

PERIODIC TABLE

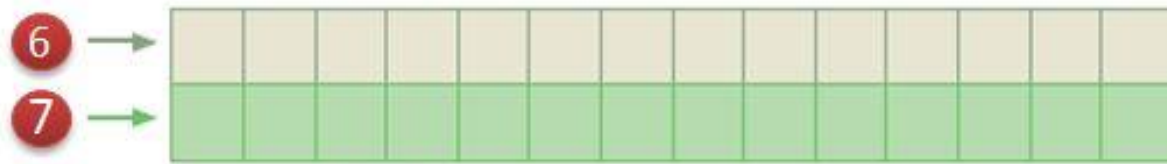
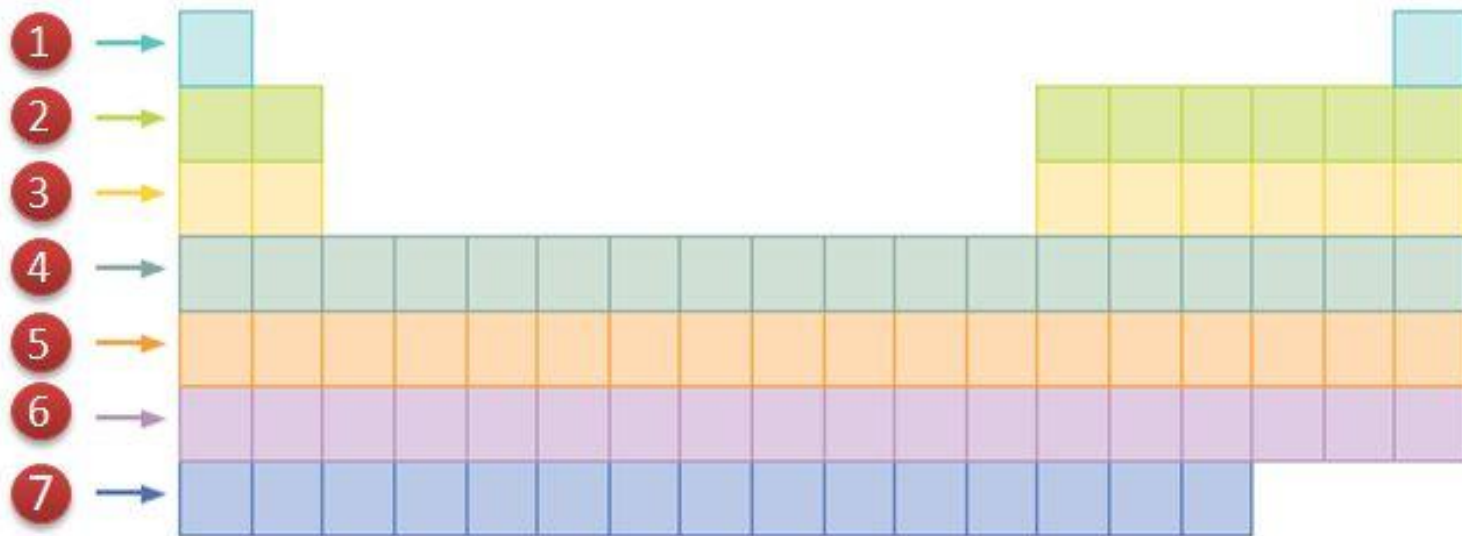
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																	
1	H	Atomic # Name Symbol Weight		C Solid												273		2	He	Helium 4.002602																
2	Li	4	Be	Hg Liquid		Metalloids		Other nonmetals		Halogens		Noble gases								10	Ne	Neon 20.1797														
3	Li	4	Be	H Gas																18	Ar	Argon 39.948														
11	Na	12	Mg	Rf Unknown		Alkali metals		Alkaline earth metals		Lanthanoids		Transition metals		Post-transition metals						17	Cl	Chlorine 35.45														
19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr	Krypton 83.799
37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe	Xenon 131.29
55	Cs	56	Ba	57-71	Hf	72	Ta	73	W	74	Re	75	Os	76	Ir	77	Pt	78	Au	79	Hg	80	Tl	81	Pb	82	Bi	83	Po	84	At	85	Rn	Radon 222		
87	Fr	88	Ra	89-103	Rf	104	Db	105	Sg	106	Hs	107	Bh	108	Mt	109	110	111	112	113	114	115	116	117	118	Uuo	Ununoctium (294)									
																						For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.														
Periodic Table Design & Interface Copyright © 1997 Michael Dayah Ptable.com Last updated Jul 31, 2013																																				
57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu	Lutetium 174.967						
89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No	103	Lr	Lr (262)						

Arrangement

- Mendeleev arranged the first periodic table.
 - Arranged by increasing atomic mass
 - Why is this not useful now? Think about isotopes.
- **Periodic Law:** arranged in order of increasing atomic number.
 - Repetition of properties in each group
 - “Periodically” repeats with each new period

Arrangement

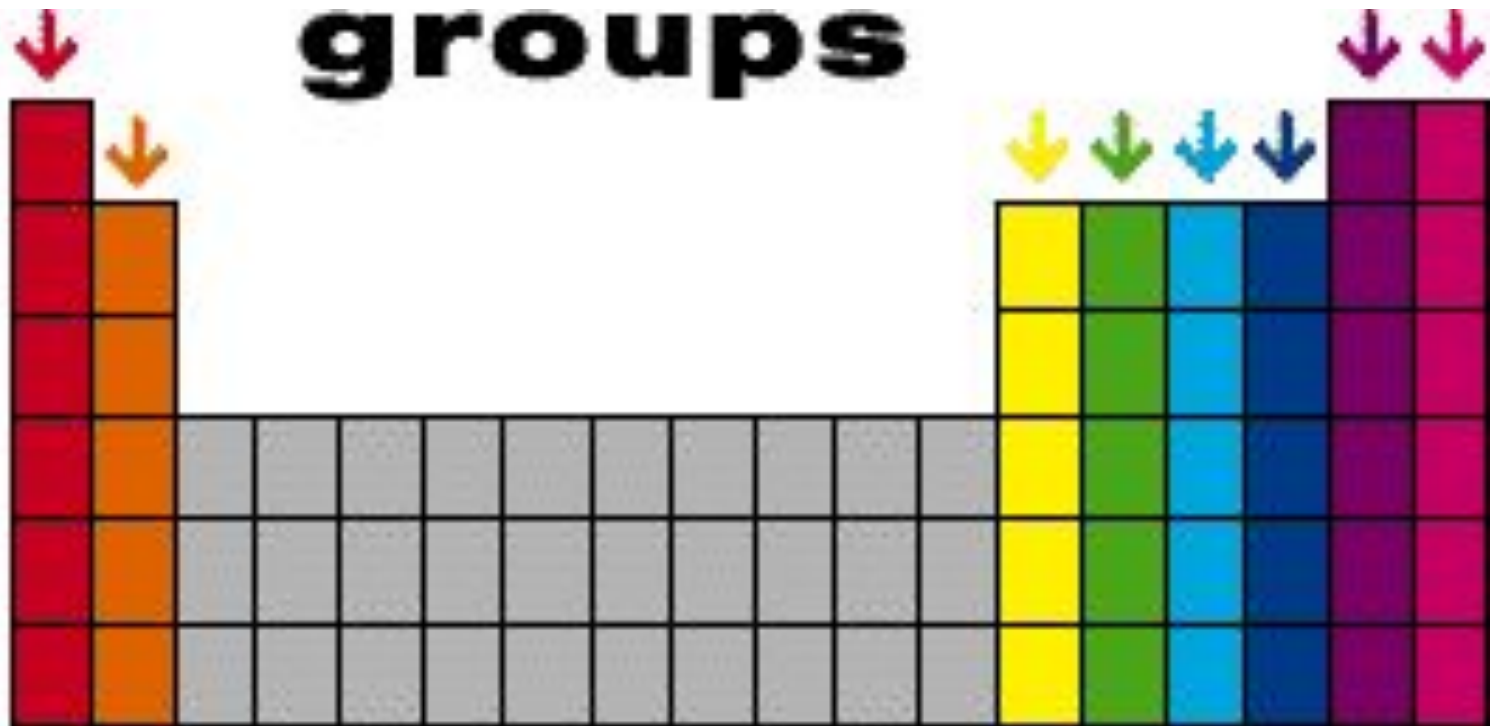
- Periods/Series: horizontal rows

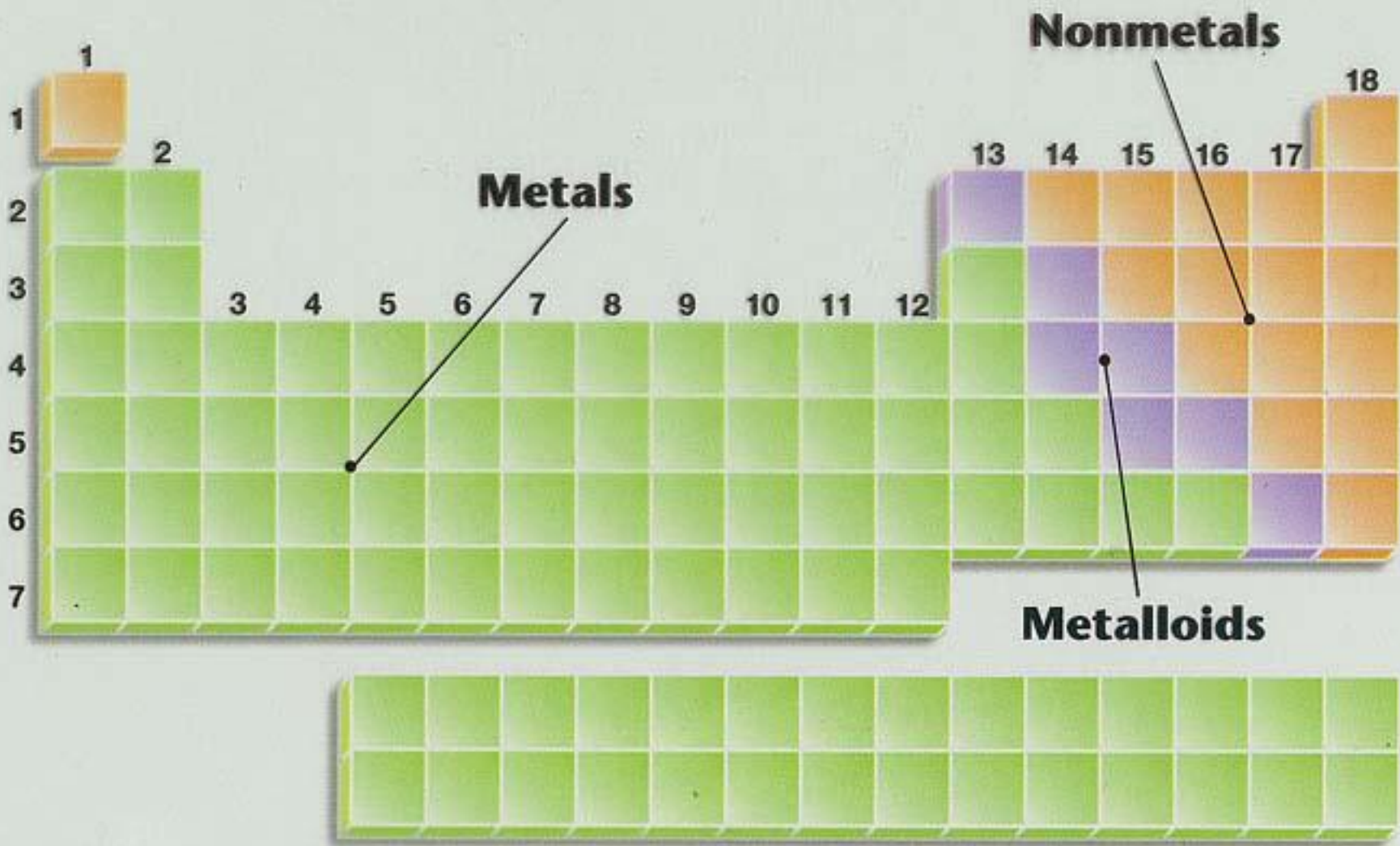


Periods

Arrangement

- Groups/Families: vertical columns





Metals

Physical Properties

- Good electrical conductors
- Good heat conductors
- Lustrous
- Ductile and malleable
- Solids at room temperature
- High melting point and boiling point
- High density

Metals

Chemical Properties

- Lose valence e^- easily (have less than 4 ve^-)
- Low Electronegativity (trend)
- Corrode easily (react with water, acids)
- Ionic bonding
- Metallic bonding (alloys)

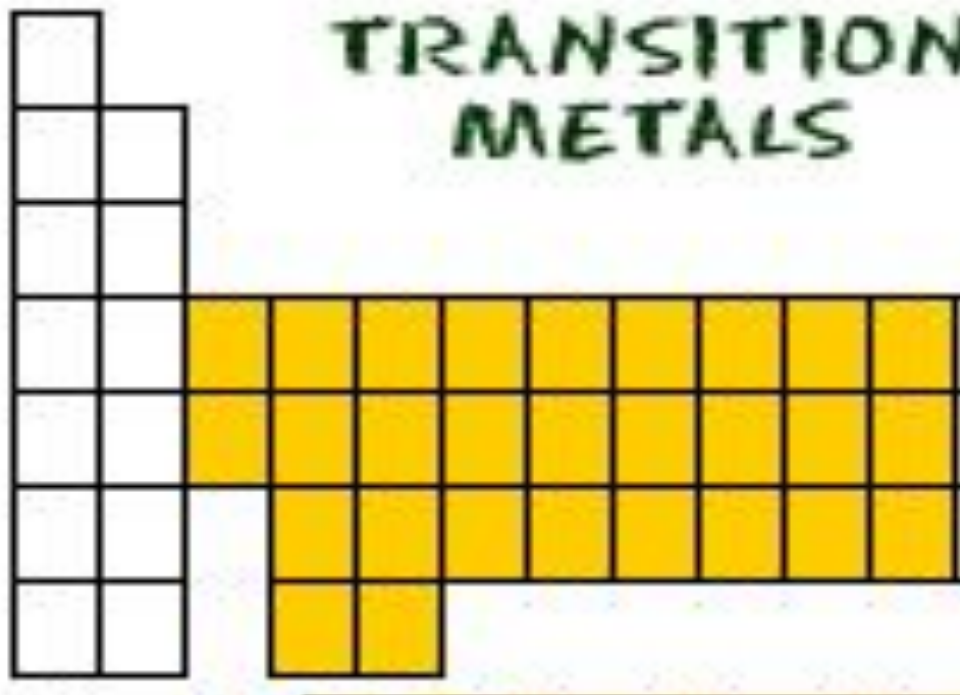
Alkali Metals

- React with water VIOLENTLY
- Not found in nature (elemental form)
- Soft
- 1 valence e^- (+1)
- Loses 1 e^- to form bonds

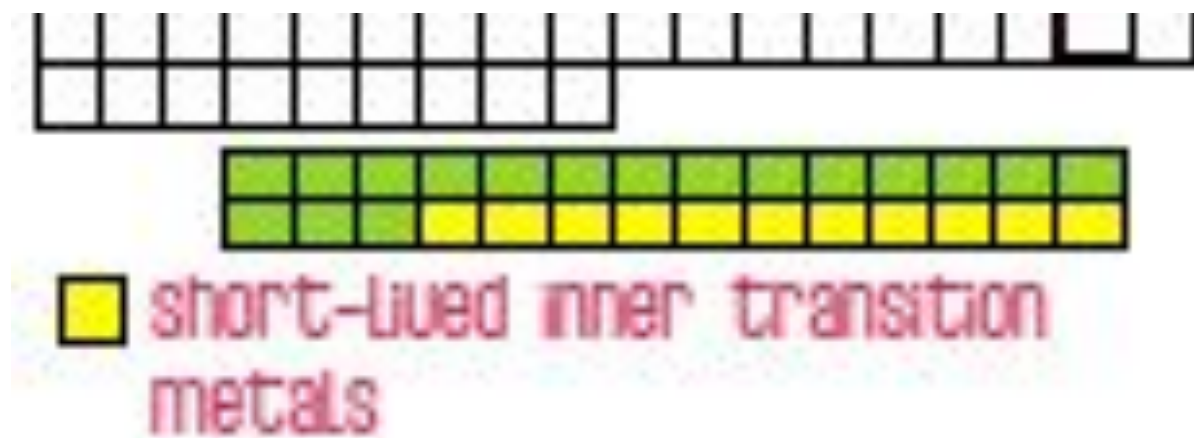
A simplified periodic table diagram with a grid structure. The first column (Group 1) is highlighted in green, representing the alkali metals. The second column is white. The third column is white. The fourth column is white. The fifth column is white. The sixth column is white. The seventh column is white. The eighth column is white. The ninth column is white. The tenth column is white. The eleventh column is white. The twelfth column is white. The thirteenth column is white. The fourteenth column is white. The fifteenth column is white. The sixteenth column is white. The seventeenth column is white. The eighteenth column is white. The nineteenth column is white. The twentieth column is white. The twenty-first column is white. The twenty-second column is white. The twenty-third column is white. The twenty-fourth column is white. The twenty-fifth column is white. The twenty-sixth column is white. The twenty-seventh column is white. The twenty-eighth column is white. The twenty-ninth column is white. The thirtieth column is white. The thirty-first column is white. The thirty-second column is white. The thirty-third column is white. The thirty-fourth column is white. The thirty-fifth column is white. The thirty-sixth column is white. The thirty-seventh column is white. The thirty-eighth column is white. The thirty-ninth column is white. The fortieth column is white. The forty-first column is white. The forty-second column is white. The forty-third column is white. The forty-fourth column is white. The forty-fifth column is white. The forty-sixth column is white. The forty-seventh column is white. The forty-eighth column is white. The forty-ninth column is white. The fiftieth column is white. The fifty-first column is white. The fifty-second column is white. The fifty-third column is white. The fifty-fourth column is white. The fifty-fifth column is white. The fifty-sixth column is white. The fifty-seventh column is white. The fifty-eighth column is white. The fifty-ninth column is white. The sixtieth column is white. The sixty-first column is white. The sixty-second column is white. The sixty-third column is white. The sixty-fourth column is white. The sixty-fifth column is white. The sixty-sixth column is white. The sixty-seventh column is white. The sixty-eighth column is white. The sixty-ninth column is white. The seventieth column is white. The seventy-first column is white. The seventy-second column is white. The seventy-third column is white. The seventy-fourth column is white. The seventy-fifth column is white. The seventy-sixth column is white. The seventy-seventh column is white. The seventy-eighth column is white. The seventy-ninth column is white. The eightieth column is white. The eighty-first column is white. The eighty-second column is white. The eighty-third column is white. The eighty-fourth column is white. The eighty-fifth column is white. The eighty-sixth column is white. The eighty-seventh column is white. The eighty-eighth column is white. The eighty-ninth column is white. The ninetieth column is white. The ninety-first column is white. The ninety-second column is white. The ninety-third column is white. The ninety-fourth column is white. The ninety-fifth column is white. The ninety-sixth column is white. The ninety-seventh column is white. The ninety-eighth column is white. The ninety-ninth column is white. The hundredth column is white.

Transition Metals

- Vary in oxidation states (no specific charge)
- Different number of ve^-



Inner Transition Metals



- Lanthanides
- Actinides
- Also called “rare-earth” metals
- “Pull out” rows in periods 6 and 7
- Trans-uranium: elements larger than U that are man-made

Nonmetals

Physical Properties

- Mostly gas at room temperature
- Poor conductors of heat and electricity
- Brittle
- Non-lustrous
- Low melting and boiling points

Non-metals

Chemical Properties

- Gain valence electrons
 - Ionic bonding
- Shares valence electrons
 - Covalent bonding

Metalloids

	5 <u>B</u> 10.81	6 <u>C</u> 12.01	7 <u>N</u> 14.01	8 <u>O</u> 16.00	9 <u>F</u> 19.00	10 <u>Ne</u> 20.18
	13 <u>Al</u> 26.98	14 <u>Si</u> 28.09	15 <u>P</u> 30.97	16 <u>S</u> 32.07	17 <u>Cl</u> 35.45	18 <u>Ar</u> 39.95
10 <u>Zn</u> 65.39	31 <u>Ga</u> 69.72	32 <u>Ge</u> 72.59	33 <u>As</u> 74.92	34 <u>Se</u> 78.96	35 <u>Br</u> 79.90	36 <u>Kr</u> 83.80
48 <u>Cd</u> 112.4	49 <u>In</u> 114.8	50 <u>Sn</u> 118.7	51 <u>Sb</u> 121.8	52 <u>Te</u> 127.6	53 <u>I</u> 126.9	54 <u>Xe</u> 131.3
80 <u>Hg</u> 200.5	81 <u>Tl</u> 204.4	82 <u>Pb</u> 207.2	83 <u>Bi</u> 209.0	84 <u>Po</u> (209)	85 <u>At</u> (210)	86 <u>Rn</u> (222)
112 <u>Cn</u>	113 <u>Nh</u>	114 <u>Fl</u>	115 <u>Mc</u>	116 <u>Lv</u>	117 <u>Ts</u>	118 <u>Og</u>

- Similar to both metals and nonmetals.
- Different conditions change properties.
- Form alloys with metals.
- “Stair-step” elements

VALENCE AND TRENDS

Valence Electrons

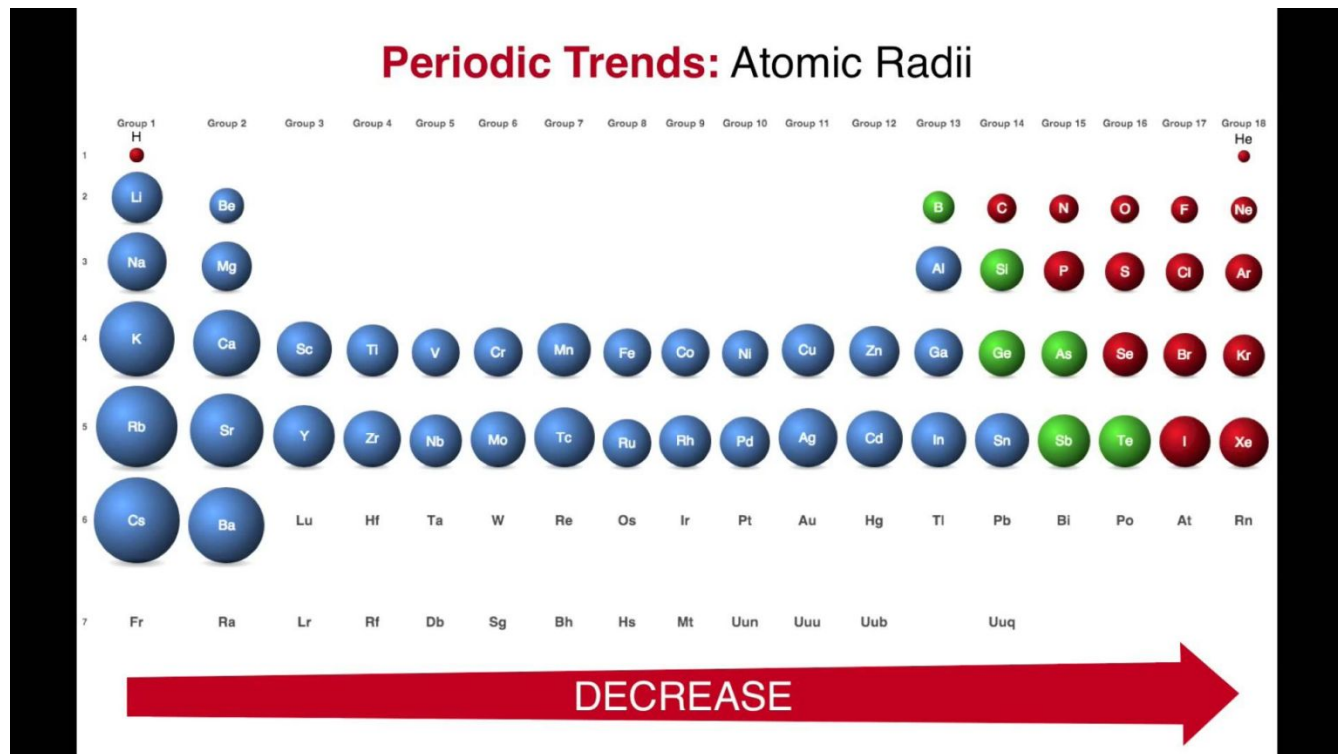
- **Valence electrons** – Electrons in an atom's highest-numbered energy level.
- How many are in each of the groups on the periodic table?

Octet Rule

- 8 electrons in outer shell (or duet= 2 e⁻)
- Atoms will combine to make the octet full, giving them the same electron configuration as the closest noble gas.
- How many electrons do elements in each group want to gain/lose to bond?

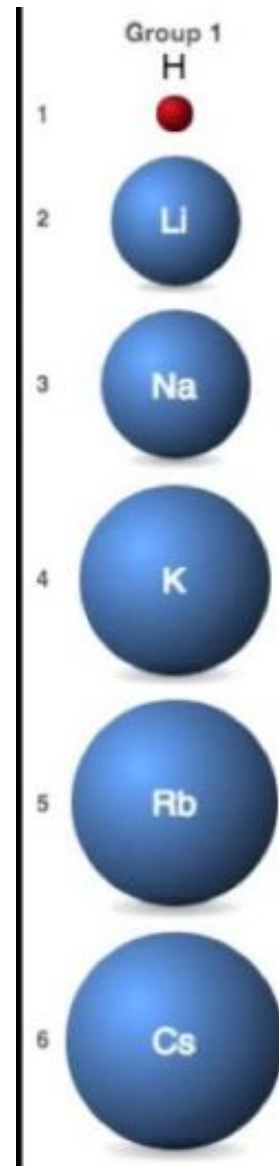
Atomic Radii (AR)

- Center of the nucleus to edge of the electron cloud.

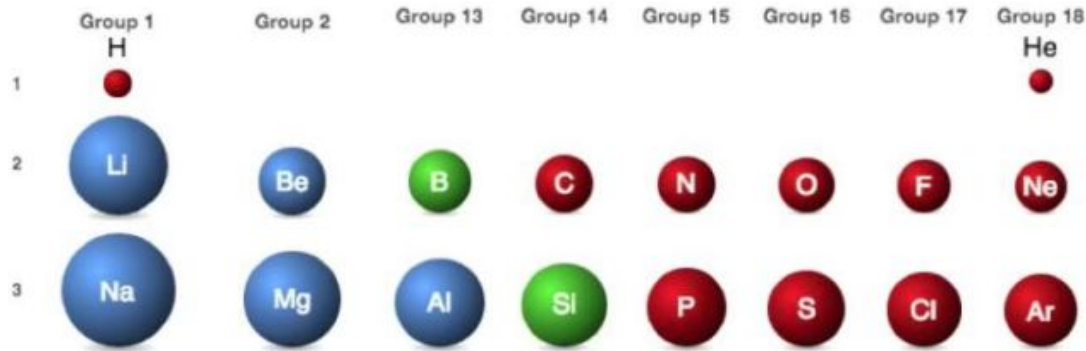


Atomic Radii (AR)

- Increases down a group (new energy levels added)
- The closer the e^- are to the nucleus (p^+), the stronger the pull on the radius (making the atom smaller)



Atomic Radii (AR)



- Decreases across a period
- More p^+ and e^- in the same energy level
- Increased # of subatomic particles cause an increase in attraction between the e^- cloud and the nucleus (like magnets)

Electronegativity (EN)

- Ability to hold on to the e^- in an atom
- Forms a negative ion (anion)
- $A + e^- \longrightarrow A^- + E$
- Does not include Noble Gases (they do not bond)

Electronegativity (EN)

- Decreases down a group
- As you move down, space is added between e^- and nucleus
- Lessens attractive force between p^+ and e^-
- Harder for atom to hold on to its e^-

N 3.0	O 3.5	F 4.0
P 2.2	S 2.6	Cl 3.0
As 2.2	Se 2.6	Br 2.8
Sb 2.1	Te 2.1	I 2.5

Electronegativity (EN)

- Increases across a period
- More e^- and p^+
- e^- are held more tightly because of an increase in attractive nuclear force

		Values					
H 2.1						He	
Li 1.0	Be 1.6	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne
Na 0.9	Mg 1.3	Al 1.5	Si 1.9	P 2.2	S 2.6	Cl 3.0	Ar

Ionization Energy (IE)

- Energy required to remove valence e^-
- Forms a positive ion (cation)
- $A + E \longrightarrow A^+ + e^-$

Ionization Energy (IE)

- Decreases down a group
- More energy levels, less attractive nuclear force
- Requires less energy to remove e^-

H	
1312.0	
Li	Be
520.2	899.4
Na	Mg
495.8	737.7
K	Ca
418.8	589.8
Rb	Sr
403.0	549.5
Cs	Ba
375.7	508.1
Fr	Ra
--	514.6

Ionization Energy (IE)

- Increases across a period
- e⁻ are held tighter because of higher attractive nuclear force (increase in # of p⁺ and e⁻)
- Requires more energy to remove e⁻

H 1312.0								H 1312.0	He 2372.3
Li 520.2	Be 899.4		B 800.6	C 1086.4	N 1420.3	O 1313.9	F 1681.0	Ne 2080.6	
Na 495.8	Mg 737.7		Al 577.6	Si 786.4	P 1011.7	S 999.6	Cl 1251.1	Ar 1520.5	