

TABLE 4A
ELECTRON CAPTURE RATE ON THE PROTON*

T_9/ρ	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}
0.5	1.45(-12)	8.80(-9)	6.45(-3)	1.68(0)	1.33(2)	7.63(3)	3.89(5)
1.0	1.47(-8)	1.72(-6)	7.42(-3)	1.69(0)	1.33(2)	7.64(3)	3.89(5)
1.5	4.62(-7)	1.67(-5)	9.08(-3)	1.72(0)	1.33(2)	7.64(3)	3.89(5)
2.0	3.12(-6)	6.66(-5)	1.15(-2)	1.76(0)	1.34(2)	7.64(3)	3.89(5)
2.5	1.18(-5)	1.76(-4)	1.47(-2)	1.81(0)	1.34(2)	7.65(3)	3.89(5)
3.0	3.67(-5)	3.67(-4)	1.89(-2)	1.87(0)	1.35(2)	7.66(3)	3.89(5)
4.0	2.57(-4)	1.12(-3)	3.03(-2)	2.03(0)	1.37(2)	7.68(3)	3.90(5)
5.0	1.18(-3)	2.78(-3)	4.66(-2)	2.24(0)	1.39(2)	7.70(3)	3.90(5)
7.0	1.05(-2)	1.44(-2)	9.67(-2)	2.82(0)	1.46(2)	7.77(3)	3.91(5)
10.0	9.15(-2)	1.01(-1)	2.55(-1)	4.14(0)	1.60(2)	7.92(3)	3.92(5)

* Rate given in units of captures per second per proton. $Y_e = 0.5$.

TABLE 4B
POSITRON CAPTURE RATE ON THE NEUTRON*

T_9/ρ	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}
0.5	2.26(-15)	3.73(-19)	1.85(-29)	0.00(0)	0.00(0)	0.00(0)	0.00(0)
1.0	6.68(-9)	5.71(-11)	7.87(-16)	3.49(-27)	0.00(0)	0.00(0)	0.00(0)
1.5	1.74(-6)	4.79(-8)	2.36(-11)	1.03(-18)	8.29(-35)	0.00(0)	0.00(0)
2.0	3.96(-5)	1.86(-6)	5.23(-9)	1.61(-14)	1.24(-26)	0.00(0)	0.00(0)
2.5	3.05(-4)	2.06(-5)	1.59(-7)	5.78(-12)	1.17(-21)	0.00(0)	0.00(0)
3.0	1.19(-3)	1.20(-4)	1.77(-6)	3.29(-10)	3.62(-18)	2.11(-35)	0.00(0)
4.0	6.20(-3)	1.44(-3)	4.74(-5)	6.55(-8)	6.58(-14)	7.93(-27)	0.00(0)
5.0	1.80(-2)	7.69(-3)	4.41(-4)	1.98(-6)	2.94(-11)	1.36(-21)	0.00(0)
7.0	8.15(-2)	5.96(-2)	8.89(-3)	1.47(-4)	4.61(-8)	1.94(-15)	2.87(-31)
10.0	3.98(-1)	3.59(-1)	1.43(-1)	6.65(-3)	1.95(-5)	1.23(-10)	9.96(-22)

* Rate given in units of captures per second per neutron. $Y_e = 0.5$.

TABLE 4C

NEUTRINO LOSS RATES FROM ELECTRON CAPTURE ON PROTONS*

T_9/ρ	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}
0.5	3.90(-13)	2.37(-9)	6.88(-3)	7.52(0)	1.61(3)	2.19(5)	2.51(7)
1.0	8.29(-9)	9.70(-7)	8.70(-3)	7.66(0)	1.61(3)	2.19(5)	2.51(7)
1.5	4.08(-7)	1.48(-5)	1.20(-2)	7.88(0)	1.62(3)	2.19(5)	2.51(7)
2.0	3.80(-6)	8.11(-5)	1.70(-2)	8.19(0)	1.63(3)	2.20(5)	2.51(7)
2.5	1.85(-5)	2.75(-4)	2.46(-2)	8.58(0)	1.64(3)	2.20(5)	2.51(7)
3.0	7.06(-5)	7.07(-4)	3.55(-2)	9.05(0)	1.66(3)	2.20(5)	2.51(7)
4.0	6.86(-4)	2.98(-3)	7.36(-2)	1.02(1)	1.70(3)	2.21(5)	2.51(7)
5.0	4.05(-3)	9.55(-3)	1.47(-1)	1.17(1)	1.75(3)	2.23(5)	2.52(7)
7.0	5.26(-2)	7.21(-2)	4.83(-1)	1.55(1)	1.88(3)	2.26(5)	2.53(7)
10.0	6.82(-1)	7.56(-1)	1.90(0)	2.46(1)	2.13(3)	2.34(5)	2.54(7)

* Rate given in units of ergs per second per proton. $Y_e = 0.5$.**TABLE 4D**

NEUTRINO LOSS RATES FROM POSITRON CAPTURE ON NEUTRONS*

T_9/ρ	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}
0.5	8.21(-15)	1.36(-18)	7.49(-29)	0.00(0)	0.00(0)	0.00(0)	0.00(0)
1.0	2.53(-8)	2.16(-10)	2.97(-15)	1.47(-26)	0.00(0)	0.00(0)	0.00(0)
1.5	6.89(-6)	1.90(-7)	9.38(-11)	4.16(-18)	3.65(-34)	0.00(0)	0.00(0)
2.0	1.66(-4)	7.79(-6)	2.19(-8)	6.77(-14)	5.71(-26)	0.00(0)	0.00(0)
2.5	1.36(-3)	9.17(-5)	7.08(-7)	2.57(-11)	5.68(-21)	0.00(0)	0.00(0)
3.0	5.66(-3)	5.68(-4)	8.40(-6)	1.56(-9)	1.72(-17)	1.08(-34)	0.00(0)
4.0	3.35(-2)	7.77(-3)	2.55(-4)	3.53(-7)	3.55(-13)	4.54(-26)	0.00(0)
5.0	1.10(-1)	4.70(-2)	2.69(-3)	1.20(-5)	1.79(-10)	8.65(-21)	0.00(0)
7.0	6.23(-1)	4.55(-1)	6.77(-2)	1.12(-3)	3.51(-7)	1.48(-14)	2.24(-30)
10.0	3.99(0)	3.60(0)	1.44(0)	6.65(-2)	1.96(-4)	1.23(-9)	1.01(-20)

* Rate given in units of ergs per second per neutron. $Y_e = 0.5$.

TABLE 4E

ELECTRON DEGENERACY PARAMETER Q_{η}^*

T_9/ρ	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}
0.5	2.92(0)	1.16(1)	3.37(1)	8.39(1)	1.93(2)	4.29(2)	9.38(2)
1.0	8.09(-1)	5.57(0)	1.68(1)	4.19(1)	9.66(1)	2.15(2)	4.69(2)
1.5	-1.51(-1)	3.44(0)	1.11(1)	2.79(1)	6.44(1)	1.43(2)	3.13(2)
2.0	-7.74(-1)	2.29(0)	8.16(0)	2.08(1)	4.83(1)	1.07(2)	2.35(2)
2.5	-1.17(0)	1.53(0)	6.39(0)	1.66(1)	3.86(1)	8.58(1)	1.88(2)
3.0	-1.33(0)	9.79(-1)	5.19(0)	1.38(1)	3.21(1)	7.15(1)	1.56(2)
4.0	-1.25(0)	2.18(-1)	3.64(0)	1.02(1)	2.40(1)	5.36(1)	1.17(2)
5.0	-1.08(0)	-2.20(-1)	2.64(0)	8.05(0)	1.92(1)	4.29(1)	9.38(1)
7.0	-8.12(-1)	-4.97(-1)	1.41(0)	5.52(0)	1.36(1)	3.06(1)	6.70(1)
10.0	-5.81(-1)	-4.78(-1)	4.42(-1)	3.51(0)	9.34(0)	2.13(1)	4.68(1)

* The chemical potential excluding the electron's rest mass divided by kT . $Y_e = 0.5$.

TABLE 5A

NUCLEI FOR WHICH REACTION RATE DATA IS PRESENTED

Z	$A_{\min}$	$A_{\max}$	Z	$A_{\min}$	$A_{\max}$	Z	$A_{\min}$	$A_{\max}$
H	1	3	S	28	47	Ga	59	89
He	3	4	Cl	31	51	Ge	62	93
Li	6	7	Ar	32	53	As	65	95
Be	7	9	K	35	55	Se	67	99
B	8	11	Ca	36	57	Br	68	117
C	11	14	Sc	40	59	Kr	69	118
N	12	15	Ti	41	61	Rb	73	119
O	14	19	V	43	64	Sr	76	120
F	17	21	Cr	44	66	Y	77	121
Ne	17	24	Mn	46	69	Zr	78	123
Na	19	27	Fe	47	72	Nb	82	125
Mg	20	29	Co	50	75	Mo	87	128
Al	22	31	Ni	53	79	Tc	89	133
Si	23	34	Cu	55	83	Ru	91	134
P	27	38	Zn	57	87			

TABLE 5B

REACTIONS INCLUDED BELOW ^{12}C

$^1\text{H}(\text{p}, \text{e}^+ \nu)^2\text{H}$	$^3\text{He}(^3\text{He}, 2\text{p})^4\text{He}$	$^9\text{Be}(\alpha, \text{n})^{12}\text{C} + \text{inv.}$
$^1\text{H}(\text{n}, \gamma)^2\text{H} + \text{inv.}^a$	$^6\text{Li}(\text{p}, \gamma)^7\text{Be} + \text{inv.}$	$^9\text{Be}(\text{p}, ^2\text{H})2^4\text{He}$
$^2\text{H}(\text{p}, \gamma)^3\text{He} + \text{inv.}$	$^6\text{Li}(\alpha, \text{p})^9\text{Be} + \text{inv.}$	$^8\text{B}(\alpha, \text{p})^{11}\text{C} + \text{inv.}$
$^2\text{H}(\text{n}, \gamma)^3\text{H} + \text{inv.}^a$	$^6\text{Li}(\alpha, \gamma)^{10}\text{B} + \text{inv.}$	$^8\text{B}(\text{e}^+ \nu, \alpha)^4\text{He}^b$
$^3\text{H}(\text{p}, \text{n})^3\text{He} + \text{inv.}$	$^7\text{Li}(\text{p}, \text{n})^7\text{Be} + \text{inv.}$	$^{10}\text{B}(\text{p}, \gamma)^{11}\text{C} + \text{inv.}$
$^3\text{H}(\text{p}, \gamma)^4\text{He} + \text{inv.}$	$^7\text{Li}(\text{p}, \gamma)^8\text{Be}$	$^{10}\text{B}(\alpha, \text{n})^{13}\text{N} + \text{inv.}$
$^3\text{H}(^2\text{H}, \text{n})^4\text{He}$	$^7\text{Li}(\text{p}, \alpha)^4\text{He}$	$^{11}\text{B}(\text{p}, \text{n})^{11}\text{C} + \text{inv.}$
$^3\text{H}(^3\text{H}, 2\text{n})^4\text{He}$	$^7\text{Li}(\text{p}, \alpha \gamma)^4\text{He}$	$^{11}\text{B}(\text{p}, \gamma)^{12}\text{C} + \text{inv.}$
$^3\text{H}(\alpha, \text{n})^6\text{Li} + \text{inv.}$	$^7\text{Li}(\alpha, \text{n})^{10}\text{B} + \text{inv.}$	$^{11}\text{B}(\text{p}, \alpha)2^4\text{He}$
$^3\text{H}(\alpha, \gamma)^7\text{Li} + \text{inv.}$	$^7\text{Li}(\alpha, \gamma)^{11}\text{B} + \text{inv.}$	$^{11}\text{B}(\alpha, \text{p})^{14}\text{C} + \text{inv.}$
$^3\text{He}(\text{n}, \gamma)^4\text{He} + \text{inv.}^a$	$^7\text{Be}(\text{e}^-, \nu)^7\text{Li}$	$^{11}\text{B}(\alpha, \text{n})^{14}\text{N} + \text{inv.}$
$^3\text{He}(\alpha, \text{p})^6\text{Li} + \text{inv.}$	$^7\text{Be}(\text{p}, \gamma)^8\text{B} + \text{inv.}$	$^{11}\text{C}(\text{n}, \alpha)2^4\text{He}^b$
$^3\text{He}(\alpha, \gamma)^7\text{Be} + \text{inv.}$	$^7\text{Be}(\alpha, \text{p})^{10}\text{B} + \text{inv.}$	$^{11}\text{C}(\text{p}, \gamma)^{12}\text{N} + \text{inv.}$
$^3\text{He}(^2\text{H}, \text{p})^4\text{He}$	$^7\text{Be}(\alpha, \gamma)^{11}\text{C} + \text{inv.}$	$^{11}\text{C}(\alpha, \text{p})^{14}\text{N} + \text{inv.}$
$^3\text{He}(^3\text{H}, ^2\text{H})^4\text{He}$	$^9\text{Be}(\text{p}, \text{n})^9\text{B} + \text{inv.}$	$^4\text{He}(\alpha, \text{n}, \gamma)^9\text{Be} + \text{inv.}$
$^3\text{He}(^3\text{H}, \text{np})^4\text{He}$	$^9\text{Be}(\text{p}, \gamma)^{10}\text{B} + \text{inv.}$	$3\alpha + \text{inv.}$

^a Rate expression given by D. N. Schramm and R. L. Wagoner 1977. ^b S.E. Woosley 1989

TABLE 5C

SPECIAL STRONG AND ELECTROMAGNETIC RATES

T_9	$^1\text{H}(\text{p}, \text{e}^+ \nu)^2\text{H}$	$^1\text{H}(\text{n}, \gamma)^2\text{H}$	$^2\text{H}(\gamma, \text{n})^1\text{H}$	$^3\text{H}(^2\text{H}, \text{n})^4\text{He}$	$^3\text{H}(^3\text{H}, 2\text{n})^4\text{He}$	T_9
0.01	7.20(-21)	4.00(4)	0.	1.50(3)	2.70(0)	0.01
0.03	4.60(-19)	3.80(4)	0.	5.20(5)	1.30(3)	0.03
0.05	1.90(-18)	3.60(4)	0.	4.00(6)	1.10(4)	0.05
0.10	8.90(-18)	3.40(4)	0.	4.80(7)	9.90(4)	0.10
0.30	5.30(-17)	2.90(4)	9.40(-25)	3.40(8)	1.10(6)	0.30
0.50	1.00(-16)	2.70(4)	1.70(-9)	4.90(8)	2.20(6)	0.50
1.00	2.20(-16)	2.50(4)	7.20(2)	5.20(8)	4.70(6)	1.00
1.50	3.20(-16)	2.60(4)	7.50(6)	4.70(8)	7.10(6)	1.50
2.00	4.10(-16)	2.80(4)	9.30(8)	4.20(8)	1.00(7)	2.00
3.00	5.80(-16)	3.50(4)	1.60E+11	3.50(8)	1.90(7)	3.00
4.00	7.30(-16)	4.40(4)	2.60E+12	3.00(8)	3.20(7)	4.00
5.00	8.60(-16)	5.40(4)	1.60E+13	2.70(8)	5.00(7)	5.00
7.00	1.10(-15)	7.60(4)	1.70E+14	2.20(8)	9.50(7)	7.00
10.00	1.40(-15)	1.10(5)	1.30E+15	1.80(8)	1.90(8)	10.00

TABLE 5D

SPECIAL STRONG AND ELECTROMAGNETIC RATES

T_9	${}^3\text{He}({}^3\text{He}, 2\text{p}){}^4\text{He}$	${}^3\text{He}({}^2\text{H}, \text{p}){}^4\text{He}$	${}^3\text{He}({}^3\text{H}, {}^2\text{H}){}^4\text{He}$	${}^3\text{He}({}^3\text{H}, \text{np}){}^4\text{He}$	${}^9\text{Be}(\text{p}, {}^2\text{H})2{}^4\text{He}$	T_9
0.01	1.10(-13)	4.30(-3)	3.00(-5)	4.20(-5)	6.40(-9)	0.01
0.03	2.10(-6)	5.90(1)	8.50(-1)	1.20(0)	8.40(-3)	0.03
0.05	7.10(-4)	1.60(3)	2.90(1)	4.20(1)	1.20(0)	0.05
0.10	4.20(-1)	5.70(4)	1.40(3)	1.90(3)	2.80(2)	0.10
0.30	6.20(2)	4.80(6)	9.80(4)	1.40(5)	2.40(5)	0.30
0.50	7.80(3)	2.20(7)	3.90(5)	5.70(5)	3.70(6)	0.50
1.00	1.30(5)	7.80(7)	1.60(6)	2.30(6)	3.10(7)	1.00
1.50	6.10(5)	1.10(8)	2.80(6)	4.20(6)	6.40(7)	1.50
2.00	1.70(6)	1.30(8)	3.80(6)	5.70(6)	9.10(7)	2.00
3.00	7.10(6)	1.40(8)	5.10(6)	7.80(6)	1.20(8)	3.00
4.00	1.90(7)	1.40(8)	5.70(6)	8.90(6)	1.40(8)	4.00
5.00	4.00(7)	1.40(8)	6.00(6)	9.40(6)	1.40(8)	5.00
7.00	1.10(8)	1.30(8)	5.90(6)	9.40(6)	1.40(8)	7.00
10.00	3.30(8)	1.20(8)	5.30(6)	8.50(6)	1.30(8)	10.00

TABLE 5E

SPECIAL STRONG AND ELECTROMAGNETIC RATES

T_9	${}^a{}^7\text{Li}(\text{p}, \alpha\gamma){}^4\text{He}$	${}^b{}^4\text{He}(\alpha \text{n}, \gamma){}^9\text{Be}$	${}^9\text{Be}(\gamma, \alpha \text{n}){}^4\text{He}$	${}^{11}\text{B}(\text{p}, \alpha)2{}^4\text{He}$	${}^{11}\text{C}(\text{n}, \alpha)2{}^4\text{He}$	T_9
0.01	1.20(-7)	9.7(-49)	0.	2.00(-11)	7.00(4)	0.01
0.03	1.10(-2)	6.0(-19)	0.	2.90(-4)	7.00(4)	0.03
0.05	5.70(-1)	3.0(-13)	0.	9.30(-2)	7.00(4)	0.05
0.10	4.40(1)	3.1(-9)	0.	5.60(1)	7.00(4)	0.10
0.30	6.60(3)	3.8(-7)	4.4(-15)	1.50(5)	7.00(4)	0.30
0.50	3.70(4)	5.3(-7)	1.1(-3)	1.40(6)	7.00(4)	0.50
1.00	2.40(5)	3.3(-7)	4.6(5)	2.60(7)	7.00(4)	1.00
1.50	5.40(5)	1.9(-7)	3.8(8)	9.20(7)	7.00(4)	1.50
2.00	8.70(5)	1.1(-7)	1.1(10)	1.50(8)	7.00(4)	2.00
3.00	1.60(6)	5.0(-8)	3.6(11)	2.00(8)	7.00(4)	3.00
4.00	2.80(6)	2.6(-8)	2.0(12)	2.10(8)	7.00(4)	4.00
5.00	4.80(6)	1.5(-8)	5.8(12)	2.20(8)	7.00(4)	5.00
7.00	1.10(7)	6.7(-9)	2.0(13)	2.20(8)	7.00(4)	7.00
10.00	2.10(7)	2.6(-9)	4.9(13)	2.10(8)	7.00(4)	10.00

^a ${}^7\text{Li}(\text{p}, \alpha\gamma){}^4\text{He} = {}^7\text{Li}(\text{p}, \gamma){}^8\text{Be} + {}^7\text{Li}(\text{p}, \alpha){}^4\text{He}$ ^b CF88 rate has been divided by 2.