

Chapter 6 – The Periodic Table

Periodic Table of Elements

1 H Hydrogen 1.00794																	2 He Helium 4.002603
3 Li Lithium 6.941	4 Be Beryllium 9.012182	METALS ■ Alkali Metals ■ Alkaline Earth Metals ■ Lanthanoids ■ Actinoids ■ Transition Metals ■ Poor Metals										5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
11 Na Sodium 22.98976928	12 Mg Magnesium 24.3050	NONMETALS ■ Other Nonmetals ■ Noble Gases										13 Al Aluminum 26.9815386	14 Si Silicon 28.0855	15 P Phosphorus 30.973762	16 S Sulfur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955912	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938045	26 Fe Iron 55.845	27 Co Cobalt 58.933195	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.96	43 Tc Technetium (97.9072)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.293
55 Cs Caesium 132.9054519	56 Ba Barium 137.327	57-71 Lanthanoids	72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98040	84 Po Polonium (209)	85 At Astatine (209)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89-103 Actinoids	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (277)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (292)	117 Uus Ununseptium (294)	118 Uuo Ununoctium (294)
89 La Lanthanum 138.90547	90 Ce Cerium 140.116	91 Pr Praseodymium 140.90765	92 Nd Neodymium 144.242	93 Pm Promethium (145)	94 Sm Samarium 150.36	95 Eu Europium 151.964	96 Gd Gadolinium 157.25	97 Tb Terbium 158.92535	98 Dy Dysprosium 162.500	99 Ho Holmium 164.93032	100 Er Erbium 167.259	101 Tm Thulium 168.93421	102 Yb Ytterbium 173.054	103 Lu Lutetium 174.9668			
104 Ac Actinium (227)	105 Th Thorium 232.03806	106 Pa Protactinium 231.03688	107 U Uranium 238.02891	108 Np Neptunium (237)	109 Pu Plutonium (244)	110 Am Americium (243)	111 Cm Curium (247)	112 Bk Berkelium (247)	113 Cf Californium (251)	114 Es Einsteinium (252)	115 Fm Fermium (257)	116 Md Mendelevium (258)	117 No Nobelium (259)	118 Lr Lawrencium (262)			

Augustine.

Mendeleev

- Mendeleev is credited with creating the first useful periodic table.
- He arranged the elements in order of increasing atomic mass.
- He also put elements with similar properties in the same group.

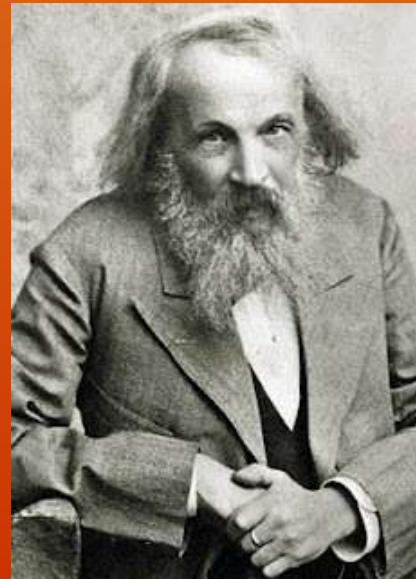
ОПЫТЪ СИСТЕМЫ ЭЛЕМЕНТОВЪ.
ОСНОВАННОЕ НА ВЪСЪ АТОМНОЕ ВѢСЪ И ХИМИЧЕСКОЕ СХОДСТВО.

		Ti=50	Zr=90	?=180.
		V=51	Nb=94	Ta=182.
		Cr=52	Mo=96	W=186.
		Mn=55	Rh=104,4	Pt=197,4
		Fe=56	Rn=104,4	Ir=198.
		Ni=Co=59	Pi=106,4	O=199.
H=1		Cu=63,4	Ag=108	Hg=200.
Be=9,4	Mg=24	Zn=65,2	Cd=112	
B=11	Al=27,4	?=68	Ur=116	Au=197?
C=12	Si=28	?=70	Sn=118	
N=14	P=31	As=75	Sb=122	Bi=210?
O=16	S=32	Se=79,4	Te=128?	
F=19	Cl=35,5	Br=80	I=127	
Li=7	Na=23	K=39	Rb=85,4	Cs=133
		Ca=40	Sr=87,4	Ba=137
		?=45	Ce=92	Pb=207.
		?Er=56	La=94	
		?Yt=60	Di=95	
		?In=75,4	Th=118?	

Д. Менделѣевъ

Mendeleev

- When he finished, there were blanks in his periodic table.
- Since he arranged his periodic table based on properties, he predicted the properties of elements that had not been discovered.
- When the elements were discovered, his predictions were right.



Modern Periodic Table

- The modern periodic table is arranged in order of increasing atomic number.
- Elements in the same group have similar properties.
- Elements in the same period have a repeating set of properties. This is referred to as the periodic law.



	47	48
d	Ag	C
	79	80

atomic number

wikiHow

Metals

○ Properties of metals include:

○ Good conductors

○ Shiny

○ Solid (except mercury)

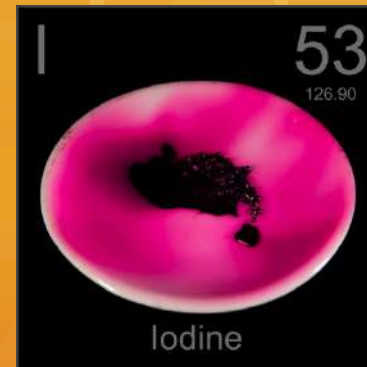
○ Ductile – can be pulled into wires

○ Malleable – can be hammered into sheets



Nonmetals

- Properties of nonmetals include:
 - Tend to be gases
 - Poor conductors (except carbon)
 - Brittle
 - Dull



Metalloids

- Metalloids generally have some of the properties of metals and nonmetals.



Section 6.1 Assessment

1. What property did Mendeleev use to organize his periodic table?
2. How are elements arranged in the modern periodic table?
3. Name the three broad classes of elements.
4. Which of these sets of elements have similar physical and chemical properties?
 - a. oxygen, nitrogen, carbon, boron
 - b. strontium, magnesium, calcium, beryllium
 - c. nitrogen, neon, nickel, niobium

Section 6.1 Assessment

5. Identify each element as a metal, metalloid, or nonmetal.
 - a. gold
 - b. silicon
 - c. sulfur
 - d. barium

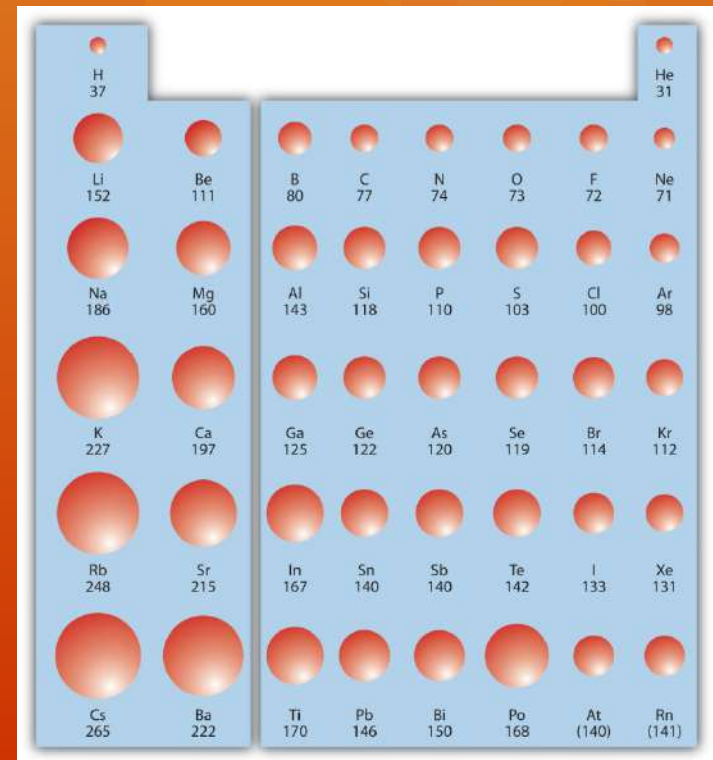
6. Name two elements that have properties similar to those of the element sodium.

Section 6.2 Assessment

1. Into what four classes can elements be sorted based on their electron configuration?
2. Why do the elements potassium and sodium have similar chemical properties?
3. Which of the following elements are transition metals: Cu, Sr, Cd, Au, Al, Ge, Co?
4. How many electrons are in the highest occupied energy level of a Group 15 element?

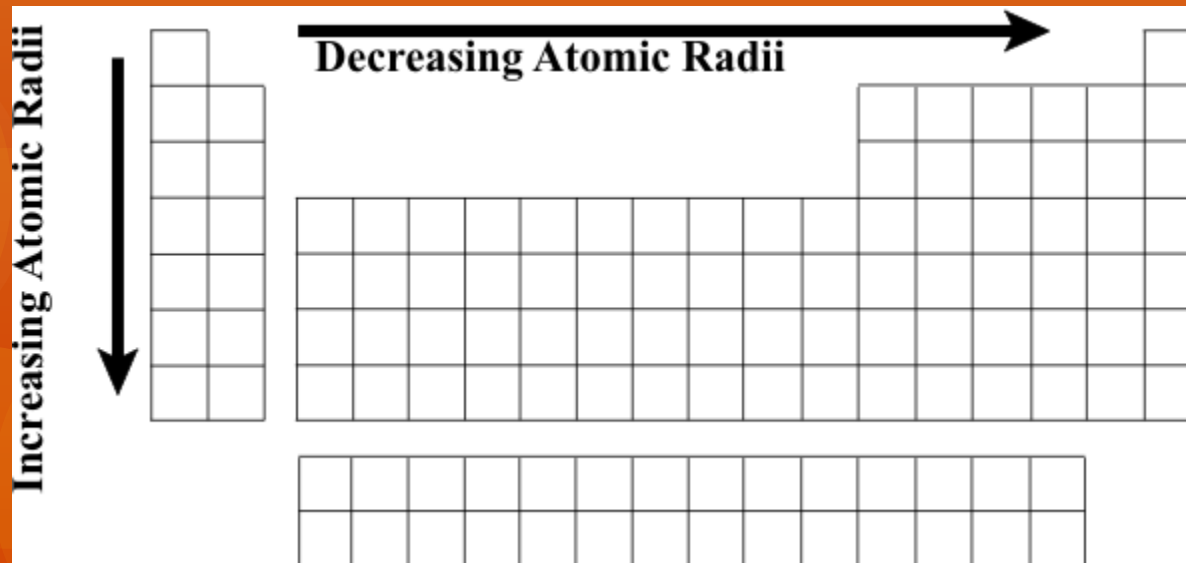
Section 6.3 – Periodic Trends

- Atomic Radius – the radius of an atom.
- In general, the atomic radius increases as you move down a group and decreases as you move across a period.



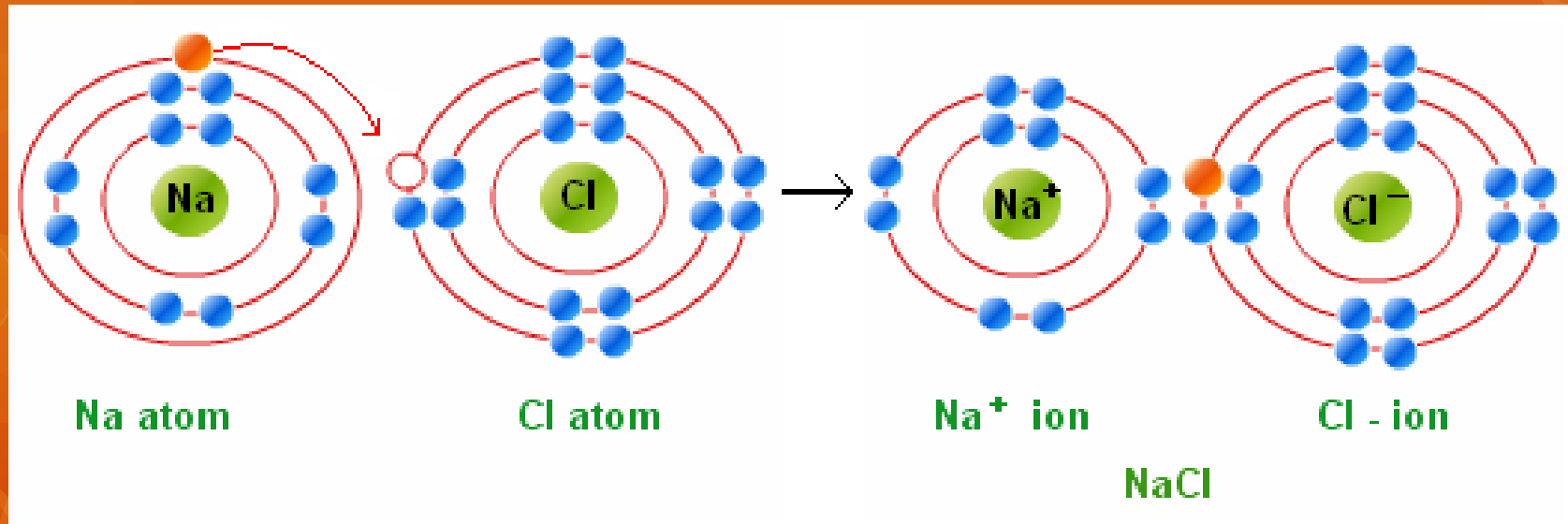
Atomic Radius

- The atomic radius increases going down a group because larger energy levels are added with each row.
- The atomic radius decreases going across a period because electrons are added to the same energy level, but protons are added to the nucleus which pull the electron in closer.



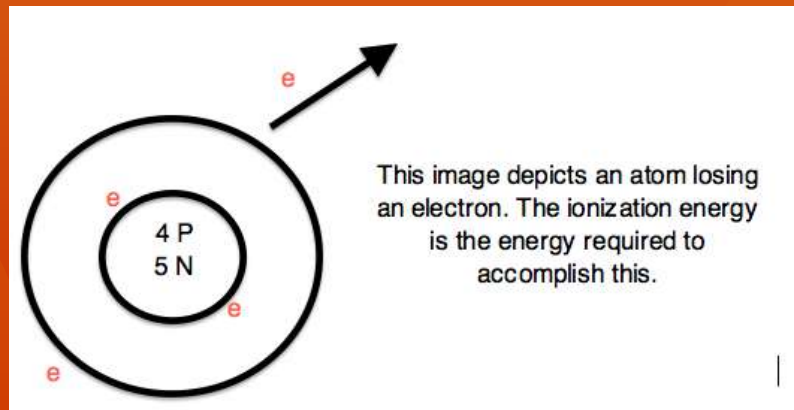
Ions

- An ion is an atom with a charge. An atom has a charge when it gains or loses electrons.
- An anion is a negative ion (gains electrons).
- A cation is a positive ion (loses electrons).



Ionization Energy

- Ionization energy decreases as you move down a group because larger energy levels are added which are farther from the nucleus. Since the electrons are far from the nucleus, it takes less energy to remove one.
- Ionization energy increases as you move across a period because the nucleus gets stronger, so it takes more energy to remove an electron.



Ionic Size

- Ionic radius is the radius of an ion.
- Cations are smaller than the parent atom.
- Anions are larger than the parent atom.

Li^+ 60 152	Be^{2+} 31 111	
Na^+ 95 186	Mg^{2+} 65 160	Al^{3+} 50 143
K^+ 133 231	Ca^{2+} 99 197	Ga^{3+} 62 122
Rb^+ 148 244	Sr^{2+} 113 215	In^{3+} 81 162

N^{3-} 171 70	O^{2-} 140 66	F^- 136 64
	S^{2-} 184 104	Cl^- 181 99
	Se^{2-} 198 117	Br^- 185 114
	Te^{2-} 221 137	I^- 216 133

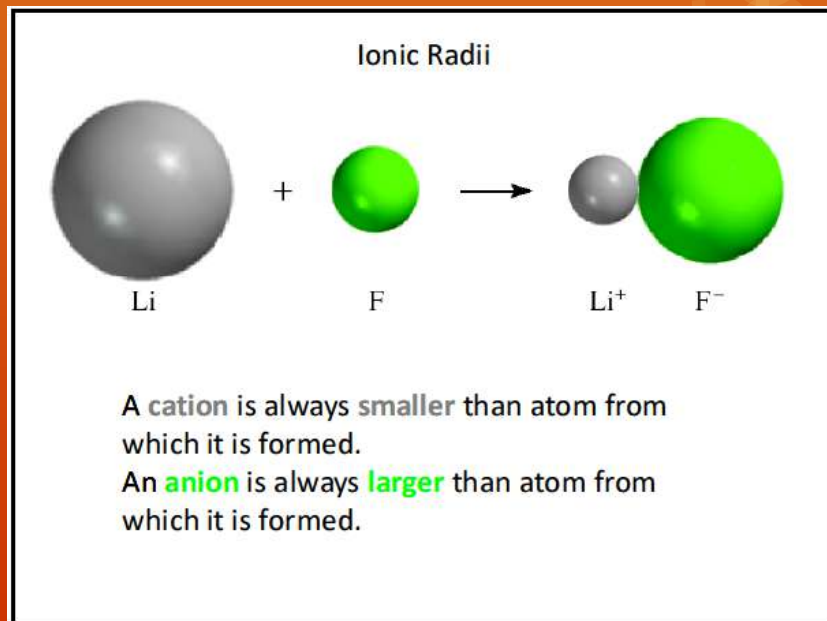
Ionic radii

S.K. Lower

Ions are colored red and blue; parent atoms brown.
Radii are in picometers.

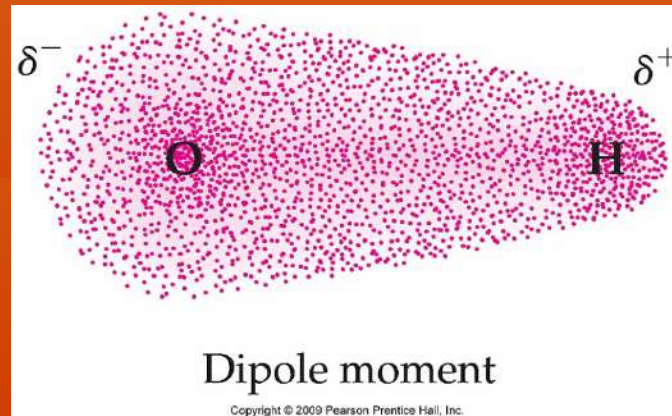
Ionic Size

- Ionic size generally decreases across the cations, then increases as you move to the anions. As you move across the anions the size decreases again. This is due to the increased strength of the nucleus and the loss or gain of electrons.

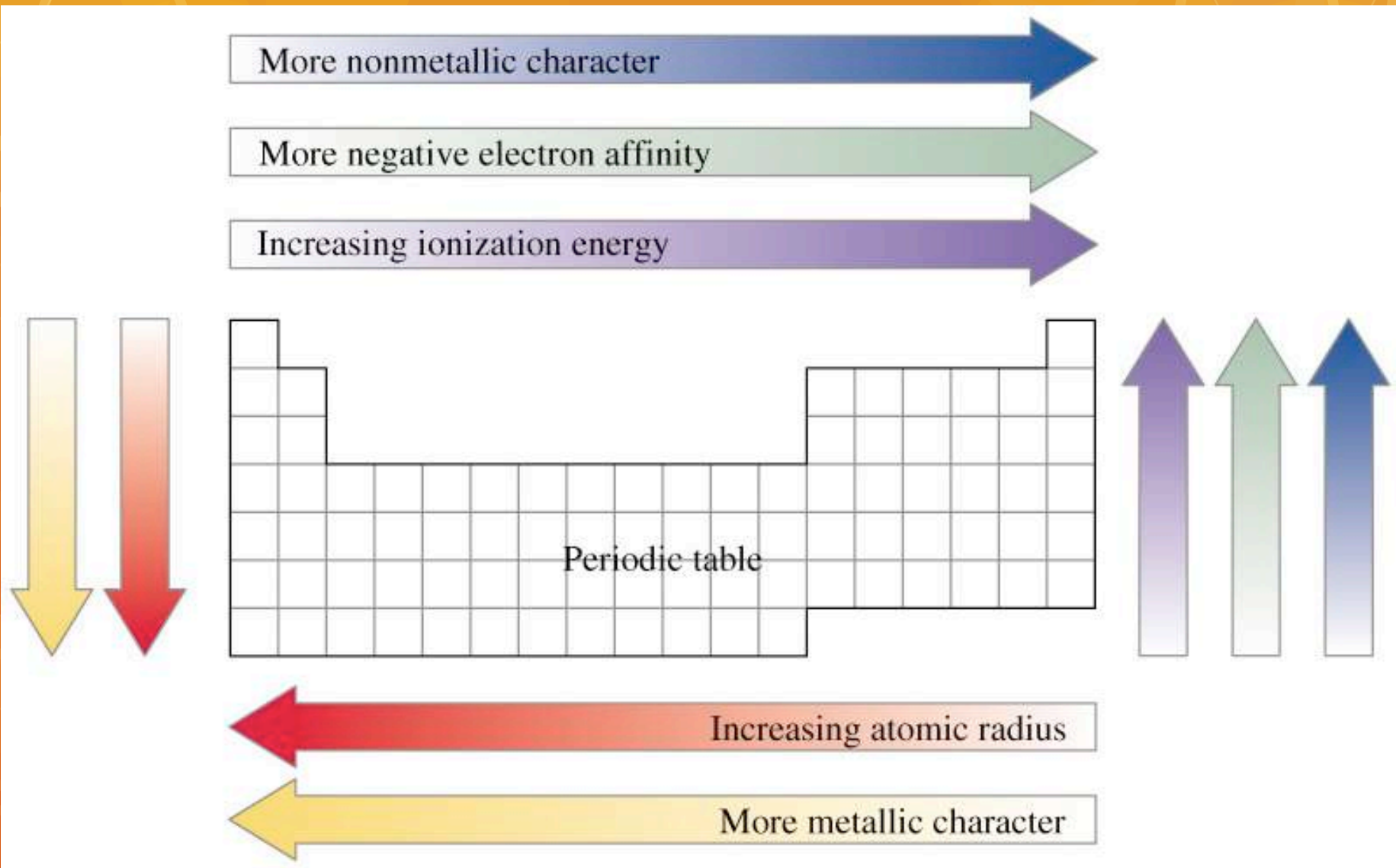


Electronegativity

- Electronegativity decreases as you move down a group because larger energy levels are added that are farther from the nucleus so the atom cannot attract electrons as well.
- Electronegativity increases as you move across a period because the nucleus is stronger and can attract more electrons.



Summary of Trends



Section 6.3 Assessment

1. How does atomic size change within groups and across periods?
2. When do ions form?
3. What happens to first ionization energy within groups and across periods?
4. Compare the size of ions to the size of the atoms from which they form.
5. How does electronegativity vary within groups and across periods?

Section 6.3 Assessment

6. Arrange these elements in order of decreasing atomic size: sulfur, chlorine, aluminum, and sodium. Does your arrangement demonstrate a periodic trend or a group trend?
7. Which element in each pair has the larger first ionization energy?
 - a. sodium, potassium
 - b. magnesium, phosphorus

The background features a vertical gradient from light yellow at the top to dark orange at the bottom. It is decorated with numerous overlapping circles of varying sizes and opacities, some appearing as solid colors and others as thin white outlines.

THE END