

Sodium Atom

$Z = 11$

Atomic Mass : $M_A = 22.989770$

$$\sigma_a(\text{Mb}) = 109.76097 \frac{df}{dE} (\text{eV}^{-1})$$

$$\mu_m = \sigma_a \cdot N_A \cdot M_A^{-1}$$

Table I. Discrete oscillator strength, f_n , for $3s \ ^2S \rightarrow np \ ^2P$ transitions.

Energy (eV)	f_n	λ (Å)	Energy (eV)	f_n	λ (Å)
2.1037E+00	9.6100E-01	5.8936E+03	4.8724E+00	1.9220E-04	2.5446E+03
3.7531E+00	1.3450E-02	3.3035E+03	4.9339E+00	1.1500E-04	2.5129E+03
4.3447E+00	1.9050E-03	2.8537E+03	4.9764E+00	7.7000E-05	2.4915E+03
4.6243E+00	7.3070E-04	2.6812E+03	5.0619E+00	2.4500E-04 ^{a)}	2.4493E+03
4.7784E+00	3.6340E-04	2.5947E+03			

^{a)} Represents $\sum_{n=11}^{\infty} f_n$.

Table II. Discrete oscillator strength, f_n , for resonance transitions.

Energy (eV)	f_n	λ (Å)	Energy (eV)	f_n	λ (Å)
3.0768E+01	1.7500E-03	4.0296E+02	3.8267E+01	6.0000E-05	3.2400E+02
3.0934E+01	1.3200E-03	4.0080E+02	3.8305E+01	5.0000E-05	3.2368E+02
3.5768E+01	6.8000E-04	3.4663E+02	3.8333E+01	3.0000E-05	3.2344E+02
3.5790E+01	2.8000E-04	3.4642E+02	3.8354E+01	3.0000E-05	3.2326E+02
3.5985E+01	1.4000E-03	3.4454E+02	3.8370E+01	2.0000E-05	3.2313E+02
3.6018E+01	4.0000E-04	3.4423E+02	3.8384E+01	2.0000E-05	3.2301E+02
3.6056E+01	8.7000E-04	3.4387E+02	3.7865E+01	2.0000E-04	3.2744E+02
3.6129E+01	5.3000E-04	3.4317E+02	3.8051E+01	4.9500E-04	3.2584E+02
3.6217E+01	7.9000E-04	3.4234E+02	3.8170E+01	3.0000E-04	3.2482E+02
3.6906E+01	8.1000E-04	3.3595E+02	3.8234E+01	2.6000E-04	3.2428E+02
3.6929E+01	6.5000E-04	3.3574E+02	3.8283E+01	1.4000E-04	3.2386E+02
3.7070E+01	2.7000E-04	3.3446E+02	3.8317E+01	1.0000E-04	3.2357E+02
3.7273E+01	2.5000E-04	3.3264E+02	3.8342E+01	8.0000E-05	3.2336E+02
3.7292E+01	2.1000E-04	3.3247E+02	3.8361E+01	6.0000E-05	3.2320E+02
3.7497E+01	2.5000E-04	3.3065E+02	3.8376E+01	5.0000E-05	3.2308E+02
3.7699E+01	2.1000E-04	3.2888E+02	3.8387E+01	4.0000E-05	3.2298E+02
3.7994E+01	2.0000E-04	3.2633E+02	3.8397E+01	3.0000E-05	3.2290E+02
3.8128E+01	1.4000E-04	3.2518E+02	3.8405E+01	3.0000E-05	3.2283E+02
3.8212E+01	9.0000E-05	3.2446E+02	3.8410E+01	2.0000E-05	3.2279E+02

Table II. Discrete oscillator strength, f_n , for resonance transitions. (Continued)

Energy (eV)	f_n	λ (Å)	Energy (eV)	f_n	λ (Å)
3.8415E+01	2.0000E-05	3.2275E+02	3.8707E+01	1.3000E-03	3.2031E+02
3.8421E+01	2.0000E-05	3.2270E+02			
3.8425E+01	1.0000E-05	3.2267E+02	6.6370E+01	1.7500E-02	1.8681E+02
3.8556E+01	2.6000E-03	3.2157E+02	6.9400E+01	4.0000E-03	1.7865E+02

Table III. Discrete oscillator strength, f_n , for the resonance transitions (around K-edge).

Energy (eV)	f_n	λ (Å)	Energy (eV)	f_n	λ (Å)
1.0749E+03	6.6700E-03	1.1534E+01	1.0831E+03	2.2000E-04	1.1447E+01
1.0765E+03	7.0000E-04	1.1518E+01	1.0835E+03	6.0000E-05	1.1443E+01
1.0782E+03	1.4500E-03	1.1500E+01	1.0836E+03	2.0000E-05	1.1442E+01
1.0784E+03	5.9000E-04	1.1497E+01	1.0838E+03	1.2000E-04	1.1440E+01
1.0790E+03	5.5000E-04	1.1491E+01	1.0854E+03	3.3000E-04	1.1423E+01
1.0790E+03	2.0000E-04	1.1490E+01	1.0857E+03	2.4000E-04	1.1420E+01
1.0814E+03	8.4000E-04	1.1465E+01	1.0871E+03	1.2000E-04	1.1405E+01
1.0815E+03	5.8000E-04	1.1464E+01	1.0880E+03	1.1000E-04	1.1396E+01

Table IV. Oscillator-strength density, df/dE , photoabsorption cross section, σ_a , and mass absorption coefficient, μ_m .

Energy (eV)	f_n (eV ⁻¹)	σ_a (Mb)	μ_m (cm ² g ⁻¹)	λ (Å)
5.1391E+00	1.1844E-03	1.3000E-01	3.4053E+03	2.4126E+03
5.1400E+00	1.1844E-03	1.3000E-01	3.4053E+03	2.4121E+03
5.1670E+00	1.1479E-03	1.2600E-01	3.3006E+03	2.3995E+03
5.2770E+00	1.0022E-03	1.1000E-01	2.8814E+03	2.3495E+03
5.3910E+00	8.3819E-04	9.2000E-02	2.4099E+03	2.2998E+03
5.5110E+00	6.3775E-04	7.0000E-02	1.8336E+03	2.2498E+03
5.6360E+00	4.0998E-04	4.5000E-02	1.1788E+03	2.1999E+03
5.7670E+00	2.0044E-04	2.2000E-02	5.7629E+02	2.1499E+03
5.9050E+00	7.2886E-05	8.0000E-03	2.0956E+02	2.0996E+03
6.0490E+00	9.1107E-06	1.0000E-03	2.6195E+01	2.0497E+03
6.3590E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.9497E+03
6.5290E+00	2.3688E-05	2.6000E-03	6.8107E+01	1.8990E+03
6.7990E+00	8.2907E-05	9.1000E-03	2.3837E+02	1.8236E+03
7.0790E+00	1.6764E-04	1.8400E-02	4.8199E+02	1.7514E+03
7.6190E+00	3.5441E-04	3.8900E-02	1.0190E+03	1.6273E+03

Table IV. Oscillator-strength density, df/dE , photoabsorption cross section, σ_a , and mass absorption coefficient, μ_m . (Continued)

Energy (eV)	f_n (eV ⁻¹)	σ_a (Mb)	μ_m (cm ² g ⁻¹)	λ (Å)
8.1590E+00	5.4209E-04	5.9500E-02	1.5586E+03	1.5196E+03
8.5000E+00	6.4686E-04	7.1000E-02	1.8598E+03	1.4586E+03
9.0000E+00	7.8352E-04	8.6000E-02	2.2528E+03	1.3776E+03
9.2490E+00	8.5458E-04	9.3800E-02	2.4571E+03	1.3405E+03
9.5000E+00	9.1107E-04	1.0000E-01	2.6195E+03	1.3051E+03
1.0000E+01	1.0022E-03	1.1000E-01	2.8814E+03	1.2398E+03
1.0500E+01	1.0751E-03	1.1800E-01	3.0910E+03	1.1808E+03
1.1000E+01	1.1479E-03	1.2600E-01	3.3006E+03	1.1271E+03
1.1500E+01	1.2026E-03	1.3200E-01	3.4577E+03	1.0781E+03
1.2000E+01	1.2436E-03	1.3650E-01	3.5756E+03	1.0332E+03
1.3000E+01	1.2810E-03	1.4060E-01	3.6830E+03	9.5372E+02
1.4000E+01	1.2901E-03	1.4160E-01	3.7092E+03	8.8560E+02
1.4000E+01	1.2901E-03	1.4160E-01	3.7092E+03	8.8560E+02
1.5000E+01	1.2846E-03	1.4100E-01	3.6935E+03	8.2656E+02
1.6000E+01	1.2728E-03	1.3970E-01	3.6594E+03	7.7490E+02
1.7000E+01	1.2482E-03	1.3700E-01	3.5887E+03	7.2932E+02
1.8000E+01	1.2163E-03	1.3350E-01	3.4970E+03	6.8880E+02
1.9000E+01	1.1889E-03	1.3050E-01	3.4184E+03	6.5255E+02
2.0000E+01	1.1571E-03	1.2700E-01	3.3267E+03	6.1992E+02
2.1000E+01	1.1224E-03	1.2320E-01	3.2272E+03	5.9040E+02
2.1769E+01	1.0960E-03	1.2030E-01	3.1512E+03	5.6954E+02
2.4730E+01	9.4751E-04	1.0400E-01	2.7243E+03	5.0135E+02
2.8140E+01	8.4730E-04	9.3000E-02	2.4361E+03	4.4060E+02
3.1810E+01	7.5619E-04	8.3000E-02	2.1742E+03	3.8976E+02
3.5760E+01	6.7419E-04	7.4000E-02	1.9384E+03	3.4671E+02
3.6500E+01	6.6508E-04	7.3000E-02	1.9122E+03	3.3968E+02
3.8100E+01	3.7354E-03	4.1000E-01	1.0740E+04	3.2542E+02
4.0000E+01	8.6552E-03	9.5000E-01	2.4885E+04	3.0996E+02
4.2000E+01	1.8586E-02	2.0400E+00	5.3438E+04	2.9520E+02
4.4300E+01	3.1068E-02	3.4100E+00	8.9325E+04	2.7987E+02
4.5000E+01	4.1636E-02	4.5700E+00	1.1971E+05	2.7552E+02
4.5500E+01	4.4916E-02	4.9300E+00	1.2914E+05	2.7249E+02
4.8000E+01	5.5849E-02	6.1300E+00	1.6057E+05	2.5830E+02
4.9300E+01	6.5415E-02	7.1800E+00	1.8808E+05	2.5149E+02
5.0000E+01	6.1133E-02	6.7100E+00	1.7577E+05	2.4797E+02
5.1300E+01	6.9241E-02	7.6000E+00	1.9908E+05	2.4168E+02

Table IV. Oscillator-strength density, df/dE , photoabsorption cross section, σ_a , and mass absorption coefficient, μ_m . (Continued)

Energy (eV)	f_n (eV ⁻¹)	σ_a (Mb)	μ_m (cm ² g ⁻¹)	λ (Å)
5.3700E+01	8.2907E-02	9.1000E+00	2.3837E+05	2.3088E+02
6.0000E+01	7.9845E-02	8.7638E+00	2.2957E+05	2.0664E+02
7.0000E+01	7.0709E-02	7.7611E+00	2.0330E+05	1.7712E+02
8.0000E+01	6.1121E-02	6.7087E+00	1.7573E+05	1.5498E+02
9.0000E+01	5.2496E-02	5.7620E+00	1.5094E+05	1.3776E+02
1.0000E+02	4.5154E-02	4.9561E+00	1.2982E+05	1.2398E+02
1.2500E+02	3.1728E-02	3.4824E+00	9.1222E+04	9.9187E+01
1.5000E+02	2.3208E-02	2.5473E+00	6.6726E+04	8.2656E+01
1.7500E+02	1.7606E-02	1.9325E+00	5.0621E+04	7.0848E+01
2.0000E+02	1.3770E-02	1.5114E+00	3.9592E+04	6.1992E+01
2.2500E+02	1.1044E-02	1.2122E+00	3.1753E+04	5.5104E+01
2.5000E+02	9.0434E-03	9.9262E-01	2.6001E+04	4.9594E+01
2.7500E+02	7.5356E-03	8.2712E-01	2.1666E+04	4.5085E+01
3.0000E+02	6.3725E-03	6.9945E-01	1.8322E+04	4.1328E+01
3.5000E+02	3.5001E-03	3.8417E-01	1.0063E+04	3.5424E+01
4.0000E+02	2.4598E-03	2.6999E-01	7.0724E+03	3.0996E+01
4.5000E+02	1.8179E-03	1.9953E-01	5.2267E+03	2.7552E+01
5.0000E+02	1.3897E-03	1.5253E-01	3.9955E+03	2.4797E+01
6.0000E+02	8.7020E-04	9.5514E-02	2.5020E+03	2.0664E+01
7.0000E+02	5.8133E-04	6.3808E-02	1.6714E+03	1.7712E+01
8.0000E+02	4.0692E-04	4.4664E-02	1.1700E+03	1.5498E+01
9.0000E+02	2.9529E-04	3.2411E-02	8.4901E+02	1.3776E+01
1.0000E+03	2.2058E-04	2.4211E-02	6.3421E+02	1.2398E+01
1.0791E+03	1.7816E-04	1.9555E-02	5.1224E+02	1.1490E+01
1.0791E+03	2.1356E-03	2.3441E-01	6.1403E+03	1.1490E+01
1.2500E+03	1.8515E-03	2.0322E-01	5.3233E+03	9.9187E+00
1.5000E+03	1.1883E-03	1.3043E-01	3.4167E+03	8.2656E+00
1.7500E+03	7.5689E-04	8.3077E-02	2.1762E+03	7.0848E+00
2.0000E+03	5.0941E-04	5.5914E-02	1.4646E+03	6.1992E+00
2.2500E+03	3.6613E-04	4.0187E-02	1.0527E+03	5.5104E+00
2.5000E+03	2.7967E-04	3.0697E-02	8.0411E+02	4.9594E+00
2.7500E+03	2.2478E-04	2.4672E-02	6.4627E+02	4.5085E+00
3.0000E+03	1.8801E-04	2.0637E-02	5.4058E+02	4.1328E+00
3.5000E+03	1.4291E-04	1.5686E-02	4.1090E+02	3.5424E+00
4.0000E+03	7.6559E-05	8.4032E-03	2.2012E+02	3.0996E+00
4.5000E+03	5.4345E-05	5.9649E-03	1.5625E+02	2.7552E+00

Table IV. Oscillator-strength density, df/dE , photoabsorption cross section, σ_a , and mass absorption coefficient, μ_m . (Continued)

Energy (eV)	f_n (eV ⁻¹)	σ_a (Mb)	μ_m (cm ² g ⁻¹)	λ (Å)
5.0000E+03	3.9924E-05	4.3821E-03	1.1479E+02	2.4797E+00
6.0000E+03	2.3315E-05	2.5591E-03	6.7036E+01	2.0664E+00
7.0000E+03	1.4732E-05	1.6170E-03	4.2357E+01	1.7712E+00
8.0000E+03	9.8646E-06	1.0827E-03	2.8362E+01	1.5498E+00
9.0000E+03	6.9065E-06	7.5806E-04	1.9857E+01	1.3776E+00
1.0000E+04	5.0479E-06	5.5406E-04	1.4513E+01	1.2398E+00
1.2500E+04	2.5305E-06	2.7775E-04	7.2755E+00	9.9187E-01
1.5000E+04	1.4395E-06	1.5800E-04	4.1388E+00	8.2656E-01
1.7500E+04	8.9348E-07	9.8069E-05	2.5689E+00	7.0848E-01
2.0000E+04	5.9106E-07	6.4875E-05	1.6994E+00	6.1992E-01
2.2500E+04	4.1044E-07	4.5051E-05	1.1801E+00	5.5104E-01
2.5000E+04	2.9484E-07	3.2362E-05	8.4771E-01	4.9594E-01
2.7500E+04	2.1764E-07	2.3888E-05	6.2575E-01	4.5085E-01
3.0000E+04	1.6450E-07	1.8056E-05	4.7297E-01	4.1328E-01
3.5000E+04	1.0009E-07	1.0986E-05	2.8778E-01	3.5424E-01
4.0000E+04	6.5094E-08	7.1447E-06	1.8716E-01	3.0996E-01
4.5000E+04	4.4535E-08	4.8883E-06	1.2805E-01	2.7552E-01
5.0000E+04	3.1715E-08	3.4811E-06	9.1187E-02	2.4797E-01
6.0000E+04	1.7625E-08	1.9346E-06	5.0675E-02	2.0664E-01
7.0000E+04	1.0726E-08	1.1773E-06	3.0838E-02	1.7712E-01
8.0000E+04	6.9757E-09	7.6566E-07	2.0056E-02	1.5498E-01
9.0000E+04	4.7730E-09	5.2389E-07	1.3723E-02	1.3776E-01
1.0000E+05	3.3991E-09	3.7309E-07	9.7731E-03	1.2398E-01

When photon energy, E , is higher than 10^5 eV, the photoabsorption cross section, σ_a , in Mb is given by

$$\sigma_a = 680 (Z - 0.3)^6 \left(\frac{Ry}{E} \right)^4 \frac{\exp[-4\chi \arctan(\chi^{-1})]}{1 - \exp(-2\pi\chi)}.$$

Here χ is represented by

$$\chi = \sqrt{\frac{E_K}{E - E_K}},$$

where $E_K = 1079.1$ eV.

