FUSION CROSS SECTIONS AND REACTIVITIES

BY

George H. Miley
Harry Towner
Nenad Ivich

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University of Illinois, C-U Campus
Nuclear Engineering Program
Urbana, Illinois 61801

June 17, 1974

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ABSTRACT

This report summarizes cross section and reactivity data for several important fusion reactions. Reactivities are included for both Maxwellian plasmas and beam-Maxwellian target fusion. Equations, tabular and also graphical presentations are included for convenience in a variety of applications.

INTRODUCTION

With the steadily increasing research in controlled thermonuclear fusion, a need has developed for a convenient collection of both fusion cross sections and reactivities (i.e. $\langle\sigma v\rangle$ values). While such data is widely available, it is generally scattered throughout reports and books. Also forms convenient for computer use are not always included.

The material that follows presents fusion cross sections and reactivity data in both graphical and tabular form for the following reactions: $T(d,n)^4\text{He}$, $^3\text{He}(d,p)^4\text{He}$, $D(d,p)T$, $D(d,n)^3\text{He}$, $T(t,2n)^4\text{He}$, $T(^3\text{He},X)Y^*$ and $^{11}\text{B}(p,2^4\text{He})^4\text{He}$.

In addition to cross sections, reaction-rate parameters ($\langle\sigma v\rangle$) are given for two important cases: 1) Maxwellian distributions for both ion species, and 2) beam-Maxwellian target fusion. Also, for the first case plots of $\langle\sigma v\rangle/T^2$ are included since this is directly related to the the maximum power density for a magnetic pressure limited system.

Rather than present experimental data per se, we have elected to use fitted cross sections which are directly usable in numerical work. In the time allowed for preparation of this report we were not able

*The following products have been considered

$\frac{1}{2}$ Probability (225-600 keV)	X	Y
51 ± 2	p+n	^4He
43 ± 2	d	^4He
6 ± 2	p	^5He

to access the accuracy* of the fits although they are generally thought to be reasonable. Thus the cross section set presented here must be considered an unevaluated set. (The user should not be confused on this point by the computer output that typically carry more significant figures than are meaningful). Hopefully the question of accuracy can be more fully studied later. However, before this can be done in a meaningful fashion, a complete review of the basic experimental data is necessary in order to select the "best" basic data from the various measurements available. Once this is done, the adequacy of the fit can be accessed in a relatively straight forward manner.

The first six reactions (Secs. 1 through 6) were fit with a form developed by Duane⁽¹⁾, namely:

$$\sigma(E) = [E(\exp(A1/\sqrt{E})-1)]^{-1} [A2/\{1+(A3xE-A4)^2\} + A5] \quad (1)$$

Here E refers to the energy of the incident particle (Lab System) in eV and values for the constants A1 through A5 are given in Appendix A. The cross section for the last reaction, $^{11}\text{B}(p,2^4\text{He})^4\text{He}$ was obtained by fitting the cross sections as given by Jarmie and Seagrave⁽²⁾ in energy segments. The exact forms used are given in Appendix B.

The average reaction-rate parameter for a Maxwellian plasma was evaluated from the expression⁽³⁾:

*The accuracy discussed here is not that of the computer programs, which are accurate to 1 part in 10^4 , but rather how well the numerical fits represent the cross sections.

1. B. H. Duane, "Fusion Cross Section Theory," BNWL-1685 (1972).
2. N. Jarmie and R. Seagrave (eds.), "Charged Particle Cross Sections," LA-2014, Los Alamos Scientific Laboratory (1957).
3. M. Clark and D. Rose, Plasmas and Controlled Fusion, M. I. T. Press, Massachusetts Institute of Technology (1965).

$$\langle \sigma v \rangle = \frac{4}{(2\pi m_1)^{1/2}} \left(\frac{\mu}{m_1 kT} \right)^{3/2} \int_0^\infty dE E \sigma(E) \exp \left(-\frac{\mu E}{m_1 kT} \right) \quad (2)$$

where, T = the temperature of both species
 m_1 = Mass of the ion with energy E
 μ = Reduced mass of the two fusing ions

This form results from assuming that both types of ions in the plasma are Maxwellian and at the same temperature T . The corresponding quantity for the beam-target case is found by assuming that the beam particles are monoenergetic but have an isotropic angular distribution. The background plasma species are assigned a Maxwellian energy distribution at temperature T . The instantaneous reaction rate parameter for a single incident particle with speed v_0 is then given by:

$$\langle \sigma v \rangle_b = \frac{\sigma}{\sqrt{\pi}} \frac{1}{v_0} \int_0^\infty \sigma \left(\frac{1}{2} m_1 v^2 \right) v^2 \{ \exp[-\beta^2 (v_0 - v)^2] - \exp[-\beta^2 (v_0 + v)^2] \} dv \quad (3)$$

$$\text{where: } \beta^2 = \frac{m_2}{2kT} \quad (3a)$$

and the various quantities are

v_0 = velocity of injected particle
 m_2 = mass of background particle
 m_1 = mass of incident particle

The format adopted here has separate sections for each reaction, e.g., Sec. 1 treats d-T and t-D data. For each reaction values and graphs for σ , $\langle \sigma v \rangle$, $\langle \sigma v \rangle / T^2$, and $\langle \sigma v \rangle_b$ are presented, in that order. Then, for comparison purposes, the last section contains composite graphs of σ , $\langle \sigma v \rangle$, and $\langle \sigma v \rangle_b$.

It is hoped that this tabulation will be of value to various workers in the fusion community. We plan to continue to improve and update the material and would welcome any comments. Please address any communication to G. H. Miley, Nuclear Engineering Program, U of Ill., Urbana, Illinois 61801 (Phone (217) 333-3772).

The authors wish to thank Dr. Fred H. Tenney of the Princeton Plasma Physics Laboratory for his time and comments which proved most valuable in this work.

Appendix AConstants Used In The Fitted Cross Section of Equation 1.

<u>Reaction</u>	<u>Constants</u>
$T(d,n)^4\text{He}$	$A1 = 1453 \sqrt{eV}$ $A2 = 502 \times 10^5 \text{ eV barn}$ $A3 = 1368 \times 10^{-8}/eV$ $A4 = 1.076$ $A5 = 409 \times 10^3 \text{ eV barn}$
$^3\text{He}(d,p)^4\text{He}$	$A1 = 2823 \sqrt{eV}$ $A2 = 259 \times 10^5 \text{ eV barn}$ $A3 = 398 \times 10^{-8}/eV$ $A4 = 1.297$ $A5 = 647 \times 10^3 \text{ eV barn}$
$D(d,p)T$	$A1 = 1457.7 \sqrt{eV}$ $A2 = 372 \times 10^3 \text{ eV barn}$ $A3 = 436 \times 10^{-9}/eV$ $A4 = 1.220$ $A5 = 0$
$D(d,n)^4\text{He}$	$A1 = 1514 \sqrt{eV}$ $A2 = 482 \times 10^3 \text{ eV barn}$ $A3 = 308 \times 10^{-8}/eV$ $A4 = 1.177$ $A5 = 0$
$T(t,2n)^4\text{He}$	$A1 = 1214 \sqrt{eV}$ $A2 = 448 \times 10^3 \text{ eV barn}$ $A3 = 102 \times 10^{-8}/eV$ $A4 = 2.09$ $A5 = 0$

$T(^3\text{He}, X)Y$

$$A1 = 3893 \text{ eV}$$

$$A2 = 1125 \times 10^4 \text{ eV barn}$$

$$A3 = 0$$

$$A4 = 0$$

$$A5 = 0$$

Appendix BParameters For the ^{11}B Reaction

The equations used for $^{11}\text{B}(p,2^4\text{He})^4\text{He}$ are as follows:

$$0 < E(\text{keV}) \leq 400 \quad \sigma^* = \frac{6.524 \times 10^{-14}}{E(\text{eV})} \exp(-9131.5/\sqrt{E(\text{eV})})$$

$$400 < E(\text{keV}) \leq 625 \quad \sigma = [(A5)E^5 + (A4)E^4 + (A3)E^3 + (A2)E^2 + (A1)E + (A0)] \times 10^{-28}$$

$$A5 = -.3498 \times 10^{-8} \quad (E \text{ in keV})$$

$$A4 = .8024 \times 10^{-5}$$

$$A3 = -.7192 \times 10^{-2}$$

$$A2 = .3182 \times 10^1$$

$$A1 = -.6895 \times 10^3$$

$$A0 = .5834 \times 10^5$$

$$625 < E(\text{keV}) \leq 725 \quad \sigma = \frac{A}{(E-E_r)^2+B} \quad (E \text{ in keV})$$

$$A = 46893.75 \times 10^{-24}$$

$$B = 76250.$$

$$E_r = 675$$

$$725 < E(\text{keV}) \leq 1175 \quad \sigma = [(A5)E^5 + (A4)E^4 + (A3)E^3 + (A2)E^2 + (A1)E + (A0)] \times 10^{-28}$$

$$A5 = .9567 \times 10^{-9} \quad (E \text{ in keV})$$

$$A4 = -.4861 \times 10^{-5}$$

$$A3 = .9729 \times 10^{-2}$$

$$A2 = -.9554 \times 10^1$$

$$A1 = .4578 \times 10^4$$

$$A0 = -.8480 \times 10^6$$

* In units of cm^2 .

$$1175 < E(\text{keV}) \leq 1200 \quad \sigma = .130 \times 10^{-24}$$

$$1200 < E(\text{keV}) \leq 1550 \quad \sigma = .135 \times 10^{-24}$$

$$1550 < E(\text{keV}) \leq 2000 \quad \sigma = [(A5)E^5 + (A4)E^4 + (A3)E^3 + (A2)E^2 + (A1)E + (A0)] \times 10^{-28}$$

$$A5 = .1291 \times 10^{-9} \quad (E \text{ in keV})$$

$$A4 = -.1106 \times 10^{-5}$$

$$A3 = .3784 \times 10^{-2}$$

$$A2 = -.6466 \times 10^1$$

$$A1 = .5518 \times 10^4$$

$$A0 = -.1880 \times 10^7$$

Section 1Deuterium-Tritium Reactions

σ for $T(d,n)^4\text{He}$	1.1
$\langle\sigma v\rangle$ for $T(d,n)^4\text{He}$	1.3
$\langle\sigma v\rangle/T^2$ for $T(d,n)^4\text{He}$	1.5
$\langle\sigma v\rangle_b$ for $T(d,n)^4\text{He}$ (Beam Case).	1.7
σ for $D(t,n)^4\text{He}$	1.12
$\langle\sigma v\rangle_b$ for $D(t,n)^4\text{He}$ (Beam Case).	1.14

Cross Section For $T(d,n)^4\text{He}$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.266180-39	1.5000	0.819960-36
2.0000	0.943270-34	2.5000	0.234590-32
3.0000	0.247550-31	3.5000	0.152850-30
4.0000	0.657780-30	4.5000	0.219010-29
5.0000	0.603070-29	5.5000	0.143620-28
6.0000	0.305200-28	6.5000	0.592020-28
7.0000	0.106610-27	7.5000	0.180510-27
8.0000	0.290250-27	8.5000	0.446690-27
9.0000	0.662140-27	9.5000	0.950160-27
10.000	0.132550-26	15.000	0.135950-25
20.000	0.534010-25	25.000	0.134920-24
30.000	0.266830-24	35.000	0.453030-24
40.000	0.693770-24	45.000	0.986340-24
50.000	0.132530-23	55.000	0.170270-23
60.000	0.210810-23	65.000	0.252870-23
70.000	0.295020-23	75.000	0.335780-23
80.000	0.373700-23	85.000	0.407520-23
90.000	0.436250-23	95.000	0.459270-23
100.00	0.476330-23	150.00	0.418660-23
200.00	0.278130-23	250.00	0.188360-23
300.00	0.135060-23	350.00	0.102020-23
400.00	0.804320-24	450.00	0.656500-24
500.00	0.551250-24	550.00	0.473820-24
600.00	0.415270-24	650.00	0.369950-24
700.00	0.334160-24	750.00	0.305400-24
800.00	0.281930-24	850.00	0.262510-24
900.00	0.246250-24	950.00	0.232480-24
1000.0	0.220710-24	1500.0	0.158650-24
2000.0	0.134220-24	2500.0	0.120720-24
3000.0	0.111740-24	3500.0	0.105090-24
4000.0	0.998380-25	4500.0	0.954960-25
5000.0	0.918030-25	5500.0	0.885930-25
6000.0	0.857580-25	6500.0	0.832220-25
7000.0	0.809310-25	7500.0	0.788450-25
8000.0	0.769330-25	8500.0	0.751690-25
9000.0	0.735350-25	9500.0	0.720130-25
10000.	0.705920-25	15000.	0.600730-25
20000.	0.533580-25	25000.	0.485640-25
30000.	0.449090-25	35000.	0.419990-25
40000.	0.396060-25	45000.	0.375930-25
50000.	0.358680-25	55000.	0.343660-25
60000.	0.330440-25	65000.	0.318670-25
70000.	0.308110-25	75000.	0.298560-25
80000.	0.289870-25	85000.	0.281910-25
90000.	0.274590-25	95000.	0.267830-25

Cross section for $T(d,n)^4\text{He}$

<σv> For T(d,n)⁴He assuming Maxwellian distributions

TEMP (keV)	<σv> (cm ³ /sec)	TEMP (keV)	<σv> (cm ³ /sec)
1.0000	0.548350-20	1.5000	0.589170-19
2.0000	0.262760-18	2.5000	0.760960-18
3.0000	0.171280-17	3.5000	0.327400-17
4.0000	0.558430-17	4.5000	0.876020-17
5.0000	0.128910-16	5.5000	0.180390-16
6.0000	0.242370-16	6.5000	0.314940-16
7.0000	0.397970-16	7.5000	0.491110-16
8.0000	0.593910-16	8.5000	0.705760-16
9.0000	0.825980-16	9.5000	0.953850-16
10.000	0.108860-15	15.000	0.265420-15
20.000	0.424340-15	25.000	0.559400-15
30.000	0.665320-15	35.000	0.744790-15
40.000	0.802520-15	45.000	0.843120-15
50.000	0.870500-15	55.000	0.887750-15
60.000	0.897290-15	65.000	0.900970-15
70.000	0.900220-15	75.000	0.896120-15
80.000	0.889510-15	85.000	0.881030-15
90.000	0.871170-15	95.000	0.860330-15
100.00	0.848790-15	150.00	0.727700-15
200.00	0.627830-15	250.00	0.552460-15
300.00	0.495420-15	350.00	0.451470-15
400.00	0.416920-15	450.00	0.389270-15
500.00	0.366790-15	550.00	0.348260-15
600.00	0.332800-15	650.00	0.319770-15
700.00	0.308670-15	750.00	0.299160-15
800.00	0.290940-15	850.00	0.283790-15
900.00	0.277540-15	950.00	0.272040-15
1000.0	0.267190-15	1500.0	0.239540-15
2000.0	0.229070-15	2500.0	0.224700-15
3000.0	0.222960-15	3500.0	0.222490-15
4000.0	0.222660-15	4500.0	0.223190-15
5000.0	0.223900-15	5500.0	0.224710-15
6000.0	0.225560-15	6500.0	0.226420-15
7000.0	0.227270-15	7500.0	0.228110-15
8000.0	0.228920-15	8500.0	0.229710-15
9000.0	0.230470-15	9500.0	0.231200-15
10000.	0.231910-15	15000.	0.237570-15
20000.	0.241540-15	25000.	0.244500-15
30000.	0.246790-15	35000.	0.248620-15
40000.	0.250130-15	45000.	0.251400-15
50000.	0.252500-15	55000.	0.253460-15
60000.	0.254310-15	65000.	0.255070-15
70000.	0.255760-15	75000.	0.256380-15
80000.	0.256940-15	85000.	0.257460-15
90000.	0.257940-15	95000.	0.258380-15

Values of $\langle\sigma v\rangle$ assuming Maxwellian distributions
for D-T fusion reactions

$\langle\sigma v\rangle/T^2$ For $T(d,n)^4\text{He}$ assuming Maxwellian distributions

TEMP (keV)	$\langle\sigma v\rangle/T^2$ ($\text{cm}^3/\text{sec}/(\text{keV})^2$)	TEMP (keV)	$\langle\sigma v\rangle/T^2$ ($\text{cm}^3/\text{sec}/(\text{keV})^2$)
1.0000	0.548350-20	1.5000	0.261850-19
2.0000	0.656900-19	2.5000	0.121750-18
3.0000	0.190320-18	3.5000	0.267270-18
4.0000	0.349020-18	4.5000	0.432600-18
5.0000	0.515650-18	5.5000	0.596330-18
6.0000	0.673260-18	6.5000	0.745430-18
7.0000	0.812180-18	7.5000	0.873090-18
8.0000	0.927980-18	8.5000	0.976830-18
9.0000	0.101970-17	9.5000	0.105690-17
10.000	0.108860-17	15.000	0.117960-17
20.000	0.106090-17	25.000	0.895040-18
30.000	0.739250-18	35.000	0.607990-18
40.000	0.501570-18	45.000	0.416360-18
50.000	0.348200-18	55.000	0.293470-18
60.000	0.249250-18	65.000	0.213250-18
70.000	0.183720-18	75.000	0.159310-18
80.000	0.138990-18	85.000	0.121940-18
90.000	0.107550-18	95.000	0.953270-19
100.00	0.848790-19	150.00	0.323420-19
200.00	0.156960-19	250.00	0.883940-20
300.00	0.550470-20	350.00	0.368540-20
400.00	0.260570-20	450.00	0.192230-20
500.00	0.146720-20	550.00	0.115130-20
600.00	0.924450-21	650.00	0.756840-21
700.00	0.629950-21	750.00	0.531840-21
800.00	0.454590-21	850.00	0.392790-21
900.00	0.342640-21	950.00	0.301430-21
1000.0	0.267190-21	1500.0	0.106460-21
2000.0	0.572690-22	2500.0	0.359530-22
3000.0	0.747730-22	3500.0	0.181620-22
4000.0	0.139170-22	4500.0	0.110220-22
5000.0	0.895610-23	5500.0	0.742840-23
6000.0	0.626550-23	6500.0	0.535900-23
7000.0	0.463820-23	7500.0	0.405530-23
8000.0	0.357690-23	8500.0	0.317940-23
9000.0	0.284530-23	9500.0	0.256180-23
10000.	0.231910-23	15000.	0.105590-23
20000.	0.603850-24	25000.	0.391200-24
30000.	0.274210-24	35000.	0.202950-24
40000.	0.156330-24	45000.	0.124150-24
50000.	0.101000-24	55000.	0.837890-25
60000.	0.706420-25	65000.	0.603720-25
70000.	0.521950-25	75000.	0.455780-25
80000.	0.401470-25	85000.	0.356340-25
90000.	0.318440-25	95000.	0.286290-25

Values of $\langle \sigma v \rangle / T^2$ assuming Maxwellian distributions for D-T reactions

$\langle \sigma v \rangle_b$ For $T(d,n)^4\text{He}$ assuming beam - Maxwellian distributions
Tritium Temperature = 0

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm^3/sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm^3/sec)
10.000	0.12571E-16	15.000	0.16294E-17
20.000	0.73505E-17	25.000	0.20876E-16
30.000	0.45227E-16	35.000	0.82942E-16
40.000	0.13575E-15	45.000	0.20476E-15
50.000	0.29001E-15	55.000	0.39079E-15
60.000	0.50523E-15	65.000	0.63090E-15
70.000	0.76386E-15	75.000	0.89551E-15
80.000	0.10394E-14	85.000	0.11627E-14
90.000	0.12808E-14	95.000	0.13853E-14
100.00	0.14741E-14	110.00	0.16008E-14
120.00	0.16626E-14	130.00	0.16713E-14
140.00	0.16415E-14	150.00	0.15868E-14
160.00	0.15175E-14	170.00	0.14424E-14
180.00	0.13653E-14	190.00	0.12896E-14
200.00	0.12172E-14	250.00	0.92166E-15
300.00	0.72391E-15	350.00	0.59064E-15
400.00	0.49781E-15	450.00	0.43098E-15
500.00	0.38146E-15	550.00	0.34388E-15
600.00	0.31478E-15	650.00	0.29188E-15
700.00	0.27360E-15	750.00	0.25882E-15
800.00	0.24677E-15	850.00	0.23684E-15
900.00	0.22861E-15	950.00	0.22175E-15
1000.0	0.21555E-15	1100.0	0.20703E-15
1200.0	0.20060E-15	1300.0	0.19594E-15
1400.0	0.19257E-15	1500.0	0.19015E-15
1600.0	0.18843E-15	1700.0	0.18724E-15
1800.0	0.18645E-15	1900.0	0.18599E-15
2000.0	0.18576E-15		

$\langle\sigma v\rangle_b$ For $T(d,n)^4\text{He}$ assuming beam - Maxwellian distributions
 Tritium Temperature = 10 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm^3/sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm^3/sec)
10.000	0.459770-16	15.000	0.814360-16
20.000	0.127500-15	25.000	0.183760-15
30.000	0.249370-15	35.000	0.323050-15
40.000	0.403280-15	45.000	0.488340-15
50.000	0.576420-15	55.000	0.665760-15
60.000	0.754610-15	65.000	0.841410-15
70.000	0.924740-15	75.000	0.100340-14
80.000	0.107650-14	85.000	0.114320-14
90.000	0.120300-14	95.000	0.125560-14
100.00	0.130080-14	110.00	0.136950-14
120.00	0.141060-14	130.00	0.142750-14
140.00	0.142380-14	150.00	0.140380-14
160.00	0.137130-14	170.00	0.132990-14
180.00	0.128250-14	190.00	0.123150-14
200.00	0.117890-14	250.00	0.930440-15
300.00	0.740240-15	350.00	0.605330-15
400.00	0.505620-15	450.00	0.440300-15
500.00	0.388960-15	550.00	0.349830-15
600.00	0.315640-15	650.00	0.295900-15
700.00	0.276970-15	750.00	0.261480-15
800.00	0.249210-15	850.00	0.238960-15
900.00	0.230460-15	950.00	0.223360-15
1000.0	0.217420-15	1100.0	0.208170-15
1200.0	0.201520-15	1300.0	0.196710-15
1400.0	0.193210-15	1500.0	0.190690-15
1600.0	0.188900-15	1700.0	0.187650-15
1800.0	0.186810-15	1900.0	0.186300-15
2000.0	0.186050-15		

$\langle \sigma v \rangle_b$ For $T(d,n)^4\text{He}$ assuming beam - Maxwellian distributions
Tritium Temperature = 30 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.29822E-15	15.000	0.36507E-15
20.000	0.43205E-15	25.000	0.49841E-15
30.000	0.56346E-15	35.000	0.62664E-15
40.000	0.68745E-15	45.000	0.74548E-15
50.000	0.80041E-15	55.000	0.85199E-15
60.000	0.90003E-15	65.000	0.94441E-15
70.000	0.98505E-15	75.000	0.10219E-14
80.000	0.10551E-14	85.000	0.10845E-14
90.000	0.11103E-14	95.000	0.11326E-14
100.00	0.11515E-14	110.00	0.11798E-14
120.00	0.11963E-14	130.00	0.12025E-14
140.00	0.11958E-14	150.00	0.11896E-14
160.00	0.11731E-14	170.00	0.11515E-14
180.00	0.11255E-14	190.00	0.10973E-14
200.00	0.10665E-14	250.00	0.90086E-15
300.00	0.74828E-15	350.00	0.62489E-15
400.00	0.53008E-15	450.00	0.45833E-15
500.00	0.40391E-15	550.00	0.36220E-15
600.00	0.32582E-15	650.00	0.30433E-15
700.00	0.28401E-15	750.00	0.26763E-15
800.00	0.25428E-15	850.00	0.24332E-15
900.00	0.23423E-15	950.00	0.22666E-15
1000.0	0.22031E-15	1100.0	0.21045E-15
1200.0	0.20335E-15	1300.0	0.19820E-15
1400.0	0.19445E-15	1500.0	0.19173E-15
1600.0	0.18978E-15	1700.0	0.18840E-15
1800.0	0.18746E-15	1900.0	0.18687E-15
2000.0	0.18654E-15		

$\langle\sigma v\rangle_b$ For $T(d,n)^4\text{He}$ assuming beam - Maxwellian distributions
 Tritium Temperature = 50 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.528990-15	15.000	0.591930-15
20.000	0.642030-15	25.000	0.689240-15
30.000	0.733520-15	35.000	0.774850-15
40.000	0.813240-15	45.000	0.848770-15
50.000	0.881430-15	55.000	0.911260-15
60.000	0.938410-15	65.000	0.962890-15
70.000	0.984800-15	75.000	0.100430-14
80.000	0.102130-14	85.000	0.103610-14
90.000	0.104880-14	95.000	0.105940-14
100.00	0.106800-14	110.00	0.107980-14
120.00	0.108500-14	130.00	0.108450-14
140.00	0.107900-14	150.00	0.106930-14
160.00	0.105590-14	170.00	0.103950-14
180.00	0.102060-14	190.00	0.999800-15
200.00	0.977460-15	250.00	0.854660-15
300.00	0.733670-15	250.00	0.628110-15
400.00	0.541250-15	450.00	0.471950-15
500.00	0.417250-15	550.00	0.374210-15
600.00	0.340210-15	650.00	0.313190-15
700.00	0.291540-15	750.00	0.274030-15
800.00	0.259790-15	850.00	0.248010-15
900.00	0.238300-15	950.00	0.230200-15
1000.0	0.223420-15	1100.0	0.212870-15
1200.0	0.205290-15	1300.0	0.199770-15
1400.0	0.195790-15	1500.0	0.192820-15
1600.0	0.190690-15	1700.0	0.189190-15
1800.0	0.188140-15	1900.0	0.187460-15
2000.0	0.187060-15

Values of $\langle \sigma v \rangle_b$ for injection of deuterium into a tritium background at various temperatures (keV)

Cross Section For $D(t,n)^4\text{He}$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.136300-43	1.5000	0.276260-39
2.0000	0.976140-37	2.5000	0.521750-35
3.0000	0.967930-34	3.5000	0.926110-33
4.0000	0.567050-32	4.5000	0.252750-31
5.0000	0.890440-31	5.5000	0.262040-30
6.0000	0.669610-30	6.5000	0.152790-29
7.0000	0.317890-29	7.5000	0.612660-29
8.0000	0.110730-28	8.5000	0.189530-28
9.0000	0.309590-28	9.5000	0.485690-28
10.000	0.735590-28	15.000	0.133990-26
20.000	0.735030-26	25.000	0.231860-25
30.000	0.538000-25	35.000	0.103170-24
40.000	0.174120-24	45.000	0.268440-24
50.000	0.387060-24	55.000	0.530180-24
60.000	0.697400-24	65.000	0.887760-24
70.000	0.109980-23	75.000	0.133140-23
80.000	0.158020-23	85.000	0.184300-23
90.000	0.211650-23	95.000	0.239670-23
100.00	0.267940-23	150.00	0.476810-23
200.00	0.465370-23	250.00	0.366590-23
300.00	0.277350-23	350.00	0.212540-23
400.00	0.167010-23	450.00	0.134640-23
500.00	0.111100-23	550.00	0.935570-24
600.00	0.801940-24	650.00	0.698050-24
700.00	0.615840-24	750.00	0.549740-24
800.00	0.495850-24	850.00	0.451370-24
900.00	0.414230-24	950.00	0.382910-24
1000.0	0.356270-24	1500.0	0.220340-24
2000.0	0.172080-24	2500.0	0.148330-24
3000.0	0.134110-24	3500.0	0.124440-24
4000.0	0.117290-24	4500.0	0.111660-24
5000.0	0.107050-24	5500.0	0.103150-24
6000.0	0.997730-25	6500.0	0.967990-25
7000.0	0.941430-25	7500.0	0.917450-25
8000.0	0.895600-25	8500.0	0.875550-25
9000.0	0.857030-25	9500.0	0.839840-25
10000.	0.823810-25	15000.	0.705450-25
20000.	0.629570-25	25000.	0.575030-25
30000.	0.533200-25	35000.	0.499720-25
40000.	0.472100-25	45000.	0.448770-25
50000.	0.428710-25	55000.	0.411210-25
60000.	0.395770-25	65000.	0.382000-25
70000.	0.369620-25	75000.	0.358410-25
80000.	0.348180-25	85000.	0.338820-25
90000.	0.330190-25	95000.	0.322200-25

Cross section for $D(t,n)^4\text{He}$

$\langle \sigma v \rangle_b$ For $D(t,n)^4\text{He}$ assuming beam - Maxwellian distributions
Deuterium Temperature = 0

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.58826E-20	15.000	0.13123E-18
20.000	0.82129E-18	25.000	0.29317E-17
30.000	0.74570E-17	35.000	0.15435E-16
40.000	0.27849E-16	45.000	0.45540E-16
50.000	0.69214E-16	55.000	0.99434E-16
60.000	0.13661E-15	65.000	0.18100E-15
70.000	0.23265E-15	75.000	0.29159E-15
80.000	0.35742E-15	85.000	0.42971E-15
90.000	0.50778E-15	95.000	0.59076E-15
100.00	0.67759E-15	110.00	0.85788E-15
120.00	0.10380E-14	130.00	0.12069E-14
140.00	0.13553E-14	150.00	0.14768E-14
160.00	0.15682E-14	170.00	0.16295E-14
180.00	0.16633E-14	190.00	0.16734E-14
200.00	0.16642E-14	250.00	0.14658E-14
300.00	0.12149E-14	350.00	0.10056E-14
400.00	0.84465E-15	450.00	0.72228E-15
500.00	0.62821E-15	550.00	0.55487E-15
600.00	0.49676E-15	650.00	0.45007E-15
700.00	0.41205E-15	750.00	0.38073E-15
800.00	0.35467E-15	850.00	0.33279E-15
900.00	0.31426E-15	950.00	0.29847E-15
1000.0	0.28491E-15	1100.0	0.26306E-15
1200.0	0.24647E-15	1300.0	0.23368E-15
1400.0	0.22369E-15	1500.0	0.21581E-15
1600.0	0.20954E-15	1700.0	0.20452E-15
1800.0	0.20049E-15	1900.0	0.19724E-15
2000.0	0.19462E-15		

$\langle \sigma v \rangle_b$ For $D(t,n)^4\text{He}$ assuming beam-Maxwellian distributions .

Deuterium Temperature = 10 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.690570-16	15.000	0.980420-16
20.000	0.131120-15	25.000	0.168010-15
30.000	0.208370-15	35.000	0.251820-15
40.000	0.297960-15	45.000	0.346360-15
50.000	0.396550-15	55.000	0.448210-15
60.000	0.500780-15	65.000	0.553900-15
70.000	0.607140-15	75.000	0.660140-15
80.000	0.712540-15	85.000	0.764000-15
90.000	0.814220-15	95.000	0.862950-15
100.00	0.909920-15	110.00	0.997860-15
120.00	0.107620-14	120.00	0.114570-14
140.00	0.120440-14	150.00	0.125270-14
160.00	0.129090-14	170.00	0.131930-14
180.00	0.133870-14	180.00	0.134980-14
200.00	0.135340-14	250.00	0.128780-14
300.00	0.114900-14	350.00	0.997040-15
400.00	0.859310-15	450.00	0.743860-15
500.00	0.650150-15	550.00	0.574830-15
600.00	0.514200-15	650.00	0.465080-15
700.00	0.424940-15	750.00	0.391830-15
800.00	0.364270-15	850.00	0.341130-15
900.00	0.321560-15	950.00	0.304880-15
1000.0	0.290590-15	1100.0	0.267570-15
1200.0	0.250120-15	1200.0	0.236690-15
1400.0	0.226200-15	1500.0	0.217930-15
1600.0	0.211350-15	1700.0	0.206090-15
1800.0	0.201850-15	1900.0	0.198430-15
2000.0	0.195670-15		

$\langle \sigma v \rangle_b$ For $D(t,n)^4\text{He}$ assuming beam-Maxwellian distribution

Deuterium Temperature = 30 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.44520E-15	15.000	0.48508E-15
20.000	0.52390E-15	25.000	0.56157E-15
30.000	0.59806E-15	35.000	0.63331E-15
40.000	0.66728E-15	45.000	0.69996E-15
50.000	0.73129E-15	55.000	0.76129E-15
60.000	0.78994E-15	65.000	0.81722E-15
70.000	0.84314E-15	75.000	0.86771E-15
80.000	0.89093E-15	85.000	0.91282E-15
90.000	0.93339E-15	95.000	0.95266E-15
100.00	0.97065E-15	110.00	0.10029E-14
120.00	0.10303E-14	120.00	0.10532E-14
140.00	0.10718E-14	150.00	0.10864E-14
160.00	0.10972E-14	170.00	0.11045E-14
180.00	0.11096E-14	190.00	0.11098E-14
200.00	0.11093E-14	250.00	0.10691E-14
300.00	0.99677E-15	350.00	0.90995E-15
400.00	0.82113E-15	450.00	0.73726E-15
500.00	0.66164E-15	550.00	0.59537E-15
600.00	0.53830E-15	650.00	0.48963E-15
700.00	0.44834E-15	750.00	0.41336E-15
800.00	0.38370E-15	850.00	0.35850E-15
900.00	0.33701E-15	950.00	0.31862E-15
1000.0	0.30280E-15	1100.0	0.27731E-15
1200.0	0.25758E-15	1200.0	0.24312E-15
1400.0	0.23153E-15	1500.0	0.22240E-15
1600.0	0.21515E-15	1700.0	0.20933E-15
1800.0	0.20466E-15	1900.0	0.20088E-15
2000.0	0.19782E-15		

$\langle \sigma v \rangle_b$ For $D(t,n)^4\text{He}$ assuming beam-Maxwellian distributions

Deuterium Temperature = 50 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.712000E-15	15.000	0.733810E-15
20.000	0.754550E-15	25.000	0.774250E-15
30.000	0.792920E-15	35.000	0.810600E-15
40.000	0.827310E-15	45.000	0.843070E-15
50.000	0.857910E-15	55.000	0.871840E-15
60.000	0.884910E-15	65.000	0.897130E-15
70.000	0.908520E-15	75.000	0.919110E-15
80.000	0.928930E-15	85.000	0.937990E-15
90.000	0.946330E-15	95.000	0.953960E-15
100.00	0.960910E-15	110.00	0.972850E-15
120.00	0.982340E-15	120.00	0.989540E-15
140.00	0.994620E-15	150.00	0.997730E-15
160.00	0.999040E-15	170.00	0.998680E-15
180.00	0.996800E-15	190.00	0.993520E-15
200.00	0.989970E-15	250.00	0.951060E-15
300.00	0.896340E-15	350.00	0.833560E-15
400.00	0.768670E-15	450.00	0.705440E-15
500.00	0.646090E-15	550.00	0.591780E-15
600.00	0.542940E-15	650.00	0.499560E-15
700.00	0.461340E-15	750.00	0.427880E-15
800.00	0.398670E-15	850.00	0.373240E-15
900.00	0.351110E-15	950.00	0.331840E-15
1000.0	0.315050E-15	1100.0	0.287590E-15
1200.0	0.266920E-15	1300.0	0.250190E-15
1400.0	0.237420E-15	1500.0	0.227350E-15
1600.0	0.219330E-15	1700.0	0.212900E-15
1800.0	0.207730E-15	1900.0	0.203540E-15
2000.0	0.200140E-15

Values of $\langle \sigma v \rangle_b$ for injection of tritium into a deuterium background at various temperatures (keV)

Section 2Deuterium-Helium-3 Reactions

σ for ${}^3\text{He}(d,p){}^4\text{He}$	2.1
$\langle\sigma v\rangle$ for ${}^3\text{He}(d,p){}^4\text{He}$	2.3
$\langle\sigma v\rangle/T^2$ for ${}^3\text{He}(d,p){}^4\text{He}$	2.5
$\langle\sigma v\rangle_b$ for ${}^3\text{He}(d,p){}^4\text{He}$ (Beam Case).	2.7
σ for $D({}^3\text{He},p){}^4\text{He}$	2.12
$\langle\sigma v\rangle_b$ for $D({}^3\text{He},p){}^4\text{He}$ (Beam Case).	2.14

Cross Section For ${}^3\text{He}(d,p){}^4\text{He}$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.175630-58	1.5000	0.152650-51
2.0000	0.199800-47	2.5000	0.125510-44
3.0000	0.143460-42	3.5000	0.563630-41
4.0000	0.107700-39	4.5000	0.123170-38
5.0000	0.962520-38	5.5000	0.561940-37
6.0000	0.260910-36	6.5000	0.100800-35
7.0000	0.335130-35	7.5000	0.983840-35
8.0000	0.260150-34	8.5000	0.629430-34
9.0000	0.141120-33	9.5000	0.296190-33
10.000	0.586930-33	15.000	0.708270-31
20.000	0.118680-29	25.000	0.795580-29
30.000	0.319990-28	35.000	0.936100-28
40.000	0.221140-27	45.000	0.448980-27
50.000	0.815080-27	55.000	0.135870-26
60.000	0.211880-26	65.000	0.313250-26
70.000	0.443460-26	75.000	0.605690-26
80.000	0.802820-26	85.000	0.103740-25
90.000	0.131180-25	95.000	0.162790-25
100.00	0.198750-25	150.00	0.821560-25
200.00	0.193960-24	250.00	0.345660-24
300.00	0.508810-24	350.00	0.641820-24
400.00	0.713130-24	450.00	0.720140-24
500.00	0.682350-24	550.00	0.622840-24
600.00	0.557840-24	650.00	0.495940-24
700.00	0.440630-24	750.00	0.392690-24
800.00	0.351730-24	850.00	0.316900-24
900.00	0.287290-24	950.00	0.262060-24
1000.0	0.240480-24	1500.0	0.131590-24
2000.0	0.957070-25	2500.0	0.796720-25
3000.0	0.709740-25	3500.0	0.655690-25
4000.0	0.618580-25	4500.0	0.591090-25
5000.0	0.569510-25	5500.0	0.551820-25
6000.0	0.536830-25	6500.0	0.523800-25
7000.0	0.512240-25	7500.0	0.501830-25
8000.0	0.492340-25	8500.0	0.483610-25
9000.0	0.475520-25	9500.0	0.467960-25
10000.	0.460870-25	15000.	0.406780-25
20000.	0.370040-25	25000.	0.342510-25
30000.	0.320750-25	35000.	0.302930-25
40000.	0.287960-25	45000.	0.275140-25
50000.	0.263990-25	55000.	0.254160-25
60000.	0.245410-25	65000.	0.237550-25
70000.	0.230430-25	75000.	0.223950-25
80000.	0.218010-25	85000.	0.212550-25
90000.	0.207490-25	95000.	0.202790-25

Cross section for ${}^3\text{He}(d,p){}^4\text{He}$

<σv> For ${}^3\text{He}(d,p){}^4\text{He}$ assuming Maxwellian distributions

TEMP (keV)	<σv> (cm ³ /sec)	TEMP (keV)	<σv> (cm ³ /sec)
1.0000	0.302280-25	1.5000	0.132270-23
2.0000	0.141970-22	2.5000	0.764130-22
3.0000	0.275130-21	3.5000	0.764140-21
4.0000	0.177330-20	4.5000	0.361060-20
5.0000	0.665960-20	5.5000	0.113730-19
6.0000	0.182650-19	6.5000	0.279010-19
7.0000	0.408950-19	7.5000	0.578920-19
8.0000	0.795690-19	8.5000	0.106630-18
9.0000	0.139770-18	9.5000	0.179740-18
10.000	0.227250-18	15.000	0.127430-17
20.000	0.379130-17	25.000	0.817740-17
30.000	0.145200-16	35.000	0.226550-16
40.000	0.322620-16	45.000	0.429700-16
50.000	0.544080-16	55.000	0.662480-16
60.000	0.782160-16	65.000	0.900940-16
70.000	0.101720-15	75.000	0.112960-15
80.000	0.123740-15	85.000	0.134000-15
90.000	0.143710-15	95.000	0.152850-15
100.00	0.161430-15	150.00	0.219610-15
200.00	0.243730-15	250.00	0.250880-15
300.00	0.249970-15	350.00	0.245360-15
400.00	0.239160-15	450.00	0.232470-15
500.00	0.225800-15	550.00	0.219430-15
600.00	0.213460-15	650.00	0.207950-15
700.00	0.202890-15	750.00	0.198250-15
800.00	0.194030-15	850.00	0.190170-15
900.00	0.186660-15	950.00	0.183450-15
1000.0	0.180530-15	1500.0	0.161960-15
2000.0	0.153920-15	2500.0	0.150400-15
3000.0	0.149060-15	3500.0	0.148850-15
4000.0	0.149250-15	4500.0	0.150000-15
5000.0	0.150930-15	5500.0	0.151970-15
6000.0	0.153040-15	6500.0	0.154140-15
7000.0	0.155220-15	7500.0	0.156290-15
8000.0	0.157330-15	8500.0	0.158340-15
9000.0	0.159320-15	9500.0	0.160270-15
10000.	0.161180-15	15000.	0.168690-15
20000.	0.174070-15	25000.	0.178130-15
30000.	0.181320-15	35000.	0.183920-15
40000.	0.186100-15	45000.	0.187940-15
50000.	0.189540-15	55000.	0.190930-15
60000.	0.192170-15	65000.	0.193280-15
70000.	0.194270-15	75000.	0.195180-15
80000.	0.196010-15	85000.	0.196770-15
90000.	0.197480-15	95000.	0.198120-15

Values of $\langle\sigma v\rangle$ assuming Maxwellian distributions for D- ^3He fusion reactions

$\langle\sigma v\rangle/T^2$ For ${}^3\text{He}(d,p){}^4\text{He}$ assuming Maxwellian distributions

TEMP (keV)	$\langle\sigma v\rangle/T^2$ ($\text{cm}^3/\text{sec}/(\text{keV})^2$)	TEMP (keV)	$\langle\sigma v\rangle/T^2$ ($\text{cm}^3/\text{sec}/(\text{keV})^2$)
1.0000	0.302280-25	1.5000	0.587870-24
2.0000	0.354920-23	2.5000	0.122260-22
3.0000	0.305700-22	3.5000	0.623790-22
4.0000	0.110830-21	4.5000	0.178300-21
5.0000	0.266380-21	5.5000	0.375960-21
6.0000	0.507350-21	6.5000	0.660390-21
7.0000	0.834580-21	7.5000	0.102920-20
8.0000	0.124330-20	8.5000	0.147580-20
9.0000	0.172560-20	9.5000	0.199160-20
10.000	0.227250-20	15.000	0.566340-20
20.000	0.947830-20	25.000	0.130840-19
30.000	0.161340-19	35.000	0.184930-19
40.000	0.201640-19	45.000	0.212200-19
50.000	0.217630-19	55.000	0.219000-19
60.000	0.217270-19	65.000	0.213240-19
70.000	0.207580-19	75.000	0.200820-19
80.000	0.193340-19	85.000	0.185470-19
90.000	0.177420-19	95.000	0.169370-19
100.00	0.161430-19	150.00	0.976040-20
200.00	0.609320-20	250.00	0.401410-20
300.00	0.277750-20	350.00	0.200290-20
400.00	0.149480-20	450.00	0.114800-20
500.00	0.903210-21	550.00	0.725390-21
600.00	0.592960-21	650.00	0.492190-21
700.00	0.414050-21	750.00	0.352450-21
800.00	0.303170-21	850.00	0.263220-21
900.00	0.230440-21	950.00	0.203270-21
1000.0	0.180530-21	1500.0	0.719820-22
2000.0	0.384800-22	2500.0	0.240640-22
3000.0	0.165620-22	3500.0	0.121510-22
4000.0	0.932830-23	4500.0	0.740730-23
5000.0	0.603730-23	5500.0	0.502360-23
6000.0	0.425120-23	6500.0	0.364820-23
7000.0	0.316780-23	7500.0	0.277850-23
8000.0	0.245830-23	8500.0	0.219160-23
9000.0	0.196690-23	9500.0	0.177580-23
10000.	0.161180-23	15000.	0.749740-24
20000.	0.435180-24	25000.	0.285000-24
30000.	0.201470-24	35000.	0.150140-24
40000.	0.116310-24	45000.	0.928110-25
50000.	0.758140-25	55000.	0.631180-25
60000.	0.533800-25	65000.	0.457460-25
70000.	0.396480-25	75000.	0.346990-25
80000.	0.306270-25	85000.	0.272350-25
90000.	0.243800-25	95000.	0.219530-25

Values of $\langle \sigma v \rangle / T^2$ assuming Maxwellian distributions for D- ^3He reactions

$\langle \sigma v \rangle_b$ For ${}^3\text{He}(d,p){}^4\text{He}$ assuming beam - Maxwellian distributions

Helium-3 Temperature = 0

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.57437E-25	15.000	0.84890E-23
20.000	0.16424E-21	25.000	0.12310E-20
30.000	0.54238E-20	35.000	0.17138E-19
40.000	0.43283E-19	45.000	0.93206E-19
50.000	0.17836E-18	55.000	0.31183E-18
60.000	0.50790E-18	65.000	0.79156E-18
70.000	0.11482E-17	75.000	0.16233E-17
80.000	0.22221E-17	85.000	0.29599E-17
90.000	0.38511E-17	95.000	0.49101E-17
100.00	0.61505E-17	110.00	0.92775E-17
120.00	0.13180E-16	120.00	0.18098E-16
140.00	0.24061E-16	150.00	0.31138E-16
160.00	0.39390E-16	170.00	0.48863E-16
180.00	0.59594E-16	190.00	0.71601E-16
200.00	0.84897E-16	250.00	0.16913E-15
300.00	0.27273E-15	350.00	0.37158E-15
400.00	0.44138E-15	450.00	0.47276E-15
500.00	0.47218E-15	550.00	0.45203E-15
600.00	0.42286E-15	650.00	0.39129E-15
700.00	0.36077E-15	750.00	0.33281E-15
800.00	0.30787E-15	850.00	0.28592E-15
900.00	0.26672E-15	950.00	0.24997E-15
1000.0	0.23534E-15	1100.0	0.21132E-15
1200.0	0.19277E-15	1300.0	0.17828E-15
1400.0	0.16684E-15	1500.0	0.15771E-15
1600.0	0.15038E-15	1700.0	0.14445E-15
1800.0	0.13962E-15	1900.0	0.13568E-15
2000.0	0.13246E-15		

$\langle \sigma v \rangle_b$ For ${}^3\text{He}(d,p){}^4\text{He}$ assuming beam - Maxwellian distributions

Helium-3 Temperature - 10 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.37255E-19	15.000	0.84823D-19
20.000	0.16427E-18	25.000	0.28600D-18
30.000	0.46135E-18	35.000	0.70231D-18
40.000	0.10214E-17	45.000	0.14313E-17
50.000	0.19452E-17	55.000	0.25759D-17
60.000	0.33365E-17	65.000	0.42396D-17
70.000	0.52977E-17	75.000	0.65229D-17
80.000	0.79268E-17	85.000	0.95206D-17
90.000	0.11315E-16	95.000	0.13320D-16
100.00	0.15545E-16	110.00	0.20690E-16
120.00	0.26811E-16	120.00	0.33957D-16
140.00	0.42163E-16	150.00	0.51449D-16
160.00	0.61818E-16	170.00	0.73258E-16
180.00	0.85739E-16	190.00	0.99212E-16
200.00	0.11361E-15	250.00	0.19617D-15
300.00	0.28452E-15	350.00	0.36165D-15
400.00	0.41553E-15	450.00	0.44268D-15
500.00	0.44661D-15	550.00	0.43415D-15
600.00	0.41213E-15	650.00	0.38587D-15
700.00	0.35893E-15	750.00	0.33295D-15
800.00	0.30917D-15	850.00	0.28781E-15
900.00	0.26886E-15	950.00	0.25216D-15
1000.0	0.23747E-15	1100.0	0.21323D-15
1200.0	0.19441E-15	1200.0	0.17967D-15
1400.0	0.16802E-15	1500.0	0.15872D-15
1600.0	0.15125E-15	1700.0	0.14520D-15
1800.0	0.14028E-15	1900.0	0.13626D-15
2000.0	0.13207E-15		

$\langle\sigma v\rangle_b$ For ${}^3\text{He}(d,p){}^4\text{He}$ assuming beam - Maxwellian distributions

Helium - 3 Temperature = 30 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.14637E-17	15.000	0.21287E-17
20.000	0.29328E-17	25.000	0.38859E-17
30.000	0.49973E-17	35.000	0.62756E-17
40.000	0.77287E-17	45.000	0.93641E-17
50.000	0.11188E-16	55.000	0.13207E-16
60.000	0.15427E-16	65.000	0.17850E-16
70.000	0.20482E-16	75.000	0.23324E-16
80.000	0.26390E-16	85.000	0.29649E-16
90.000	0.33134E-16	95.000	0.36833E-16
100.00	0.40745E-16	110.00	0.49201E-16
120.00	0.58478E-16	130.00	0.68541E-16
140.00	0.79344E-16	150.00	0.90832E-16
160.00	0.10294E-15	170.00	0.11560E-15
180.00	0.12873E-15	190.00	0.14226E-15
200.00	0.15609E-15	250.00	0.22683E-15
300.00	0.29282E-15	350.00	0.34632E-15
400.00	0.38335E-15	450.00	0.40356E-15
500.00	0.43974E-15	550.00	0.40313E-15
600.00	0.38940E-15	650.00	0.37096E-15
700.00	0.35027E-15	750.00	0.32908E-15
800.00	0.30845E-15	850.00	0.28916E-15
900.00	0.27142E-15	950.00	0.25536E-15
1000.0	0.24056E-15	1100.0	0.21669E-15
1200.0	0.19752E-15	1300.0	0.18237E-15
1400.0	0.17034E-15	1500.0	0.16071E-15
1600.0	0.15296E-15	1700.0	0.14668E-15
1800.0	0.14157E-15	1900.0	0.13739E-15
2000.0	0.12397E-15		

$\langle\sigma v\rangle_b$ For ${}^3\text{He}(d,p){}^4\text{He}$ assuming beam - Maxwellian distributions

Helium-3 Temperature = 50 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.690850-17	15.000	0.874080-17
20.000	0.107620-16	25.000	0.129780-16
30.000	0.153850-16	35.000	0.179850-16
40.000	0.207770-16	45.000	0.237590-16
50.000	0.269310-16	55.000	0.302900-16
60.000	0.338320-16	65.000	0.375550-16
70.000	0.414520-16	75.000	0.455240-16
80.000	0.497620-16	85.000	0.541610-16
90.000	0.587160-16	95.000	0.634210-16
100.00	0.682650-16	110.00	0.783690-16
120.00	0.899550-16	130.00	0.999780-16
140.00	0.111370-15	150.00	0.123060-15
160.00	0.134950-15	170.00	0.147090-15
180.00	0.159310-15	190.00	0.171570-15
200.00	0.183830-15	250.00	0.242970-15
300.00	0.294510-15	350.00	0.334780-15
400.00	0.362430-15	450.00	0.377920-15
500.00	0.382840-15	550.00	0.379340-15
600.00	0.369660-15	650.00	0.355840-15
700.00	0.339590-15	750.00	0.322250-15
800.00	0.304760-15	850.00	0.287780-15
900.00	0.271720-15	950.00	0.256810-15
1000.0	0.243130-15	1100.0	0.219490-15
1200.0	0.200350-15	1300.0	0.184980-15
1400.0	0.172650-15	1500.0	0.162730-15
1600.0	0.154710-15	1700.0	0.148210-15
1800.0	0.142900-15	1900.0	0.138560-15
2000.0	0.135000-15

Values of $\langle \sigma v \rangle_b$ for injection of deuterium into a helium-3 background at various temperatures (keV).

Cross Section For $D(^3\text{He},p)^4\text{He}$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.557650-67	1.5000	0.189130-58
2.0000	0.219850-53	2.5000	0.612930-50
3.0000	0.210430-47	3.5000	0.194340-45
4.0000	0.739530-44	4.5000	0.149620-42
5.0000	0.189430-41	5.5000	0.167480-40
6.0000	0.111670-39	6.5000	0.593680-39
7.0000	0.262300-38	7.5000	0.994020-38
8.0000	0.331130-37	8.5000	0.988570-37
9.0000	0.268650-36	9.5000	0.673020-36
10.000	0.157050-35	15.000	0.600170-33
20.000	0.199430-31	25.000	0.212890-30
30.000	0.120510-29	35.000	0.459160-29
40.000	0.134050-28	45.000	0.323950-28
50.000	0.680830-28	55.000	0.128610-27
60.000	0.223490-27	65.000	0.363240-27
70.000	0.559110-27	75.000	0.822720-27
80.000	0.116580-26	85.000	0.160010-26
90.000	0.213680-26	95.000	0.278710-26
100.00	0.356130-26	150.00	0.200050-25
200.00	0.561940-25	250.00	0.114650-24
300.00	0.194880-24	350.00	0.293250-24
400.00	0.402220-24	450.00	0.510390-24
500.00	0.604710-24	550.00	0.674240-24
600.00	0.713630-24	650.00	0.723940-24
700.00	0.710780-24	750.00	0.681470-24
800.00	0.642790-24	850.00	0.599960-24
900.00	0.556530-24	950.00	0.514630-24
1000.0	0.475420-24	1500.0	0.239800-24
2000.0	0.153760-24	2500.0	0.115560-24
3000.0	0.955550-25	3500.0	0.837560-25
4000.0	0.761550-25	4500.0	0.709060-25
5000.0	0.670730-25	5500.0	0.641430-25
6000.0	0.618150-25	6500.0	0.599070-25
7000.0	0.583010-25	7500.0	0.569180-25
8000.0	0.557060-25	8500.0	0.546280-25
9000.0	0.536550-25	9500.0	0.527690-25
10000.	0.519530-25	15000.	0.460640-25
20000.	0.421980-25	25000.	0.392960-25
30000.	0.369820-25	35000.	0.350710-25
40000.	0.334520-25	45000.	0.320550-25
50000.	0.308310-25	55000.	0.297470-25
60000.	0.287780-25	65000.	0.279030-25
70000.	0.271080-25	75000.	0.263810-25
80000.	0.257130-25	85000.	0.250960-25
90000.	0.245240-25	95000.	0.239910-25

Cross Section For $\text{D}(^3\text{He}, \text{p})^4\text{He}$

$\langle\sigma v\rangle_b$ For $D(^3\text{He},p)^4\text{He}$ assuming beam - Maxwellian distribution

Deuterium Temperature = 0

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.125590-27	15.000	0.597830-25
20.000	0.225540-23	25.000	0.269197-22
30.000	0.166920-21	35.000	0.686950-21
40.000	0.214400-20	45.000	0.549570-20
50.000	0.121750-19	55.000	0.241210-19
60.000	0.437780-19	65.000	0.740600-19
70.000	0.118300-18	75.000	0.180180-18
80.000	0.263700-18	85.000	0.373060-18
90.000	0.512650-18	95.000	0.686980-18
100.00	0.900610-18	110.00	0.146430-17
120.00	0.224030-17	130.00	0.326470-17
140.00	0.457220-17	150.00	0.619600-17
160.00	0.816760-17	170.00	0.105170-16
180.00	0.132710-16	190.00	0.164560-16
200.00	0.200970-16	250.00	0.458420-16
300.00	0.853610-16	350.00	0.138740-15
400.00	0.203430-15	450.00	0.273800-15
500.00	0.341950-15	550.00	0.359880-15
600.00	0.442000-15	650.00	0.466760-15
700.00	0.475570-15	750.00	0.471960-15
800.00	0.459770-15	850.00	0.442350-15
900.00	0.422220-15	950.00	0.401130-15
1000.0	0.380200-15	1100.0	0.341120-15
1200.0	0.307230-15	1200.0	0.278650-15
1400.0	0.254780-15	1500.0	0.234870-15
1600.0	0.218220-15	1700.0	0.204240-15
1800.0	0.192440-15	1900.0	0.182430-15
2000.0	0.173900-15		

$\langle \sigma v \rangle_b$ For $D(^3\text{He}, p)^4\text{He}$ assuming beam - Maxwellian distributions

Deuterium Temperature = 10 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.89066E-15	15.000	0.14969E-18
20.000	0.22146E-18	25.000	0.33776E-18
30.000	0.47212E-18	35.000	0.63810E-18
40.000	0.83935E-18	45.000	0.10795E-17
50.000	0.13623E-17	55.000	0.16915E-17
60.000	0.20707E-17	65.000	0.25035E-17
70.000	0.26937E-17	75.000	0.35447E-17
80.000	0.41602E-17	85.000	0.48436E-17
90.000	0.55982E-17	95.000	0.64274E-17
100.00	0.72347E-17	110.00	0.93938E-17
120.00	0.11800E-16	130.00	0.14575E-16
140.00	0.17737E-16	150.00	0.21304E-16
160.00	0.25291E-16	170.00	0.29709E-16
180.00	0.34567E-16	190.00	0.39872E-16
200.00	0.45627E-16	250.00	0.81059E-16
300.00	0.12648E-15	350.00	0.17901E-15
400.00	0.23454E-15	450.00	0.28855E-15
500.00	0.32695E-15	550.00	0.37674E-15
600.00	0.40632E-15	650.00	0.42540E-15
700.00	0.43472E-15	750.00	0.43572E-15
800.00	0.42011E-15	850.00	0.41965E-15
900.00	0.40550E-15	950.00	0.39016E-15
1000.0	0.37346E-15	1100.0	0.33991E-15
1200.0	0.30878E-15	1300.0	0.28139E-15
1400.0	0.25790E-15	1500.0	0.23798E-15
1600.0	0.22114E-15	1700.0	0.20691E-15
1800.0	0.19485E-15	1900.0	0.18460E-15
2000.0	0.17585E-15		

$\langle \sigma v \rangle_b$ For $D(^3\text{He}, p)^4\text{He}$ assuming beam - Maxwellian distributions

Deuterium Temperature = 30 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.414990-17	15.000	0.505800-17
20.000	0.604670-17	25.000	0.711740-17
30.000	0.827120-17	35.000	0.950930-17
40.000	0.108320-16	45.000	0.122410-16
50.000	0.137360-16	55.000	0.153190-16
60.000	0.169880-16	65.000	0.187450-16
70.000	0.205890-16	75.000	0.225200-16
80.000	0.245380-16	85.000	0.266430-16
90.000	0.288350-16	95.000	0.311110-16
100.00	0.334730-16	110.00	0.384480-16
120.00	0.437500-16	130.00	0.493700-16
140.00	0.552970-16	150.00	0.615170-16
160.00	0.680170-16	170.00	0.747800-16
180.00	0.817890-16	190.00	0.890290-16
200.00	0.964790-16	250.00	0.136210-15
300.00	0.178230-15	350.00	0.220060-15
400.00	0.259510-15	450.00	0.294890-15
500.00	0.325010-15	550.00	0.349240-15
600.00	0.367400-15	650.00	0.379690-15
700.00	0.386550-15	750.00	0.388740-15
800.00	0.386870-15	850.00	0.381740-15
900.00	0.374070-15	950.00	0.364500-15
1000.0	0.353620-15	1100.0	0.329780-15
1200.0	0.305410-15	1300.0	0.282210-15
1400.0	0.261060-15	1500.0	0.242260-15
1600.0	0.225820-15	1700.0	0.211600-15
1800.0	0.199320-15	1900.0	0.188750-15
2000.0	0.179650-15		

$\langle \sigma v \rangle_b$ For $D(^3\text{He}, p)^4\text{He}$ assuming beam - Maxwellian distributions

Deuterium Temperature = 50 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.185310-16	15.000	0.206620-16
20.000	0.228660-16	25.000	0.251410-16
30.000	0.274860-16	35.000	0.299000-16
40.000	0.323800-16	45.000	0.349250-16
50.000	0.375220-16	55.000	0.402020-16
60.000	0.429310-16	65.000	0.457180-16
70.000	0.485610-16	75.000	0.514580-16
80.000	0.544070-16	85.000	0.574060-16
90.000	0.604530-16	95.000	0.635470-16
100.00	0.666850-16	110.00	0.730860-16
120.00	0.796400-16	130.00	0.863330-16
140.00	0.931470-16	150.00	0.100070-15
160.00	0.107080-15	170.00	0.114170-15
180.00	0.121310-15	190.00	0.128510-15
200.00	0.135730-15	250.00	0.171840-15
300.00	0.206820-15	350.00	0.239390-15
400.00	0.268620-15	450.00	0.293900-15
500.00	0.314920-15	550.00	0.331600-15
600.00	0.344050-15	650.00	0.352540-15
700.00	0.357620-15	750.00	0.359120-15
800.00	0.358070-15	850.00	0.354710-15
900.00	0.349480-15	950.00	0.342760-15
1000.0	0.334510-15	1100.0	0.317020-15
1200.0	0.297820-15	1300.0	0.278680-15
1400.0	0.260440-15	1500.0	0.243610-15
1600.0	0.228380-15	1700.0	0.214810-15
1800.0	0.202830-15	1900.0	0.192310-15
2000.0	0.183120-15

Values of $\langle \sigma v \rangle_b$ for injection of helium-3 into a deuterium background
at various temperatures (keV)

Section 3Deuterium-Deuterium Reactions

(Proton Branch)

σ for $D(d,p)T$	3.1
$\langle\sigma v\rangle$ for $D(d,p)T$	3.3
$\langle\sigma v\rangle/T^2$ for $D(d,p)T$	3.5
$\langle\sigma v\rangle_b$ for $D(d,p)T$ (Beam Case).	3.7

Cross Section For D(d,p)T

ENERGY (keV)	$\sigma(\text{cm}^2)$	ENERGY (keV)	$\sigma(\text{cm}^2)$
1.0000	0.143000-41	1.5000	0.449760-38
2.0000	0.522470-36	2.5000	0.130530-34
3.0000	0.137980-33	3.5000	0.851830-33
4.0000	0.366080-32	4.5000	0.121610-31
5.0000	0.333890-31	5.5000	0.792420-31
6.0000	0.167750-30	6.5000	0.324070-30
7.0000	0.581000-30	7.5000	0.979220-30
8.0000	0.156700-29	8.5000	0.239970-29
9.0000	0.353910-29	9.5000	0.505230-29
10.000	0.701080-29	15.000	0.679700-28
20.000	0.251670-27	25.000	0.599070-27
30.000	0.111720-26	35.000	0.179200-26
40.000	0.259980-26	45.000	0.351480-26
50.000	0.451250-26	55.000	0.557100-26
60.000	0.667210-26	65.000	0.780060-26
70.000	0.894400-26	75.000	0.100920-25
80.000	0.112380-25	85.000	0.123750-25
90.000	0.134990-25	95.000	0.146050-25
100.00	0.156910-25	150.00	0.252420-25
200.00	0.325370-25	250.00	0.381510-25
300.00	0.425920-25	350.00	0.462100-25
400.00	0.492420-25	450.00	0.518470-25
500.00	0.541370-25	550.00	0.561900-25
600.00	0.580620-25	650.00	0.597950-25
700.00	0.614210-25	750.00	0.629610-25
800.00	0.644360-25	850.00	0.658570-25
900.00	0.672360-25	950.00	0.685810-25
1000.0	0.698980-25	1500.0	0.821010-25
2000.0	0.920090-25	2500.0	0.966400-25
3000.0	0.932120-25	3500.0	0.823840-25
4000.0	0.680210-25	4500.0	0.539570-25
5000.0	0.421220-25	5500.0	0.328680-25
6000.0	0.258550-25	6500.0	0.205810-25
7000.0	0.166000-25	7500.0	0.135650-25
8000.0	0.112250-25	8500.0	0.939600-26
9000.0	0.794860-26	9500.0	0.678910-26
10000.	0.584960-26	15000.	0.185200-26
20000.	0.843110-27	25000.	0.464190-27
30000.	0.287080-27	35000.	0.192000-27
40000.	0.135860-27	45000.	0.100300-27
50000.	0.765490-28	55000.	0.599970-28
60000.	0.480620-28	65000.	0.392100-28
70000.	0.324860-28	75000.	0.272760-28
80000.	0.231660-28	85000.	0.198750-28
90000.	0.172040-28	95000.	0.150110-28

Cross section for $D(d,p)T$

<ov> For D(d,p)T assuming Maxwellian distributions

Temp (keV)	<ov> (cm ³ /sec)	Temp (keV)	<ov> (cm ³ /sec)
1.0000	0.829990-22	1.5000	0.728880-21
2.0000	0.282000-20	2.5000	0.730820-20
3.0000	0.150120-19	3.5000	0.265530-19
4.0000	0.423630-19	4.5000	0.627120-19
5.0000	0.877420-19	5.5000	0.117500-18
6.0000	0.151950-18	6.5000	0.191020-18
7.0000	0.234600-18	7.5000	0.282520-18
8.0000	0.334640-18	8.5000	0.390780-18
9.0000	0.450770-18	9.5000	0.514430-18
10.000	0.581580-18	10.000	0.140980-17
20.000	0.243350-17	25.000	0.356610-17
30.000	0.475700-17	35.000	0.597640-17
40.000	0.720660-17	45.000	0.843670-17
50.000	0.966040-17	55.000	0.108740-16
60.000	0.120750-16	65.000	0.132620-16
70.000	0.144350-16	75.000	0.155950-16
80.000	0.167410-16	85.000	0.178730-16
90.000	0.189930-16	95.000	0.201020-16
100.00	0.211980-16	150.00	0.316530-16
200.00	0.413620-16	250.00	0.503470-16
300.00	0.585000-16	350.00	0.657280-16
400.00	0.719980-16	450.00	0.773280-16
500.00	0.817770-16	550.00	0.854220-16
600.00	0.883500-16	650.00	0.906470-16
700.00	0.923970-16	750.00	0.936750-16
800.00	0.945490-16	850.00	0.950770-16
900.00	0.953130-16	950.00	0.953010-16
1000.0	0.950810-16	1500.0	0.868720-16
2000.0	0.759160-16	2500.0	0.660290-16
3000.0	0.577530-16	3500.0	0.509310-16
4000.0	0.452960-16	4500.0	0.406050-16
5000.0	0.366630-16	5500.0	0.333180-16
6000.0	0.304540-16	6500.0	0.279810-16
7000.0	0.258280-16	7500.0	0.239400-16
8000.0	0.222750-16	8500.0	0.207970-16
9000.0	0.194780-16	9500.0	0.182940-16
10000.	0.172280-16	15000.	0.105240-16
20000.	0.729780-17	25000.	0.545220-17
30000.	0.427860-17	35000.	0.347670-17
40000.	0.289970-17	45000.	0.246770-17
50000.	0.213420-17	55000.	0.187030-17
60000.	0.165710-17	65000.	0.148190-17
70000.	0.133580-17	75000.	0.121240-17
80000.	0.110700-17	85000.	0.101620-17
90000.	0.937280-18	95000.	0.868140-18

Values of $\langle\sigma v\rangle$ assuming Maxwellian distributions for
D-D (proton branch) fusion reactions

$\langle \sigma v \rangle / T^2$ For D(d,p)T assuming Maxwellian distributions

TEMP (keV)	$\langle \sigma v \rangle / T^2$ (cm ³ /sec/(keV) ²)	TEMP (keV)	$\langle \sigma v \rangle / T^2$ (cm ³ /sec/(keV) ²)
1.0000	0.829990-22	1.5000	0.323950-21
2.0000	0.704990-21	2.5000	0.116930-20
3.0000	0.166800-20	3.5000	0.216760-20
4.0000	0.264770-20	4.5000	0.309690-20
5.0000	0.350970-20	5.5000	0.388430-20
6.0000	0.422090-20	6.5000	0.452130-20
7.0000	0.478770-20	7.5000	0.502260-20
8.0000	0.522870-20	8.5000	0.540870-20
9.0000	0.556510-20	9.5000	0.570000-20
10.000	0.581580-20	15.000	0.626570-20
20.000	0.608380-20	25.000	0.570580-20
30.000	0.528560-20	35.000	0.487870-20
40.000	0.450410-20	45.000	0.416630-20
50.000	0.386410-20	55.000	0.359460-20
60.000	0.335400-20	65.000	0.313890-20
70.000	0.294600-20	75.000	0.277240-20
80.000	0.261570-20	85.000	0.247380-20
90.000	0.234490-20	95.000	0.222730-20
100.00	0.211980-20	150.00	0.140680-20
200.00	0.103410-20	250.00	0.805540-21
300.00	0.650000-21	350.00	0.536560-21
400.00	0.449990-21	450.00	0.381870-21
500.00	0.327110-21	550.00	0.282390-21
600.00	0.245420-21	650.00	0.214550-21
700.00	0.188570-21	750.00	0.166530-21
800.00	0.147730-21	850.00	0.131590-21
900.00	0.117670-21	950.00	0.105600-21
1000.0	0.950810-22	1500.0	0.386100-22
2000.0	0.189790-22	2500.0	0.105650-22
3000.0	0.641700-23	3500.0	0.415760-23
4000.0	0.283100-23	4500.0	0.200520-23
5000.0	0.146650-23	5500.0	0.110140-23
6000.0	0.845950-24	6500.0	0.662270-24
7000.0	0.527100-24	7500.0	0.425610-24
8000.0	0.348050-24	8500.0	0.287850-24
9000.0	0.240470-24	9500.0	0.202710-24
10000.	0.172280-24	15000.	0.467740-25
20000.	0.182440-25	25000.	0.872350-26
30000.	0.475390-26	35000.	0.283810-26
40000.	0.181230-26	45000.	0.121860-26
50000.	0.853700-27	55000.	0.618290-27
60000.	0.460310-27	65000.	0.350740-27
70000.	0.272610-27	75000.	0.215530-27
80000.	0.172970-27	85000.	0.140650-27
90000.	0.115710-27	95000.	0.961920-28

Values of $\langle \sigma v \rangle / T^2$ assuming Maxwellian distributions for
D-D (proton branch) reactions

$\langle\sigma v\rangle_b$ For D(d,p)T assuming beam - Maxwellian distributions

Deuterium Temperature = 0

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.68609E-21	15.000	0.81465D-20
20.000	0.34831E-19	25.000	0.92696D-19
30.000	0.18937E-18	35.000	0.32808D-18
40.000	0.50884E-18	45.000	0.72966D-18
50.000	0.98744E-18	55.000	0.12786D-17
60.000	0.15954E-17	65.000	0.19462D-17
70.000	0.23157E-17	75.000	0.27048D-17
80.000	0.31107E-17	85.000	0.35308D-17
90.000	0.39679E-17	95.000	0.44052D-17
100.00	0.48558E-17	110.00	0.57762D-17
120.00	0.67143E-17	130.00	0.76624D-17
140.00	0.86148E-17	150.00	0.95672D-17
160.00	0.10516E-16	170.00	0.11460D-16
180.00	0.12395E-16	190.00	0.13322D-16
200.00	0.14240E-16	250.00	0.18668D-16
300.00	0.22829D-16	350.00	0.26753D-16
400.00	0.30477E-16	450.00	0.34036D-16
500.00	0.37462E-16	550.00	0.40780D-16
600.00	0.44013E-16	650.00	0.47177D-16
700.00	0.50289E-16	750.00	0.53360D-16
800.00	0.56400E-16	850.00	0.59419D-16
900.00	0.62422E-16	950.00	0.65415D-16
1000.0	0.68403E-16	1100.0	0.74378D-16
1200.0	0.80365E-16	1300.0	0.86369D-16
1400.0	0.92386E-16	1500.0	0.98402D-16
1600.0	0.10439E-15	1700.0	0.11033D-15
1800.0	0.11616E-15	1900.0	0.12185D-15
2000.0	0.12734E-15	3000.0	0.15799D-15
4000.0	0.13313E-15	5000.0	0.92172D-16
6000.0	0.61976E-16	7000.0	0.42979D-16
8000.0	0.31070E-16	9000.0	0.23336D-16
10000.0	0.18102E-16		

$\langle\sigma v\rangle_b$ For D(d,p)T assuming beam - Maxwellian distributions

Deuterium Temperature = 10 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.333100-18	15.000	0.501680-18
20.000	0.699280-18	25.000	0.924340-18
30.000	0.117510-17	35.000	0.144980-17
40.000	0.174640-17	45.000	0.206320-17
50.000	0.239830-17	55.000	0.274990-17
60.000	0.311640-17	65.000	0.349620-17
70.000	0.388790-17	75.000	0.429000-17
80.000	0.470130-17	85.000	0.512060-17
90.000	0.554690-17	95.000	0.597920-17
100.00	0.641650-17	110.00	0.730330-17
120.00	0.820160-17	120.00	0.910690-17
140.00	0.100150-16	150.00	0.109240-16
160.00	0.118310-16	170.00	0.127340-16
180.00	0.136310-16	190.00	0.145220-16
200.00	0.154060-16	250.00	0.196970-16
300.00	0.237680-16	350.00	0.276330-16
400.00	0.313200-16	450.00	0.348580-16
500.00	0.382730-16	550.00	0.415890-16
600.00	0.448250-16	650.00	0.479960-16
700.00	0.511180-16	750.00	0.542010-16
800.00	0.572540-16	850.00	0.602850-16
900.00	0.633020-16	950.00	0.663080-16
1000.0	0.693080-16	1100.0	0.753020-16
1200.0	0.812970-16	1200.0	0.872970-16
1400.0	0.932930-16	1500.0	0.992680-16
1600.0	0.105200-15	1700.0	0.111040-15
1800.0	0.116750-15	1900.0	0.122290-15
2000.0	0.127600-15	3000.0	0.156140-15
4000.0	0.132050-15	5000.0	0.922660-16
6000.0	0.623050-16	7000.0	0.432520-16
8000.0	0.312610-16	9000.0	0.234670-16
10000.	0.181940-16		

$\langle\sigma v\rangle_b$ For D(d,p)T assuming beam - Maxwellian distributions

Deuterium Temperature = 30 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.206390-17	15.000	0.240740-17
20.000	0.276080-17	25.000	0.312320-17
30.000	0.349380-17	35.000	0.387180-17
40.000	0.425670-17	45.000	0.464770-17
50.000	0.504410-17	55.000	0.544560-17
60.000	0.585140-17	65.000	0.626110-17
70.000	0.667430-17	75.000	0.709060-17
80.000	0.750940-17	85.000	0.793050-17
90.000	0.835350-17	95.000	0.877820-17
100.00	0.920410-17	110.00	0.100590-16
120.00	0.109150-16	130.00	0.117730-16
140.00	0.126290-16	150.00	0.134840-16
160.00	0.143350-16	170.00	0.151820-16
180.00	0.160250-16	190.00	0.168630-16
200.00	0.176950-16	250.00	0.217650-16
300.00	0.256730-16	350.00	0.294250-16
400.00	0.330370-16	450.00	0.365290-16
500.00	0.399190-16	550.00	0.432240-16
600.00	0.464610-16	650.00	0.496410-16
700.00	0.527760-16	750.00	0.558770-16
800.00	0.589490-16	850.00	0.620000-16
900.00	0.650360-16	950.00	0.680590-16
1000.0	0.710740-16	1100.0	0.770830-16
1200.0	0.830770-16	1300.0	0.890370-16
1400.0	0.949610-16	1500.0	0.100820-15
1600.0	0.106590-15	1700.0	0.112220-15
1800.0	0.117680-15	1900.0	0.122900-15
2000.0	0.127860-15	3000.0	0.152680-15
4000.0	0.129890-15	5000.0	0.922940-16
6000.0	0.628910-16	7000.0	0.437700-16
8000.0	0.316320-16	9000.0	0.237230-16
10000.	0.183720-16		

$\langle\sigma v\rangle_b$ For D(d,p)T assuming beam-Maxwellian distributions

Deuterium Temperature = 50 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.435280-17	15.000	0.475060-17
20.000	0.515120-17	25.000	0.555430-17
30.000	0.595960-17	35.000	0.636700-17
40.000	0.677600-17	45.000	0.718660-17
50.000	0.759860-17	55.000	0.801160-17
60.000	0.842550-17	65.000	0.884020-17
70.000	0.925540-17	75.000	0.967110-17
80.000	0.100870-16	85.000	0.105030-16
90.000	0.109190-16	95.000	0.113350-16
100.00	0.117510-16	110.00	0.125820-16
120.00	0.134110-16	120.00	0.142370-16
140.00	0.150600-16	150.00	0.158790-16
160.00	0.166950-16	170.00	0.175060-16
180.00	0.183130-16	190.00	0.191150-16
200.00	0.199120-16	250.00	0.238210-16
300.00	0.276010-16	350.00	0.312570-16
400.00	0.348010-16	450.00	0.382480-16
500.00	0.416100-16	550.00	0.449020-16
600.00	0.481340-16	650.00	0.513170-16
700.00	0.544600-16	750.00	0.575700-16
800.00	0.606540-16	850.00	0.637160-16
900.00	0.667610-16	950.00	0.697910-16
1000.0	0.728090-16	1100.0	0.788090-16
1200.0	0.847630-16	1300.0	0.906590-16
1400.0	0.964790-16	1500.0	0.102190-15
1600.0	0.107770-15	1700.0	0.113170-15
1800.0	0.118350-15	1900.0	0.123260-15
2000.0	0.127870-15	3000.0	0.149560-15
4000.0	0.127870-15	5000.0	0.921890-16
6000.0	0.634120-16	7000.0	0.442750-16
8000.0	0.320040-16	9000.0	0.239820-16
10000.	0.185530-16

Values of $\langle \sigma v \rangle_b$ (proton branch) for injection of Deuterium into a Deuterium background at various temperatures (keV).

Section 4Deuterium-Deuterium Reactions

(Neutron Branch)

σ for $D(d,n)^3\text{He}$	4.1
$\langle\sigma v\rangle$ for $D(d,n)^3\text{He}$	4.3
$\langle\sigma v\rangle/T^2$ for $D(d,n)^3\text{He}$	4.5
$\langle\sigma v\rangle_b$ for $D(d,n)^3\text{He}$ (Beam Case).	4.7

Cross Section For $D(d,n)^3\text{He}$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.325810-42	1.5000	0.142060-38
2.0000	0.200490-36	2.5000	0.572070-35
3.0000	0.666990-34	3.5000	0.444370-33
4.0000	0.203060-32	4.5000	0.709780-32
5.0000	0.203440-31	5.5000	0.501000-31
6.0000	0.109540-30	6.5000	0.217720-30
7.0000	0.400350-30	7.5000	0.690270-30
8.0000	0.112760-29	8.5000	0.175940-29
9.0000	0.263970-29	9.5000	0.382820-29
10.000	0.539010-29	15.000	0.579090-28
20.000	0.227900-27	25.000	0.565400-27
30.000	0.108690-26	35.000	0.178480-26
40.000	0.263840-26	45.000	0.362230-26
50.000	0.471090-26	55.000	0.588040-26
60.000	0.710980-26	65.000	0.838130-26
70.000	0.968010-26	75.000	0.109940-25
80.000	0.123130-25	85.000	0.136290-25
90.000	0.149360-25	95.000	0.162280-25
100.00	0.175020-25	150.00	0.288640-25
200.00	0.376420-25	250.00	0.443840-25
300.00	0.496600-25	350.00	0.538860-25
400.00	0.573510-25	450.00	0.602520-25
500.00	0.627310-25	550.00	0.648860-25
600.00	0.667910-25	650.00	0.685010-25
700.00	0.700550-25	750.00	0.714860-25
800.00	0.728170-25	850.00	0.740670-25
900.00	0.752520-25	950.00	0.763830-25
1000.0	0.774690-25	1500.0	0.870570-25
2000.0	0.956220-25	2500.0	0.103040-24
3000.0	0.108110-24	3500.0	0.109430-24
4000.0	0.106140-24	4500.0	0.985350-25
5000.0	0.879810-25	5500.0	0.762370-25
6000.0	0.647590-25	6500.0	0.544100-25
7000.0	0.455290-25	7500.0	0.381230-25
8000.0	0.320390-25	8500.0	0.270720-25
9000.0	0.230210-25	9500.0	0.197070-25
10000.	0.169840-25	15000.	0.522610-26
20000.	0.231580-26	25000.	0.125190-26
30000.	0.764420-27	35000.	0.506560-27
40000.	0.355950-27	45000.	0.261370-27
50000.	0.198600-27	55000.	0.155110-27
60000.	0.123890-27	65000.	0.100820-27
70000.	0.833500-28	75000.	0.698510-28
80000.	0.592310-28	85000.	0.507440-28
90000.	0.438700-28	95000.	0.382340-28

Cross Section for $D(d,n)^3\text{He}$

<ov> For $D(d,n)^3\text{He}$ assuming Maxwellian distributions

TEMP (keV)	<ov> (cm ³ /sec)	TEMP (keV)	<ov> (cm ³ /sec)
1.0000	0.692140-22	1.5000	0.646520-21
2.0000	0.260030-20	2.5000	0.692700-20
3.0000	0.145290-19	3.5000	0.261300-19
4.0000	0.422610-19	4.5000	0.632830-19
5.0000	0.894160-19	5.5000	0.120770-18
6.0000	0.157360-18	6.5000	0.199150-18
7.0000	0.246050-18	7.5000	0.297920-18
8.0000	0.354620-18	8.5000	0.415980-18
9.0000	0.481820-18	9.5000	0.551960-18
10.000	0.626220-18	15.000	0.155620-17
20.000	0.272530-17	25.000	0.403120-17
30.000	0.541180-17	35.000	0.682950-17
40.000	0.826140-17	45.000	0.969310-17
50.000	0.111160-16	55.000	0.125240-16
60.000	0.139140-16	65.000	0.152840-16
70.000	0.166340-16	75.000	0.179640-16
80.000	0.192730-16	85.000	0.205610-16
90.000	0.218310-16	95.000	0.230810-16
100.00	0.243140-16	150.00	0.358190-16
200.00	0.462460-16	250.00	0.559300-16
300.00	0.649810-16	350.00	0.734060-16
400.00	0.811750-16	450.00	0.882620-16
500.00	0.946550-16	550.00	0.100360-15
600.00	0.105410-15	650.00	0.109820-15
700.00	0.113640-15	750.00	0.116920-15
800.00	0.119700-15	850.00	0.122020-15
900.00	0.123940-15	950.00	0.125480-15
1000.0	0.126700-15	1500.0	0.127090-15
2000.0	0.118010-15	2500.0	0.107080-15
3000.0	0.966350-16	3500.0	0.872950-16
4000.0	0.791380-16	4500.0	0.720610-16
5000.0	0.659200-16	5500.0	0.605730-16
6000.0	0.558950-16	6500.0	0.517830-16
7000.0	0.481490-16	7500.0	0.449200-16
8000.0	0.420380-16	8500.0	0.394540-16
9000.0	0.371260-16	9500.0	0.350200-16
10000.	0.331090-16	15000.	0.207720-16
20000.	0.146190-16	25000.	0.110280-16
30000.	0.871360-17	35000.	0.711720-17
40000.	0.596000-17	45000.	0.508890-17
50000.	0.441320-17	55000.	0.387640-17
60000.	0.344130-17	65000.	0.308270-17
70000.	0.278300-17	75000.	0.252930-17
80000.	0.231230-17	85000.	0.212490-17
90000.	0.196180-17	95000.	0.181870-17

Values of $\langle\sigma v\rangle$ assuming Maxwellian distributions for D-D
(neutron branch) fusion reactions

$\langle\sigma v\rangle/T^2$ For $D(d,n)^3\text{He}$ assuming Maxwellian distributions

TEMP (keV)	$\langle\sigma v\rangle/T^2$ (cm ³ /sec/(keV) ²)	TEMP (keV)	$\langle\sigma v\rangle/T^2$ (cm ³ /sec/(keV) ²)
1.0000	0.692140-22	1.5000	0.287340-21
2.0000	0.650080-21	2.5000	0.110830-20
3.0000	0.161440-20	3.5000	0.213310-20
4.0000	0.264130-20	4.5000	0.312510-20
5.0000	0.357670-20	5.5000	0.399240-20
6.0000	0.437120-20	6.5000	0.471370-20
7.0000	0.502140-20	7.5000	0.529640-20
8.0000	0.554100-20	8.5000	0.575750-20
9.0000	0.594840-20	9.5000	0.611600-20
10.000	0.626220-20	15.000	0.691640-20
20.000	0.681320-20	25.000	0.644990-20
30.000	0.601310-20	35.000	0.557510-20
40.000	0.516340-20	45.000	0.478670-20
50.000	0.444630-20	55.000	0.414010-20
60.000	0.386500-20	65.000	0.361760-20
70.000	0.339480-20	75.000	0.319360-20
80.000	0.301140-20	85.000	0.284590-20
90.000	0.269510-20	95.000	0.255750-20
100.00	0.243140-20	150.00	0.159200-20
200.00	0.115620-20	250.00	0.894880-21
300.00	0.722010-21	350.00	0.599230-21
400.00	0.507340-21	450.00	0.435860-21
500.00	0.378620-21	550.00	0.331780-21
600.00	0.292790-21	650.00	0.259920-21
700.00	0.231920-21	750.00	0.207860-21
800.00	0.187030-21	850.00	0.168890-21
900.00	0.153010-21	950.00	0.139040-21
1000.0	0.126700-21	1500.0	0.564840-22
2000.0	0.295040-22	2500.0	0.171340-22
3000.0	0.107370-22	3500.0	0.712610-23
4000.0	0.494610-23	4500.0	0.355860-23
5000.0	0.263680-23	5500.0	0.200240-23
6000.0	0.155260-23	6500.0	0.122560-23
7000.0	0.982630-24	7500.0	0.798580-24
8000.0	0.656850-24	8500.0	0.546070-24
9000.0	0.458340-24	9500.0	0.388030-24
10000.	0.331090-24	15000.	0.923190-25
20000.	0.365480-25	25000.	0.176450-25
30000.	0.968180-26	35000.	0.581000-26
40000.	0.372500-26	45000.	0.251300-26
50000.	0.176530-26	55000.	0.128150-26
60000.	0.955920-27	65000.	0.729640-27
70000.	0.567950-27	75000.	0.449650-27
80000.	0.361300-27	85000.	0.294110-27
90000.	0.242200-27	95000.	0.201520-27

Values of $\langle \sigma v \rangle / T^2$ assuming Maxwellian distributions for
D-D (neutron branch) reactions

$\langle \sigma v \rangle_b$ For $D(d,n)^3\text{He}$ assuming beam-Maxwellian distributions

Deuterium Temperature = 0

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.577450-21	15.000	0.694070-20
20.000	0.315400-19	25.000	0.974860-19
30.000	0.184240-18	35.000	0.326760-18
40.000	0.516390-18	45.000	0.751980-18
50.000	0.103090-17	55.000	0.134960-17
60.000	0.170430-17	65.000	0.209110-17
70.000	0.250630-17	75.000	0.294640-17
80.000	0.340810-17	85.000	0.388850-17
90.000	0.438480-17	95.000	0.489480-17
100.00	0.541630-17	110.00	0.648650-17
120.00	0.758270-17	130.00	0.869510-17
140.00	0.981610-17	150.00	0.109400-16
160.00	0.120620-16	170.00	0.131780-16
180.00	0.142870-16	190.00	0.153860-16
200.00	0.164740-16	250.00	0.217170-16
300.00	0.266180-16	350.00	0.311980-16
400.00	0.354560-16	450.00	0.395540-16
500.00	0.434080-16	550.00	0.470910-16
600.00	0.506300-16	650.00	0.540460-16
700.00	0.573590-16	750.00	0.605840-16
800.00	0.637360-16	850.00	0.668260-16
900.00	0.693630-16	950.00	0.728560-16
1000.0	0.758120-16	1100.0	0.816370-16
1200.0	0.873780-16	1300.0	0.930630-16
1400.0	0.987130-16	1500.0	0.104340-15
1600.0	0.109960-15	1700.0	0.115570-15
1800.0	0.121170-15	1900.0	0.126770-15
2000.0	0.132340-15	3000.0	0.183250-15
4000.0	0.207740-15	5000.0	0.192520-15
6000.0	0.155230-15	7000.0	0.117880-15
9000.0	0.886820-16	9000.0	0.675850-16
10000.0	0.525600-16		

$\langle \sigma v \rangle_b$ For $D(d,n)^3\text{He}$ assuming beam-Maxwellian distributions

Deuterium Temperature = 10 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle$ (cm ³ /sec)
10.000	0.35092E-18	15.000	0.53352E-18
20.000	0.74945E-18	25.000	0.99724E-18
30.000	0.12752E-17	35.000	0.15814E-17
40.000	0.15139E-17	45.000	0.22708E-17
50.000	0.26499E-17	55.000	0.30493E-17
60.000	0.34672E-17	65.000	0.39017E-17
70.000	0.43512E-17	75.000	0.48140E-17
80.000	0.52887E-17	85.000	0.57738E-17
90.000	0.62680E-17	95.000	0.67702E-17
100.00	0.72793E-17	110.00	0.83140E-17
120.00	0.93652E-17	120.00	0.10427E-16
140.00	0.11495E-16	150.00	0.12564E-16
160.00	0.13632E-16	170.00	0.14696E-16
180.00	0.15755E-16	180.00	0.16806E-16
200.00	0.17848E-16	250.00	0.22900E-16
300.00	0.27665E-16	350.00	0.32148E-16
400.00	0.36379E-16	450.00	0.40390E-16
500.00	0.44212E-16	550.00	0.47872E-16
600.00	0.51396E-16	650.00	0.54804E-16
700.00	0.58112E-16	750.00	0.61337E-16
800.00	0.64491E-16	850.00	0.67585E-16
900.00	0.70627E-16	950.00	0.73627E-16
1000.0	0.76591E-16	1100.0	0.82432E-16
1200.0	0.88188E-16	1300.0	0.93888E-16
1400.0	0.99551E-16	1500.0	0.10519E-15
1600.0	0.11081E-15	1700.0	0.11642E-15
1800.0	0.12201E-15	1900.0	0.12759E-15
2000.0	0.13313E-15	3000.0	0.18309E-15
4000.0	0.20615E-15	5000.0	0.19103E-15
6000.0	0.15474E-15	7000.0	0.11801E-15
8000.0	0.88980E-16	9000.0	0.67876E-16
10000.	0.52758E-16		

$\langle \sigma v \rangle_D$ For $D(d,n)^3\text{He}$ assuming beam-Maxwellian distributions

Deuterium Temperature = 30 keV

ENERGY (keV)	$\langle \sigma v \rangle_D$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_D$ (cm ³ /sec)
10.000	0.230020-17	15.000	0.269260-17
20.000	0.309730-17	25.000	0.351320-17
30.000	0.393940-17	35.000	0.437500-17
40.000	0.481920-17	45.000	0.527120-17
50.000	0.573020-17	55.000	0.619550-17
60.000	0.666660-17	65.000	0.714270-17
70.000	0.762330-17	75.000	0.810800-17
80.000	0.859600-17	85.000	0.908710-17
90.000	0.958080-17	95.000	0.100770-16
100.00	0.105740-16	110.00	0.115740-16
120.00	0.125760-16	130.00	0.135800-16
140.00	0.145830-16	150.00	0.155830-16
160.00	0.165800-16	170.00	0.175720-16
180.00	0.185500-16	190.00	0.195380-16
200.00	0.205110-16	250.00	0.252520-16
300.00	0.297730-16	350.00	0.340740-16
400.00	0.381760-16	450.00	0.420830-16
500.00	0.458350-16	550.00	0.494470-16
600.00	0.529370-16	650.00	0.563230-16
700.00	0.596200-16	750.00	0.628400-16
800.00	0.659940-16	850.00	0.690910-16
900.00	0.721410-16	950.00	0.751500-16
1000.0	0.781250-16	1100.0	0.839900-16
1200.0	0.897710-16	1300.0	0.954920-16
1400.0	0.101170-15	1500.0	0.106810-15
1600.0	0.112430-15	1700.0	0.118020-15
1800.0	0.123580-15	1900.0	0.129100-15
2000.0	0.134570-15	3000.0	0.182560-15
4000.0	0.203050-15	5000.0	0.188120-15
6000.0	0.153650-15	7000.0	0.118130-15
8000.0	0.894980-16	9000.0	0.684150-16
10000.	0.532490-16		

$\langle \sigma v \rangle_b$ For $D(d,n)^3\text{He}$ assuming beam-Maxwellian distributions

Deuterium Temperature = 50 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.49420E-17	15.000	0.54032E-17
20.000	0.58681E-17	25.000	0.63362E-17
30.000	0.68073E-17	35.000	0.72810E-17
40.000	0.77565E-17	45.000	0.82348E-17
50.000	0.87145E-17	55.000	0.91956E-17
60.000	0.96780E-17	65.000	0.10161E-16
70.000	0.10645E-16	75.000	0.11130E-16
80.000	0.11615E-16	85.000	0.12101E-16
90.000	0.12586E-16	95.000	0.13071E-16
100.00	0.13556E-16	110.00	0.14525E-16
120.00	0.15491E-16	120.00	0.16454E-16
140.00	0.17413E-16	150.00	0.18367E-16
160.00	0.19316E-16	170.00	0.20258E-16
180.00	0.21195E-16	190.00	0.22125E-16
200.00	0.23049E-16	250.00	0.27559E-16
300.00	0.31883E-16	350.00	0.36027E-16
400.00	0.40000E-16	450.00	0.43820E-16
500.00	0.47502E-16	550.00	0.51063E-16
600.00	0.54518E-16	650.00	0.57879E-16
700.00	0.61160E-16	750.00	0.64371E-16
800.00	0.67522E-16	850.00	0.70621E-16
900.00	0.73675E-16	950.00	0.76690E-16
1000.0	0.79671E-16	1100.0	0.85553E-16
1200.0	0.91350E-16	1300.0	0.97081E-16
1400.0	0.10276E-15	1500.0	0.10840E-15
1600.0	0.11400E-15	1700.0	0.11955E-15
1800.0	0.12506E-15	1900.0	0.13052E-15
2000.0	0.13590E-15	3000.0	0.18191E-15
4000.0	0.20017E-15	5000.0	0.18541E-15
6000.0	0.15252E-15	7000.0	0.11815E-15
8000.0	0.89963E-16	9000.0	0.68933E-16
10000.	0.53694E-16

Values of $\langle \sigma v \rangle_b$ (neutron branch) for injection of deuterium into a deuterium background at various temperatures (keV)

Section 5Tritium-Tritium Reactions

σ for $T(t,2n)^4\text{He}$	5.1
$\langle\sigma v\rangle$ for $T(t,2n)^4\text{He}$	5.3
$\langle\sigma v\rangle/T^2$ for $T(t,2n)^4\text{He}$	5.5
$\langle\sigma v\rangle_b$ for $T(t,2n)^4\text{He}$ (Beam Case)	5.7

Cross Section For $T(t,2n)^4\text{He}$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.177510-38	1.5000	0.135760-35
2.0000	0.678920-34	2.5000	0.954360-33
3.0000	0.659860-32	3.5000	0.292900-31
4.0000	0.964900-31	4.5000	0.257200-30
5.0000	0.586150-30	5.5000	0.118520-29
6.0000	0.218180-29	6.5000	0.372620-29
7.0000	0.598590-29	7.5000	0.914150-29
8.0000	0.133810-28	8.5000	0.188940-28
9.0000	0.258700-28	9.5000	0.344920-28
10.000	0.449340-28	15.000	0.279080-27
20.000	0.793090-27	25.000	0.157710-26
30.000	0.257720-26	35.000	0.373260-26
40.000	0.499020-26	45.000	0.630800-26
50.000	0.765450-26	55.000	0.900650-26
60.000	0.103480-25	65.000	0.116660-25
70.000	0.129550-25	75.000	0.142090-25
80.000	0.154250-25	85.000	0.166020-25
90.000	0.177380-25	95.000	0.188340-25
100.00	0.198920-25	150.00	0.285970-25
200.00	0.348660-25	250.00	0.396980-25
300.00	0.436750-25	350.00	0.471330-25
400.00	0.502780-25	450.00	0.532410-25
500.00	0.561120-25	550.00	0.589520-25
600.00	0.618080-25	650.00	0.647140-25
700.00	0.676970-25	750.00	0.707810-25
800.00	0.739830-25	850.00	0.773190-25
900.00	0.808010-25	950.00	0.844410-25
1000.0	0.882440-25	1500.0	0.134180-24
2000.0	0.164360-24	2500.0	0.128050-24
3000.0	0.757600-25	3500.0	0.439220-25
4000.0	0.270450-25	4500.0	0.177800-25
5000.0	0.123530-25	5500.0	0.897100-26
6000.0	0.675100-26	6500.0	0.522900-26
7000.0	0.414750-26	7500.0	0.335540-26
8000.0	0.276040-26	8500.0	0.230370-26
9000.0	0.194650-26	9500.0	0.166260-26
10000.	0.143360-26	15000.	0.462260-27
20000.	0.213600-27	25000.	0.118770-27
30000.	0.739520-28	35000.	0.497030-28
40000.	0.352980-28	45000.	0.261330-28
50000.	0.199890-28	55000.	0.156950-28
60000.	0.125910-28	65000.	0.102850-28
70000.	0.852980-29	75000.	0.716790-29
80000.	0.609250-29	85000.	0.523040-29
90000.	0.453020-29	95000.	0.395470-29

Cross Section for $T(t, 2n)^4\text{He}$

$\langle \sigma v \rangle$ For $T(t, 2n)^4\text{He}$ assuming Maxwellian distributions

TEMP (keV)	$\langle \sigma v \rangle$ (cm ³ /sec)	TEMP (keV)	$\langle \sigma v \rangle$ (cm ³ /sec)
1.0000	0.328340-21	1.5000	0.218350-20
2.0000	0.709080-20	2.5000	0.162290-19
3.0000	0.303270-19	3.5000	0.497520-19
4.0000	0.746100-19	4.5000	0.104840-18
5.0000	0.140260-18	5.5000	0.180650-18
6.0000	0.225730-18	6.5000	0.275220-18
7.0000	0.328830-18	7.5000	0.386290-18
8.0000	0.447320-18	8.5000	0.511660-18
9.0000	0.579060-18	9.5000	0.649310-18
10.000	0.722190-18	15.000	0.155840-17
20.000	0.251060-17	25.000	0.351410-17
30.000	0.453860-17	35.000	0.556970-17
40.000	0.660070-17	45.000	0.762920-17
50.000	0.865480-17	55.000	0.967840-17
60.000	0.107020-16	65.000	0.117260-16
70.000	0.127540-16	75.000	0.137870-16
80.000	0.148260-16	85.000	0.158740-16
90.000	0.169320-16	95.000	0.180010-16
100.00	0.190820-16	150.00	0.305190-16
200.00	0.424380-16	250.00	0.535780-16
300.00	0.631060-16	350.00	0.707480-16
400.00	0.765710-16	450.00	0.807980-16
500.00	0.836940-16	550.00	0.855100-16
600.00	0.864710-16	650.00	0.867610-16
700.00	0.865320-16	750.00	0.859040-16
800.00	0.849750-16	850.00	0.838200-16
900.00	0.824990-16	950.00	0.810590-16
1000.0	0.795380-16	1500.0	0.638930-16
2000.0	0.513430-16	2500.0	0.420940-16
3000.0	0.352270-16	3500.0	0.300140-16
4000.0	0.259620-16	4500.0	0.227450-16
5000.0	0.201430-16	5500.0	0.180040-16
6000.0	0.162200-16	6500.0	0.147150-16
7000.0	0.134310-16	7500.0	0.123250-16
8000.0	0.113640-16	8500.0	0.105230-16
9000.0	0.978210-17	9500.0	0.912480-17
10000.	0.853870-17	15000.	0.499130-17
20000.	0.337340-17	25000.	0.247730-17
30000.	0.191980-17	35000.	0.154500-17
40000.	0.127870-17	45000.	0.108130-17
50000.	0.930250-18	55000.	0.811490-18
60000.	0.716140-18	65000.	0.638200-18
70000.	0.573490-18	75000.	0.519060-18
80000.	0.472750-18	85000.	0.432960-18
90000.	0.398510-18	95000.	0.368520-18

Values of $\langle \sigma v \rangle$ assuming Maxwellian distributions for T-T fusion reactions.

$\langle\sigma v\rangle/T^2$ For $T(t,2n)^4\text{He}$ assuming Maxwellian distributions

TEMP (keV)	$(\text{cm}^3/\text{sec}/(\text{keV})^2)$	TEMP (keV)	$(\text{cm}^3/\text{sec}/(\text{keV})^2)$
1.0000	0.32834D-21	1.5000	0.97046D-21
2.0000	0.17727D-20	2.5000	0.25966D-20
3.0000	0.33697D-20	3.5000	0.40614D-20
4.0000	0.46631D-20	4.5000	0.51771D-20
5.0000	0.56104D-20	5.5000	0.59718D-20
6.0000	0.62703D-20	6.5000	0.65141D-20
7.0000	0.67109D-20	7.5000	0.68674D-20
8.0000	0.69893D-20	8.5000	0.70817D-20
9.0000	0.71489D-20	9.5000	0.71946D-20
10.000	0.72219D-20	15.000	0.69263D-20
20.000	0.62764D-20	25.000	0.56225D-20
30.000	0.50429D-20	35.000	0.45467D-20
40.000	0.41255D-20	45.000	0.37675D-20
50.000	0.34619D-20	55.000	0.31995D-20
60.000	0.29727D-20	65.000	0.27754D-20
70.000	0.26028D-20	75.000	0.24510D-20
80.000	0.23166D-20	85.000	0.21972D-20
90.000	0.20904D-20	95.000	0.19946D-20
100.00	0.19082D-20	150.00	0.13564D-20
200.00	0.10609D-20	250.00	0.85725D-21
300.00	0.70118D-21	350.00	0.57753D-21
400.00	0.47857D-21	450.00	0.39900D-21
500.00	0.33477D-21	550.00	0.28268D-21
600.00	0.24020D-21	650.00	0.20535D-21
700.00	0.17660D-21	750.00	0.15272D-21
800.00	0.13277D-21	850.00	0.11601D-21
900.00	0.10185D-21	950.00	0.89817D-22
1000.0	0.79538D-22	1500.0	0.28397D-22
2000.0	0.12836D-22	2500.0	0.67350D-23
3000.0	0.39142D-23	3500.0	0.24501D-23
4000.0	0.16226D-23	4500.0	0.11232D-23
5000.0	0.80571D-24	5500.0	0.59517D-24
6000.0	0.45057D-24	6500.0	0.34829D-24
7000.0	0.27411D-24	7500.0	0.21911D-24
8000.0	0.17757D-24	8500.0	0.14565D-24
9000.0	0.12077D-24	9500.0	0.10111D-24
10000.	0.85387D-25	15000.	0.22183D-25
20000.	0.84335D-26	25000.	0.39637D-26
30000.	0.21331D-26	35000.	0.12613D-26
40000.	0.79919D-27	45000.	0.53399D-27
50000.	0.37210D-27	55000.	0.26826D-27
60000.	0.19893D-27	65000.	0.15105D-27
70000.	0.11704D-27	75000.	0.92278D-28
80000.	0.73867D-28	85000.	0.59925D-28
90000.	0.49199D-28	95000.	0.40833D-28

Values of $\langle \sigma v \rangle / T^2$ assuming Maxwellian
distributions for T-T reactions

$\langle \sigma v \rangle_b$ For $T(t, 2n)^4\text{He}$ assuming beam-Maxwellian distributions

Tritium Temperature = 0

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.25934E-20	15.000	0.27334E-19
20.000	0.85656E-19	25.000	0.19942E-18
30.000	0.35697E-18	35.000	0.55843E-18
40.000	0.79814E-18	45.000	0.10701E-17
50.000	0.13688E-17	55.000	0.16892E-17
60.000	0.20270E-17	65.000	0.23786E-17
70.000	0.27411E-17	75.000	0.31120E-17
80.000	0.34891E-17	85.000	0.38707E-17
90.000	0.42556E-17	95.000	0.46424E-17
100.00	0.50304E-17	110.00	0.58067E-17
120.00	0.65800E-17	120.00	0.73473E-17
140.00	0.81067E-17	150.00	0.88573E-17
160.00	0.95986E-17	170.00	0.10330E-16
180.00	0.11052E-16	190.00	0.11765E-16
200.00	0.12465E-16	250.00	0.15874E-16
300.00	0.19130E-16	350.00	0.22299E-16
400.00	0.25430E-16	450.00	0.28562E-16
500.00	0.31730E-16	550.00	0.34963E-16
600.00	0.38287E-16	650.00	0.41724E-16
700.00	0.45295E-16	750.00	0.49021E-16
800.00	0.52919E-16	850.00	0.57007E-16
900.00	0.61302E-16	950.00	0.65818E-16
1000.0	0.70570E-16	1100.0	0.80822E-16
1200.0	0.92112E-16	1300.0	0.10442E-15
1400.0	0.11762E-15	1500.0	0.13142E-15
1600.0	0.14533E-15	1700.0	0.15864E-15
1800.0	0.17046E-15	1900.0	0.17984E-15
2000.0	0.18589E-15	3000.0	0.10494E-15
4000.0	0.42256E-16	5000.0	0.22089E-16
6000.0	0.13274E-16	7000.0	0.87753E-17
8000.0	0.67439E-17	9000.0	0.46700E-17
10000.	0.36255E-17		

$\langle \sigma v \rangle_b$ For $T(t, 2n)^4\text{He}$ assuming beam-Maxwellian distributions

Tritium Temperature = 10 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.456100-18	15.000	0.657010-18
20.000	0.882010-18	25.000	0.113110-17
30.000	0.130890-17	35.000	0.168400-17
40.000	0.198410-17	45.000	0.229710-17
50.000	0.262130-17	55.000	0.295480-17
60.000	0.329630-17	65.000	0.364440-17
70.000	0.399900-17	75.000	0.435590-17
80.000	0.471730-17	85.000	0.508140-17
90.000	0.544750-17	95.000	0.581510-17
100.00	0.618350-17	110.00	0.692130-17
120.00	0.765800-17	130.00	0.839170-17
140.00	0.912100-17	150.00	0.984480-17
160.00	0.105620-16	170.00	0.112740-16
180.00	0.119750-16	190.00	0.126770-16
200.00	0.133650-16	250.00	0.167440-16
300.00	0.200100-16	350.00	0.232140-16
400.00	0.263550-16	450.00	0.296010-16
500.00	0.328520-16	550.00	0.361810-16
600.00	0.396110-16	650.00	0.431650-16
700.00	0.468640-16	750.00	0.507270-16
800.00	0.547710-16	850.00	0.590120-16
900.00	0.634640-16	950.00	0.681380-16
1000.0	0.730450-16	1100.0	0.835740-16
1200.0	0.950410-16	1300.0	0.107330-15
1400.0	0.120210-15	1500.0	0.133280-15
1600.0	0.145970-15	1700.0	0.157620-15
1800.0	0.167480-15	1900.0	0.174880-15
2000.0	0.179320-15	3000.0	0.105830-15
4000.0	0.442170-16	5000.0	0.224540-16
6000.0	0.133840-16	7000.0	0.885630-17
8000.0	0.628990-17	9000.0	0.469850-17
10000.	0.364460-17		

$\langle\sigma v\rangle_b$ For $T(t,2n)^4\text{He}$ assuming beam-Maxwellian distributions

Tritium Temperature = 30 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.21786E-17	15.000	0.24977E-17
20.000	0.28219E-17	25.000	0.31506E-17
30.000	0.34832E-17	35.000	0.38194E-17
40.000	0.41585E-17	45.000	0.45002E-17
50.000	0.48446E-17	55.000	0.51897E-17
60.000	0.55365E-17	65.000	0.58853E-17
70.000	0.62347E-17	75.000	0.65848E-17
80.000	0.69355E-17	85.000	0.72864E-17
90.000	0.76374E-17	95.000	0.79888E-17
100.00	0.83398E-17	110.00	0.90412E-17
120.00	0.97409E-17	120.00	0.10438E-16
140.00	0.11132E-16	150.00	0.11825E-16
160.00	0.12514E-16	170.00	0.13199E-16
180.00	0.13882E-16	190.00	0.14561E-16
200.00	0.15237E-16	250.00	0.18578E-16
300.00	0.21874E-16	350.00	0.25157E-16
400.00	0.28459E-16	450.00	0.31810E-16
500.00	0.35237E-16	550.00	0.38766E-16
600.00	0.42117E-16	650.00	0.46211E-16
700.00	0.50165E-16	750.00	0.54294E-16
800.00	0.58610E-16	850.00	0.63121E-16
900.00	0.67824E-16	950.00	0.72749E-16
1000.0	0.77863E-16	1100.0	0.88643E-16
1200.0	0.10003E-15	1300.0	0.11177E-15
1400.0	0.12351E-15	1500.0	0.13481E-15
1600.0	0.14518E-15	1700.0	0.15614E-15
1800.0	0.16126E-15	1900.0	0.16621E-15
2000.0	0.16880E-15	3000.0	0.10621E-15
4000.0	0.46116E-16	5000.0	0.23213E-16
6000.0	0.13712E-16	7000.0	0.90205E-17
8000.0	0.63822E-17	9000.0	0.47550E-17
10000.	0.36812E-17		

$\langle \sigma v \rangle_b$ For $T(t, 2n)^4\text{He}$ assuming beam-Maxwellian distributions

Tritium Temperature = 50 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.419560-17	15.000	0.453750-17
20.000	0.488030-17	25.000	0.522370-17
30.000	0.556770-17	35.000	0.591220-17
40.000	0.625700-17	45.000	0.660200-17
50.000	0.694710-17	55.000	0.729240-17
60.000	0.763760-17	65.000	0.798270-17
70.000	0.832790-17	75.000	0.867260-17
80.000	0.901730-17	85.000	0.936170-17
90.000	0.970580-17	95.000	0.100500-16
100.00	0.103930-16	110.00	0.110790-16
120.00	0.117620-16	120.00	0.124450-16
140.00	0.131200-16	150.00	0.138060-16
160.00	0.144830-16	170.00	0.151590-16
180.00	0.158340-16	190.00	0.165080-16
200.00	0.171800-16	250.00	0.205320-16
300.00	0.238860-16	350.00	0.272670-16
400.00	0.307010-16	450.00	0.342130-16
500.00	0.378260-16	550.00	0.415550-16
600.00	0.454290-16	650.00	0.494500-16
700.00	0.526230-16	750.00	0.575850-16
800.00	0.625100-16	850.00	0.672060-16
900.00	0.720680-16	950.00	0.770850-16
1000.0	0.822410-16	1100.0	0.928820-16
1200.0	0.103760-15	1300.0	0.114590-15
1400.0	0.125000-15	1500.0	0.134640-15
1600.0	0.143150-15	1700.0	0.150190-15
1800.0	0.155530-15	1900.0	0.159010-15
2000.0	0.160560-15	3000.0	0.105510-15
4000.0	0.479060-16	5000.0	0.240210-16
6000.0	0.140620-16	7000.0	0.919390-17
8000.0	0.647860-17	9000.0	0.481360-17
10000.0	0.371940-17

Values of $\langle \sigma v \rangle_b$ for injection of tritium into a tritium background at various temperature (keV)

Section 6Tritium-Helium-3 Reactions

σ for $T(^3\text{He},X)Y$	6.1
$\langle\sigma v\rangle$ for $T(^3\text{He},X)Y$	6.3
$\langle\sigma v\rangle/T^2$ for $T(^3\text{He},X)Y$	6.5
$\langle\sigma v\rangle_b$ for $T(^3\text{He},X)Y$ (Beam Case).	6.7
σ for $^3\text{He}(t,X)Y$	6.12
$\langle\sigma v\rangle_b$ for $^3\text{He}(t,X)Y$ (Beam Case).	6.14

Cross Section For $T(^3\text{He},X)Y$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.385710-73	1.5000	0.166400-63
2.0000	0.880510-58	2.5000	0.690310-54
3.0000	0.508230-51	3.5000	0.848980-49
4.0000	0.520770-47	4.5000	0.156440-45
5.0000	0.276670-44	5.5000	0.326050-43
6.0000	0.279290-42	6.5000	0.185170-41
7.0000	0.995920-41	7.5000	0.450270-40
8.0000	0.175940-39	8.5000	0.607330-39
9.0000	0.188490-38	9.5000	0.533490-38
10.000	0.139340-37	15.000	0.117620-34
20.000	0.623750-33	25.000	0.912500-32
30.000	0.649710-31	35.000	0.295030-30
40.000	0.989810-30	45.000	0.267830-29
50.000	0.618170-29	55.000	0.126350-28
60.000	0.234810-28	65.000	0.404330-28
70.000	0.654300-28	75.000	0.100580-27
80.000	0.148080-27	85.000	0.210210-27
90.000	0.289210-27	95.000	0.387300-27
100.00	0.506600-27	150.00	0.323360-26
200.00	0.932510-26	250.00	0.187060-25
300.00	0.307320-25	350.00	0.446550-25
400.00	0.598100-25	450.00	0.756650-25
500.00	0.918180-25	550.00	0.107980-24
600.00	0.123930-24	650.00	0.139530-24
700.00	0.154680-24	750.00	0.169320-24
800.00	0.183410-24	850.00	0.196930-24
900.00	0.209880-24	950.00	0.222270-24
1000.0	0.234090-24	1500.0	0.325890-24
2000.0	0.383020-24	2500.0	0.419390-24
3000.0	0.442990-24	3500.0	0.458420-24
4000.0	0.468430-24	4500.0	0.474720-24
5000.0	0.478410-24	5500.0	0.480240-24
6000.0	0.480720-24	6500.0	0.480210-24
7000.0	0.478970-24	7500.0	0.477190-24
8000.0	0.475000-24	8500.0	0.472510-24
9000.0	0.469790-24	9500.0	0.466920-24
10000.	0.463940-24	15000.	0.432930-24
20000.	0.405230-24	25000.	0.381870-24
30000.	0.362130-24	35000.	0.345250-24
40000.	0.330630-24	45000.	0.317810-24
50000.	0.306450-24	55000.	0.296300-24
60000.	0.287140-24	65000.	0.278830-24
70000.	0.271250-24	75000.	0.264290-24
80000.	0.257860-24	85000.	0.251910-24
90000.	0.246370-24	95000.	0.241210-24

Cross Section for $T(^3\text{He}, X)Y$

<σv> For T(³He,X)Y assuming Maxwellian distributions

TEMP (keV)	<σv> (cm ³ /sec)	TEMP (keV)	<σv> (cm ³ /sec)
1.0000	0.124990-27	1.5000	0.104280-25
2.0000	0.167200-24	2.5000	0.119200-23
3.0000	0.530070-23	3.5000	0.173730-22
4.0000	0.461080-22	4.5000	0.104950-21
5.0000	0.212680-21	5.5000	0.393740-21
6.0000	0.678180-21	6.5000	0.110150-20
7.0000	0.170420-20	7.5000	0.253130-20
8.0000	0.363200-20	8.5000	0.505870-20
9.0000	0.686690-20	9.5000	0.911400-20
10.000	0.118600-19	15.000	0.801930-19
20.000	0.262910-18	25.000	0.605360-18
30.000	0.113580-17	35.000	0.186850-17
40.000	0.280720-17	45.000	0.394940-17
50.000	0.528790-17	55.000	0.681330-17
60.000	0.851440-17	65.000	0.103800-16
70.000	0.123980-16	75.000	0.145570-16
80.000	0.168470-16	85.000	0.192560-16
90.000	0.217760-16	95.000	0.243950-16
100.00	0.271070-16	150.00	0.577800-16
200.00	0.917150-16	250.00	0.126340-15
300.00	0.160480-15	350.00	0.193580-15
400.00	0.225420-15	450.00	0.255910-15
500.00	0.285060-15	550.00	0.312900-15
600.00	0.339500-15	650.00	0.364930-15
700.00	0.389260-15	750.00	0.412550-15
800.00	0.434880-15	850.00	0.456310-15
900.00	0.476890-15	950.00	0.496690-15
1000.0	0.515740-15	1500.0	0.674040-15
2000.0	0.791870-15	2500.0	0.884500-15
3000.0	0.960100-15	3500.0	0.102350-14
4000.0	0.107780-14	4500.0	0.112510-14
5000.0	0.116670-14	5500.0	0.120390-14
6000.0	0.123730-14	6500.0	0.126750-14
7000.0	0.129520-14	7500.0	0.132050-14
8000.0	0.134390-14	8500.0	0.136550-14
9000.0	0.138570-14	9500.0	0.140450-14
10000.	0.142210-14	15000.	0.155340-14
20000.	0.163760-14	25000.	0.169780-14
30000.	0.174370-14	35000.	0.178030-14
40000.	0.181040-14	45000.	0.183570-14
50000.	0.185740-14	55000.	0.187630-14
60000.	0.189300-14	65000.	0.190780-14
70000.	0.192110-14	75000.	0.193310-14
80000.	0.194410-14	85000.	0.195410-14
90000.	0.196330-14	95000.	0.197180-14

Values of $\langle \sigma v \rangle$ assuming Maxwellian distributions
for T-³He fusion reactions

$\langle \sigma v \rangle / T^2$ For $T(^3\text{He}, X)Y$ assuming Maxwellian distributions

TEMP (keV)	$(\text{cm}^3/\text{sec}/(\text{keV})^2)$	TEMP (keV)	$(\text{cm}^3/\text{sec}/(\text{keV})^2)$
1.0000	0.12499D-27	1.5000	0.46348D-26
2.0000	0.41800D-25	2.5000	0.19073D-24
3.0000	0.58891D-24	3.5000	0.14182D-23
4.0000	0.28818D-23	4.5000	0.51826D-23
5.0000	0.85073D-23	5.5000	0.13016D-22
6.0000	0.18838D-22	6.5000	0.26071D-22
7.0000	0.34779D-22	7.5000	0.45001D-22
8.0000	0.56750D-22	8.5000	0.70017D-22
9.0000	0.84776D-22	9.5000	0.10099D-21
10.000	0.11860D-21	15.000	0.35641D-21
20.000	0.65727D-21	25.000	0.96857D-21
30.000	0.12620D-20	35.000	0.15253D-20
40.000	0.17545D-20	45.000	0.19503D-20
50.000	0.21152D-20	55.000	0.22523D-20
60.000	0.23651D-20	65.000	0.24568D-20
70.000	0.25302D-20	75.000	0.25880D-20
80.000	0.26324D-20	85.000	0.26652D-20
90.000	0.26884D-20	95.000	0.27031D-20
100.00	0.27107D-20	150.00	0.25680D-20
200.00	0.22929D-20	250.00	0.20215D-20
300.00	0.17831D-20	350.00	0.15803D-20
400.00	0.14089D-20	450.00	0.12638D-20
500.00	0.11402D-20	550.00	0.10344D-20
600.00	0.94306D-21	650.00	0.86374D-21
700.00	0.79440D-21	750.00	0.73343D-21
800.00	0.67951D-21	850.00	0.63157D-21
900.00	0.58876D-21	950.00	0.55035D-21
1000.0	0.51574D-21	1500.0	0.29957D-21
2000.0	0.19797D-21	2500.0	0.14152D-21
3000.0	0.10668D-21	3500.0	0.83552D-22
4000.0	0.67363D-22	4500.0	0.55558D-22
5000.0	0.46669D-22	5500.0	0.39797D-22
6000.0	0.34368D-22	6500.0	0.30001D-22
7000.0	0.26432D-22	7500.0	0.23476D-22
8000.0	0.20998D-22	8500.0	0.18900D-22
9000.0	0.17107D-22	9500.0	0.15562D-22
10000.	0.14221D-22	15000.	0.69039D-23
20000.	0.40940D-23	25000.	0.27165D-23
30000.	0.19375D-23	35000.	0.14533D-23
40000.	0.11315D-23	45000.	0.90654D-24
50000.	0.74298D-24	55000.	0.62028D-24
60000.	0.52583D-24	65000.	0.45155D-24
70000.	0.39206D-24	75000.	0.34367D-24
80000.	0.30376D-24	85000.	0.27046D-24
90000.	0.24238D-24	95000.	0.21849D-24

Values of $\langle \sigma v \rangle / T^2$ assuming Maxwellian distributions
for T- ^3He reactions.

$\langle \sigma v \rangle_b$ For $T(^3\text{He}, X)Y$ assuming beam-Maxwellian distributions

Tritium Temperature = 0

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.11143E-25	15.000	0.11520E-26
20.000	0.70547E-25	25.000	0.11538E-23
30.000	0.49994E-23	35.000	0.44140E-22
40.000	0.15831E-21	45.000	0.45436E-21
50.000	0.11054E-20	55.000	0.23697E-20
60.000	0.45996E-20	65.000	0.82438E-20
70.000	0.13844E-19	75.000	0.22027E-19
80.000	0.22495E-19	85.000	0.49011E-19
90.000	0.69386E-19	95.000	0.95465E-19
100.00	0.12011E-18	110.00	0.21663E-18
120.00	0.34186E-18	130.00	0.51044E-18
140.00	0.72849E-18	150.00	0.10015E-17
160.00	0.13344E-17	170.00	0.17311E-17
180.00	0.21951E-17	190.00	0.27291E-17
200.00	0.33351E-17	250.00	0.74796E-17
300.00	0.13461E-16	350.00	0.21127E-16
400.00	0.30251E-16	450.00	0.40591E-16
500.00	0.51921E-16	550.00	0.64038E-16
600.00	0.76767E-16	650.00	0.89960E-16
700.00	0.10349E-15	750.00	0.11726E-15
800.00	0.12119E-15	850.00	0.14520E-15
900.00	0.15923E-15	950.00	0.17325E-15
1000.0	0.18721E-15	1100.0	0.21483E-15
1200.0	0.24194E-15	1300.0	0.26841E-15
1400.0	0.29417E-15	1500.0	0.31919E-15
1600.0	0.34347E-15	1700.0	0.36699E-15
1800.0	0.38977E-15	1900.0	0.41182E-15
2000.0	0.43318E-15	3000.0	0.61360E-15
4000.0	0.74921E-15	5000.0	0.85550E-15
6000.0	0.94169E-15	7000.0	0.10134E-14
8000.0	0.10744E-14	9000.0	0.11271E-14
10000.	0.11732E-14		

$\langle \sigma v \rangle_b$ For $T(^3\text{He}, X)Y$ assuming beam-Maxwellian distributions

Tritium Temperature = 10 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.250270-20	15.000	0.516520-20
20.000	0.935680-20	25.000	0.155300-19
30.000	0.741810-19	35.000	0.358470-19
40.000	0.510980-19	45.000	0.705320-19
50.000	0.947700-19	55.000	0.124450-18
60.000	0.160200-18	65.000	0.202700-18
70.000	0.252570-18	75.000	0.310480-18
80.000	0.377060-18	85.000	0.452920-18
90.000	0.538690-18	95.000	0.634950-18
100.00	0.742270-18	110.00	0.992270-18
120.00	0.129280-17	120.00	0.164740-17
140.00	0.205940-17	150.00	0.253140-17
160.00	0.306590-17	170.00	0.366450-17
180.00	0.432850-17	190.00	0.506000-17
200.00	0.585860-17	250.00	0.108670-16
300.00	0.175110-16	350.00	0.256410-16
400.00	0.350600-16	450.00	0.455650-16
500.00	0.569590-16	550.00	0.690660-16
600.00	0.817330-16	650.00	0.948280-16
700.00	0.108240-15	750.00	0.121870-15
800.00	0.135650-15	850.00	0.149500-15
900.00	0.163390-15	950.00	0.177250-15
1000.0	0.191060-15	1100.0	0.218400-15
1200.0	0.245240-15	1200.0	0.271460-15
1400.0	0.297010-15	1500.0	0.321830-15
1600.0	0.345930-15	1700.0	0.369280-15
1800.0	0.391920-15	1900.0	0.413840-15
2000.0	0.435080-15	2000.0	0.614740-15
4000.0	0.750020-15	5000.0	0.856130-15
6000.0	0.942210-15	7000.0	0.101390-14
8000.0	0.107480-14	9000.0	0.112750-14
10000.	0.117360-14		

$\langle \sigma v \rangle_b$ For $T(^3\text{He}, X)Y$ assuming beam-Maxwellian distributions

Tritium Temperature = 30 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.17402E-18	15.000	0.23374E-18
20.000	0.30266E-18	25.000	0.38121E-18
30.000	0.46983E-18	35.000	0.56895E-18
40.000	0.67895E-18	45.000	0.80021E-18
50.000	0.93309E-18	55.000	0.10779E-17
60.000	0.12350E-17	65.000	0.14047E-17
70.000	0.15872E-17	75.000	0.17829E-17
80.000	0.19918E-17	85.000	0.22144E-17
90.000	0.24507E-17	95.000	0.27009E-17
100.00	0.29653E-17	110.00	0.35370E-17
120.00	0.41668E-17	130.00	0.48554E-17
140.00	0.56035E-17	150.00	0.64113E-17
160.00	0.72790E-17	170.00	0.82065E-17
180.00	0.91934E-17	190.00	0.10240E-16
200.00	0.11345E-16	250.00	0.17726E-16
300.00	0.25444E-16	350.00	0.34352E-16
400.00	0.44289E-16	450.00	0.55096E-16
500.00	0.66623E-16	550.00	0.78733E-16
600.00	0.91306E-16	650.00	0.10424E-15
700.00	0.11743E-15	750.00	0.13082E-15
800.00	0.14432E-15	850.00	0.15789E-15
900.00	0.17149E-15	950.00	0.18506E-15
1000.0	0.19858E-15	1100.0	0.22537E-15
1200.0	0.25169E-15	1300.0	0.27744E-15
1400.0	0.30254E-15	1500.0	0.32697E-15
1600.0	0.35065E-15	1700.0	0.37372E-15
1800.0	0.39605E-15	1900.0	0.41770E-15
2000.0	0.43868E-15	3000.0	0.61676E-15
4000.0	0.75129E-15	5000.0	0.85700E-15
6000.0	0.94285E-15	7000.0	0.10144E-14
8000.0	0.10752E-14	9000.0	0.11278E-14
10000.	0.11739E-14		

$\langle \sigma v \rangle_b$ For $T(^3\text{He}, X)Y$ assuming beam-Maxwellian distributions

Tritium Temperature = 50 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.919710-18	15.000	0.109620-17
20.000	0.128580-17	25.000	0.148870-17
30.000	0.170500-17	35.000	0.193480-17
40.000	0.217820-17	45.000	0.243530-17
50.000	0.270620-17	55.000	0.299100-17
60.000	0.328960-17	65.000	0.360230-17
70.000	0.392890-17	75.000	0.426950-17
80.000	0.462420-17	85.000	0.499290-17
90.000	0.537570-17	95.000	0.577250-17
100.00	0.618330-17	110.00	0.704690-17
120.00	0.756630-17	130.00	0.894090-17
140.00	0.957040-17	150.00	0.110540-16
160.00	0.121920-16	170.00	0.133820-16
180.00	0.146240-16	190.00	0.159180-16
200.00	0.172620-16	250.00	0.247050-16
300.00	0.332560-16	350.00	0.427800-16
400.00	0.531390-16	450.00	0.642040-16
500.00	0.758550-16	550.00	0.879820-16
600.00	0.100490-15	650.00	0.113290-15
700.00	0.126310-15	750.00	0.139480-15
800.00	0.152750-15	850.00	0.166070-15
900.00	0.179410-15	950.00	0.192720-15
1000.0	0.205580-15	1100.0	0.232260-15
1200.0	0.258090-15	1300.0	0.283370-15
1400.0	0.308050-15	1500.0	0.332090-15
1600.0	0.355440-15	1700.0	0.378160-15
1800.0	0.400190-15	1900.0	0.421570-15
2000.0	0.442310-15	2000.0	0.618790-15
4000.0	0.752580-15	5000.0	0.857890-15
6000.0	0.943490-15	7000.0	0.101490-14
8000.0	0.107560-14	9000.0	0.112810-14
10000.	0.117410-14

Values of $\langle \sigma v \rangle_b$ for injection of helium-3 into a tritium background at various temperatures (keV)

Cross Section For ${}^3\text{He}(t,X)Y$

ENERGY (keV)	σ (cm ²)	ENERGY (keV)	σ (cm ²)
1.0000	0.385540-73	1.5000	0.166340-63
2.0000	0.880250-58	2.5000	0.690130-54
3.0000	0.508110-51	3.5000	0.848790-49
4.0000	0.520660-47	4.5000	0.156410-45
5.0000	0.276610-44	5.5000	0.325990-43
6.0000	0.279240-42	6.5000	0.185140-41
7.0000	0.995760-41	7.5000	0.450200-40
8.0000	0.175920-39	8.5000	0.607250-39
9.0000	0.188460-38	9.5000	0.533420-38
10.000	0.139320-37	15.000	0.117610-34
20.000	0.623690-33	25.000	0.912430-32
30.000	0.649670-31	35.000	0.295010-30
40.000	0.989750-30	45.000	0.267820-29
50.000	0.618130-29	55.000	0.126350-28
60.000	0.234800-28	65.000	0.404310-28
70.000	0.654270-28	75.000	0.100570-27
80.000	0.148080-27	85.000	0.210200-27
90.000	0.289200-27	95.000	0.387290-27
100.00	0.506580-27	150.00	0.323350-26
200.00	0.932490-26	250.00	0.187050-25
300.00	0.307310-25	350.00	0.446540-25
400.00	0.598090-25	450.00	0.756640-25
500.00	0.918170-25	550.00	0.107970-24
600.00	0.123930-24	650.00	0.139530-24
700.00	0.154680-24	750.00	0.169320-24
800.00	0.183410-24	850.00	0.196930-24
900.00	0.209880-24	950.00	0.222270-24
1000.0	0.234090-24	1500.0	0.325890-24
2000.0	0.383020-24	2500.0	0.419380-24
3000.0	0.442990-24	3500.0	0.458420-24
4000.0	0.468430-24	4500.0	0.474720-24
5000.0	0.478410-24	5500.0	0.480240-24
6000.0	0.480720-24	6500.0	0.480210-24
7000.0	0.478970-24	7500.0	0.477190-24
8000.0	0.475000-24	8500.0	0.472510-24
9000.0	0.469790-24	9500.0	0.466920-24
10000.	0.463940-24	15000.	0.432930-24
20000.	0.405230-24	25000.	0.381870-24
30000.	0.362130-24	35000.	0.345250-24
40000.	0.330630-24	45000.	0.317810-24
50000.	0.306450-24	55000.	0.296300-24
60000.	0.287140-24	65000.	0.278840-24
70000.	0.271250-24	75000.	0.264290-24
80000.	0.257860-24	85000.	0.251910-24
90000.	0.246380-24	95000.	0.241210-24

Cross Section For ${}^3\text{He}(t,X)\text{Y}$

$\langle \sigma v \rangle_b$ For ${}^3\text{He}(t, X)Y$ assuming beam-Maxwellian distributions

Helium-3 Temperature = 0

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)		$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.111420-29	15.000	0.115190-26
20.000	0.705370-25	25.000	0.115370-23
30.000	0.999880-22	35.000	0.441370-22
40.000	0.158300-21	45.000	0.454340-21
50.000	0.110530-20	55.000	0.236960-20
60.000	0.459940-20	65.000	0.824330-20
70.000	0.138430-19	75.000	0.220260-19
80.000	0.334940-19	85.000	0.490090-19
90.000	0.693920-19	95.000	0.954610-19
100.00	0.128110-18	110.00	0.216620-18
120.00	0.341850-18	130.00	0.510420-18
140.00	0.728470-18	150.00	0.100150-17
160.00	0.133430-17	170.00	0.173110-17
180.00	0.219500-17	190.00	0.272900-17
200.00	0.323500-17	250.00	0.747940-17
300.00	0.134610-16	350.00	0.211260-16
400.00	0.302500-16	450.00	0.405910-16
500.00	0.519210-16	550.00	0.640370-16
600.00	0.767860-16	650.00	0.899590-16
700.00	0.103490-15	750.00	0.117260-15
800.00	0.131190-15	850.00	0.145200-15
900.00	0.159230-15	950.00	0.173250-15
1000.0	0.187200-15	1100.0	0.214830-15
1200.0	0.241540-15	1300.0	0.268400-15
1400.0	0.294170-15	1500.0	0.319190-15
1600.0	0.343460-15	1700.0	0.366990-15
1800.0	0.389770-15	1900.0	0.411820-15
2000.0	0.433180-15	2500.0	0.613600-15
3000.0	0.749210-15	5000.0	0.855500-15
6000.0	0.941680-15	7000.0	0.101340-14
8000.0	0.107440-14	9000.0	0.112710-14
10000.	0.117320-14		

$\langle \sigma v \rangle_b$ For $^3\text{He}(t, X)Y$ assuming beam-Maxwellian distributions

Helium-3 Temperature = 10 keV

ENERGY (keV)	$\langle \sigma v \rangle$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.290270-20	15.000	0.516520-20
20.000	0.935650-20	25.000	0.155300-19
30.000	0.241810-19	35.000	0.358470-19
40.000	0.510580-19	45.000	0.705320-19
50.000	0.947650-19	55.000	0.124440-18
60.000	0.160200-18	65.000	0.202690-18
70.000	0.252570-18	75.000	0.310480-18
80.000	0.377050-18	85.000	0.452920-18
90.000	0.538680-18	95.000	0.634940-18
100.00	0.742260-18	110.00	0.992260-18
120.00	0.129270-17	130.00	0.164740-17
140.00	0.205930-17	150.00	0.253140-17
160.00	0.306580-17	170.00	0.366450-17
180.00	0.432880-17	190.00	0.506000-17
200.00	0.585850-17	250.00	0.108660-16
300.00	0.175100-16	350.00	0.256400-16
400.00	0.350600-16	450.00	0.455640-16
500.00	0.565580-16	550.00	0.690650-16
600.00	0.817320-16	650.00	0.948260-16
700.00	0.108240-15	750.00	0.121870-15
800.00	0.135650-15	850.00	0.149500-15
900.00	0.163380-15	950.00	0.177250-15
1000.0	0.191060-15	1100.0	0.218400-15
1200.0	0.245740-15	1300.0	0.271460-15
1400.0	0.297010-15	1500.0	0.321830-15
1600.0	0.345920-15	1700.0	0.369280-15
1800.0	0.391910-15	1900.0	0.413840-15
2000.0	0.435070-15	2500.0	0.614740-15
4000.0	0.750010-15	5000.0	0.856130-15
6000.0	0.942210-15	7000.0	0.101390-14
9000.0	0.107480-14	9000.0	0.112750-14
10000.	0.117360-14		

$\langle \sigma v \rangle_b$ For ${}^3\text{He}(t, X)\gamma$ assuming beam-Maxwellian distributions

Helium-3 Temperature = 30 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.17402E-18	15.000	0.23375E-18
20.000	0.30266E-18	25.000	0.38121E-18
30.000	0.46983E-18	35.000	0.56895E-18
40.000	0.67895E-18	45.000	0.80021E-18
50.000	0.92310E-18	55.000	0.10779E-17
60.000	0.12350E-17	65.000	0.14047E-17
70.000	0.15872E-17	75.000	0.17829E-17
80.000	0.19918E-17	85.000	0.22144E-17
90.000	0.24507E-17	95.000	0.27009E-17
100.00	0.29653E-17	110.00	0.35370E-17
120.00	0.41668E-17	120.00	0.48554E-17
140.00	0.56035E-17	140.00	0.64113E-17
160.00	0.72789E-17	170.00	0.82064E-17
180.00	0.91935E-17	180.00	0.10240E-16
200.00	0.11345E-16	250.00	0.17726E-16
300.00	0.25444E-16	350.00	0.34352E-16
400.00	0.44285E-16	450.00	0.55096E-16
500.00	0.66622E-16	550.00	0.78732E-16
600.00	0.91305E-16	650.00	0.10423E-15
700.00	0.11743E-15	750.00	0.13081E-15
800.00	0.14432E-15	850.00	0.15789E-15
900.00	0.17149E-15	950.00	0.18506E-15
1000.0	0.19858E-15	1100.0	0.22537E-15
1200.0	0.25169E-15	1300.0	0.27744E-15
1400.0	0.30254E-15	1500.0	0.32696E-15
1600.0	0.35069E-15	1700.0	0.37372E-15
1800.0	0.39605E-15	1900.0	0.41770E-15
2000.0	0.43868E-15	3000.0	0.61676E-15
4000.0	0.75125E-15	5000.0	0.85700E-15
6000.0	0.94285E-15	7000.0	0.10144E-14
8000.0	0.10752E-14	9000.0	0.11278E-14
10000.0	0.11735E-14		

$\langle \sigma v \rangle_b$ For ${}^3\text{He}(t, X)Y$ assuming beam-Maxwellian distributions

Helium-3 Temperature = 50 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.919730-18	15.000	0.109620-17
20.000	0.128560-17	25.000	0.148870-17
30.000	0.170500-17	35.000	0.193480-17
40.000	0.217820-17	45.000	0.243530-17
50.000	0.270620-17	55.000	0.299100-17
60.000	0.328960-17	65.000	0.360230-17
70.000	0.392890-17	75.000	0.426950-17
80.000	0.462420-17	85.000	0.499290-17
90.000	0.537570-17	95.000	0.577250-17
100.00	0.618330-17	110.00	0.704690-17
120.00	0.796620-17	120.00	0.894090-17
140.00	0.997040-17	150.00	0.110540-16
160.00	0.121920-16	170.00	0.133820-16
180.00	0.146240-16	190.00	0.159180-16
200.00	0.172620-16	250.00	0.247050-16
300.00	0.322560-16	350.00	0.427800-16
400.00	0.531390-16	450.00	0.642040-16
500.00	0.758540-16	550.00	0.879810-16
600.00	0.100490-15	650.00	0.113290-15
700.00	0.126300-15	750.00	0.139480-15
800.00	0.152750-15	850.00	0.166070-15
900.00	0.179410-15	950.00	0.192720-15
1000.0	0.205980-15	1100.0	0.232260-15
1200.0	0.258050-15	1200.0	0.283370-15
1400.0	0.308050-15	1500.0	0.332090-15
1600.0	0.355460-15	1700.0	0.378160-15
1800.0	0.400190-15	1900.0	0.421570-15
2000.0	0.442310-15	3000.0	0.618750-15
4000.0	0.752570-15	5000.0	0.857880-15
6000.0	0.943450-15	7000.0	0.101490-14
8000.0	0.107560-14	9000.0	0.112810-14
10000.0	0.117410-14

Values of $\langle \sigma v \rangle_b$ for injection of tritium into a helium-3 background at various temperatures (keV)

Section 7Proton-Boron-11 Reactions

σ for $^{11}\text{B}(p, 2^4\text{He})^4\text{He}$	7.1
$\langle\sigma v\rangle$ for $^{11}\text{B}(p, 2^4\text{He})^4\text{He}$	7.3
$\langle\sigma v\rangle/T^2$ for $^{11}\text{B}(p, 2^4\text{He})^4\text{He}$	7.5
$\langle\sigma v\rangle_b$ for $^{11}\text{B}(p, 2^4\text{He})^4\text{He}$ (Beam Case).	7.7

Cross Section For $^{11}\text{B}(p,2^4\text{He})^4\text{He}$

ENERGY (keV)	$\sigma(\text{cm}^2)$	ENERGY (keV)	$\sigma(\text{cm}^2)$
35.000	0.118180-38	40.000	0.241890-37
45.000	0.292750-36	50.000	0.239940-35
55.000	0.145900-34	60.000	0.701760-34
65.000	0.279630-33	70.000	0.955490-33
75.000	0.287420-32	80.000	0.776810-32
85.000	0.191700-31	90.000	0.437570-31
95.000	0.933550-31	100.00	0.187780-30
125.00	0.316750-29	150.00	0.250520-28
175.00	0.123440-27	200.00	0.442330-27
225.00	0.126400-26	250.00	0.305510-26
275.00	0.649750-26	300.00	0.125000-25
325.00	0.221920-25	350.00	0.369030-25
375.00	0.581290-25	400.00	0.870610-25
425.00	0.112750-24	450.00	0.141270-24
475.00	0.173990-24	500.00	0.212470-24
525.00	0.257960-24	550.00	0.311060-24
575.00	0.371290-24	600.00	0.436640-24
625.00	0.595480-24	650.00	0.610000-24
675.00	0.615000-24	700.00	0.610000-24
725.00	0.547870-24	750.00	0.490960-24
775.00	0.429940-24	800.00	0.369200-24
825.00	0.312040-24	850.00	0.260790-24
875.00	0.216930-24	900.00	0.181200-24
925.00	0.153690-24	950.00	0.133980-24
975.00	0.121250-24	1000.0	0.114360-24
1025.0	0.112000-24	1050.0	0.112800-24
1075.0	0.115390-24	1100.0	0.118600-24
1125.0	0.121490-24	1150.0	0.123510-24
1175.0	0.130000-24	1200.0	0.135000-24
1225.0	0.135000-24	1250.0	0.135000-24
1275.0	0.135000-24	1300.0	0.135000-24
1325.0	0.135000-24	1350.0	0.135000-24
1375.0	0.135000-24	1400.0	0.135000-24
1425.0	0.135000-24	1450.0	0.135000-24
1475.0	0.135000-24	1500.0	0.135000-24
1525.0	0.135000-24	1550.0	0.134440-24
1575.0	0.133080-24	1600.0	0.131350-24
1625.0	0.129400-24	1650.0	0.127290-24
1675.0	0.125050-24	1700.0	0.122640-24
1725.0	0.120030-24	1750.0	0.117170-24
1775.0	0.114000-24	1800.0	0.110500-24
1825.0	0.106690-24	1850.0	0.102630-24
1875.0	0.984590-25	1900.0	0.943870-25
1925.0	0.907290-25	1950.0	0.879120-25
1975.0	0.864900-25

Cross section for $^{11}\text{B}(p, 2^4\text{He})^4\text{He}$

<σv> For $^{11}\text{B}(p,2^4\text{He})^4\text{He}$ assuming Maxwellian distributions

TEMP (keV)	<σv> (cm ³ /sec)	TEMP (keV)	<σv> (cm ³ /sec)
35.000	0.658540-16	40.000	0.167560-16
45.000	0.362990-16	50.000	0.693050-16
55.000	0.120330-17	60.000	0.194780-17
65.000	0.293760-17	70.000	0.422170-17
75.000	0.584490-17	80.000	0.771820-17
85.000	0.958190-17	90.000	0.125710-16
95.000	0.153210-16	100.00	0.185110-16
125.00	0.373550-16	150.00	0.589170-16
175.00	0.805810-16	200.00	0.100820-15
225.00	0.118710-15	250.00	0.134680-15
275.00	0.147710-15	300.00	0.158790-15
325.00	0.167750-15	350.00	0.175140-15
375.00	0.180750-15	400.00	0.185240-15
425.00	0.189140-15	450.00	0.191410-15
475.00	0.193180-15	500.00	0.193690-15
525.00	0.194050-15	550.00	0.194210-15
575.00	0.193810-15	600.00	0.193190-15
625.00	0.192030-15	650.00	0.190150-15
675.00	0.189110-15	700.00	0.186890-15
725.00	0.184910-15	750.00	0.183120-15
775.00	0.180480-15	800.00	0.178080-15
825.00	0.175690-15	850.00	0.173890-15
875.00	0.176250-15	900.00	0.169030-15
925.00	0.166400-15	950.00	0.163850-15
975.00	0.161600-15	1000.0	0.160060-15
1025.0	0.157630-15	1050.0	0.155220-15
1075.0	0.152280-15	1100.0	0.150360-15
1125.0	0.148640-15	1150.0	0.145720-15
1175.0	0.143720-15	1200.0	0.141770-15
1225.0	0.138860-15	1250.0	0.137080-15
1275.0	0.135230-15	1300.0	0.133930-15
1325.0	0.131120-15	1350.0	0.129770-15
1375.0	0.127510-15	1400.0	0.125740-15
1425.0	0.124010-15	1450.0	0.122260-15
1475.0	0.120670-15	1500.0	0.119090-15
1525.0	0.117010-15	1550.0	0.115760-15
1575.0	0.114170-15	1600.0	0.112580-15
1625.0	0.110920-15	1650.0	0.109320-15
1675.0	0.108080-15	1700.0	0.106590-15
1725.0	0.104930-15	1750.0	0.103300-15
1775.0	0.102130-15	1800.0	0.100500-15
1825.0	0.994760-16	1850.0	0.983750-16
1875.0	0.971600-16	1900.0	0.959170-16
1925.0	0.945230-16	1950.0	0.931110-16
1975.0	0.914970-16	2000.0	0.902760-16

Values of $\langle \sigma v \rangle$ assuming Maxwellian
distributions for $p-^{11}\text{B}$ fusion reactions

$\langle \sigma v \rangle / T^2$ For $^{11}\text{B}(p, 2^4\text{He})^4\text{He}$ assuming Maxwellian distributions.

TEMP (keV)	$\langle \sigma v \rangle / T^2$ ($\text{cm}^3/\text{sec}/(\text{keV})^2$)	TEMP (keV)	$\langle \sigma v \rangle / T^2$ ($\text{cm}^3/\text{sec}/(\text{keV})^2$)
35.000	0.53759E-22	40.000	0.10472E-21
45.000	0.17925E-21	50.000	0.27722E-21
55.000	0.39779E-21	60.000	0.53966E-21
65.000	0.69528E-21	70.000	0.86156E-21
75.000	0.10391E-20	80.000	0.12060E-20
85.000	0.13816E-20	90.000	0.15520E-20
95.000	0.16976E-20	100.00	0.18511E-20
125.00	0.23907E-20	150.00	0.26185E-20
175.00	0.26317E-20	200.00	0.25205E-20
225.00	0.23448E-20	250.00	0.21548E-20
275.00	0.19537E-20	300.00	0.17642E-20
325.00	0.15882E-20	350.00	0.14297E-20
375.00	0.12854E-20	400.00	0.11578E-20
425.00	0.10472E-20	450.00	0.94524E-21
475.00	0.85671E-21	500.00	0.77476E-21
525.00	0.70404E-21	550.00	0.64201E-21
575.00	0.58619E-21	600.00	0.53665E-21
625.00	0.49161E-21	650.00	0.45006E-21
675.00	0.41286E-21	700.00	0.38140E-21
725.00	0.35179E-21	750.00	0.32555E-21
775.00	0.30049E-21	800.00	0.27825E-21
825.00	0.25813E-21	850.00	0.24068E-21
875.00	0.23021E-21	900.00	0.20867E-21
925.00	0.19448E-21	950.00	0.18156E-21
975.00	0.16999E-21	1000.0	0.16006E-21
1025.0	0.15004E-21	1050.0	0.14079E-21
1075.0	0.13177E-21	1100.0	0.12426E-21
1125.0	0.11745E-21	1150.0	0.11018E-21
1175.0	0.10410E-21	1200.0	0.98450E-22
1225.0	0.92533E-22	1250.0	0.87728E-22
1275.0	0.83186E-22	1300.0	0.79249E-22
1325.0	0.74688E-22	1350.0	0.71202E-22
1375.0	0.67442E-22	1400.0	0.64155E-22
1425.0	0.61069E-22	1450.0	0.58152E-22
1475.0	0.55485E-22	1500.0	0.52979E-22
1525.0	0.50315E-22	1550.0	0.48181E-22
1575.0	0.46024E-22	1600.0	0.43975E-22
1625.0	0.42008E-22	1650.0	0.40156E-22
1675.0	0.38523E-22	1700.0	0.36881E-22
1725.0	0.35264E-22	1750.0	0.33731E-22
1775.0	0.32415E-22	1800.0	0.31018E-22
1825.0	0.29867E-22	1850.0	0.28744E-22
1875.0	0.27637E-22	1900.0	0.26570E-22
1925.0	0.25508E-22	1950.0	0.24487E-22
1975.0	0.23457E-22	2000.0	0.22569E-22

Values of $\langle \sigma v \rangle / T^2$ assuming Maxwellian
distributions for p- ^{11}B reactions

$\langle\sigma v\rangle_b$ For $^{11}\text{B}(p,2^4\text{He})^4\text{He}$ assuming beam-Maxwellian distributions.

Boron-11 Temperature = 0

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm^3/sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm^3/sec)
10.000	0.198540-48	20.000	0.579130-37
30.000	0.661540-32	40.000	0.669290-29
50.000	0.742230-27	60.000	0.237810-25
70.000	0.349730-24	80.000	0.303960-23
90.000	0.181600-22	100.00	0.821500-22
150.00	0.134230-19	200.00	0.273670-18
250.00	0.211330-17	300.00	0.947170-17
350.00	0.302030-16	400.00	0.765590-16
450.00	0.131100-15	500.00	0.207840-15
550.00	0.319150-15	600.00	0.467910-15
625.00	0.550380-15	650.00	0.680370-15
675.00	0.899010-15	700.00	0.706050-15
725.00	0.701440-15	750.00	0.588210-15
775.00	0.523620-15	800.00	0.456840-15
825.00	0.392090-15	850.00	0.332620-15
875.00	0.280730-15	900.00	0.237810-15
925.00	0.204490-15	950.00	0.180670-15
975.00	0.165630-15	1000.0	0.158210-15
1025.0	0.156870-15	1050.0	0.159900-15
1075.0	0.165520-15	1100.0	0.172080-15
1125.0	0.178270-15	1150.0	0.183240-15
1175.0	0.186850-15	1200.0	0.197010-15
1225.0	0.206710-15	1250.0	0.208810-15
1275.0	0.210890-15	1300.0	0.212940-15
1325.0	0.214980-15	1350.0	0.217000-15
1375.0	0.219000-15	1400.0	0.220980-15
1425.0	0.222950-15	1450.0	0.224890-15
1475.0	0.226820-15	1500.0	0.228740-15
1525.0	0.230640-15	1550.0	0.232520-15
1575.0	0.231050-15	1600.0	0.229860-15
1625.0	0.228200-15	1650.0	0.226210-15
1675.0	0.223890-15	1700.0	0.221220-15
1725.0	0.218100-15	1750.0	0.214430-15
1775.0	0.210110-15	1800.0	0.205100-15

$\langle\sigma v\rangle_b$ For $^{11}\text{B}(p,2^4\text{He})^4\text{He}$ assuming beam-Maxwellian distributions.

Boron 11 Temperature = 50 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.620920-26	20.000	0.176530-24
30.000	0.186450-23	40.000	0.117510-22
50.000	0.533700-22	60.000	0.192610-21
70.000	0.585620-21	80.000	0.155820-20
90.000	0.372560-20	100.00	0.815970-20
150.00	0.165720-18	200.00	0.132120-17
250.00	0.613850-17	300.00	0.197700-16
350.00	0.479530-16	400.00	0.939210-16
450.00	0.160200-15	500.00	0.251060-15
550.00	0.364410-15	600.00	0.480030-15
625.00	0.527030-15	650.00	0.560380-15
675.00	0.577040-15	700.00	0.576040-15
725.00	0.559060-15	750.00	0.528860-15
775.00	0.489620-15	800.00	0.445460-15
825.00	0.399430-15	850.00	0.355100-15
875.00	0.314320-15	900.00	0.278650-15
925.00	0.248880-15	950.00	0.225110-15
975.00	0.207150-15	1000.0	0.194480-15
1025.0	0.186410-15	1050.0	0.182160-15
1075.0	0.180870-15	1100.0	0.181870-15
1125.0	0.184310-15	1150.0	0.188060-15
1175.0	0.191840-15	1200.0	0.196070-15
1225.0	0.200130-15	1250.0	0.203950-15
1275.0	0.207480-15	1300.0	0.210650-15
1325.0	0.213470-15	1350.0	0.215970-15
1375.0	0.218180-15	1400.0	0.220100-15
1425.0	0.221740-15	1450.0	0.223090-15
1475.0	0.224120-15	1500.0	0.224800-15
1525.0	0.225090-15	1550.0	0.224960-15
1575.0	0.224350-15	1600.0	0.223250-15
1625.0	0.221600-15	1650.0	0.219390-15
1675.0	0.216470-15	1700.0	0.212840-15
1725.0	0.208360-15	1750.0	0.203190-15
1775.0	0.196750-15	1800.0	0.189320-15

$\langle\sigma v\rangle_b$ For $^{11}\text{B}(p,2^4\text{He})^4\text{He}$ assuming beam-Maxwellian distributions.

Boron 11 Temperature = 75 keV

ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle\sigma v\rangle_b$ (cm ³ /sec)
10.000	0.300660-24	20.000	0.403480-23
30.000	0.260900-22	40.000	0.114590-21
50.000	0.392690-21	60.000	0.112890-20
70.000	0.284340-20	80.000	0.645730-20
90.000	0.134870-19	100.00	0.262890-19
150.00	0.357510-18	200.00	0.225530-17
250.00	0.890930-17	300.00	0.253090-16
350.00	0.563230-16	400.00	0.105440-15
450.00	0.175470-15	500.00	0.266880-15
550.00	0.370900-15	600.00	0.466960-15
625.00	0.502550-15	650.00	0.528120-15
675.00	0.340140-15	700.00	0.538790-15
725.00	0.525540-15	750.00	0.501590-15
775.00	0.470450-15	800.00	0.434440-15
825.00	0.396390-15	850.00	0.358780-15
875.00	0.323250-15	900.00	0.291180-15
925.00	0.263530-15	950.00	0.240660-15
975.00	0.222460-15	1000.0	0.208810-15
1025.0	0.199110-15	1050.0	0.192910-15
1075.0	0.189580-15	1100.0	0.188530-15
1125.0	0.189170-15	1150.0	0.191000-15
1175.0	0.193670-15	1200.0	0.196810-15
1225.0	0.200060-15	1250.0	0.203360-15
1275.0	0.206620-15	1300.0	0.209610-15
1325.0	0.212310-15	1350.0	0.214780-15
1375.0	0.216920-15	1400.0	0.218750-15
1425.0	0.220260-15	1450.0	0.221430-15
1475.0	0.222170-15	1500.0	0.222630-15
1525.0	0.222630-15	1550.0	0.222170-15
1575.0	0.221200-15	1600.0	0.219660-15
1625.0	0.217570-15	1650.0	0.214870-15
1675.0	0.211360-15	1700.0	0.206920-15
1725.0	0.201610-15	1750.0	0.195780-15
1775.0	0.188840-15	1800.0	0.180830-15

$\langle \sigma v \rangle_b$ For $^{11}\text{B}(p, 2^4\text{He})^4\text{He}$ assuming beam-Maxwellian distributions.

Boron 11 Temperature = 100 keV

ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)	ENERGY (keV)	$\langle \sigma v \rangle_b$ (cm ³ /sec)
10.000	0.401110-23	20.000	0.344340-22
30.000	0.165220-21	40.000	0.580190-21
50.000	0.166480-20	60.000	0.413670-20
70.000	0.921900-20	80.000	0.188570-19
90.000	0.359770-19	100.00	0.647820-19
150.00	0.662750-18	200.00	0.348270-17
250.00	0.120430-16	300.00	0.310690-16
350.00	0.649990-16	400.00	0.117210-15
450.00	0.189170-15	500.00	0.278110-15
550.00	0.372380-15	600.00	0.452950-15
625.00	0.482500-15	650.00	0.502310-15
675.00	0.511180-15	700.00	0.509820-15
725.00	0.498670-15	750.00	0.479400-15
775.00	0.453570-15	800.00	0.423660-15
825.00	0.391640-15	850.00	0.359360-15
875.00	0.328350-15	900.00	0.299790-15
925.00	0.274490-15	950.00	0.252810-15
975.00	0.234970-15	1000.0	0.220900-15
1025.0	0.210320-15	1050.0	0.202800-15
1075.0	0.198010-15	1100.0	0.195370-15
1125.0	0.194480-15	1150.0	0.194950-15
1175.0	0.196390-15	1200.0	0.198430-15
1225.0	0.200900-15	1250.0	0.203590-15
1275.0	0.206300-15	1300.0	0.208980-15
1325.0	0.211400-15	1350.0	0.213610-15
1375.0	0.215630-15	1400.0	0.217270-15
1425.0	0.218580-15	1450.0	0.219540-15
1475.0	0.220100-15	1500.0	0.220220-15
1525.0	0.219900-15	1550.0	0.219090-15
1575.0	0.217670-15	1600.0	0.215760-15
1625.0	0.213150-15	1650.0	0.209780-15
1675.0	0.205720-15	1700.0	0.201310-15
1725.0	0.195600-15	1750.0	0.189180-15
1775.0	0.181770-15	1800.0	0.173630-15

Values of $\langle \sigma v \rangle_b$ for injection of boron 11 into a proton background at various temperatures (keV).

Section 8

Composite Plots

Nomenclature for Plots	8.1
Composite Plot for σ	8.2
Composite Plot for $\langle \sigma v \rangle$	8.3
Composite Plot for $\langle \sigma v \rangle_b$	8.4

NOMENCLATURE

Cross sections for several prominent fusion reactions.

(Nomenclature found on p. 8.1)

Maxwellian-Maxwellian reactivities for several prominent fusion reactions.
 (Nonenclature found on p. 8.1)

Beam-Maxwellian reactivities for several prominent fusion reactions.

(Nomenclature found on p. 8.1)

* Except for reaction (6) for which $T_i = 100$ keV.