{126}Te			0.0016	26	7, 94
										6.0×10^{-4}	9.8	80
	(n, p*)		^{126}Sb^m	β^- (IT)	~3.7	19m	^{126}Te			0.0045	73	7, 94
										0.0027	44	80
	(n, α)	3.39	^{123}Sn	β^-	1.42	125d	^{123}Sb	+		4.8×10^{-4}	7.8	1
										0.0011	18	94
	(n, α*)		^{123}Sn^m	β^-	1.45	40m	^{123}Sb	+		4.8×10^{-4}	7.8	1
										0.0010	16	94
^{128}Te (31.79%)	(n, γ)	6.09	^{129}Te	β^-	1.48	69m	^{129}I$\rightarrow^{129}$Xe (1.7×10^7y)	0.155	thermal	0.002	32	1, 5
	(n, γ*)		^{129}Te^m	β^-	1.58	34d	^{129}I$\rightarrow^{129}$Xe	0.014	thermal	2×10^{-4}	3	1, 5
	(n, 2n)	−8.77	^{127}Te	β^-	0.69	9.4h	^{127}I	0.8	13	0.79	12800	1
								0.9	15	0.85	13800	7
	(n, 2n*)		^{127}Te^m	IT	0.0887	109d	^{127}Te$^g \rightarrow ^{127}$I (9.4h)	0.8	13	0.79	12800	1
								0.9	14	0.9	15000	7
	(n, p)	−3.50	^{128}Sb	β^-	4.3	9h	^{128}Te	+		0.0023	37	1, 27
										0.00108	17.6	80
										0.0013	21	7, 94
	(n, p*)		^{128}Sb^m	β^-	4.4	11m	^{128}Te	+		0.065	1050	1
										0.00108	17.6	80
										0.001	16	7, 94
	(n, α)	2.55	^{125}Sn	β^-	2, 34	9.4d	^{125}Sb$\rightarrow^{125}$Te (2.7y)	0.42	14	0.42	6800	1

										5.3×10^{-4}	8.6	94
										0.0011	17	27
	(n, α*)		$^{125}Sn^{m}$	β^-	2.36	9.7m	$^{125}Sb\rightarrow^{125}Te$ (2.7y)	0.42	14	0.42	6800	1
	(n, np)	−9.57	^{127}Sb	β^-	1.6	93h	$^{127}Te\rightarrow^{127}I$ (9.4h)	+		2.4×10^{-4}	3.9	1
										6.9×10^{-4}	11.2	94
^{130}Te (34.49%)	(n, γ)	5.92	^{131}Te	β^-	2.28	25m	$^{131}I\rightarrow^{131}Xe$ (8d)	0.22	thermal	0.002	32	1, 5
	(n, γ*)		$^{131}Te^{m}$	β^-	2.46	30h	$^{131}I\rightarrow^{131}Xe$ (8d)	0.04	thermal	3×10^{-4}	5	1
	(n, 2n)	−8.41	^{129}Te	β^-	1.48	69m	$^{129}I\rightarrow^{129}Xe$ (1.7×10^{7}y)	0.6	14	0.60	9770	1
								0.8	14	0.8	13000	7
	(n, 2n*)		$^{129}Te^{m}$	β^-	1.58	34d	$^{129}I\rightarrow^{129}Xe$ (1.7×10^{7}y)	0.6	14	0.60	9770	1
								1.0	14	1.0	16000	7
	(n, p)	−4.22	^{130}Sb	β^-	~5	33m	^{130}Te	+		0.0024	39	1, 5
										6×10^{-4}	10	7, 94
										8.1×10^{-4}	13.2	80
	(n, p*)		$^{130}Sb^{m}$	β^-	~5	7m	^{130}Te	+		0.014	228	1, 5
										8.8×10^{-4}	14	80
										6×10^{-4}	10	7, 94
	(n, ^{3}He)	−10.80	^{128}Sn	β^-	1.3	59.0m	$^{128}Sb\rightarrow^{128}Te$ (11m)			1.5×10^{-5}	0.24	54
	(n, α)	1.81	^{127}Sn	β^-	3.1	2.1h	$^{127}Sb\rightarrow^{127}Te\rightarrow^{127}I$ (93h) (9.4h)	+		3.0×10^{-4}	4.8	1
										3.9×10^{-4}	6.4	94
	(n, α*)		$^{127}Sn^{m}$	β^-	3.1	4m	$^{127}Sb\rightarrow^{127}Te\rightarrow^{127}I$ (93h) (9.4h)	+		3.0×10^{-4}	4.8	1
	(n, np)	−10.04	^{129}Sb	β^-	2.5	4.3h	$^{129}Te\rightarrow^{129}I\rightarrow^{129}Xe$ (69m)(1.7×10^{7}y)	+		1.5×10^{-4}	2.4	1
										6.7×10^{-4}	10.9	94

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{127}I (100%)	(n, γ)	6.83	^{128}I	(EC, β^+) β^-	1.26 2.14	25m	^{128}Te ^{128}Xe	60	3.6×10^{-5}	0.0071	116	96
										0.0012	20	75
	(n, 2n)	−9.14	^{126}I	(EC, β^+ β^-	2.150 1.251	13d	^{126}Te ^{126}Xe	1.5	16	1.3	21100	1, 2, 7
										1.66	26900	23
	(n, p)	0.09	^{127}Te	β^-	0.69	9.4h	^{127}I	+		0.016	259	1, 7
	(n, p*)	0.008	$^{127}Te^m$	IT	0.0887	109d	$^{127}Te^g\rightarrow^{127}I$ (9.4h)	+		0.016	259	1
										0.008	130	98
										0.005	81	7
	(n, d)	−3.98	^{126}Te							9×10^{-4}		96
	(n, α)	4.28	^{124}Sb	β^-	2.916	60d	^{124}Te	+		5.5×10^{-4}	9.0	1
										0.0015	24	7, 27
	(n, α*)		$^{124}Sb^m$	(IT β^-	0.010 2.926	1.55m	$^{124}Sb\rightarrow^{124}Te$ (60d) ^{124}Te	+		6.3×10^{-4}	10.2	1
				IT	0.035	20m	$^{124}Sb\rightarrow^{124}Te$ (60d)			0.0015	24	7
	(n, np)	−6.25	^{126}Te							0.0013		52
	(n, nα)	−2.19	^{123}Sb					+		2×10^{-5}		96
	(n, 3n)	−16.25	^{125}I	EC	0.149	60d	$^{125}Te^m\rightarrow^{125}Te^g$ (1.6ns)			0.040 at 14.7 MeV?		96
	nonelastic	—	—							2.0		96
^{124}Xe (0.096%)	(n, 2n)	−1.02	^{123}Xe	EC, β^+	2.8	2.1h	$^{123}I\rightarrow^{123}Te$ (13.3h)			1.13	18400	7, 96
^{126}Xe (0.090%)	(n, 2n)	−1.01	$^{125}Xe^g$	EC	1.9	16.8h	$^{125}I\rightarrow^{125}Te$ (60d)			1.36	22100	7, 96
	(n, 2n*)		$^{125}Xe^m$	IT	~0.2	55s	$^{125}Xe^g\rightarrow^{125}I\rightarrow^{125}Te$ (16.8h) (60d)			0.70	11400	7
^{128}Xe (1.919%)	(n, 2n)	−9.61	$^{127}Xe^g$	EC	0.44	36.4d	^{127}I			1.53	24900	7, 96
	(n, 2n*)		$^{127}Xe^m$	IT	~0.3	70s	$^{127}Xe^g\rightarrow^{127}I$ (36.4d)			0.84	13700	7

^{130}Xe (4.08%)	(n, 2n*)	(−9.26)	^{129}Xe^{m}	IT	0.2361	8.0d	^{129}Xe^{g}			1.44	23400	7
	(n, p)	−2.21	^{130}I	β^-	2.99	12.3h	^{130}Xe			0.0067	109	96
^{132}Xe (26.9%)	(n, 2n*)	(−8.94)	^{131}Xe^{m}	IT	0.16398	11.8d	^{131}Xe^{g}			0.77	12500	7
	(n, p)	−2.80	^{132}I	β^-	3.56	2.3h	^{132}Xe			0.0025	40	7
										0.0067	109	27
^{131}Xe (21.18%)	(n, p)	−0.19	^{131}I	β^-	0.970	8.05d	^{131}Xe			0.0053	86	96
^{134}Xe (10.44%)	(n, 2n)	−8.54	^{133}Xe^{g}	β^-	0.427	5.65d	^{133}Cs			2.36	38400	7, 96
	(n, 2n*)		^{133}Xe^{m}	IT	0.2328	5.2d	^{133}Xe$^{g}\rightarrow^{133}$Cs (5.65d)			0.665	10800	7
	(n, p)	−3.37	^{134}I	β^-	4.2	52m	^{134}Xe			0.0022	36	96
^{136}Xe (8.87%)	(n, 2n)	−8.00	^{135}Xe^{g}	β^-	1.16	9.15h	^{135}Cs$\rightarrow^{135}$Ba (3×10^{6}y)			1.70	27700	96
	(n, 2n*)		^{135}Xe^{m}	IT	0.527	15.6m	^{135}Xe$^{g}\rightarrow^{135}$Cs$\rightarrow^{135}$Ba^{g} (9.15h) (3×10^{6}y)			0.75	12200	7
^{133}Cs (100%)	(n, γ)	6.89	^{134}Cs	β^- (EC)	2.062 1.33	2.05y	^{134}Ba	90	6×10^{-6}	0.002	33	1, 5
										0.0071	116	86
	(n, γ*)		^{134}Cs^{m}	IT	0.138	9.2h	^{134}Cs$^{g}\rightarrow^{134}$Ba (2y)	10	6×10^{-6}	2×10^{-4}	3.3	1
										0.00182	80	86
	(n, 2n)	−8.98	^{132}Cs	EC (β^-)	2.09 1.2	6.5d	^{132}Xe ^{132}Ba	1.45	15	1.4	22700	1, 7
										1.3	21200	85
										1.57	25400	23
										1.62	26400	86
	(n, p)	0.36	^{133}Xe	β^-	0.427	5.27d	^{133}Cs	+		0.0085	138	1
										0.0105	171	86
										0.015	244	7
	(n, p*)		^{133}Xe^{m}	IT	0.2328	2.26d	^{133}Xe$^{g}\rightarrow^{133}$Cs (5d)	+		0.0085	138	1
										0.0048	78	86

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{133}Cs (100%)	(n, d)	−3.87	^{132}Xe							9×10^{-4}		96
	(n, ^{3}He)	−7.50	^{131}I	β^-	0.970	8.05d	^{131}Xe			3.2×10^{-6}	0.05	55, 86
	(n, α)	4.45	^{130}I	β^-	2.99	12.4h	^{130}Xe	+		0.0012	19	1
										0.002	32	22, 27
	(n, α*)		^{130}I^m			9.2m	^{130}Xe			5.4×10^{-4}	8.8	86
	(n, np)	−6.10	^{132}Xe							0.003	49	5
										0.0013	21	52
	(n, nα)	−2.01	^{129}I	β^-	0.189	1.7×10^{7}y	^{129}Xe			2×10^{-5}	0.3	96
	(n, 2p)	−8.90	^{132}I	β^-	3.56	2.3h	^{132}Xe			2×10^{-4}	3.3	96
										$\leq1.2\times10^{-5}$	$\leq$0.20	86
	(n, 3n)	−16.17	^{131}Cs							0.66 at 19.5 MeV		96
^{130}Ba (0.10%)	(n, γ)	7.49	^{131}Ba	EC	1.16	12d	^{131}Cs→^{131}Xe (9.7d)	1.1	thermal	0.002	32	1, 5
	(n, γ*)		^{131}Ba^m	IT	0.18	15m	^{131}Ba→^{131}Cs→^{131}Xe (12d) (9.70d)	2.52	thermal	5×10^{-4}	8	1, 5
	(n, 2n)	−10.22	^{129}Ba	EC, β^+	2.45	2.5h	^{129}Cs→^{129}Xe (32h)	+		1.6	25900	1
										1.37	22200	23
^{132}Ba (0.097%)	(n, γ)	7.19	^{133}Ba	EC	0.488	7.2y	^{133}Cs	8.5	thermal	0.002	32	1, 5
	(n, γ*)		^{133}Ba^m	IT	0.288	38.9h	^{133}Ba^g→^{133}Cs (7y)	0.3	thermal	8×10^{-5}	1.3	1
	(n, 2n)	−9.80	^{131}Ba	EC	1.16	12d	^{131}Cs→^{131}Xe (9.7y)	+		0.89	14400	1
										0.16	2590	7
	(n, 2n*)	−9.80	^{131}Ba^m	IT	0.18	15m	^{131}Ba→^{131}Cs→^{131}Xe (12d) (9.70d)			0.89	14400	1
^{134}Ba (2.42%)	(n, γ*)	(6.98)	^{135}Ba^m	IT	0.268	28.7h	^{135}Ba^g	0.16	thermal	5×10^{-5}	0.81	1, 5
	(n, 2n)	−9.46	^{133}Ba	EC	0.488	7.2y	^{133}Cs	+		0.85	13800	1
	(n, 2n*)		^{133}Ba^m	IT	0.288	38.9h	^{133}Ba^g→^{133}Cs (7.2y)	+		0.85	13800	1

	(n, p)	1.28	^{134}Cs	β^-	2.059	2.05y	^{134}Ba	+		0.03	490	1
	(n, p*)		^{134}Cs^m	IT	0,138	2.9h	^{134}Cs$^g \rightarrow ^{134}$Ba (2y)	+		0.03	490	1
^{135}Ba	(n, 2n)	−6.95	^{134}Ba							1.62		15
^{136}Ba (7.81%)	(n, γ*)	(6.90)	^{137}Ba^m	IT	0.6616	2.55m	^{137}Ba^g	0.012	thermal	5×10^{-5}	0.81	1,5
	(n, 2n*)	(−9.11)	^{135}Ba^m	IT	0.268	28.7h	^{135}Ba^g	+		0.68	11000	1
	(n, p)	−1.77	^{136}Cs	β^-	2.54	13d	^{136}Ba	+		0.042	680	1
										0.008	130	27
	(n, α)	4.40	^{133}Xe	β^-	0.427	5.27d	^{133}Cs					
^{137}Ba (11.32%)	(n, n′)	——	^{137}Ba^m	IT	0.6616	2.55m	^{137}Ba^g	0.60	3.5	0.30	4860	1
	(n, 2n)	−6.90	^{136}Ba							1.74		15
	(n, p)	−0.39	^{137}Cs	β^-	1.176	30y	^{137}Ba$^m \rightarrow ^{137}$Ba^g (2.6h) ^{137}Ba^g	+		0.06	980	1
^{138}Ba (71.86%)	(n, γ)	4.72	^{139}Ba	β^-	2.30	82.9m	^{139}La	0.5	thermal	1×10^{-6}	0.02	1,5
								0.35	thermal	0.0013	21	5
	(n, 2n*)	(−8.61)	^{137}Ba^m	IT	0.6616	2.55m	^{137}Ba^g	+		1.2	19400	1
	(n, p)	−4.62	^{138}Cs	β^-	4.83	32.2m	^{138}Ba	+		0.0019	30	1
										0.0038	82	22, 27
	(n, α)	3.88	^{135}Xe	β^-	1.16	9.2h	^{135}Cs$\rightarrow^{135}$Ba (3×10^6y)	+		0.0125	202	1
										0.0036	58	7
										0.0020	32	22
	(n, α*)		^{135}Xe^m	IT	0.527	15.6m	^{135}Xe$^g \rightarrow ^{135}$Cs$\rightarrow^{135}$Ba (9h) (3×10^6y)	+		0.0125	203	1
										5.5×10^{-4}	8.9	7, 22
^{138}La (0.0089%)	(n, 2n)	−7.32	^{137}La	EC	0.5	6×10^4y	^{137}Ba	1.95	14.5	1.95	31700	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{139}La (99.911%)	(n, γ)	5.16	^{140}La	β^-	3.760	40.22h	^{140}Ce	8.2	thermal	0.002	33	1, 5
										0.0014	23	74
	(n, 2n)	−8.78	^{138}La	β^- EC	0.99 1.78	1.12×10^{11}y	^{138}Ce ^{138}Ba			1.7	27700	15
	(n, p)	−1.48	^{139}Ba	β^-	2.30	82.9m	^{139}La	+		0.0033	53	1
										0.0048	78	27
	(n, t*)	−7.12	^{137}Ba^m	IT	0.6616	2.5m	^{137}Ba^g			2.1×10^{-5}	0.34	83
	(n, α)	4.82	^{136}Cs	β^-	2.54	13d	^{136}Ba	+		0.002	32	1, 27
^{136}Ce (0.193%)	(n, γ)	7.64	^{137}Ce	EC, (β^+)	1.2	9h	^{137}La→^{137}Ba (6×10^4y)	8	thermal	0.002	33	1
	(n, γ*)		^{137}Ce^m	IT	0.255	34.4h	^{137}Ce^g→^{137}La→^{137}Ba (9h) (6×10^4y)	1	thermal	2×10^{-4}	3	1, 5
	(n, 2n)	−10.01	^{135}Ce	EC	2.1	17.2h	^{135}La→^{135}Ba (19h)	+		1.7	27600	1
										1.32	21400	23
^{138}Ce (0.250%)	(n, γ)	7.45	^{139}Ce	EC	0.27	140d	^{139}La	1.1	thermal	0.002	33	1, 5
	(n, 2n)	−9.57	^{137}Ce	EC, (β^+)	1.2	9h	^{137}La→^{137}Ba (6×10^4y)	+		0.90	14600	1
	(n, 2n*)		^{137}Ce^m	IT	0.255	34.4h	^{137}Ce^g→^{137}La→^{137}Ba (9h) (6×10^4y)	+		0.90	14600	1
^{140}Ce (88.48%)	(n, γ)	5.43	^{141}Ce	β^-	0.581	33d	^{141}Pr	0.6	thermal	0.003	49	1, 5
	(n, 2n)	−9.20	^{139}Ce	EC	0.27	140d	^{139}La	+		2.5	41000	1
										1.8	29000	88
										0.4	6500	7
	(n, 2n*)		^{139}Ce^m	IT	0.746	55s	^{139}Ce^g→^{139}La (140d)	1.4	13.5	1.2	19400	7
	(n, p)	−2.98	^{140}La	β^-	3.769	40.22h	^{140}Ce	+		0.0095	154	1
	(n, α*)	(5.34)	^{137}Ba^m	IT	0.6616	2.55m	^{137}Ba^g	±		0.0095	154	1
										0.013	211	7

^{142}Ce (11.04%)	(n, γ)	5.18	^{143}Ce	β⁻	1.44	33h	^{143}Pr→^{143}Nd (13.6d)	0.95	thermal	0.008	130	1, 5
	(n, 2n)	−7.16	^{141}Ce	β⁻	0.58	33d	^{141}Pr	2.05	12.5	1.8	29300	1, 23
								1.7	14	1.7	27700	7, 88
	(n, p)	−3.74	^{142}La	β⁻	4.51	92m	^{142}Ce	+		0.006	97	1
	(n, α)	6.09	^{139}Ba	β⁻	2.30	82.9m	^{139}La	+		0.0065	105	1
										0.0060	97.7	22
	(n, np)	−8.81	^{141}La	β⁻	2.43	3.9h	^{141}Ce→^{141}Pr (33d)	+		8.5×10^{-4}	13.8	1
^{141}Pr (100%)	(n, γ)	5.84	^{142}Pr	β⁻ (EC)	2.16 0.118	19.2h	^{142}Nd	12	thermal	0.0033	54	1, 5, 74
										9.8×10^{-4}	16	58
	(n, 2n)	−9.40	^{140}Pr	EC, β⁺	3.34	3.39m	^{140}Ce	1.9	15	1.75	24500	1, 23
										1.59	25400	97
								1.7	15	1.61	26200	7, 88
	(n, p)	0.20	^{141}Ce	β⁻	0.581	33d	^{141}Pr	+		0.010	160	27
										0.0033	54	1
										0.0063	103	22
	(n, t)	−5.79	^{139}Ce	EC	0.27	140d	^{139}La^{m}→^{139}La^{g} (1.5ns)			5.0×10^{-5}	0.81	65
										3.0×10^{-5}	0.49	55
	(n, α)	6.15	^{138}La	EC β⁻	1.78 0.99	1.12×10^{11}y	^{138}Ba ^{138}Ce			0.003	49	5
	(n, 2p)	−8.211	^{140}La	β⁻	3.769	40.22h	^{140}Ce			8.4×10^{-4}	13	96
	(n, 3n)	−17.33	^{139}Pr	EC, β⁺	2.11	4.5h	^{139}Ce→^{139}La (140d)			0.010 at 14.7 MeV?		96
^{142}Nd (27.13%)	(n, γ)	6.13	^{143}Nd					~18	thermal			(6)
	(n, 2n)	−9.81	^{141}Nd	EC, β⁺	1.80	2.5h	^{141}Pr	+		2.2	35600	5
								1.7	17	1.5	24400	7
	(n, 2n*)		^{141}Nd^{m}	IT	0.755	1.05m	^{141}Nd^{g}→^{141}Pr (2.5h)	+		0.65	10500	1
	(n, p)	−1.38	^{142}Pr	β⁻	2.16	19.2h	^{142}Nd	+		0.011	178	1
	(n, α)	6.64	^{139}Ce	EC	0.27	140d	^{139}La	+		0.002	32	5
	(n, α*)		^{139}Ce^{m}	IT	0.746	55s	^{139}Ce^{g}→^{139}La (9.5m)			0.01	160	5

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{143}Nd (12.20%)	(n, 2n)	−6.13	^{142}Nd							1.5		15
	(n, p)	−0.15	^{143}Pr	β^-	0.933	13.6d	^{143}Nd	+		0.01	160	1
^{144}Nd (23.87%)	(n, γ)	5.76	^{145}Nd					~5.0	thermal			(6)
	(n, 2n)	−7.82	^{143}Nd							1.7		15
	(n, p)	−2.21	^{144}Pr	β^-	2.989	17.3m	^{144}Nd			0.0098	159	27
	(n, α)	7.33	^{141}Ce	β^-	0.581	33d	^{141}Pr	+		0.013	212	1
^{145}Nd (8.30%)	(n, 2n)	−5.76	^{144}Nd	α	1.90	2.4×10^{15}y	^{140}Ce			1.81	29500	15
										1.77	28800	23
	(n, p)	−1.02	^{145}Pr	β^-	1.80	5.98h	^{145}Nd			0.0069	112	27
^{146}Nd (17.18%)	(n, γ)	5.30	^{147}Nd	β^-	0.90	11.1d	^{147}Pm	1.8	thermal	0.006	97	1, 6
	(n, 2n)	−7.57	^{145}Nd							2.0		15
	(n, p)	−3.30	^{146}Pr	β^-	42	24.0m	^{146}Nd			0.0053	86	27
	(n, α)	6.34	^{143}Ce	β^-	1.44	33h	^{143}Pr→^{143}Nd (13.6d)	+		0.004	64	1
^{148}Nd (5.72%)	(n, γ)	5.07	^{149}Nd	β^-	1.67	1.8h	^{149}Pm→^{149}Sm (53h)	3	thermal	0.003	48	1, 5
	(n, 2n)	−7.32	^{147}Nd	β^-	0.90	11.1d	^{147}Pm→^{147}Sm (2.62y) (α)	3.1	12	2.6	42100	1
										1.6	25900	7
										1.95	31600	23
	(n, p)	−4.12	^{148}Pr	β^-	4.5	2m	^{148}Nd	+		0.0026	42	1
	(n, ^{3}He)	−8.53	^{146}Ce	β^-	1.0	14m	^{146}Pr→^{146}Nd (24.0m)			$(6\sim8)\times10^{-4}$	11	ref. in 54
	(n, α)	5.37	^{145}Ce	β^-	2.6	3m	^{145}Pr→^{145}Nd (6h)	+		0.0040	65	1
^{150}Nd (5.60%)	(n, γ)	5.31	^{151}Nd	β^-	2.4	12m	^{151}Pm→^{151}Sm→^{151}Eu (28h) (≈87y)	1.8	thermal	0.005	81	1, 5
	(n, 2n)	−7.36	^{149}Nd	β^-	1.67	1.8h	^{149}Pm→^{149}Sm (53h)	3.1	12	2.7	43900	1

										1.7	27500	7
										2.01	32600	23
						Pm						
^{144}Sm (3.16%)	(n, γ)	6.76	^{145}Sm	EC	0.65	340d	^{145}Pm→^{145}Nd (17y)	0.7	thermal	0.002	33	1, 5
	(n, 2n)	−10.55	^{143}Sm	EC, β^+	3.3	8.9m	^{143}Pm→^{143}Nd (0.73y)	+		0.68	11000	1, 89
										1.37	22300	88
								1.8	18	1.3	21200	7, 97
	(n, 2n)	−10.554	^{143}Sm^m	IT	0.748	64s	^{143}Sm^g→^{143}Pm→^{143}Nd (8.9m) (0.73y)	+		0.68	11000	1, 89
	(n, α)	7.92	^{141}Nd	EC, (β^+)	1.80	2.5h	^{141}Pr			0.011	178	7
^{147}Sm (15.07%)	(n, 2n)	−6.37	^{146}Sm							1.3		15
	(n, p)	0.56	^{147}Sm	β^-	0.225	2.62y	^{147}Sm (α emitter)	+		0.012	195	1
^{148}Sm (11.27%)	(n. 2n)	−8.14	^{147}Sm	α	2.314	1.05×10^{7}y	^{143}Nd			1.52	24700	15
										1.62	26400	23
	(n, p)	−1.68	^{148}Pm	β^-	2.48	5.4d	^{148}Sm			0.0143	233	73
^{149}Sm (13.8%)	(n, 2n)	−5.87	^{148}Sm							1.64		15
										1.59		23
^{150}Sm (7.47%)	(n, γ)	5.59	^{151}Sm	β^-	0.076	87y	^{151}Eu	102	thermal	0.008	130	1, 5
	(n, 2n)	−7.99	^{149}Sm							1.8		15
^{152}Sm (26.63%)	(n, γ)	5.87	^{153}Sm	β^-	0.801	47h	^{153}Eu	210	thermal	0.009	146	1, 5
	(n, 2n)	−8.27	^{151}Sm	β^-	0.076	87y	^{151}Eu	2.05	14	2.05	33400	1
	(n, p)	−2.62	^{152}Pm	β^-	3.5	6m	^{152}Sm	+		0.003	49	1
	(n, α)	5.28	^{149}Nd	β^-	1.67	1.8h	^{149}Pm→^{149}Sm (53h)	+		0.008	130	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{154}Sm (22.53%)	(n, γ)	5.81	^{155}Sm	β^-	1.65	23m	^{155}Eu→^{155}Gd (1.8y)	5.5	thermal	0.008	130	1, 6
										$(3\sim9)\times10^{-4}$	5~15	97
	(n, 2n)	−7.98	^{153}Sm	β^-	0.801	47h	^{153}Eu	2.1	13.5	2.0	32400	1
										1.63	26400	23
	(n, p)	−3.22	^{154}Pm	β^-	≈2.2	2.5m	^{154}Sm	+		0.0028	45	1
	(n, α)	4.10	^{151}Nd	β^-	2.4	12m	^{151}Pm→^{151}Sm→^{151}Eu (28h) (87y)	+		0.0075	122	1
^{151}Eu (47.77%)	(n, γ)	6.31	^{152}Eu	(EC, β^+ / β^-)	1.857 / 1.82	12y	^{152}Sm / ^{152}Gd (1.1×10^{14}y) (α)	6000	thermal	0.005	81	1
	(n, γ*)	6.31	^{152}Eu^m	(EC, β^+ / β^-)	1.90 / 1.87	9.3h	^{152}Sm / ^{152}Gd	3100	thermal	0.002	33	5
	(n, 2n)	−7.98	^{150}Eu	EC	≈2.3	5y	^{150}Sm	0.61	14	0.61	9900	1
	(n, 2n*)		^{150}Eu^m	(EC, β^+ / β^-)	2.25 / 1.010	12.6h	^{150}Sm / ^{150}Gd (α emitter)	0.61	14	0.61	9900	1
	(n, α*)	(7.87)	^{148}Pm^m	(IT) / β^-	0.1372 / 2.62	42d	^{148}Sm			0.019	309	7
^{153}Eu (52.23%)	(n, γ)	6.44	^{154}Eu	β^-	1.978	16y	^{154}Gd	390	thermal	0.009	147	1, 5
	(n, 2n)	−8.56	^{152}Eu	(EC, β^+ / β^-)	1.857 / 1.82	12y	^{152}Sm / ^{152}Gd (α emitter)	+		0.76	12300	1
	(n, 2n*)		^{152}Eu^m	(EC, β^+ / β^-)	1.90 / 1.87	9.3h	^{152}Sm / ^{152}Gd	+		0.76	12300	1
	(n, p)	−0.02	^{153}Sm	β^-	0.80	47h	^{153}Eu	+		0.0065	106	1
	(n, α)	5.83	^{150}Pm	β^-	3.43	2.7h	^{150}Sm	+		0.0075	122	1
^{152}Gd (0.20%)	(n, γ)	6.49	^{153}Gd	EC	0.243	242d	^{153}Eu	100	thermal	0.008	130	1, 5
	(n, 2n)	−8.60	^{151}Gd	EC	0.4	120d	^{151}Eu	2.0	14	2.0	32600	1
										1.3	21200	15
^{154}Gd (2.15%)	(n, 2n)	−8.66	^{153}Gd	EC	0.243	242d	^{153}Eu	2.05	14	2.05	33400	1
										1.90	30900	23

^{155}Cd (14.73%)	(n, 2n)	−6.45	^{154}Gd							2.1		8
										1.8		15
	(n, p)	0.54	^{155}Eu	β^-	0.248	1.81y	^{155}Gd	+		0.012	195	1
^{156}Gd (20.47%)	(n, γ)	6.37	^{157}Gd					11.5	thermal			(5)
	(n, 2n)	−8.53	^{155}Gd							2.1		8
										2.0		15
	(n, p)	−1.67	^{156}Eu	β^-	2.45	15d	^{156}Gd					
	(n, α)	5.67	^{153}Sm	β^-	0.801	47h	^{153}Eu	+		0.0029	47	1
										0.0085	138	7
^{157}Gd (15.68%)	(n, 2n)	−6.37	^{156}Gd							2.1		8
										2.0		15
	(n, p)	−0.58	^{157}Eu	β^-	1.34	15.2h	^{157}Gd			0.0095	154	1
^{158}Gd (24.87%)	(n, γ)	5.95	^{159}Gd	β^-	0.95	18h	^{159}Tb	3.5	thermal	0.004	64	1, 5
	(n, 2n)	−7.93	^{157}Gd							2.2		8, 15
	(n, p)	−2.65	^{158}Eu	β^-	3.5	46m	^{158}Gd			0.0015	24	26
	(n, α)	5.16	^{155}Sm	β^-	1.64	23m	^{155}Eu→^{155}Gd (1.81y)			0.0024	39	7
^{160}Gd (21.90%)	(n, γ)	5.63	^{161}Gd	β^-	2.0	3.7m	^{161}Tb→^{161}Dy (6.9d)	0.77	thermal	0.010	162	1, 5
										(4∼10)×10^{-4}	7∼16	97
	(n, 2n)	−7.45	^{159}Gd	β^-	0.95	18h	^{159}Tb	2.2	12.5	1.9	30800	1
										1.53	24800	23
	(n, α)	4.63	^{157}Sm	β^-	2.83	30s (83s)	^{157}Eu→^{157}Gd (15h)	+		0.0017	27	1
^{159}Tb (100%)	(n, γ)	6.38	^{160}Tb	β^-	1.827	72.1d	^{160}Dy	50	thermal	0.01	160	1
	(n, 2n)	−8.14	^{158}Tb	(EC, β^-)	1.20, 0.95	1.2×10^{3}y	^{158}Gd, ^{158}Dy	+		0.26	4230	1
	(n, 2n*)		^{158}Tb^m	IT	0.110	11s	^{158}Tb^g (1×10^{3}y) → ^{158}Gd, ^{158}Dy			0.16	2590	5
	(n, p)	−0.17	^{159}Gd	β^-	0.95	18h	^{159}Tb	+		0.00185	30.1	1

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	Max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{159}Tb (100%)	(n, ^{3}He)	−6.90	^{157}Eu	β^-	1.34	15.2s	^{157}Gd			9×10^{-6}	0.15	55
	(n, α)	6.22	^{156}Eu	β^-	2.45	15d	^{156}Gd	+		0.00185	30.1	1
	(n, 2p)	−8.76	^{158}Eu	β^-	3.5	46m	^{158}Gd			8×10^{-4}	13	96
^{156}Dy (0.0524%)	(n, γ)	6.98	^{157}Dy	EC	1.1	8.1h	^{157}Tb→^{157}Gd (150d)			0.01	163	ref. in 75
	(n, 2n)	−9.44	^{155}Dy	EC	0.9	10.2h	^{155}Tb→^{155}Gd (5.6h)	+		1.8	29300	1
										1.1	17800	15
										1.9	30800	7
^{158}Dy (0.0902%)	(n, γ)	6.83	^{159}Dy	EC	0.38	144d	^{159}Tb	96	thermal	0.01	160	1, 5
	(n, 2n)	−9.06	^{157}Dy	EC	1.1	8.1h	^{157}Tb→^{157}Gd^g (150y)	+		2.0	32400	1
^{160}Dy (2.294%)	(n, 2n)	−8.58	^{159}Dy	EC	0.38	144d	^{159}Tb	2.1	14.5	2.1	34200	1
										2.06	33500	23
^{161}Dy (18.88%)	(n, 2n)	−6.45	^{160}Dy							2.2		8
										2.0		15
^{162}Dy (25.53%)	(n, γ)	6.27	^{163}Dy					160	thermal			(5)
	(n, 2n)	−8.19	^{161}Dy							2.1		8, 15
	(n, α)	6.05	^{159}Gd	β^-	0.95	18h	^{159}Tb	+		0.003	49	1
^{163}Dy (24.97%)	(n, γ)	7.65	^{164}Dy					125	thermal			(5)
	(n, 2n)	−6.27	^{162}Dy							2.2		8
										2.1		15
	(n, p)	−0.90	^{163}Tb	β^-	1.68	6.5h	^{163}Dy	+		0.0024	39	1
	(n, p*)		^{163}Tb^m	β^-	~1.7	7m	^{163}Dy	+		0.0024	39	1

^{164}Dy (28.18%)	(n, γ)	5.72	^{165}Dy	β^-	1.30	139.2m	^{165}Ho	600	thermal	0.010	162	1, 5
	(n, γ*)		^{165}Dy^m	IT (β^-)	0.10816 1.40	1.26m	^{165}Dy^g→^{165}Ho (139.2m)	2200	thermal	0.001	16	1, 5
	(n, 2n)	−7.65	^{163}Dy							2.2		8
										2.3		15
	(n, α)	5.21	^{161}Gd	β^-	2.0	3.7m	^{161}Tb→^{161}Dy (6.9d)	+		0.0036	58	1
^{165}Ho (100%)	(n, γ)	6.24	^{166}Ho	β^-	1.847	26.9h	^{166}Er	64	thermal	9.4×10^{-4}	15.3	58
										0.009	150	1, 5
										0.0088	143	74
	(n, 2n)	−7.99	^{164}Ho	(EC β^-	1.11 1.03	37m	^{164}Dy ^{164}Er			2.3	37300	1
								0.7	14	0.7	11000	7
	(n, 2n*)		^{164}Ho^m			24m		1.0	14	1.0	16200	7
										1.78	29000	88
	(n, p)	−0.51	^{165}Dy	β^-	1.30	139.2m	^{165}Ho	+		0.04	648	1, 24
	(n, p*)		^{165}Dy^m	IT (β^-)	0.108	1.26m	^{165}Dy^g→^{165}Ho (139.2m)	+		0.001	16	1
	(n, α)	6.46	^{162}Tb	β^-	2.8	7.5m	^{162}Dy			0.0012	19.5	7
^{162}Er (0.136%)	(n, γ)	6.91	^{163}Er	EC, β^+	1.21	75m	^{163}Ho ($>10^3$y)	10	10^{-4}	0.010	162	1
	(n, 2n)	−9.21	^{161}Er	EC, β^+	2.4	3.1h	^{161}Ho→^{161}Dy (2.5h)	2.05	14.5	2.05	33200	1
										1.95	31600	23
^{164}Er (1.56%)	(n, γ)	6.66	^{165}Er	EC	0.37	10.3h	^{165}Ho^g	10	10^{-4}	0.010	162	1
	(n, 2n)	−8.86	^{163}Er	EC, β^+	1.2	75m	^{163}Ho^g	2.1	14.5	2.1	34000	1
^{166}Er (33.41%)	(n, γ)	6.44	^{167}Er					45	thermal			(5)
	(n, γ*)		^{167}Er^m	IT	0.2078	2.3s	^{167}Er	15	thermal			(5)
	(n, 2n)	−8.47	^{165}Er	EC	0.37	10.3h	^{165}Ho^g	+		0.96	15600	1
										2.0	32400	7, 23
	(n, p)	−1.08	^{166}Ho	β^-	1.847	26.9h	^{166}Er			0.011	179	26
	(n, α)	7.09	^{163}Dy									

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	Max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{167}Er (22.94%)	(n, γ)	7.77	^{168}Er					650	thermal			(5)
	(n, 2n)	−6.44	^{166}Er							2.0		15
	(n, p)	−0.19	^{167}Ho	β^-	1.0	3.1h	^{167}Er	+		0.0024	39	1, 27
^{168}Er (27.07%)	(n, γ)	6.00	^{169}Er	β^-	0.340	9.4d	^{169}Tm	5	10^{-4}	0.010	162	1
	(n, 2n*)	(−7.77)	^{167}Er^m	IT	0.20780	2.3s	^{167}Er^g	1.0	14	1.0	16200	7
										0.19	3080	5
	(n, p)	−1.99	^{168}Ho	β^-	3.3	3.3m	^{168}Er	+		0.0017	27	1
	(n, α)	6.26	^{165}Dy	β^-	1.3	139.2m	^{165}Ho	+		5×10^{-4}	8	1
	(n, α*)		^{165}Dy^m	IT (β^-)	0.10816 1.4	1.26m	^{165}Dy$^g\rightarrow^{165}$Ho (139.2m)	+		9×10^{-4}	14	1
^{170}Er (14.88%)	(n, γ)	5.68	^{171}Er	β^-	1.490	7.52h	^{171}Tm$\rightarrow^{171}$Yb (1.92y)	10	thermal	0.010	162	1, 5
										(8~9)$\times10^{-4}$	13~15	97
	(n, 2n)	−7.26	^{169}Er	β^-	0.34	9.4d	^{169}Tm	2.2	12.5	2.0	32400	1
										1.86	30100	23
	(n, p)	−2.92	^{170}Ho	β^-	4.2	45s	^{170}Er			0.0018	29	5, 27
	(n, α)	5.73	^{167}Dy	β^-	3.3	4.4m	^{167}Ho$\rightarrow^{167}$Er (3.1h)	+		9×10^{-4}	14	1, 27
^{169}Tm (100%)	(n, γ)	6.59	^{170}Tm	(EC, β^-)	0.5 0.967	130d	^{170}Er ^{170}Yb	130	thermal	0.010	162	1, 6
	(n, 2n)	−8.06	^{168}Tm	EC	1.72	85d	^{168}Er	~1.0	~14	1.0	16200	1, 7
										2.05	33400	23
	(n, p)	0.43	^{169}Er	β^-	0.340	9.4d	^{169}Tm			0.010	162	26
^{168}Yb (0.140%)	(n, γ)	6.87	^{169}Yb	EC	1.2	32d	^{169}Tm	5500	thermal	0.010	162	1
	(n, 2n)	−9.06	^{167}Yb	EC, β^+	1.96	18m	^{167}Tm$\rightarrow^{167}$Er$^m\rightarrow^{167}$Er^g (9.6d) (2.3s)	2.2	14	2.2	35600	1
										1.5	24300	15

^{170}Yb (3.03%)	(n, 2n)	−8.47	^{169}Yb	EC	1.2	32d	^{169}Tm	1.6	14	1.6	26000	1
	(n, 2n*)		^{169}Yb^{m}	IT	0.0243	46s	^{169}Yb$^{g}\rightarrow^{169}$Tm (32d)	0.54	14	0.54	8730	1
^{171}Yb (14.31%)	(n, 2n)	−6.62	^{170}Yb							1.9		15
^{172}Yb (21.82%)	(n, 2n)	−8.02	^{171}Yb							2.0		15
	(n, p)	−1.09	^{172}Tm	β^-	1.88	63.6h	^{172}Yb			0.0063	102	30
^{173}Yb (16.13%)	(n, 2n)	−6.37	^{172}Yb							2.1		15
	(n, p)	−0.54	^{173}Tm	β^-	1.32	8.2h	^{173}Yb			0.0042	68	30
^{174}Yb (31.84%)	(n, γ)	5.82	^{175}Yb	β^-	0.467	101h	^{175}Lu	55	thermal	0.01	162	1, 5
	(n, 2n)	−7.47	^{173}Yb							2.2		15
	(n, p)	−2.28	^{174}Tm	β^-	2.5	5.5m	^{174}Yb			0.002	32	26, 30
	(n, α)	6.41	^{171}Er	β^-	1.490	7.52h	^{171}Tm$\rightarrow^{171}$Yb (1.92y)			8.2×10^{-4}	13.3	30
^{176}Yb (12.73%)	(n, γ)	5.56	^{177}Yb	β^-	1.40	1.9h	^{177}Lu$\rightarrow^{177}$Hf (6.7d)	20	thermal	0.009	146	1, 5
										$(3\sim10)\times10^{-4}$	5∼16	97
	(n, 2n)	−6.88	^{175}Yb	β^-	0.467	101h	^{175}Lu	2.1	13	1.75	28400	1
										1.78	28800	23
	(n, p)	−3.36	^{176}Tm	β^-	4.2	1.5m	^{176}Yb			5.5×10^{-4}	8.9	30
	(n, α)	5.58	^{173}Er	β^-	2.5	1.4m	^{173}Tm$\rightarrow^{173}$Yb (8.2h)			3.3×10^{-4}	5.3	30
^{175}Lu (97.40%)	(n, γ*)	(6.29)	^{176}Lu	β^-	1.31	3.7h	^{176}Hf	23	thermal	0.002	32	1, 5
	(n, 2n)	−7.66	^{174}Lu	EC	1.5	3.6y	^{174}Yb	1.6	14.5	1.6	26000	1
	(n, 2n*)		^{174}Lu^{m}	EC IT	1.7 0.1708	140d	^{174}Yb ^{174}Lu$^{g}\rightarrow^{174}$Yb (3.6y)	1.6	14.5	1.6	26000	1
										0.65	10600	7
	(n, p)	0.31	^{175}Yb	β^-	0.467	101h	^{175}Lu	+		0.002	32	1
	(n, α)	7.87	^{172}Tm	β^-	1.88	63.6h	^{172}Yb					

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	Max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{176}Lu (2.60%)	(n, γ)	7.07	^{177}Lu	β^-	0.497	6.7d	^{177}Hf	2100	thermal	0.01	162	1, 5
	(n, γ*)		^{177}Lu^m	β^- IT	1.467 0.9702	155d	^{177}Lu$^g \rightarrow ^{177}$Hf (6.7d) ^{177}Hf	1	thermal	1×10^{-5}	0.2	1, 5
	(n, n′)	—-	^{176}Lu^m	β^-	1.31	3.7h	^{176}Hf	0.29	4	0.08	1300	1
	(n, 2n)	−6.29	^{175}Lu							2.3		8
	(n, 3n)	−13.95	^{174}Lu	EC	1.5	3.6y	^{174}Yb	+		0.15	2440	1
	(n, 3n*)		^{174}Lu^m	EC IT	1.7 0.1708	140d	^{174}Yb ^{174}Lu$^g \rightarrow ^{174}$Yb (3.6y)	+		0.15	2440	1
^{174}Hf (0.18%)	**(n, γ)**	6.85	^{175}Hf	EC	0.59	71d	^{175}Lu	390	thermal	0.01	162	1, 5
	(n, 2n)	−8.59	^{173}Hf	EC	>2	23.6h	^{173}Lu$\rightarrow^{173}$Yb (1.4y)	+		1.6	25900	1
										0.86	13900	5, 7
^{176}Hf (5.15%)	(n, 2n)	−8.09	^{175}Hf	EC	0.59	70d	^{175}Lu	2.2	14	2.2	35800	1
										2.27	37000	23
										2	32000	5
^{177}Hf (18.39%)	(n, 2n)	−6.38	^{176}Hf							2.3		8
										1.9		15
^{178}Hf (27.08%)	(n, γ)	(6.10)	^{179}Hf^m	IT	0.378	18.6s	^{179}Hf^g	50	thermal			(5)
	(n, 2n)	−7.63	^{177}Hf							2.3		8
										2.1		15
	(n, p)	−1.47	^{178}Lu	β^-	2.25	30m	^{178}Hf^g			0.0017	27	37
	(n, p*)		^{178}Lu^m	β^-	2.65	20m	^{178}Hf$^m \rightarrow ^{178}$Hf^g (4.3s)			0.0010	16	37
	(n, α)	7.91	^{175}Yb	β^-	0.467	101h	^{175}Lu	+		0.0016	26	1
										0.002	32	5
^{179}Hf (13.78%)	(n, γ*)	(7.39)	^{180}Hf^m	IT	1.1422	5.5h	^{180}Hf^g	0.34	thermal	1×10^{-4}	1.6	1, 5
	(n, 2n*)	(−6.10)	^{178}Hf^m	IT	1.148	4.3s	^{178}Hf^g			0.9	15000	7

^{180}Hf (35.44%)	(n, γ)	5.69	^{181}Hf	β⁻	1.023	42.5d	^{181}Ta	12.6	thermal	0.008	130	1, 5
	(n, n′)	—	^{180}Hf^{m}	IT	1.1422	5.5h	^{180}Hf^{g}	0.07	5	0.02	320	1
	(n, 2n*)	(−7.39)	^{179}Hf^{m}	IT	0.378	18.6s	^{179}Hf^{g}			0.6	9720	7
	(n, p)	−2.52	^{180}Lu	β⁻	3.3	2.5m	^{180}Hf			0.0014	22	26
	(n, α)	6.86	^{177}Yb	β⁻	1.40	1.9h	^{177}Lu→^{177}Hf (6.7d)	+		0.0021	34	1
										0.0022	35	5
^{180}Ta	(n, n′)	—						3.5	5	1.0		1
	(n, 2n)	−9.44	^{179}Ta	EC	0.115	600d	^{179}Hf	2.3	12	2.25	36600	1
^{181}Ta (100%)	(n, γ)	6.06	^{182}Ta	β⁻	1.811	115d	^{182}W	2000	3.8×10^{-5}			(1)
	(n, n′)	—								0.48		95
	(n, 2n)	(−7.64)	^{180}Ta^{m}	EC β⁻	0.9 0.70	8.1h	^{180}Hf ^{180}W	1.1	13	1.1	17800	1, 88
								−		1.9	30900	7
	(n, 3n)	−14.22	^{179}Ta	EC	0.115	600d	^{179}Hf	+		0.2	3300	1, 7
	(n, p)	−0.24	^{181}Hf	β⁻	1.023	42.5d	^{181}Ta	+		0.002	32	1, 27
										0.005	81	41
	(n, ^{3}He)	−6.56	^{179}Lu	β⁻	1.34	4.6h	^{179}Hf			3.4×10^{-6}	0.06	55, 56
	(n, α)	7.41	^{178}Lu	β⁻	2.25	30m	^{178}Hf^{g}	+		0.001	16	1
										0.0003	4.8	37
	(n, α*)		^{178}Lu^{m}	β⁻	2.6	20m	^{178}Hf^{m}→^{178}Hf^{g} (4.3s)	+		0.0012	19	7, 18
										0.00014	2.2	37
	(n, t)+ (n, nt)	—	—							0.0045 at 22.5 MeV		60
	(n, α)+ (n, nα)	—	—							0.002		41
^{180}W (0.135%)	(n, γ)	6.65	^{181}W	EC	0.19	140d	^{181}Ta	20	thermal	0.009	146	1
	(n, 2n)	−8.44	^{179}W	EC	1.2	38m	^{179}Ta→^{179}Hf (600d)	+		1.3	21100	1
										1.87	30400	87

Nuclide (Abud-dance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (brans)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{180}W (0.135%)	(n, 2n*)		^{179}W^{m}	IT	0.2218	5.2m	^{179}W$^{g}\rightarrow^{179}$Ta$\rightarrow^{179}$Hf (38m) (600d)	+		0.42	6800	1
										0.49	7980	87
	(n, p*)	(−0.06)	^{180}Ta^{m}	EC β^-	0.9 0.7	8.1h	^{180}Hf ^{180}W			0.0096	156	87
^{182}W (26.4%)	(n, γ)	6.19	^{183}W					20	thermal			(5)
	(n, 2n)	−8.05	^{181}W	EC	0.19	140d	^{181}Ta	2.3	14	2.3	37000	1
										2.17	35300	87
										2.23	36300	23
	(n, p)	−1.02	^{182}Ta	β^-	1.811	115d	^{182}W			0.0023	37	7
										0.0059	96	87
	(n, p*)	(−1.54)	^{182}Ta^{m}	IT	0.503	16m	^{182}Ta$^{g}\rightarrow^{182}$W (115d)			1.2×10^{-4}	2.0	87
	(n, α)	7.39	^{179}Hf^{m}			18.6s				1.2×10^{-4}	2.0	87
^{183}W (14.4%)	(n, γ)	7.41	^{184}W					1×10^{3}	8×10^{-6}			(96)
	(n, 2n)	−6.19	^{182}W							2.35		8
										2.0		15
	(n, 3n)	−14.25	^{181}W	EC	0.19	140d	^{181}Ta	+		0.4	6500	1
	(n, p)	−0.29	^{183}Ta	β^-	1.07	5.1d	^{183}W	+		0.0028	45	1
										0.0041	67	87
	(n, α*)	(−7.78)	^{180}Hf^{m}	IT	1.1422	5.5h	^{180}Hf			2.2×10^{-4}	3.6	87
	(n, np)	−7.21	^{182}Ta	β^-	1.811	115d	^{182}W			0.0013	21	87
^{184}W (30.6%)	(n, γ)	5.75	^{185}W	β^-	0.429	75d	^{185}Re	1.8	thermal	0.005	81	1, 5
	(n, γ*)		^{185}W^{m}	IT	0.368	1.6m	^{185}W$^{g}\rightarrow^{185}$Re (75d)	0.02	thermal	3×10^{-5}	0.5	1, 5
	(n, 2n*)	(−7.41)	^{183}W^{m}	IT	0.309	5.3s	^{183}W^{g}	1.6	13.5	1.6	26000	7
	(n, p)	−2.25	^{184}Ta	β^-	2.75	8.7h	^{184}W	+		0.0056	91	1
										0.0029	47	87

	(n, α)	7.37	^{181}Hf	β⁻	1.023	42.5d	^{181}Ta	+		0.0034	55	1
										0.0015	16	87
	(n, d+pn)	——	^{183}Ta	β⁻	1.07	5.1d	^{183}W			0.0018	29	5
										6.5×10^{-4}	10.6	87
^{186}W (28.4%)	(n, γ)	5.47	^{187}W	β⁻	1.31	23.9h	^{187}Re	38	thermal	0.005	81	1, 5
										$(4\sim11)\times10^{-4}$	7~18	97
	(n, 2n)	−7.58	^{185}W	β⁻	0.429	75d	^{185}Re	1.1	12	0.8	13000	1
										2.3	37000	7, 87
	(n, 2n*)		^{185}W^{m}	IT	0.368	1.6m	^{185}W$^{g}\rightarrow^{185}$Re (75d)	1.1	12	0.8	13000	1
										0.64	10400	87
										0.5	8100	7
	(n, p)	−3.12	^{186}Ta	β⁻	3.7	10m	^{186}W	+		0.0014	22	1, 87
								~0.025	~20	0.001	16	7
	(n, α)	6.39	^{183}Hf	β⁻	2.2	65m	^{183}Ta→^{183}W (5.1d)	+		0.0012	20	1
										5.5×10^{-4}	9.0	87
	(n, np)	−8.43	^{185}Ta	β⁻	2.0	50m	^{185}W→^{185}Re (75d)	+		3×10^{-4}	5	1
										2.5×10^{-4}	4.1	87
^{185}Re (37.07%)	(n, γ)	6.18	^{186}Re	β⁻ (EC)	1.071 0.54	90h	^{186}Os ^{186}W	105	thermal	0.008	130	1, 5
	(n, 2n)	−7.79	^{184}Re	EC	1.6	38d	^{184}W	2.25	12	2.25	36600	1
										1.91	31100	5
	(n, 2n*)		^{184}Re^{m}	(EC IT	0.1880	169d	^{184}W ^{184}Re$^{g}\rightarrow^{184}$W (38d)	0.047	12	0.046	749	1
										0.26	4200	7
	(n, 2n**)		^{184}Re^{m}			2.2d				1.1	17300	5
	(n, α)	8.28	^{182}Ta	β⁻	1.811	115d	^{182}W			0 mb		NP-11571 (1962)

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (brans)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{187}Re (62.93%)	(n, γ)	5.87	^{188}Re	β^-	2.116	16.7h	^{188}Os	73	thermal	0.005	81	1, 5
	(n, γ*)		^{188}Re^m	IT	0.172	18.7m	^{188}Re$^g \rightarrow ^{188}$Os	1.3	thermal	3×10^{-4}	5	1, 5
	(n, 2n)	−7.37	^{186}Re	β^- (EC)	1.071 0.54	90h	^{186}Os ^{186}W	1.7	13	1.7	27500	1
										1.43	23200	23
	(n, p)	−0.59	^{187}W	β^-	1.31	23.9h	^{187}Re	+		0.0033	53	1
										0.0039	63	5, 27
	(n, ^{3}He)	−6.600	^{185}Ta	β^-	2.0	50m	^{185}W			4×10^{-6}	0.1	54
	(n, α)	7.10	^{184}Ta	β^-	2.75	8.7h	^{184}W	+		9.2×10^{-4}	14	1
										9.4×10^{-4}	15	5, 27
^{184}Os (0.018%)	(n, γ)	6.67	^{185}Os	EC	0.982	94d	^{185}Re	200	thermal	0.008	130	1
	(n, 2n)	−8.86	^{183}Os	EC	2.0	12h	^{183}Re$\rightarrow^{183}$W (71d)	+		1.3	21100	1
	(n, 2n*)		^{183}Os^m	IT EC	0.1707 2.2	9.9h	^{183}Os$\rightarrow^{183}$Re$\rightarrow^{183}$W (12h) (71d) ^{183}Re$\rightarrow^{183}$W (71d)	+		0.43	7000	1
^{186}Os (1.59%)	(n, 2n)	−8.27	^{185}Os	EC	0.982	94d	^{185}Re	2.25	14	2.25	36600	1
										1.8	29000	15
	(n, p)	−0.32	^{186}Re	β^- (EC)	1.071 0.54	90.6h	^{186}Os ^{186}W			0.0055	90	98
^{187}Os (1.64%)	(n, 2n)	−6.30	^{186}Os							1.9		15
^{188}Os (13.3%)	(n, γ*)	(5.92)	^{189}Os^m	IT	0.03081	5.7h	^{189}Os^g	0.9	10^{-4}	5×10^{-4}	8	1
	(n, 2n)	−7.99	^{187}Os							2.0		15
	(n, p)	−1.34	^{188}Re	β^-	2.116	16.7h	^{188}Os	+		0.0042	68	1
										0.0074	120	98
	(n, p*)		^{188}Re^m	IT	0.1720	18.7m	^{188}Re$^g\rightarrow^{188}$Os (16.7h)	+		0.0042	68	1
^{189}Os (16.1%)	(n, γ*)	(7.79)	^{190}Os^m	IT	1.706	9.9m	^{190}Os^g	0.01	10^{-4}	5×10^{-6}	0.08	1
	(n, n′)	——	^{189}Os^m	IT	0.03081	5.7h	^{189}Os^g	3.5	4	1.0	16200	1
	(n, 2n)	−5.92	^{188}Os							2.1		15
	(n, p)	−0.22	^{189}Re	β^-	1.00	24.3h	^{189}Os			0.005	80	98

	(n, p*)	(−2.23)	$^{189}Re^{m}$			2.8h				0.002	32	7
^{190}Os (26.4%)	(n, γ)	5.76	^{191}Os	β^-	0.310	15d	^{191}Ir	6	thermal	0.003	48	1, 5
	(n, γ*)		$^{191}Os^{m}$	IT	0.0742	13h	$^{191}Os^{g} \rightarrow {}^{191}Ir$ (15d)	8.5	thermal	0.003	48	1, 5
	(n, n′)	——	$^{190}Os^{m}$	IT	1.706	9.9m	$^{190}Os^{g}$	0.0175	5	0.005	81	1
	(n, 2n*)	(−7.79)	$^{189}Os^{m}$	IT	0.0308	5.7h	$^{189}Os^{g}$	1.15	13	1.15	18600	1
	(n, p)	−2.40	^{190}Re	β^-	3.1	2.8m	^{190}Os			0.0020	32	27
	(n, α)	6.84	^{187}W	β^-	1.31	23.9h	$^{187}Re \rightarrow {}^{187}Os$ (4×10^{10}y)	+		4.7×10^{-4}	7.6	1, 27
^{192}Os (41.0%)	(n, γ)	5.59	^{193}Os	β^-	1.132	31h	^{193}Ir	1.6	thermal	0.005	81	1, 6
	(n, 2n)	−7.56	^{191}Os	β^-	0.310	15d	^{191}Ir	1.15	14	1.15	18600	1
										1.26	20500	99
								2.2	14	2	33000	7
	(n, 2n*)		$^{191}Os^{m}$	IT	0.0742	13h	$^{191}Os^{g} \rightarrow {}^{191}Ir$ (15d)	1.15	14	1.15	18600	1
										1.07	17400	99
	(n, p)	−3.09	^{192}Re	β^-	3.1	6s	^{192}Os			7×10^{-4}	11	26
^{191}Ir (38.5%)	(n, γ)	6.20	^{192}Ir	(EC β^-	1.2 1.453	74.2d	^{192}Os ^{192}Pt	300	thermal	0.002	32	1, 5
	(n, γ*)		$^{192}Ir^{m}$	IT	0.0580	1.4m	$^{192}Ir^{g} \rightarrow {}^{192}Pt$, $\rightarrow {}^{192}Os$ (74d)	610	thermal	0.002	32	1, 5
	(n, 2n)	−8.12	^{190}Ir	EC	2.1	11d	^{190}Os	2.0	14	2.0	32000	1
	(n, 2n*)		$^{190}Ir^{m}$	IT	0.0263	1.2h	$^{190}Ir^{g} \rightarrow {}^{190}Os$ (11d)	0.37	~15	0.37	6000	1
	(n, p)	0.47	^{191}Os	β^-	0.310	15d	^{191}Ir			0.0048	78	98
	(n, α)	7.96	^{188}Re	β^-	2.116	16.7h	^{188}Os	+		0.0018	29	1
	(n, α*)		$^{188}Re^{m}$	IT	0.1720	18.7m	$^{188}Re^{g} \rightarrow {}^{188}Os$ (16.7h)	+		2×10^{-4}	3	1
^{193}Ir (61.5%)	(n, γ)	6.07	^{194}Ir	β^-	2.24	17.4h	^{194}Pt	110	thermal	0.005	81	1, 5
	(n, n′)	——	$^{193}Ir^{m}$	IT	0.0802	12d	$^{193}Ir^{g}$	1.15	5	0.3	4860	1
	(n, 2n)	−7.77	^{192}Ir	(EC β^-	1.2 1.453	74.5d	^{192}Os ^{192}Pt	1.15	14	1.15	18700	1
										2.1	34000	7

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{193}Ir (61.5%)	(n, 2n*)		^{192}Ir^{m}	IT	0.161	>5y	^{192}Ir^{g} (74d) $\nearrow$ ^{192}Os, $\searrow$ ^{192}Pt	0.59	14	0.59	9600	1
	(n, p)	−0.35	^{193}Os	β^-	1.132	31h	^{193}Ir	+		0.0027	44	1, 27
										0.0049	80	98
^{190}Pt (0.012%)	(n, γ)	6.45	^{191}Pt	EC	0.8	3.0d	^{191}Ir	200	thermal	0.008	130	1
	(n, 2n)	−8.81	^{189}Pt	EC	1.6	10.9d	^{189}Ir→^{189}Os (13d)	2.25	14	2.25	36400	1
										1.7	27500	15
^{192}Pt (0.78%)	(n, γ)	6.25	^{193}Pt	EC	0.05	<500y	^{193}Ir	10	thermal	0.003	48	1
	(n, γ*)		^{193}Pt^{m}	IT	0.1481	4.3d	^{193}Pt^{g}→^{193}Ir (<500y)	10	thermal	0.003	48	1
	(n, 2n)	−8.66	^{191}Pt	EC	0.8	3.0d	^{191}Ir	2.3	~15	2.3	37300	1
										2.0	32600	25
^{194}Pt (32.8%)	(n, γ*)	(6.12)	^{195}Pt^{m}	IT	0.2593	4.1d	^{195}Pt^{g}	0.2	10^{-4}	5×10^{-4}	8	1
	(n, 2n)	−8.37	^{193}Pt	EC	0.05	<500y	^{193}Ir	+		1.15	18700	1
	(n, 2n*)		^{193}Pt^{m}	IT	0.1481	4.3d	^{193}Pt^{g}→^{193}Ir (<500y)	+		1.15	18700	1
	(n, p)	−1.46	^{194}Ir	β^-	2.24	17.4h	^{194}Pt	+		0.0034	55	1
										0.0039	63	98
										0.0043	70	25
	(n, α)	7.28	^{191}Os	β^-	0.310	15d	^{191}Ir	+		5×10^{-4}	8	1
	(n, α*)		^{191}Os^{m}	IT	0.0742	13h	^{191}Os^{g}→^{191}Ir (1.5d)	+		5×10^{-4}	8	1
^{195}Pt (33.7%)	(n, γ)	7.92	^{196}Pt					27	thermal			(6)
	(n, n′)	——	^{195}Pt^{m}	IT	0.2593	4.1d	^{195}Pt^{g}	0.29	4	0.08	1300	1
	(n, 2n)	−6.12	^{194}Pt							2.4		8
										2.1		15
	(n, p)	−0.15	^{195}Ir	β^-	1.0	4.2h	^{195}Pt	+		0.0026	42	1
										0.0029	47	5, 27

										0.0013	21	98
^{196}Pt (25.4%)	(n, γ)	5.85	^{197}Pt	β⁻	0.75	18h	^{197}Au	1	thermal	0.003	48	1
	(n, γ*)		^{197}Pt^{m}	IT (β⁻)	0.399 1.15	80m	^{197}Pt^{g} → ^{197}Au (18h) ^{197}Au	0.06	thermal	3×10^{-4}	5	1
	(n, 2n*)	(−7.92)	^{195}Pt^{m}	IT	0.2593	4.1d	^{195}Pt^{g}	1.2	~15	1.2	19400	1
										0.46	7450	7
	(n, p)	−2.39	^{196}Ir	β⁻	3.40	120m	^{196}Pt			0.0011	17	25, 98
	(n, α)	6.38	^{193}Os	β⁻	1.132	31h	^{193}Ir	+		5.2×10^{-4}	8.4	1, 27
^{198}Pt (7.23%)	(n, γ)	5.58	^{199}Pt	β⁻	1.68	30m	^{199}Au → ^{199}Hg (3.2d)	5	thermal	0.002	32	1
	(n, 2n)	−7.56	^{197}Pt	β⁻	0.75	18h	^{197}Au	2.8	14	2.8	45400	1
								1.2	15	1.1	17800	7
	(n, 2n*)		^{197}Pt^{m}	IT (β⁻)	0.2593 1.15	80m	^{197}Pt^{g} → ^{197}Au (18h) ^{197}Au	1.4	14	1.4	22700	1
								1.2	14	1.2	19500	7
										1.0	16200	25
^{197}Au (100%)	(n, γ)	6.51	^{198}Au	β⁻ (EC)	1.374 0.31	2.7d	^{198}Hg	26000	5×10^{-6}	0.0020	32.5	(1, 5), 49
	(n, n′)	(En′=9~14 MeV)	^{197}Au^{m}	IT	0.4095	7.2s	^{197}Au^{g}			0.2	3300	1
										0.3	4900	96
	(n, 2n)	−8.08	^{196}Au	(EC, β⁺ / β⁻)	1.48 0.684	6.18d	^{196}Pt ^{196}Hg	2.25	14	2.25	36500	1
	(n, 2n*)		^{196}Au^{m}	IT	0.5955	9.7h	^{196}Au^{g} → ^{196}Pt, ^{196}Hg (6d)	0.17	16	0.15	2430	1, 25
	(n, p)	0.04	^{197}Pt	β⁻	0.75	18h	^{197}Au	+		0.0018	29	1
								0.006	18	0.0015	24	7
	(n, p*)		^{197}Pt^{m}	IT (β⁻)	0.399 1.15	80m	^{197}Pt^{g} → ^{197}Au^{g} (18h) ^{197}Au^{m} → ^{197}Au^{g} (7.2s)			1.8×10^{-4}	2.9	1
	(n, t)	−5.38	^{195}Pt^{m}	IT	0.2593	4.1d	^{195}Pt			$<6\times10^{-6}$	<0.10	83

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{197}Au (100%)	(n, ^{3}He)	−6.03	^{195}Ir	β^-	1.0	4.2h	^{195}Pt			2×10^{-5}	0.8	ref. in 54
	(n, α)	6.98	^{194}Ir	β^-	2.24	17.4h	^{194}Pt	+		2.5×10^{-4}	4.0	1
										5×10^{-4}	8	18, 27
										3×10^{-4}	5	7
	(n, 3n)	−14.75	^{195}Au	EC	0.226	183d	^{195}Pt			0.071		96
	(n, nα)	0.91	^{193}Ir							4×10^{-4}		96
	(n, t)+(n, nt)	—	—							0.0039		60
	nonelastic	—	—					2.8	5	2.4		96
^{196}Hg (0.146%)	(n, γ)	6.98	^{197}Hg	EC	0.42	65h	^{197}Au	2900	thermal	0.005	81	1, 5
	(n, γ*)		^{197}Hg^m	IT EC	0.2993 0.72	24h	^{197}Hg$^g\to^{197}$Au^g (65h) ^{197}Au$^m\to^{197}$Au^g (7.2s)	125	thermal	2×10^{-4}	3	1, 5
	(n, 2n)	−8.75	^{195}Hg	EC	1.5	9.5h	^{195}Au$\to^{195}$Pt (183d)	+		0.58	9400	1
										0.36	5830	25
	(n, 2n*)		^{195}Hg^m	EC IT	1.7 0.176	40h	^{195}Au$\to^{195}$Pt ^{195}Hg$^g\to^{195}$Au$\to^{195}$Pt (9.7h) (183d)	+		1.75	28400	1, 25
^{198}Hg (10.02%)	(n, γ*)	(6.65)	^{199}Hg^m	IT	0.533	43m	^{199}Hg^g	0.2	10^{-4}	4×10^{-4}	6	1
	(n, 2n)	−8.30	^{197}Hg	EC	0.42	65h	^{197}Au	+		0.47	7610	1
										1.0	16200	7, 25
	(n, 2n*)		^{197}Hg^m	IT EC	0.2993 0.72	24h	^{197}Hg$^g\to^{197}$Au^g (18h) ^{197}Au$^m\to^{197}$Au^g (7.2s)	+		1.9	30800	1
										0.90	14600	7, 25
	(n, p)	−0.59	^{198}Au	β^-	1.374	2.70d	^{198}Hg			0.0046	75	7, 25, 27
^{199}Hg (16.84%)	(n, n′)	—	^{199}Hg^m	IT	0.533	43m	^{199}Hg^g	0.25	3	0.20	3240	1
										0.13	2110	25

	(n, 2n)	−6.65	^{198}Hg							2.0		15
	(n, p)	0.32	^{199}Au	β^-	0.46	3.15d	^{199}Hg			0.0023	37	25
^{200}Hg (23.13%)	(n, γ)	6.23	^{201}Hg					<60	thermal			(6)
	(n, 2n*)	(−8.03)	^{199}Hg^m	IT	0.533	43m	^{199}Hg^g	+		1.2	19400	1
										0.79	12800	25
	(n, p)	−1.42	^{200}Au	β^-	2.2	48.4m	^{200}Hg	+		0.0038	61	1, 27
	(n, α)	6.55	^{197}Pt	β^-	0.75	18h	^{197}Au	+		0.0018	29	1, 27
										2×10^{-4}	3	7
	(n, α*)		^{197}Pt^m	IT β^-	0.399 1.15	80m	^{197}Pt$^g\rightarrow^{197}$Au^g (18h) ^{197}Au$^m\rightarrow^{197}$Au^g (7.2s)			0.0018	29	1
^{201}Hg (13.12%)	(n, 2n)	−6.23	^{100}Hg							2.2		15
	(n, p)	−0.72	^{201}Au	β^-	1.5	26m	^{201}Hg	+		0.0019	31	1, 27
^{202}Hg (29.80%)	(n, γ)	5.99	^{203}Hg	β^-	0.492	46.9d	^{203}Tl	4.5	thermal	0.003	48	1, 5
	(n, 2n)	−7.76	^{201}Hg							2.3		15
	(n, α)	5.71	^{199}Pt	β^-	1.68	31m	^{199}Au$\rightarrow^{199}$Hg (3.2d)			0.001	16	7, 27
^{204}Hg (6.85%)	(n, γ)	5.67	^{205}Hg	β^-	1.6	5.5m	^{205}Tl	0.5	thermal	2×10^{-4}	3	1
	(n, 2n)	−7.49	^{203}Hg	β^-	0.492	46.9d	^{203}Tl	2.4	14	2.4	39000	1
								2.0	14	2.0	33000	7
										2.18	35500	23
										2.08	33900	25
^{203}Tl (29.50%)	(n, γ)	6.66	^{204}Tl	β^- (EC)	0.765 0.34	3.8y	^{204}Pb ^{204}Hg	40	2.5×10^{-4}	0.003	48	1, 5
	(n, 2n)	−7.72	^{202}Tl	EC	1.22	12d	^{202}Hg	1.35	14	1.35	21900	1
										1.75	28400	23, 25
	(n, p)	0.29	^{203}Hg	β^-	0.492	46.9d	^{203}Tl	+		0.027	440	1
										0.0042	68	98
	(n, α)	7.20	^{200}Au	β^-	2.2	48.4m	^{200}Hg			0.0022	35	7, 25
										3.7×10^{-4}	6.0	5

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{203}Tl (29.50%)	(n, 3n)	−14.65	^{201}Tl	EC	0.41	73h	^{201}Hg			0.01		96
	(n, nα)	0.20	^{199}Au	β^-	0.46	3.15d	^{199}Hg			$<1.2\times10^{-5}$	<0.20	73
										1.2×10^{-4}	2.0	96
^{205}Tl (70.50%)	(n, γ)	6.50	^{206}Tl	β^-	1.524	4.19m	^{206}Pb	0.5	3×10^{-3}	0.002	3	1, 5
	(n, 2n)	−7.54	^{204}Tl	β^- (EC)	0.765 0.34	3.9y	^{204}Pb ^{204}Hg	2.5	14	2.45	39900	1
										1.93	31400	23
	(n, p)	−0.75	^{205}Hg	β^-	1.6	5.5m	^{205}Tl	+		0.0025	40	1
										0.0019	31	98
										5.7×10^{-5}	0.93	25
	(n, ^{3}He)	−7.90	^{203}Au	β^-	2.1	55s	^{203}Hg→^{203}Tl (46.9h)			$<1\times10^{-5}$	<0.16	73
	(n, α)	5.68	^{202}Au	β^-	3.5	29s	^{202}Hg			0.001	16	7
^{204}Pb (1.48%)	(n, γ)	6.73	^{205}Pb	EC	0.035	3×10^7y	^{205}Tl	0.8	thermal	0.003	50	1
	(n, n′)	——	^{204}Pb^m	IT	2.186	66.9m	^{204}Pb^g	0.27	8	0.18	2920	1
										0.051	826	25
	(n, 2n)	−8.40	^{203}Pb	EC	0.96	52.1h	^{203}Tl	1.8	14～17	1.8	29200	1, 7, 25
	(n, 2n*)		^{203}Pb^m	IT	0.8252	6.1s	^{203}Pb^g→^{203}Tl (52.1h)	1.3	14.5	1.2	19400	7
	(n, t)	−5.86	^{202}Tl	EC	1.22	12.4d	^{202}Hg			3.2×10^{-5}	0.52	65
^{206}Pb (23.6%)	(n, γ)	6.74	^{207}Pb					0.038	1.7×10^{-2}			(5)
	(n, 2n)	−8.08	^{205}Pb	EC	0.035	3×10^7y	^{205}Tl	+		2.4	39000	1
										2.7	44000	21
	(n, 2n*)		^{205}Pb^m	IT	1.0138	4ms	^{205}Pb^g			1.1	17800	7
	(n, α)	7.14	^{203}Hg	β^-	0.492	46.9d	^{203}Tl	+		0.0023	37	1
	nonelastic	——	——							2.5		5
^{207}Pb (22.6%)	(n, γ)	7.37	^{208}Pb					0.709	thermal			(5)
	(n, n′γ)	——	^{207}Pb^m	IT	1.6331	0.8s	^{207}Pb			0.20	3300	57

	(n, 2n)	−6.74	^{206}Pb							2.5		8
										2.2		15
^{208}Pb (52.3%)	(n, γ)	3.94	^{209}Pb	β^-	0.64	3.3h	^{209}Bi (>2×10^{18}y) (α)	0.008	10^{-3}	0.003	50	1
										0.001	16	74
	(n, 2n*)	(−7.37)	^{207}Pb^m	IT	1.633	0.80s	^{207}Pb^g	1.8	15	1.5	24400	7
	(n, p)	−4.21	^{208}Tl	β^-	4.994	3.1m	^{208}Pb	+		9.5×10^{-4}	15.4	1
										4.6×10^{-4}	7.4	25
	(n, α)	6.19	^{205}Hg	β^-	1.6	5.5m	^{205}Tl			0.0015	24	24
	nonelastic	—	—							2.6		5
^{209}Bi (100%)	(n, γ)	4.60	^{210}Bi	β^- (α)	1.160 5.044	5.01d	^{210}Po (α emitter)	0.06	10^{-2}	0.0015	24	1
										0.0012	20	74
	(n, γ*)		^{210}Bi^m	α (β^-)	5.312 1.428	3×10^{6}y	^{206}Tl ^{210}Po	0.06	10^{-2}	0.0015	24	1
	(n, n′)	(En′=9~14 MeV)	^{209}Bi^{excit}							0.14	2300	5
										0.17	2800	96
	(n, 2n)	−7.45	^{208}Bi	EC	2.87	3.7×10^{5}y	^{208}Pb	2.5	13.5	2.5	41000	1
										2.2	36000	23
	(n, p)	0.14	^{209}Pb	β^-	0.64	3.30h	^{209}Bi			0.001	16	7
	(n, α)	9.63	^{206}Tl	β^-	1.524	4.19m	^{206}Pb			0.001	16	7, 18
	(n, t)+ (n, nt)	—	—							0.0037 at 22.5 MeV		60
	nonelastic	—	—					flat 6~15 MeV		2.5		5

Po, At, Em, Fr, Ra, Ac

	(n, 2n)	−6.74	^{206}Pb							2.5		8
										2.2		15
^{208}Pb (52.3%)	(n, γ)	3.94	^{209}Pb	β^-	0.64	3.3h	^{209}Bi (>2×10^{18}y) (α)	0.008	10^{-3}	0.003	50	1
										0.001	16	74
	(n, 2n*)	(−7.37)	^{207}Pb^m	IT	1.633	0.80s	^{207}Pb^g	1.8	15	1.5	24400	7
	(n, p)	−4.21	^{208}Tl	β^-	4.994	3.1m	^{208}Pb	+		9.5×10^{-4}	15.4	1
										4.6×10^{-4}	7.4	25
	(n, α)	6.19	^{205}Hg	β^-	1.6	5.5m	^{205}Tl			0.0015	24	24
	nonelastic	—	—							2.6		5
^{209}Bi (100%)	(n, γ)	4.60	^{210}Bi	β^- (α)	1.160 5.044	5.01d	^{210}Po (α emitter)	0.06	10^{-2}	0.0015	24	1
										0.0012	20	74
	(n, γ*)		^{210}Bi^m	α (β^-)	5.312 1.428	3×10^{6}y	^{206}Tl ^{210}Po	0.06	10^{-2}	0.0015	24	1
	(n, n′)	(En′=9∼14 MeV)	^{209}Bi^{excit}							0.14	2300	5
										0.17	2800	96
	(n, 2n)	−7.45	^{208}Bi	EC	2.87	3.7×10^{5}y	^{208}Pb	2.5	13.5	2.5	41000	1
										2.2	36000	23
	(n, p)	0.14	^{209}Pb	β^-	0.64	3.30h	^{209}Bi			0.001	16	7
	(n, α)	9.63	^{206}Tl	β^-	1.524	4.19m	^{206}Pb			0.001	16	7, 18
	(n, t)+ (n, nt)	—	—							0.0037 at 22.5 MeV		60
	nonelastic	—	—					flat 6∼15 MeV		2.5		5

Po, At, Em, Fr, Ra, Ac

Nuclide (Abundance)	Type of reaction	Reaction Q-value (MeV)	Reaction product	Type of decay	Decay Q-value (MeV)	Half life	Decay product	max. σ (barns)	Energy for max. σ (MeV)	σ at 14 MeV (barns)	$10^{15}R_{sat.}$ $\left(\frac{\text{curie}}{\text{mol. unit flux}}\right)$	Reference
^{232}Th (100%)	(n, γ)	4.79	^{233}Th	β^-	1.246	22.2m	^{233}Pa→^{233}U (27d)	1000	2×10^{-4}	0.005	81	1
	(n, 2n)	−6.43	^{231}Th	β^-	0.38	25.5h	^{231}Pa (3.25×10^4y) (α)	1.85	10	1.5	24300	1
										1.16	18800	23
								1.9	10	1.3	21000	7
	(n, α)	8.08	^{229}Ra							0.0046	75	73
	(n, 3n)	−11.56	^{230}Th							0.85	13800	96
	nonelastic	—	—							2.8		96
					Pa							
^{238}U (99.28%)	(n, γ)	4.80	^{239}U	β^-	1.28	23.5m	^{239}Np→^{239}Pu (2.4d)	10000	8×10^{-6}	0.001	16	1
	(n, 2n)	−6.14	^{237}U	β^-	0.517	6.75d	^{237}Np (2.14×10^6y) (α)	1.65	10	0.9	14600	1
										0.70	11300	23
	(n, p)	−3.18	^{238}Pa							0.0015	24	96
	(n, t)	−5.10	^{236}Pa	β^-	2.9	12m	^{236}U→^{232}Th (2.39×10^7y) (α)			2×10^{-5}	0.33	ref. in 55
	(n, α)	9.07	^{235}Th							0.0015	24	73
	(n, 3n)	−11.27	^{236}U	α	4.573	2.39×10^7y	^{232}Th			0.50 (1.1)	8140	96
	(n, np)	−7.66	^{237}Pa	β^-	2.30	39m	^{237}U→^{237}Np(αemitter) (6.75d)			2.3×10^{-4}	3.7	96