

# Periodic Trends

1.) Valence electrons -  $e^-$  in the highest orbital of an atom. Maximum # is 8. These are the  $e^-$ 's involved in chemical reactions

Ex)	Na (11e <sup>-</sup> )	$1s^2 2s^2 2p^6 [3s^1]$	1 val e <sup>-</sup>
	Mg (12e <sup>-</sup> )	$1s^2 2s^2 2p^6 [3s^2]$	2 val e <sup>-</sup>
	Al (13e <sup>-</sup> )	$1s^2 2s^2 2p^6 [3s^2 3p^1]$	3 val e <sup>-</sup>
	Si (14e <sup>-</sup> )	$1s^2 2s^2 2p^6 [3s^2 3p^2]$	4 val e <sup>-</sup>
	P (15e <sup>-</sup> )	$1s^2 2s^2 2p^6 [3s^2 3p^3]$	5 val e <sup>-</sup>
	S (16e <sup>-</sup> )	$1s^2 2s^2 2p^6 [3s^2 3p^4]$	6 val e <sup>-</sup>
	Cl (17e <sup>-</sup> )	$1s^2 2s^2 2p^6 [3s^2 3p^5]$	7 val e <sup>-</sup>
	Ar (18e <sup>-</sup> )	$1s^2 2p^6 [3s^2 3p^6]$	8 val e <sup>-</sup>
		core e <sup>-</sup>	
	ONLY s & p sublevels are valence e <sup>-</sup>		
	Pr (59e <sup>-</sup> )	$[Xe] [6s^2] 4f^3$	2 val e <sup>-</sup>

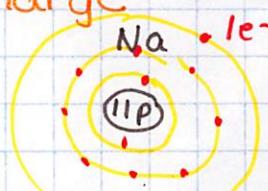
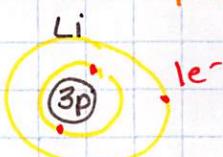
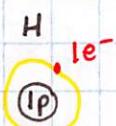
Use the PT to determine the # val. e<sup>-</sup> in an atom

- (A) across a period - # val e<sup>-</sup> increases
- (B) down a group - # val e<sup>-</sup> stays the same

2) Atomic Radius -  $\frac{1}{2}$  the distance b/w <sup>the nuclei of</sup> 2 identical atoms bonded together

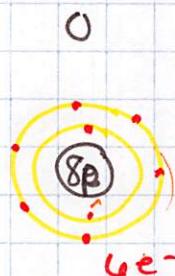
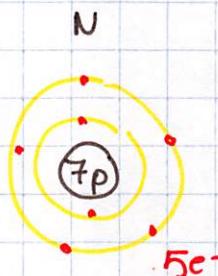
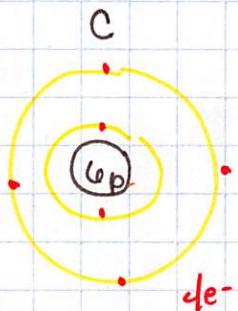
- (A) down a group - radius increases

Why? Inner core e<sup>-</sup> SHIELD valence e<sup>-</sup> from the nucleus's positive charge



(B) across a period - radius decreases

why?



Shielding remains constant so adding more  $p^+$  & more valence  $e^-$  increases the attraction between them, moving them closer to each other

(E) Rank the elements below in order of increasing radius.

(A) Sn Si Pb

Si < Sn < Pb

(B) Fe As K

As < Fe < K

3) First Ionization Energy - energy needed to remove the 1<sup>st</sup> valence  $e^-$  from an atom.

(A) down a group - 1<sup>st</sup> ionization energy decreases

why? The larger the atom, the more shielding there is & the less the attraction bw the nucleus & the valence  $e^-$ ,  $\therefore$  the easier it is to therefore remove the  $e^-$

(B) across a period - 1<sup>st</sup> ionization energy increases

why? As you go from left to right you are adding more valence  $e^-$  along w/ more  $p^+$ . That makes the atom smaller, making valence  $e^-$  closer to the nucleus. It takes more energy to remove them.

4. Electronegativity - the attraction one atom's nucleus has for another atom's electrons

(A) down a group - electronegativity decreases

why? Larger atoms tend to have a lot of shielding & do not really "feel" the attraction of another atom's electrons

(B) across a period - electronegativity increases

why? The smaller the atom gets, the less shielding there is and the ability to "feel" or be attracted to another atom's e<sup>-</sup>'s increases

Ex) Rank these elements in order of increasing electronegativity. (smallest to largest)

(1) Sn Si Pb      Pb < Sn < Si

(2) Fe As K      K < Fe < As