Periodic Table & Trends



History of the Periodic Table

- 1871 Mendeleev arranged the elements according to: 1. Increasing atomic mass
 2. Elements w/ similar properties were put in the same row
- 1913 Moseley arranged the elements according to: 1. Increasing atomic number
 2. Elements w/ similar properties were put in the same column

Group Names

Alkali	Alkaline Earth					Halogen	Noble Gases
. 1	Metals						
τ Ι	+2	+3		-3	-2	-1	0
Η							Не
1							2
Li	Be	В	С	Ν	Ο	F	Ne
3	4	5	6	7	8	9	10
Na	Mg	Al	Si	Р	S	C1	Ar
11	12	13	14	15	16	17	18

VI.	ΕT	AL	5			R	egio	ns of	the	Peri	odic	Tab		IO	NM	ЕТ	A	L
	1 1A												_					18 8/
	1 H	2 2A							N // T		ТО		13 3A	14 4A	15 5A	16 6A	17 7A	2 H
2	3 Li	4 Be		Th	KA ľ	NSI.	11(JN	IVIE		LS		5 B	6 C	7 N	8 0	9 F	1 N
3	11 Na	12 Mg	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 - 8B -	10	11 1B	12 2B	13 Al	14 Si	15 P	16 S	17 Cl	11 A
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	3 K
5	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	5 X
6	55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Ti	82 Pb	83 Bi	84 Po	85 At	8 R
7	87 Fr	88 Ra	89 Ac	104	105	106	107	108	109									
			58	59	60	61	62	63	64	65	66	67	68	69 T	70	71		
			90 Th	91 Pa	Nd 92 U	93 Np	Sm 94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr		

S & P block – Representative Elements

Metalloids (Semimetals, Semiconductors) – B,Si, Ge, As, Sb, Te (properties of both metals & nonmetals)

Columns – groups or families

Rows - periods

Periodic Groups

• Elements in the same column have similar chemical and physical properties

 These similarities are observed because elements in a column have similar e⁻ configurations (same amount of electrons in outermost shell)

Periodic Trends

- Periodic Trends patterns (don't always hold true) can be seen with our current arrangement of the elements (Moseley)
- Trends we'll be looking at:
- 1. Atomic Radius
- 2. Ionization Energy
 - 3. Electronegativity

Atomic Radius

TABLE 11-7



 Atomic Radius – size of an atom (distance from nucleus to outermost e⁻)

Atomic Radius Trend

- Group Trend As you go down a column, atomic radius increases
- As you go down, e⁻ are filled into orbitals that are farther away from the nucleus (attraction not as strong)
- Periodic Trend As you go across a period (L to R), atomic radius decreases
- As you go L to R, e^- are put into the same orbital, but more p^+ and e^- total (more attraction = smaller size)





 Ionic Radius – size of an atom when it is an ion

Ionic Radius Trend

Metals – lose e⁻, which means more p^+ than e⁻ (more attraction) SO...

Cation Radius < Neutral Atomic Radius

Nonmetals – gain e^- , which means more e^- than p^+ (not as much attraction) SO...

Anion Radius > Neutral Atomic Radius

Ionic Radius Trend

- Group Trend As you go down a column, ionic radius increases
- Periodic Trend As you go across a period (L to R), cation radius decreases, anion radius decreases, too.
- As you go L to R, cations have more attraction (smaller size because more p^+ than e^-). The anions have a larger size than the cations, but also decrease L to R because of less attraction (more $e^$ than p^+)



How do I remember this?????

The more electrons that are lost, the greater the reduction in size.

Li⁺¹ Be⁺² protons 3 protons 4 electrons 2 electrons 2

Which ion is smaller?

How do I remember this???

The more electrons that are gained, the greater the increase in size.

P⁻³ S⁻² protons 15 protons 16 electrons 18 electrons 18

Which ion is smaller?

Ionization Energy



Ionization
 Energy –
 energy needed
 to remove
 outermost e⁻

Ionization Energy

- Group Trend As you go down a column, ionization energy decreases
- As you go down, atomic size is increasing (less attraction), so easier to remove an e⁻
- Periodic Trend As you go across a period (L to R), ionization energy increases

As you go L to R, atomic size is decreasing (more attraction), so more difficult to remove an e⁻ (also, metals want to lose e⁻, but nonmetals do not)

Electronegativity

Table 14.2

E	lectronega	tivity Value	es for Atom	s of Select	ed Elemen	ts
Н 2.1						
Li	Be	B	C	N	0	F
1.0	1.5	2.0	2.5	3.0	3.5	4.0
Na	Mg	AI	Si	P	S	CI
0.9	1.2	1.5	1.8	2.1	2.5	3.0
K	Ca	Ga	Ge	As 2.0	Se	Br
0.8	1.0	1.6	1.8		2.4	2.8
Rb	Sr	In	Sn	Sb	Te	I
0.8	1.0	1.7	1.8	1.9	2.1	2.5
Cs 0.7	Ba 0.9	TI 1.8	Pb 1.9	Bi 1.9		

 Electronegativitytendency of an atom to attract e⁻

Electronegativity Trend

- Group Trend As you go down a column, electronegativity decreases
- As you go down, atomic size is increasing, so less attraction to its own e⁻ and other atom's e⁻
- Periodic Trend As you go across a period (L to R), electronegativity increases

As you go L to R, atomic size is decreasing, so there is more attraction to its own e⁻ and other atom's e⁻

Reactivity

- Reactivity tendency of an atom to react
- Metals lose e⁻ when they react, so metals' reactivity is based on lowest Ionization Energy (bottom/left corner) Low I.E = High Reactivity
- Nonmetals gain e⁻ when they react, so nonmetals' reactivity is based on high electronegativity (upper/right corner)

High electronegativity = High reactivity

Metallic Character

- Properties of a Metal 1. Easy to shape
- 2. Conduct electricity 3. Shiny

- Group Trend As you go down a column, metallic character increases
- Periodic Trend As you go across a period (L to R), metallic character decreases (L to R, you are going from metals to non-metals