

# 1 物理定数表

## 1.1 基礎定数

真空中の光速	$c$	$2.99792458 \times 10^{10} \text{ cm s}^{-1}$
単位電荷	$e = q_e / \sqrt{4\pi\epsilon_0}$ $q_e = e\sqrt{4\pi\epsilon_0}$ $[e^2] = [(q_e/4\pi\epsilon_0)^2]$	$4.80 \times 10^{-10} \text{ esu (CGS)}$ $1.60 \times 10^{-19} \text{ C (SI)}$ $[\text{ML}^3\text{T}^{-2}]$
真空の誘電率	$\epsilon_0 = (1/4\pi c^2) \times 10^7$ $1/4\pi\epsilon_0 = c^2 \times 10^{-7}$ $q_e^2/4\pi\epsilon_0$	$8.85 \times 10^{-12} \text{ Fm}^{-1} \text{ (SI)}$ $8.99 \times 10^9 \text{ kg m}^3 \text{ s}^{-2} \text{ C}^{-2} \text{ (SI)}$ $2.31 \times 10^{-28} \text{ kg m}^3 \text{ s}^{-2} \text{ (SI)}$
真空の透磁率	$\mu_0 = 4\pi \times 10^{-7}$	$1.26 \times 10^{-6} \text{ Hm}^{-1} \text{ (SI) (exact)}$
プランク定数	$h$ $\hbar = h/2\pi$ $\hbar c$ $[h]$	$6.63 \times 10^{-27} \text{ erg s} = 4.14 \times 10^{-15} \text{ eV s}$ $1.05 \times 10^{-27} \text{ erg s} = 6.58 \times 10^{-16} \text{ eVs}$ $197.3 \text{ MeV fm}$ $[\text{ML}^2\text{T}^{-1}]$
重力定数	$G$ $[G]$	$6.67 \times 10^{-8} \text{ dyn cm}^2 \text{ g}^{-2}$ $[\text{M}^{-1}\text{L}^3\text{T}^{-2}]$
微細構造定数	$\alpha_e = e^2/\hbar c \text{ (CGS)} = q_e^2/4\pi\epsilon_0\hbar c \text{ (SI)}$	$1/(1.37 \times 10^2) = 7.30 \times 10^{-3}$
重力微細構造定数	$\alpha_g = Gm_p^2/\hbar c$	$5.90 \times 10^{-39}$
アボガドロ数	$N$	$6.02 \times 10^{23} \text{ mol}^{-1}$
ボルツマン定数	$k$	$1.38 \times 10^{-16} \text{ erg K}^{-1} = 8.62 \times 10^{-5} \text{ eV K}^{-1}$
ボーア磁子	$\mu_B = e\hbar/2m_e$	$9.27 \times 10^{-21} \text{ gauss cm}^3$

(2019 年からの新 SI 単位系では  $c$ ,  $q_e$ ,  $h$ ,  $N$ ,  $k$  が不確かさのない定義値になったが、ここには全桁の値は表示していない)

## 1.2 長さと面積

	cm	pc	light year	AU
cm	1	$3.24 \times 10^{-19}$	$1.06 \times 10^{-18}$	$6.69 \times 10^{-14}$
pc (パーセク)	$3.09 \times 10^{18}$	1	3.26	$2.06 \times 10^5$
light year (光年)	$9.46 \times 10^{17}$	0.307	1	$6.32 \times 10^4$
AU (天文単位)	$1.50 \times 10^{13}$	$4.85 \times 10^{-6}$	$1.58 \times 10^{-5}$	1
電子のコンプトン波長	$\lambda_e = h/m_e c$	$2.43 \times 10^{-10} \text{ cm}$	$(\lambda_e/2\pi = 3.84 \times 10^{-11} \text{ cm})$	
陽子のコンプトン波長	$\lambda_p = h/m_p c$	$1.32 \times 10^{-13} \text{ cm}$	$(\lambda_p/2\pi = 2.10 \times 10^{-14} \text{ cm})$	
古典電子半径	$r_e = e^2/m_e c^2$	$2.82 \times 10^{-13} \text{ cm}$		
ボーア半径	$a_0 = \hbar^2/m_e e^2$	$0.529 \times 10^{-8} \text{ cm}$	$(\pi a_0^2 = 0.880 \times 10^{-16} \text{ cm}^2)$	
リュードベリ定数	$R_\infty = 2\pi^2 m_e e^4 / ch^3$	$1.10 \times 10^5 \text{ cm}^{-1}$		
1 keV の光子の波長	$hc/1\text{keV}$	$12.4 \times 10^{-8} \text{ cm}$	$= 12.4 \text{ \AA}$	
ラーモア半径	$r_g = p_\perp / qB$	$3.3 \times 10^2 (\gamma mc^2 / \text{GeV}) (v_\perp / c) (q/e)^{-1} (B/\text{G})^{-1} \text{ cm}$		
地球半径	$R_\oplus$	$6.37 \times 10^8 \text{ cm}$	$(4\pi R_\oplus^2 = 5.10 \times 10^{18} \text{ cm}^2)$	
太陽半径	$R_\odot$	$6.96 \times 10^{10} \text{ cm}$	$(4\pi R_\odot^2 = 6.09 \times 10^{22} \text{ cm}^2)$	
シュバルツシルト半径	$R_s = 2GM/c^2$	$2.95 \times 10^5 (M/M_\odot) \text{ cm}$	$\sim 3 \text{ km}$	
銀河系中心から太陽の距離		$\sim 10 \text{ kpc}$	$(\text{c.f., IAU } 8.5 \text{ kpc})$	
銀河系の直径		$\sim 25 \text{ kpc}$		
銀河団の平均直径		$\sim 3 \text{ Mpc}$		
プランク長	$(G\hbar/c^3)^{1/2}$	$1.62 \times 10^{-33} \text{ cm}$		
トムソン散乱断面積	$\sigma_T = 8\pi r_e^2/3$	$6.65 \times 10^{-25} \text{ cm}^2$		
バーン (barn, 反応断面積)	b	$10^{-24} \text{ cm}^2 = 10^{-28} \text{ m}^2$		

## 1.3 時間

1 恒星年	$3.6526 \times 10^2 \text{ days} = 3.1558150 \times 10^7 \text{ s}$
1 日	$24 \text{ h} = 1,440 \text{ min} = 86,400 \text{ s}$
光の伝搬時間	$3.33(r/1 \text{ m}) \text{ ns} = 500(r/1 \text{ AU}) \text{ s}$
ハッブル時間 $1/H_0$	$9.8 \times 10^9 h^{-1} \text{ year} = 3.09 \times 10^{17} h^{-1} \text{ s}$ (宇宙年齢の目安)
宇宙年齢	138 億年 [Planck Collaboration A&A (2016), Table 4]
プランク時間 $(G\hbar/c^5)^{1/2}$	$5.39 \times 10^{-44} \text{ s}$

## 1.4 質量とエネルギー

電子の質量	$m_e$	$9.11 \times 10^{-28} \text{ g}$	電子の静止質量エネルギー	$m_e c^2$	0.511 MeV
陽子の質量	$m_p$	$1.67 \times 10^{-24} \text{ g}$	陽子の静止質量エネルギー	$m_p c^2$	938 MeV
陽子電子質量比	$m_n/m_e$	$1.84 \times 10^3$	水素の基底状態エネルギー	$m_e c^2 (\alpha_e^2/2)$	13.6 eV
地球質量	$M_\oplus$	$5.98 \times 10^{27} \text{ g}$		=1Ry	912 Å
太陽質量	$M_\odot$	$1.99 \times 10^{33} \text{ g}$			
銀河系質量	$M_{\text{gal}}$	$\sim 2 \times 10^{11} M_\odot$	$E\lambda = 12.39842 \text{ keV } \text{\AA}$		
宇宙の質量	$M_U$	$10^{54}\text{--}10^{56} \text{ g}$	$\hbar c = 1.973 \text{ keV } \text{\AA} = 197.3 \text{ MeV fm}$		
プランク質量	$(\hbar c/G)^{1/2}$	$2.18 \times 10^{-5} \text{ g}$	$1 \text{ J} = 1 \times 10^7 \text{ ergs}, 1 \text{ cal} = 4.19 \text{ J}$		

	eV	erg	cm <sup>-1</sup>	Hz	K
eV	1	$1.60 \times 10^{-12}$	$8.07 \times 10^3$	$2.42 \times 10^{14}$	$1.16 \times 10^4$
erg	$6.24 \times 10^{11}$	1	$5.03 \times 10^{15}$	$1.51 \times 10^{26}$	$7.24 \times 10^{15}$
cm <sup>-1</sup>	$1.24 \times 10^{-4}$	$1.99 \times 10^{-16}$	1	$3.00 \times 10^{10}$	1.44
Hz	$4.14 \times 10^{-15}$	$6.63 \times 10^{-27}$	$3.34 \times 10^{-11}$	1	$4.80 \times 10^{-11}$
K	$8.62 \times 10^{-5}$	$1.38 \times 10^{-16}$	$6.95 \times 10^{-1}$	$2.08 \times 10^{10}$	1

## 1.5 輻射

黒体放射の輻射密度定数	$a = \pi^2 k^4 / 15 c^3 \hbar^3$	$7.57 \times 10^{-15} \text{ erg cm}^{-3} \text{ K}^{-4}$
シュテファン-ボルツマン定数	$\sigma_{\text{sb}} = ac/4$	$5.67 \times 10^{-5} \text{ erg cm}^{-2} \text{ K}^{-4} \text{ s}^{-1}$
黒体放射の最大強度波長	$T\lambda_{\text{max}}$	0.290 cm K
黒体放射の光度	$L_x = 4\pi R^2 \sigma_{\text{sb}} T^4$	$= 1.045 \times 10^{35} (R/10 \text{ km})^2 (kT/0.3 \text{ keV})^4 \text{ erg s}^{-1}$
太陽光度	$L_\odot$	$3.8 \times 10^{33} \text{ erg s}^{-1} = 3.8 \times 10^{26} \text{ W}$
絶対輻射等級	$M_{\text{bol}} = 4.75 - 2.5 \log (L/L_\odot)$	
絶対輻射等級 0 等星の輻射		$3.0 \times 10^{35} \text{ erg s}^{-1}$
輻射等級 0 等星の明るさ		$2.5 \times 10^{-5} \text{ erg cm}^{-2} \text{ s}^{-1}$
見かけの等級	$m = M + 5 \log (D/\text{pc}) - 5 + \text{空間吸収の大きさ}$	
X線光度	$L_x = 4\pi d^2 F_x$	$= 1.200 \times 10^{32} (d/1 \text{ kpc})^2 (F_x/10^{-12} \text{ erg s cm}^{-2}) \text{ erg s}^{-1}$
エディントン光度	$L_{\text{Edd}} \sim 1.3 \times 10^{38} (M/M_\odot) \text{ erg s}^{-1}$	
スピンドウン光度	$L_{\text{sd}} = 3.94 \times 10^{35} \text{ erg s}^{-1} (P/1 \text{ s})^{-3} (\dot{P}/10^{-11} \text{ s s}^{-1})$	(at $I = 10^{45} \text{ g cm}^2$ )
かに星雲のX線強度	1 Crab	$\sim 2.3 \times 10^{-8} \text{ erg s cm}^{-2} \text{ (2-10 keV)}$

## 1.6 磁場

量子電磁力学の臨界磁場	$B_{\text{cr}} = m_e^2 c^3 / \hbar e$	$4.414 \times 10^{13} \text{ G}$
パルサーの表面磁場強度	$B_d = (3c^3 I P \dot{P} / 2\pi^2 R_{\text{ns}}^6)^{1/2}$	$1.0 \times 10^{14} (P/1 \text{ s})^{1/2} (\dot{P}/10^{-11} \text{ s s}^{-1})^{1/2} \text{ G}$
電子サイクロトロン共鳴	$E_{\text{cyc}} = m_e c^2 (1 + B/B_{\text{cr}})$	$11.6 (B/10^{12} \text{ G}) \text{ keV}$
磁気エネルギー密度	$U_{\text{mag}} = B^2 / 8\pi \text{ (CGS)}$	$3.98 \times 10^{-2} (B/1 \text{ G})^2 \text{ erg cm}^{-3} \quad (1\text{T}=10^4 \text{ G})$

## 1.7 宇宙論

ハッブル定数	$H_0$	$100h \text{ km s}^{-1} \text{ Mpc}^{-1} = 3.2h \times 10^{-18} \text{ s}^{-1} \quad (h \sim 0.70)$
ハッブル距離	$c/H_0$	$3000h^{-1} \text{ Mpc} = 9.26 \times 10^{27} h^{-1} \text{ cm}$
臨界密度	$\rho_c = (3H_0^2) / (8\pi G)$	$1.9 \times 10^{-29} h^2 \text{ g cm}^{-3} = 2.8 \times 10^{11} h^2 M_\odot \text{ Mpc}^{-3}$
宇宙黒体輻射密度	$\rho_{r0} = aT_{r0}^4$	$4.0 \times 10^{-13} [T_{r0}/2.7\text{K}]^4 \text{ erg cm}^{-3}$
宇宙黒体輻射光子数密度	$n_{r0}$	$4.0 \times 10^2 [T_{r0}/2.7\text{K}]^3 \text{ cm}^{-3}$
宇宙論的赤方偏移 (近傍)	$z \sim (H_0/c)d$	$3.3 \times 10^{-4} h (d/\text{Mpc}) \quad (z < 0.05)$
運動学的赤方偏移	$1+z = \sqrt{(1+\beta)/(1-\beta)}$	$E' = \gamma(1-\beta)E = \{(1-\beta)/(1+\beta)\}^{1/2} E$
重力赤方偏移	$1+z = (1 - R_s/R)^{-1/2}$	

## 1.8 その他

[力] = [MLT <sup>-2</sup> ], [エネルギー] = [ML <sup>2</sup> T <sup>-2</sup> ], [圧力] = [ML <sup>-1</sup> T <sup>-2</sup> ]	
$1 \text{ g cm}^{-3} = 5.99 \times 10^{23} \text{ proton cm}^{-3} = 5.61 \times 10^{32} \text{ eV cm}^{-3} = 1.48 \times 10^{40} M_\odot \text{ Mpc}^{-3}$	
$1 \text{ Jy} = 10^{-23} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ Hz}^{-1} = 10^{-26} \text{ J m}^{-2} \text{ s}^{-1} \text{ Hz}^{-1}$	
$760 \text{ torr} = 1.013 \times 10^6 \text{ dyn cm}^{-2} = 1 \text{ atmos} = 1.013 \text{ bars} = 1.013 \times 10^5 \text{ Nm}^{-2} \text{ (Pa)}$	
$1 \text{ radian} = 57.296 \text{ degrees}, 1 \text{ arcsec} = 4.848 \times 10^{-6} \text{ radians}$	
天体の赤経と赤緯を $(\alpha, \delta)$ として、人工衛星のオイラー角は $(\alpha, 90^\circ - \delta, 90^\circ - [\text{ロール角}])$	

## 2 中性原子や高階電離イオンからの代表的な輝線

Table 1: 中性原子、ヘリウム様イオン、水素様イオンの輝線エネルギーと K 殻束縛エネルギー (単位 eV)

Neutral atom			$\rho$ (g cm <sup>-3</sup> )	Fluorescence						
Element	Z			K $\alpha_1$	K $\alpha_2$	K $\beta_1$	L $\alpha_1$	L $\alpha_2$	L $\beta_1$	K-edge
C	6	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>2</sup>	2.27	277.						284.2
N	7	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>3</sup>	1.25	392.4						409.9
O	8	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>4</sup>	1.42	524.9						543.1
Ne	10	1s <sup>2</sup> 2s <sup>2</sup> 2p <sup>6</sup>	0.90	848.6	848.6					870.2
Na	11	[Ne]3s <sup>1</sup>	0.97	1,040.9	1,040.9	1,071.1				1,070.8
Mg	12	[Ne]3s <sup>2</sup>	1.74	1,253.6	1,253.6	1,302.2				1,303.0
Al	13	[Ne]3s <sup>2</sup> 3p <sup>1</sup>	2.70	1,486.7	1,486.2	1,557.4				1,559.6
Si	14	[Ne]3s <sup>2</sup> 3p <sup>2</sup>	2.33	1,739.9	1,739.3	1,835.9				1,839.
S	16	[Ne]3s <sup>2</sup> 3p <sup>4</sup>	2.09	2,307.8	2,306.6	2,464.0				2,472.
Ar	18	[Ne]3s <sup>2</sup> 3p <sup>6</sup>	1.78	2,957.7	2,955.6	3,190.5				3,205.9
Ca	20	[Ar]4s <sup>2</sup>	1.53	3,691.6	3,688.0	4,012.7	341.3	341.3	344.9	4,038.5
Fe	26	[Ar]3d <sup>6</sup> 4s <sup>2</sup>	7.87	6,403.8	6,390.8	7,057.9	705.0	705.0	718.5	7,112.
Ni	28	[Ar]3d <sup>8</sup> 4s <sup>2</sup>	8.91	7,478.1	7,460.8	8,264.6	851.5	851.5	868.8	8,333.

Ion	He-like					H-like				
	F or z	I1 or y	I2 or x	R or x	K-edge	Ly $\alpha_2$	Ly $\alpha_1$	Ly $\beta_2$	Ly $\beta_1$	K-edge
C	298.9	304.4	304.4	307.9	392.0	367.4	367.5	435.5	435.5	489.9
N	419.8	426.3	426.3	430.7	552.0	500.2	500.3	592.9	592.9	667.0
O	560.9	568.5	568.6	573.9	739.3	653.4	653.6	774.5	774.6	871.4
Ne	905.0	914.8	915.0	922.0	1,195.8	1,021.5	1,021.9	1,210.8	1,210.9	1,362.1
Na	1,107.8	1,118.7	1,119.0	1,126.8	1,465.1	1,236.3	1,236.9	1,465.4	1,465.6	1,648.7
Mg	1,331.1	1,343.1	1,343.5	1,352.2	1,761.8	1,471.6	1,472.6	1,744.5	1,744.8	1,962.6
Al	1,574.9	1,588.1	1,588.7	1,598.2	2,085.9	1,727.6	1,728.9	2,048.0	2,048.4	2,304.1
Si	1,839.4	1,853.7	1,854.6	1,864.9	2,437.6	2,004.3	2,006.0	2,376.1	2,376.6	2,673.1
S	2,430.3	2,447.1	2,448.7	2,460.6	3,223.7	2,619.7	2,622.7	3,105.8	3,106.7	3,494.1
Ar	3,104.1	3,123.5	3,126.2	3,139.5	4,120.6	3,318.1	3,322.9	3,934.2	3,935.7	4,426.2
Ca	3,861.1	3,883.3	3,887.7	3,902.2	5,128.8	4,100.1	4,107.5	4,861.9	4,864.1	5,469.8
Fe	6,636.6	6,667.5	6,682.3	6,700.4	8,828.1	6,951.9	6,973.1	8,246.3	8,252.6	9,277.6
Ni	7,731.6	7,765.7	7,786.4	7,805.5	10,288.8	8,073.1	8,101.7	9,577.5	9,586.0	10,775.3

(a) X-ray Data Booklet (<http://xdb.lbl.gov>) are used for line and K-edge (ionization) energies of neutral elements, NIST Atomic Spectra Database version 5.6 (<https://www.nist.gov/pml/atomic-spectra-database>) for K-edge (ionization) energies of He-like and H-like ions, and AtomDB v3.0.9 <http://www.atomdb.org> for emission line energies of H-like and H-like ions. (b) Inner shell lines are denoted by K $\alpha$  ( $n=1$  to 2), K $\beta$  ( $n=1$  to 3) for Li-like or higher ions, but called Ly $\alpha$  and Ly $\beta$  for H- and He-like ions.

Table 2: An incomplete list of astrophysically important X-ray spectral features (keV)

Energy		Energy		Energy		Energy	
Ne VII	0.127	O VII	0.574	Fe XX	0.996	Fe I K $\alpha_1$	6.404
Si XI	0.283	O VIII	0.654	Ne X	1.022	Fe XXV	6.64
C I K edge	0.284	O VII	0.666	Mg I K edge	1.305	Fe XXV	6.68
Si XII	0.303	O VII	0.698	Mg XI	1.340	Fe XXV	6.70
C V	0.308	Fe I LIII edge	0.707	Mg XI	1.352	Fe XXVI	6.93
N I K edge	0.402	Fe I LII edge	0.721	Si K edge	1.839	Fe I K $\beta$	7.058
N VI	0.431	Fe XVII	0.826	Si XIII	1.86	Fe I Kedge	7.111
N VII	0.500	Ne I K edge	0.867	S I K edge	2.472		
O I K edge	0.532	Ne IX	0.915	Ar I K edge	3.203		
O VII	0.569	Ne IX	0.922	Fe I K $\alpha_2$	6.391		

3 原子核からの代表的な輝線

Table 3: 放射線源 (校正用、環境放射線) からのガンマ線

	Decay	Half-life	Energy	$I_g$		Decay	Half-life	Energy	$I_g$
		$T_{1/2}$	(keV)	(%)			$T_{1/2}$	(keV)	(%)
$^{22}\text{Na}$	$\text{EC}/\beta^+$	2.6019 y	511.	181.4	$^{152}\text{Eu}$	$\text{EC}/\beta^-$	13.53 y	121.78	28.58
$^{40}\text{K}$	$\text{EC}/\beta^+$	$1.27 \times 10^9$ y	1460.83	11				244.69	7.58
$^{55}\text{Fe}$	EC	2.73 y	5.888	8.5				344.27	26.5
			5.899	16.9				778.90	12.94
			6.490	2.99				867.37	4.24
$^{57}\text{Co}$	EC	271.79 d	14.41	9.16				964.07	14.60
			122.06	85.60				1085.86	10.20
			136.47	10.68				1112.07	13.64
$^{60}\text{Co}$	$\beta^-$	5.27 y	1173.23	99.97				1408.00	21.00
			1332.50	99.98	$^{241}\text{Am}$	$\alpha$	432.2 y	59.54	35.9
$^{88}\text{Y}$	$\text{EC}/\beta^+$	106.65 d	898.04	93.7	$^{214}\text{Bi}$	$\alpha/\beta^-$	19.9 m	609.31	46.1
			1836.06	99.2				768.35	4.94
$^{133}\text{Ba}$	EC	10.51 y	53.16	2.19				934.06	3.03
			79.61	2.62				1120.28	15.1
			80.99	34.06	$^{208}\text{Tl}$	$\beta^-$	3.05 m	277.35	6.31
			276.39	7.16				510.77	22.6
			302.85	18.33				583.19	84.5
			356.01	62.05				860.56	12.42
			383.85	8.94				2614.53	99
$^{137}\text{Cs}$	$\beta^-$	30.07 y	661.65	85.1					

Data from the Lund/LBNL Nuclear Data Search Version 2.0 (1999) <http://nucleardata.nuclear.lu.se/toi/>, shown for  $I_g > 5\%$ . Lines from  $^{55}\text{Fe}$  are Mn  $K\alpha 2$  (5.888 keV), Mn  $K\alpha 1$  (5.899 keV), and Mn  $K\beta 1 + \text{Mn } K\beta 3$  (6.490 keV).

4 周期律表

Periodic Table of the Elements

<div><div><div>12.201 H Hydrogen 1.00794- 1.00811</div><div>30.973761908(5) Li Lithium 6.938-6.997</div><div>9.0121831(5) Be Beryllium 9.0121831(5)</div><div>11.009305 Na Sodium 22.98976928(2)</div><div>12.01097 Mg Magnesium 24.304-24.307</div><div>26.9815385(7) Al Aluminum 26.9815385(7)</div><div>28.0855836(9) Si Silicon 28.084-28.086</div><div>30.973761908(5) P Phosphorus 30.973761908(5)</div><div>32.065047(5) S Sulphur 32.059-32.076</div><div>35.4463(1) Cl Chlorine 35.446-35.457</div><div>39.9481(1) Ar Argon 39.948(1)</div><div>39.0983(1) K Potassium 39.0983(1)</div><div>40.078(4) Ca Calcium 40.078(4)</div><div>44.955908(5) Sc Scandium 44.955908(5)</div><div>47.867(1) Ti Titanium 47.867(1)</div><div>50.9415(1) V Vanadium 50.9415(1)</div><div>51.9961(6) Cr Chromium 51.9961(6)</div><div>54.938044(3) Mn Manganese 54.938044(3)</div><div>55.845(2) Fe Iron 55.845(2)</div><div>58.933194(4) Co Cobalt 58.933194(4)</div><div>58.6934(4) Ni Nickel 58.6934(4)</div><div>63.546(3) Cu Copper 63.546(3)</div><div>65.38(2) Zn Zinc 65.38(2)</div><div>69.723(1) Ga Gallium 69.723(1)</div><div>72.630(8) Ge Germanium 72.630(8)</div><div>74.921595(6) As Arsenic 74.921595(6)</div><div>78.971(8) Se Selenium 78.971(8)</div><div>79.901-79.907 Br Bromine 79.901-79.907</div><div>83.798(2) Kr Krypton 83.798(2)</div><div>85.4678(3) Rb Rubidium 85.4678(3)</div><div>87.62(1) Sr Strontium 87.62(1)</div><div>88.90584(2) Y Yttrium 88.90584(2)</div><div>91.224(2) Zr Zirconium 91.224(2)</div><div>92.90637(2) Nb Niobium 92.90637(2)</div><div>95.95(1) Mo Molybdenum 95.95(1)</div><div>98.9062(1) Tc Technetium (98)</div><div>101.07(2) Ru Ruthenium 101.07(2)</div><div>102.90550(2) Rh Rhodium 102.90550(2)</div><div>106.42(1) Pd Palladium 106.42(1)</div><div>107.8682(2) Ag Silver 107.8682(2)</div><div>112.414(4) Cd Cadmium 112.414(4)</div><div>114.818(1) In Indium 114.818(1)</div><div>118.710(7) Sn Tin 118.710(7)</div><div>121.760(1) Sb Antimony 121.760(1)</div><div>127.60(3) Te Tellurium 127.60(3)</div><div>126.90447(3) I Iodine 126.90447(3)</div><div>131.293(6) Xe Xenon 131.293(6)</div><div>132.90545196(6) Cs Cesium 132.90545196(6)</div><div>137.327(7) Ba Barium 137.327(7)</div><div>178.49(2) Hf Hafnium 178.49(2)</div><div>180.94788(2) Ta Tantalum 180.94788(2)</div><div>183.84(1) W Tungsten 183.84(1)</div><div>186.207(1) Re Rhenium 186.207(1)</div><div>186.207(1) Os Osmium 186.207(1)</div><div>192.227(3) Ir Iridium 192.227(3)</div><div>195.084(9) Pt Platinum 195.084(9)</div><div>196.966569(5) Au Gold 196.966569(5)</div><div>200.592(3) Hg Mercury 200.592(3)</div><div>204.385 Tl Thallium 204.385</div><div>207.2(1) Pb Lead 207.2(1)</div><div>208.98040(1) Bi Bismuth 208.98040(1)</div><div>209 Po Polonium (209)</div><div>210 At Astatine (210)</div><div>222 Rn Radon (222)</div><div>223 Fr Francium (223)</div><div>226 Ra Radium (226)</div><div>261 Rf Rutherfordium (261)</div><div>268 Db Dubnium (268)</div><div>269 Sg Seaborgium (269)</div><div>270 Bh Bohrium (270)</div><div>270 Hs Hassium (269)</div><div>278 Mt Meitnerium (278)</div><div>278 Ds Darmstadtium (281)</div><div>282 Rg Roentgenium (282)</div><div>285 Cn Copernicium (285)</div><div>286 Nh Nihonium (286)</div><div>289 Fl Flerovium (289)</div><div>289 Mc Moscovium (289)</div><div>293 Lv Livermorium (293)</div><div>294 Ts Tennessine (294)</div><div>294 Og Oganesson (294)</div></div></div>																		<div><div><div>2 He Helium 4.002602(2)</div><div>6 B Boron 10.806-10.821</div><div>12 C Carbon 12.0096- 12.0116</div><div>14 N Nitrogen 14.00643- 14.00728</div><div>16 O Oxygen 15.99903- 15.99977</div><div>18 F Fluorine 18.998403163(6)</div><div>20 Ne Neon 20.1797(6)</div><div>22 Na Sodium 22.98976928(2)</div><div>24 Mg Magnesium 24.304-24.307</div><div>26 Al Aluminum 26.9815385(7)</div><div>28 Si Silicon 28.084-28.086</div><div>30 P Phosphorus 30.973761908(5)</div><div>32 S Sulphur 32.059-32.076</div><div>34 Cl Chlorine 35.446-35.457</div><div>36 Ar Argon 39.948(1)</div><div>38 K 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107.8682(2)</div><div>96 Cd Cadmium 112.414(4)</div><div>98 In Indium 114.818(1)</div><div>100 Sn Tin 118.710(7)</div><div>102 Sb Antimony 121.760(1)</div><div>104 Te Tellurium 127.60(3)</div><div>106 I Iodine 126.90447(3)</div><div>108 Xe Xenon 131.293(6)</div><div>110 Cs Cesium 132.90545196(6)</div><div>112 Ba Barium 137.327(7)</div><div>114 * Lanthanides</div><div>116 Hf Hafnium 178.49(2)</div><div>118 Ta Tantalum 180.94788(2)</div><div>120 W Tungsten 183.84(1)</div><div>122 Re Rhenium 186.207(1)</div><div>124 Os Osmium 186.207(1)</div><div>126 Ir Iridium 192.227(3)</div><div>128 Pt Platinum 195.084(9)</div><div>130 Au Gold 196.966569(5)</div><div>132 Hg Mercury 200.592(3)</div><div>134 Tl Thallium 204.385</div><div>136 Pb Lead 207.2(1)</div><div>138 Bi Bismuth 208.98040(1)</div><div>140 Po Polonium (209)</div><div>142 At Astatine (210)</div><div>144 Rn Radon (222)</div><div>146 Fr Francium (223)</div><div>148 Ra Radium (226)</div><div>150 ** Actinides</div><div>152 Rf Rutherfordium (261)</div><div>154 Db Dubnium (268)</div><div>156 Sg Seaborgium (269)</div><div>158 Bh Bohrium (270)</div><div>160 Hs Hassium (269)</div><div>162 Mt Meitnerium (278)</div><div>164 Ds Darmstadtium (281)</div><div>166 Rg Roentgenium (282)</div><div>168 Cn Copernicium (285)</div><div>170 Nh Nihonium (286)</div><div>172 Fl Flerovium (289)</div><div>174 Mc Moscovium (289)</div><div>176 Lv Livermorium (293)</div><div>178 Ts Tennessine (294)</div><div>180 Og Oganesson (294)</div></div></div>																	
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Standard atomic weights taken from the Commission on Isotopic Abundances and Atomic Weights (ciaw.org/atomic-weights.htm). Adapted from Ivan Griffin's L<sup>A</sup>T<sub>E</sub>X Periodic Table. © 2017 Paul Danese

An asterisk (\*) next to a subshell indicates an anomalous (Aufbau rule-breaking) ground state electron configuration.