

Quantity	Symbol	Value
electron mass	m_e	9.10939×10^{-31} kg
proton mass	m_p	1.67262×10^{-27} kg
neutron mass	m_n	1.67493×10^{-27} kg
atomic mass unit	u	1.66054×10^{-27} kg
elementary charge	e	1.60218×10^{-19} C
Avogadro constant	N_A	6.02214×10^{23} mol ⁻¹
molar gas constant	R	8.31451 J mol ⁻¹ K ⁻¹
standard atmosphere	atm	1.01325×10^5 Pa
molar volume	V_m	22.41410 L mol ⁻¹
speed of light	c	2.99792×10^8 m s ⁻¹
Planck constant	h	6.62608×10^{-34} J s
Faraday constant	F	9.64853×10^4 C mol ⁻¹
Boltzmann constant	k	1.38066×10^{-23} J K ⁻¹



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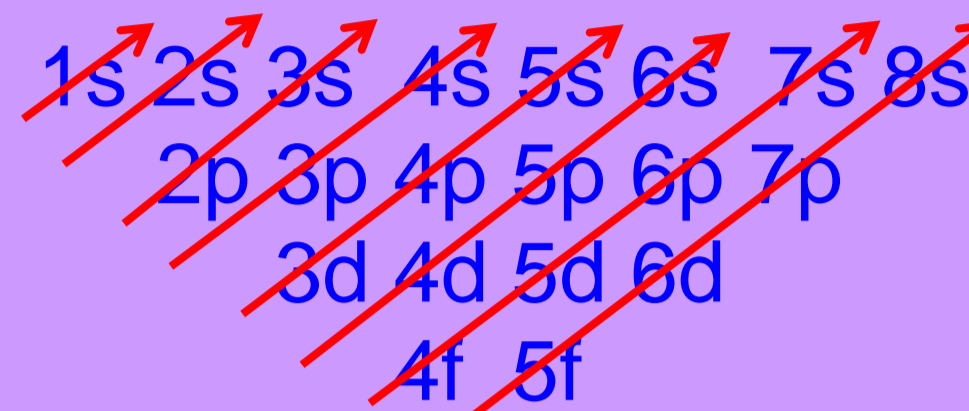
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Dr. Ma: Ph.D. in Organic Chemistry; Postdoctoral research fellow at University of California (Irvine) & University of Toronto; Alexander von Humboldt research fellow at University of Kaiserslautern, Germany; Former professor at University of New Brunswick; Currently teaching at Seneca College and MPC Academy; Over 15 years of instructing experience. This Periodic Table of the Elements was designed by Dr. Ma.

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Periodic Table of the Elements



UNIVERSITY COURSES*	HIGH SCHOOL COURSES
<ul style="list-style-type: none"> General Chemistry U1: CHEM1000, CHEM1001, CHEM1500; U2: CHM151Y; U3: 1A03, 1AA3, 1E03, 2E03, 2LA3, 2LB3. Organic Chemistry U1: CHEM2020 & 3020; U2: CHM138H, CHM247S, CHM249S, CHM347F, CHM348F, CHM343S, CHM342F; U3: 2OA3, 2OB3, 2OC3, 2OD3, 3D03, 4D03; U4: Chemistry 2213a, 2223b. Physics U1: PHYS1010, PHYS1070, PHYS1410; U2: PHY131H1, PHY132H1, PHY151H1, PHY152H1; U3: 1B03, 1BB3, 1E03, 1L03. Test Preparation: MCAT (Medical College Admission Test); PCAT (Pharmacy College Admission Test); DAT (Dental Admission Test); OAT (Optometry Admission Test). Biochemistry: U1: BIOL2020; U2: BCH210H1; Calculus: U1: 1300 & 1310; U3: Math 1ZB3; Thermodynamics: U1: Chem2011. <p>*U1: York Univ.; U2: Univ. of Toronto; U3: McMaster Univ.; U4: Univ. of Western Ontario</p>	<ul style="list-style-type: none"> Chemistry: Gr. 11&12, International Baccalaureate & Advanced Placement Physics: Gr. 11&12, International Baccalaureate & Advanced Placement Math (Algebra, Trigonometry, Adv. Functions & Calculus): Gr. 11&12. Science: Gr. 9&10 Test Preparation: <ul style="list-style-type: none"> > SAT (General, Chemistry & Physics) > Contest (Chemistry & Physics)

Group	IA	IIA	IIIB	IVB	VB	VIB	VIIIB	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA		
1	H 1.008 14 2.10 1s ¹ 14.3 20 9.0n5 Hydrogen															He 4.003 (1) 1s ² 5.193 4 1.8n4 Helium		
2	Li 6.941 454 0.98 [He]2s ¹ 3.58 1615 Lithium	Be 9.012 923 1.57 [He]2s ² 1.83 2744 Beryllium																
3	Na 22.990 371 0.93 [Ne]3s ¹ 1.23 1156 Sodium	Mg 24.305 923 1.31 [Ne]3s ² 1.02 1363 Magnesium																
4	K 39.098 337 0.82 [Ar]4s ¹ 0.757 1033 Potassium	Ca 40.08 1115 1.00 [Ar]4s ² 0.647 1115 Calcium	Sc 44.956 1814 1.36 [Ar]3d ¹ 4s ² 2 3109 Scandium	Ti 47.88 1941 1.54 [Ar]3d ² 4s ² 0.523 3560 Titanium	V 50.942 2183 1.63 [Ar]3d ³ 4s ² 0.489 3680 Vanadium	Cr 51.996 2130 1.66 [Ar]3d ⁵ 4s ¹ 0.479 2945 Chromium	Mn 54.938 2130 1.55 [Ar]3d ⁵ 4s ² 0.479 2234 Manganese	Fe 55.847 1811 1.83 [Ar]3d ⁶ 4s ² 0.449 3134 Iron	Co 58.933 1768 1.88 [Ar]3d ⁷ 4s ² 0.421 3200 Cobalt	Ni 58.69 1728 1.91 [Ar]3d ⁸ 4s ² 0.106 3186 Nickel	Cu 63.546 1358 1.90 [Ar]3d ¹⁰ 4s ¹ 0.385 2835 Copper	Zn 65.38 693 1.65 [Ar]3d ¹⁰ 4s ² 0.371 1180 Zinc	Ga 69.72 303 1.81 [Ar]3d ¹⁰ 4s ² 4p ¹ 0.371 2477 Gallium	Ge 72.59 1211 2.01 [Ar]3d ¹⁰ 4s ² 4p ² 0.32 3115 Germanium	As 74.922 (1090) 2.18 [Ar]3d ¹⁰ 4s ² 4p ³ 0.29 (876) Arsenic	Se 78.96 494 2.55 [Ar]3d ¹⁰ 4s ² 4p ⁴ 0.321 958 Selenium	Br 79.904 266 2.96 [Ar]3d ¹⁰ 4s ² 4p ⁵ 0.226 332 Bromine	Kr 83.80 116 x [Ar]3d ¹⁰ 4s ² 4p ⁶ 0.248 120 Krypton
5	Rb 85.468 312 0.79 [Kr]5s ¹ 0.363 961 Rubidium	Sr 87.62 1050 0.95 [Kr]5s ² 0.301 1655 Strontium	Y 88.906 1795 1.22 [Kr]4d ¹ 5s ² 2 3618 Yttrium	Zr 91.224 2128 1.33 [Kr]4d ² 5s ² 0.278 4682 Zirconium	Nb 92.906 1912 1.6 [Kr]4d ⁴ 5s ¹ 0.265 4912 Niobium	Mo 95.94 2107 1.9 [Kr]4d ⁵ 5s ¹ 0.25 1022 Molybdenum	Tc 98 2430 1.9 [Kr]4d ⁵ 5s ² 0.24 11.5 Technetium	Ru 101.07 2607 2.2 [Kr]4d ⁷ 5s ¹ 0.238 4423 Ruthenium	Rh 102.906 2237 2.28 [Kr]4d ⁸ 5s ¹ 0.243 3968 Rhodium	Pd 106.42 1828 2.20 [Kr]4d ¹⁰ 0.058 4236 Palladium	Ag 107.868 1235 1.93 [Kr]4d ¹⁰ 5s ¹ 0.235 1040 Silver	Cd 112.41 594 1.69 [Kr]4d ¹⁰ 5s ² 0.232 1040 Cadmium	In 114.82 430 1.78 [Kr]4d ¹⁰ 5s ² 5p ¹ 0.233 865 Indium	Sn 118.69 505 1.96 [Kr]4d ¹⁰ 5s ² 5p ² 0.228 731 Tin	Sb 121.75 904 2.05 [Kr]4d ¹⁰ 5s ² 5p ³ 0.207 1860 Antimony	Te 127.60 723 2.1 [Kr]4d ¹⁰ 5s ² 5p ⁴ 0.202 624 Tellurium	I 126.905 387 2.66 [Kr]4d ¹⁰ 5s ² 5p ⁵ 0.145 458 Iodine	Xe 131.29 161 2.6 [Kr]4d ¹⁰ 5s ² 5p ⁶ 0.158 165 Xenon
6	Cs 132.905 302 0.7 [Xe]6s ¹ 0.240 944 Cesium	Ba 137.33 1000 0.89 [Xe]6s ² 1.204 2170 Barium	(La-Lu) Lanthanides	Hf 178.49 2506 1.3 [Xe]4f ¹⁴ 5d ² 6s ² 0.144 4876 Hafnium	Ta 180.948 3290 1.5 [Xe]4f ¹⁴ 5d ³ 6s ² 0.140 5730 Tantalum	W 183.85 3680 2.36 [Xe]4f ¹⁴ 5d ⁴ 6s ² 0.132 5828 Tungsten	Re 186.207 3459 1.9 [Xe]4f ¹⁴ 5d ⁵ 6s ² 0.137 5870 Rhenium	Os 190.2 3306 2.2 [Xe]4f ¹⁴ 5d ⁶ 6s ² 0.130 5285 Osmium	Ir 192.22 2720 2.20 [Xe]4f ¹⁴ 5d ⁷ 6s ² 0.131 4700 Iridium	Pt 195.08 2370 2.28 [Xe]4f ¹⁴ 5d ⁹ 6s ¹ 0.031 4097 Platinum	Au 196.967 1337 2.54 [Xe]4f ¹⁴ 5d ¹⁰ 6s ¹ 0.129 3130 Gold	Hg 200.59 234 2.00 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 0.140 630 Mercury	Tl 204.383 577 2.04 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹ 0.129 1746 Thallium	Pb 207.2 601 2.33 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ² 0.129 1925 Lead	Bi 208.980 545 2.02 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ³ 0.122 1837 Bismuth	Po (209) 527 2.0 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴ 4, 2, 6 9.3 Polonium	At (210) 575 2.2 [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵ ± 1, 3, 5, 7 610 Astatine	Rn (222) 202 x [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶ 0.094 211 Radon
7	Fr (223) 300 1 [Rn]7s ¹ (950) Francium	Ra 226.025 973 0.89 [Rn]7s ² 0.094 1413 Radium	(Ac-Lr) Actinides	Rf (261) 111 1 [Rn]5f ¹⁴ 6d ² 7s ² (261.11) Rutherfordium	Db (262) 111 1 [Rn]5f ¹⁴ 6d ³ 7s ² (262.11) Dubnium	Sg (266) 111 1 [Rn]5f ¹⁴ 6d ⁴ 7s ² (266.12) Seaborgium	Bh (264) 111 1 [Rn]5f ¹⁴ 6d ⁵ 7s ² (264.12) Bohrium	Hs (277) 111 1 [Rn]5f ¹⁴ 6d ⁶ 7s ² (269.13) Hassium	Mt (268) 111 1 [Rn]5f ¹⁴ 6d ⁷ 7s ² (268.14) Meitnerium	Ds (284) 111 1 [Rn]5f ¹⁴ 6d ⁸ 7s ¹ (271.15) Darmstadtium	Rg (269) 111 1 [Rn]5f ¹⁴ 6d ⁹ 7s ¹ (272.15) Ununquadium	Cn (285) 111 1 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² (277) Ununbium	Uut (284) 111 1 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ¹ (284) Ununtrium	Fl (289) 111 1 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ² (289) Ununquadium	Uup (286) 111 1 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ³ (288) Ununpentium	Lv (289) 111 1 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁴ (293) Ununhexium	Uus (293) 111 1 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁵ (293) Ununseptium	Uuo (294) 111 1 [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁶ (294) Ununoctium

	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
atomic #	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
symbol	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
electron config	[Xe]5d ¹ 6s ²	[Xe]4f ¹ 5d ¹ 6s ²	[Xe]4f ² 6s ²	[Xe]4f ³ 6s ²	[Xe]4f ⁴ 6s ²	[Xe]4f ⁶ 6s ²	[Xe]4f ⁷ 6s ²	[Xe]4f ⁷ 5d ¹ 6s ²	[Xe]4f ⁹ 6s ²	[Xe]4f ¹⁰ 6s ²	[Xe]4f ¹¹ 6s ²	[Xe]4f ¹² 6s ²	[Xe]4f ¹³ 6s ²	[Xe]4f ¹⁴ 6s ²	[Xe]4f ¹⁴ 5d ¹ 6s ²	
specific heat (J/g°C)	0.449	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6	2.3, 3.6
bp(K)	3134	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874	7.874
name	Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium	
atomic weight (g/mol)	138.906	140.12	140.12	140.908	144.24	151.96	151.96	157.25	158.925	162.50	164.930	167.26	168.934	173.04	174.967	
oxidation # (stable)	3	3, 4	3, 4	3, 4	3	3, 2	3, 2	3, 2	3, 4	3	3	3	3	3	3	3
density	6.2	3716	6.8	3785	6.8	3347	7.0	3273	7.5	1869	5.2	3546	7.9	3503	8.2	2840
electron config	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²	[Rn]5f ¹⁴ 6d ¹ 7s ²
name	Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium	