

So, the nucleus gets heavier and bigger...what about **atomic radius**?

ATOMIC RADIUS: distance from the center of the nucleus to the furthest electron(s) surrounding the atom.

Rank each atom in order from **smallest** to **largest** atomic radius.

Make a Claim: Which of these 4 atoms you drew has the biggest radius? Why did you make this choice?

Graphing the data....does it match our claim?

Actual data:

Atomic #	Element Symbol	Atomic radius
3	Li	1.67
4	Be	1.12
5	B	0.87
6	C	0.67
7	N	0.56
8	O	0.48
9	F	0.42
10	Ne	0.38

Answer underneath your graph:



1. Before you saw the data which atom did you think had the biggest atomic radius?
2. Was the trend we graphed something you expected? Why do you think we see this trend?

Paste in Periodic Table to PAGE _16_

hydrogen 1 H 1.0079																	helium 2 He 4.0026																		
lithium 3 Li 6.941	beryllium 4 Be 9.0122																	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180												
sodium 11 Na 22.990	magnesium 12 Mg 24.305																	aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948												
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.38	gallium 31 Ga 69.723	germanium 32 Ge 72.64	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.798																		
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.96	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29																		
cesium 55 Cs 132.91	barium 56 Ba 137.33																	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]			
francium 87 Fr [223]	radium 88 Ra [226]																	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [277]	meitnerium 109 Mt [268]	darmstadtium 110 Ds [271]	roentgenium 111 Rg [272]										
lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.05	lutetium 71 Lu 174.97																					
actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]	lawrencium 103 Lr [262]																					

We will use this to keep track of the trends we identify...

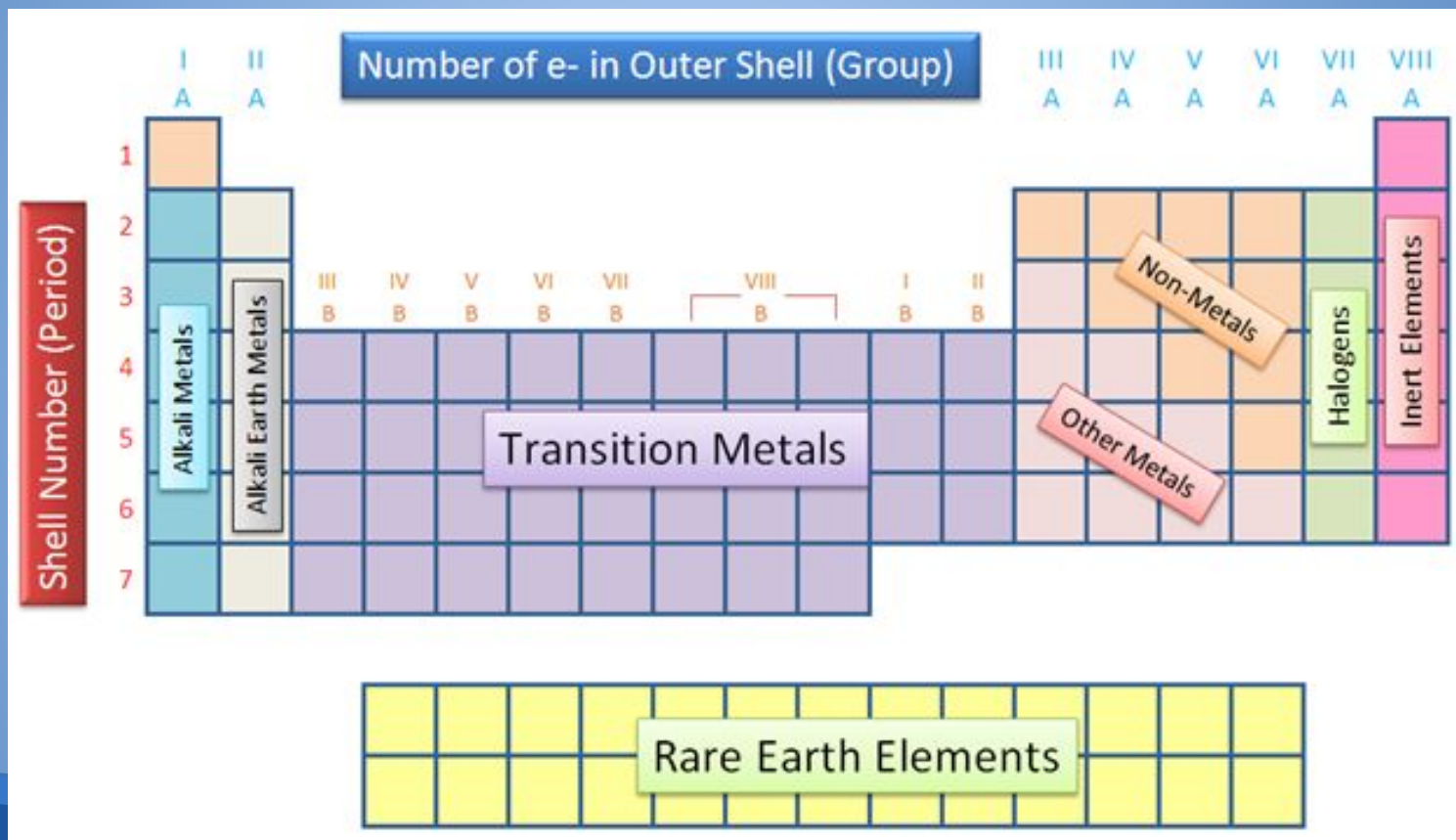
Periods and Groups

Groups are columns of the table.
Elements in the same group react with other elements in similar ways.

Periods are rows of the table. As you go left to right, the number of valence electrons an element has increases

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lithium 3 Li 6.941	beryllium 4 Be 9.0122																	boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180										
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Based on where in the periodic table you are, you will see different common properties

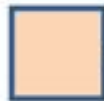


Based on where in the periodic table you are, you will see different common properties

	1																		17	18
1	1 H																		1 H	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O			9 F	10 Ne
3	11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S			17 Cl	18 Ar
4	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
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 In	49 In	50 Sn	51 Sb	52 Te			53 I	54 Xe
6	55 Cs	56 Ba	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	81 Tl	81 Tl	82 Pb	83 Bi	84 Po			85 At	86 Rn



Metals



Metalloids



Non-Metals

We will learn more about the chemical and physical properties of these groups of elements and the molecules they make later in the unit...

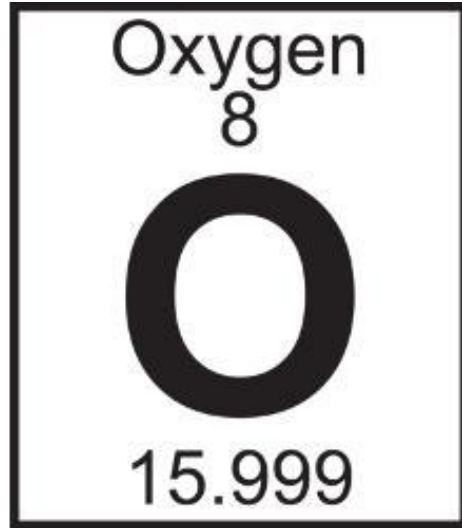
for now...back why they are organized in the periodic table this way

Trends we will identify:

- 1. Atomic radius**
- 2. Number of valence electrons an element has**
- 3. Ionization energy**

Refresh: How can we find electron count from looking at the Periodic Table?

Atomic number gives us
the number of protons...



....and since this atom is neutral,
then # of
protons = # of electrons!

Atomic radius

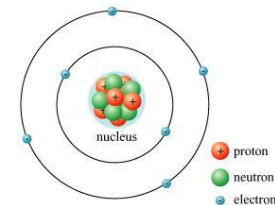
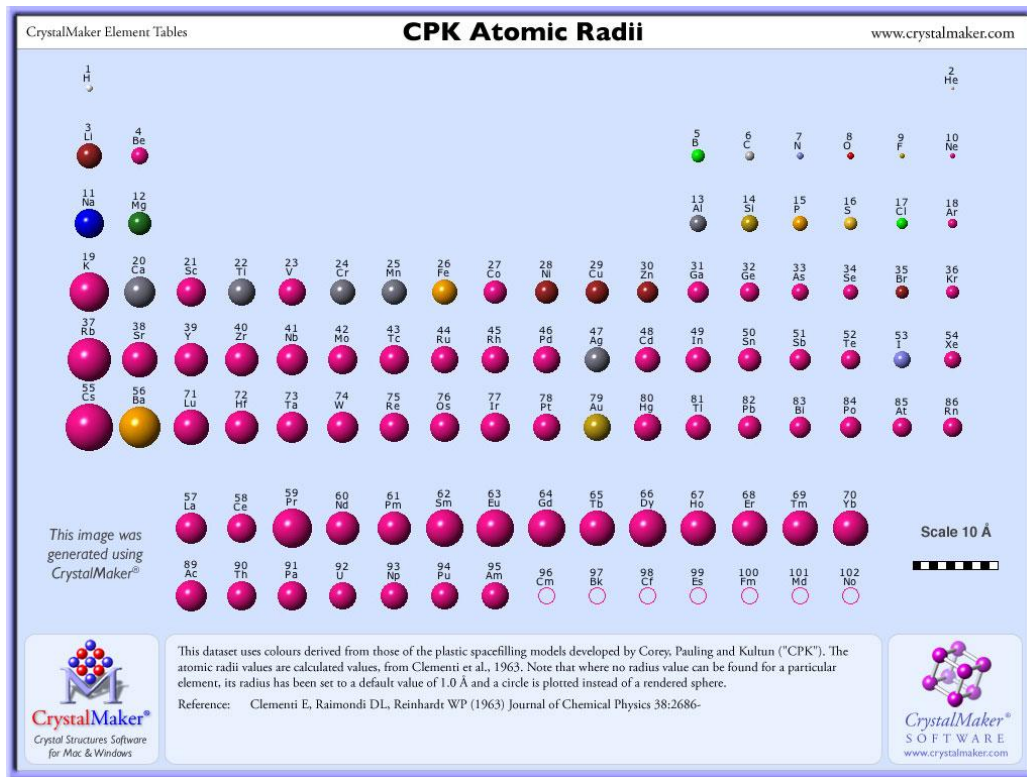
ATOMIC RADIUS: distance from the center of the nucleus to the furthest electron(s) surrounding the atom.

Trend (that we just graphed):

Atomic radius increases DOWN in group and from RIGHT to LEFT across a period.

Atomic radius **increases** from RIGHT to LEFT across a period

Atomic radius **increases** DOWN a column



Has to do with the amount of electrons are on the furthest orbital

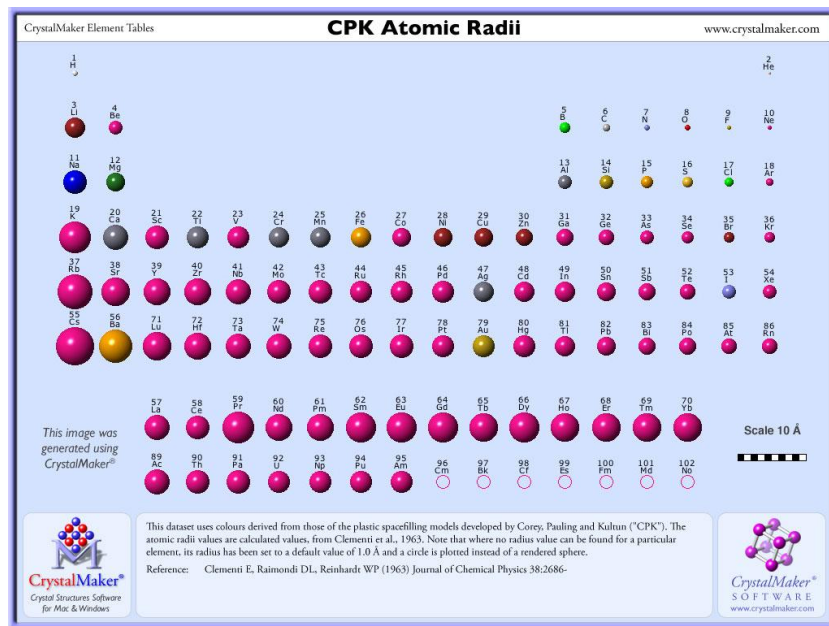
Valence electrons (a super brief intro)

An atom's electrons orbit the nucleus at specific, but varied, distances. The one's furthest from the nucleus are called...

Valence electrons: Electrons on the outermost orbital of an atom. The amount of valence electrons an element has will determine the kinds of bonds this the element can make.

This explains the atomic radius trend...

The more electrons on the outer orbit, the stronger the attraction to the nucleus!



Ionization energy

Ionization energy: The amount of energy required to remove one of an atom's valence electrons.

Atoms want to be “stable,” aka have 8 electrons in their outer orbital. They do this by forming bonds!

For elements on the left side of the table (like Na) it's easier to GET RID OF electrons to be stable. Elements on the right side of the table (like Cl) find it easier to ACCEPT electrons. Atoms with 8 valence electrons DO NOT GET RID OF OR ACCEPT.

It takes less energy to take an electron off an element on the left side of the table, so...

Ionization energy **increases** from LEFT to RIGHT across a period.

Ionization energy **increases** going UP a group.

INCREASING IONIZATION ENERGY

←																		→			
1 H Hydrogen 1.00784																	2 He Helium 4.003				
3 Li Lithium 6.931	4 Be Beryllium 9.012182															5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.006434	8 O Oxygen 13.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.81197
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050															13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.845	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80				
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 (98)	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 131.29				
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 La Lanthanum 138.9055	58 Hf Hafnium 178.49	59 Ta Tantalum 180.9479	60 W Tungsten 183.84	61 Re Rhenium 186.207	62 Os Osmium 190.23	63 Ir Iridium 192.222	64 Pt Platinum 195.084	65 Au Gold 196.96655	66 Hg Mercury 200.59	67 Tl Thallium 204.3833	68 Pb Lead 207.2	69 Bi Bismuth 208.98038	70 Po Polonium (209)	71 At Astatine 121(0)	72 Rn Radon 122(0)				
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (264)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110	111 (271)	112 (272)	113 (273)	114 (274)								

INCREASING IONIZATION ENERGY