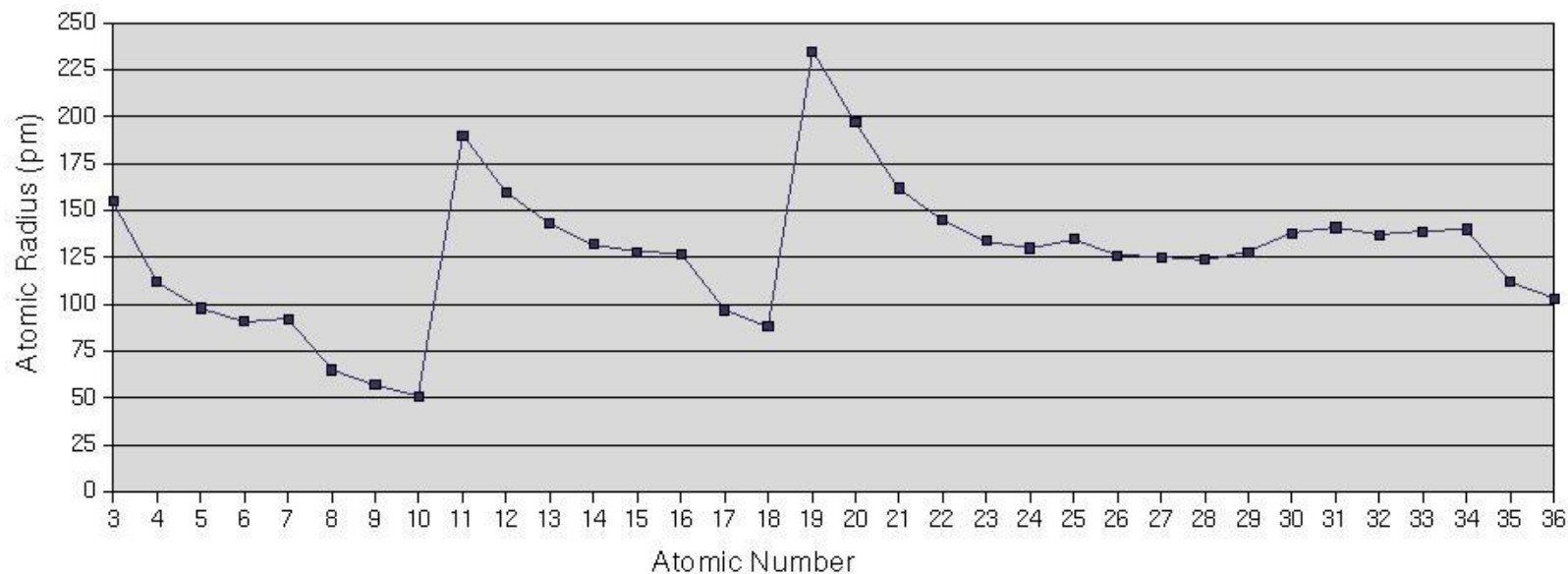


Section 3: Periodic Trends

Atomic Radius as a Function of Atomic Number



Nuclear Charge

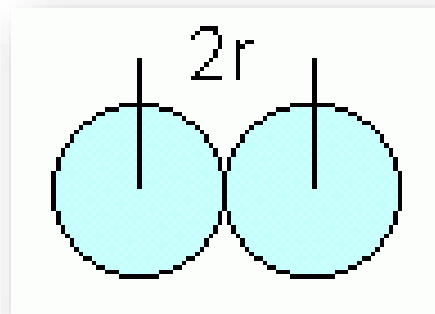
- Nuclear charge is the pull that an electron “feels” from the nucleus.
- The closer an electron is to the nucleus, the more pull it feels.
- As nuclear charge increases, the electron cloud is pulled in tighter.
- Increases across a period.

Shielding

- As more energy levels are added to atoms, the inner layers of electrons **shield** the outer electrons from the nucleus.
- Outer electrons are less tightly held.
- Constant across a period.
- Increases down a group.

Atomic Radius

- Definition: Half of the distance between nuclei in covalently bonded diatomic molecule













































Atomic Radius

decreases across a period

1 -due to greater nuclear charge 18

(more protons)

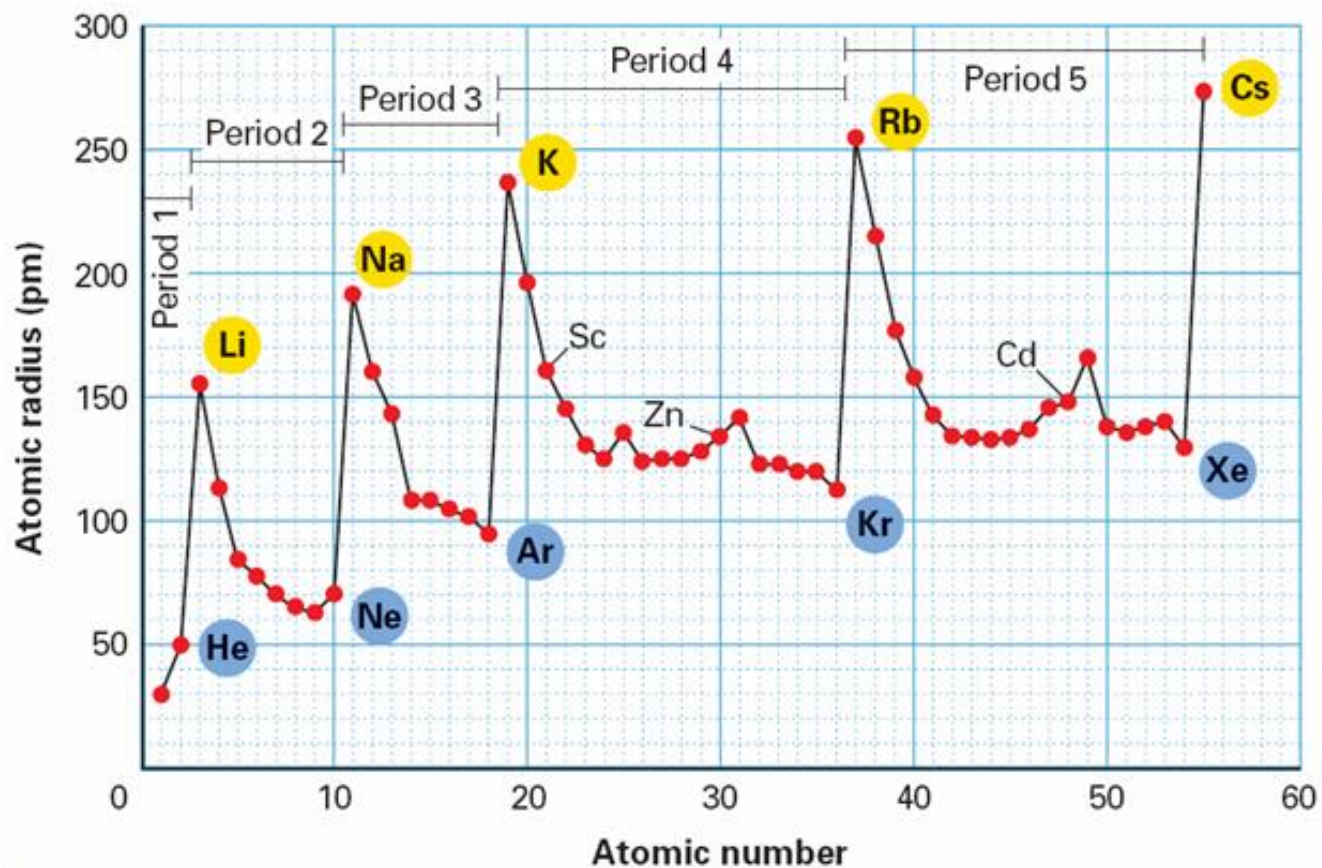
1	H 37 	2	13	14	15	16	17	18	He 31 
2	Li 152 	Be 112 	B 85 	C 77 	N 75 	O 73 	F 72 	Ne 71 	
3	Na 186 	Mg 160 	Al 143 	Si 118 	P 110 	S 103 	Cl 100 	Ar 98 	
4	K 227 	Ca 197 	Ga 135 	Ge 122 	As 120 	Se 119 	Br 114 	Kr 112 	
5	Rb 248 	Sr 215 	In 167 	Sn 140 	Sb 140 	Te 142 	I 133 	Xe 131 	
6	Cs 265 	Ba 222 	Tl 170 	Pb 146 	Bi 150 	Po 168 	At 140 	Rn 140 	

increases down a group

-due to *more shielding*
(more energy levels)

Atomic Radius

Atomic Radius Versus Atomic Number



Example of Atomic Radius Trend

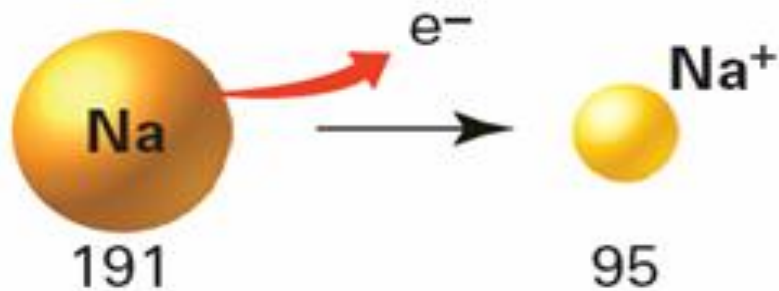
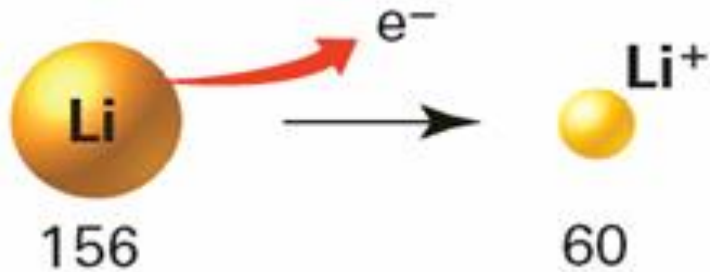
- Arrange the following elements in order of increasing atomic radii: Cs, F, K, Cl

IA										VIA									
1											2								
H 1.008											He 4.003								
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 15.99	9 F 19	10 Ne 20.18		
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.94		
19 K 39.1	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.9	36 Kr 83.8		
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc -98	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3		
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197	80 Hg 200.8	81 Tl 204.4	82 Pb 207.2	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)		
87 Fr (223)	88 Ra 226	89 Ac 227																	
			58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173	71 Lu 175			
			90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (251)	98 Cf (252)	99 Es (257)	100 Fm (258)	101 Md (258)	102 No (259)	103 Lr (260)			

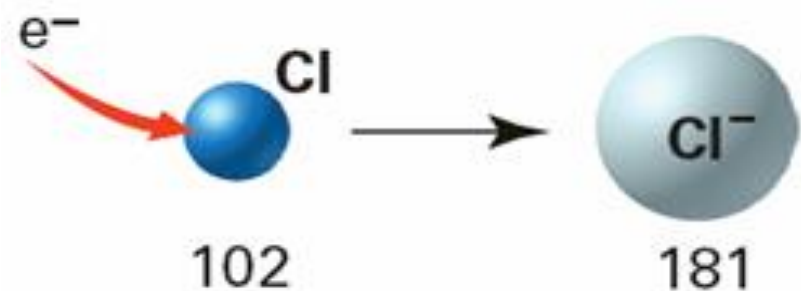
F < Cl < K < Cs

Ionic Radius

Group 1A



Group 7A



Cations from metals:

- e⁻'s lost
- positive (+) charge
- smaller
- outer shell lost

Anions from nonmetals:

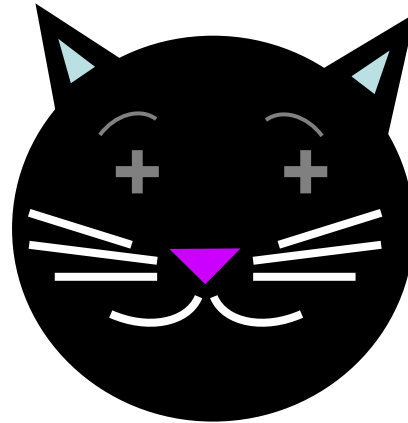
- e⁻'s gained
- negative (-) charge
- larger
- less nuclear charge

Ions

- Here is a simple way to remember which is the cation and which the anion:



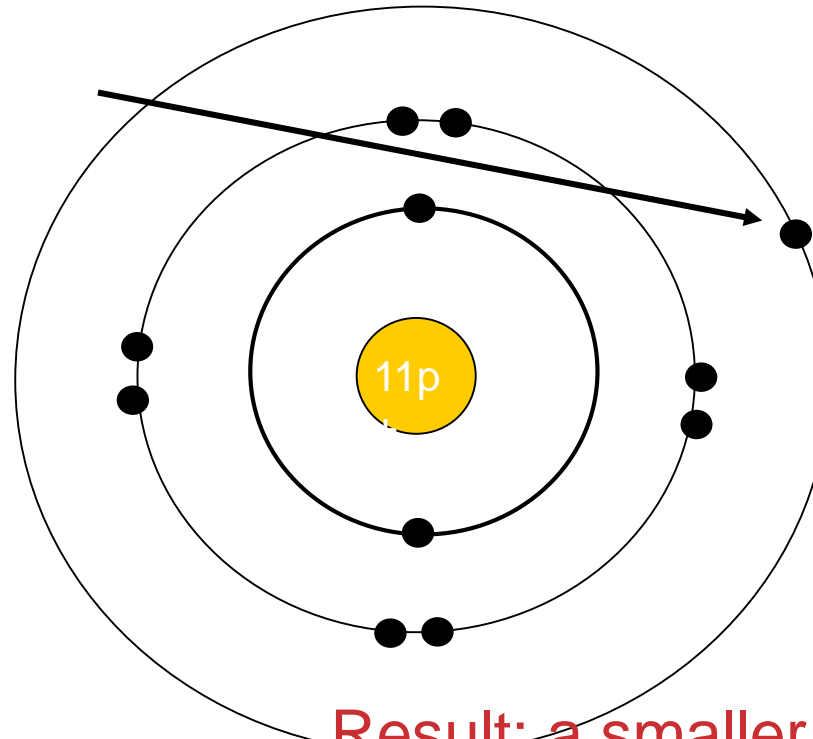
This is Ann Ion.
She's unhappy
and negative.



This is a cat-ion.
He's a "plussy"
cat!

Cation Formation

Na atom
1 valence
electron



Nuclear charge on
remaining electrons
increases.

Remaining e- are
pulled in closer to
the nucleus.
Ionic size
decreases.

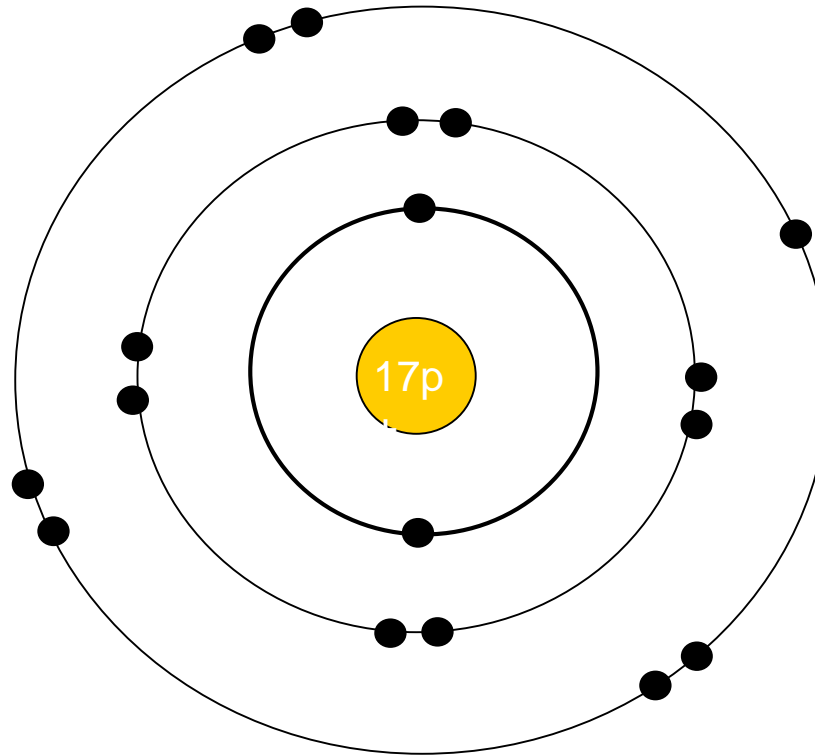
Valence
e- lost in
ion
formation

Result: a smaller
sodium cation, Na^+

Anion Formation

A chloride ion is produced. It is larger than the original atom.

Chlorine atom with 7 valence e-

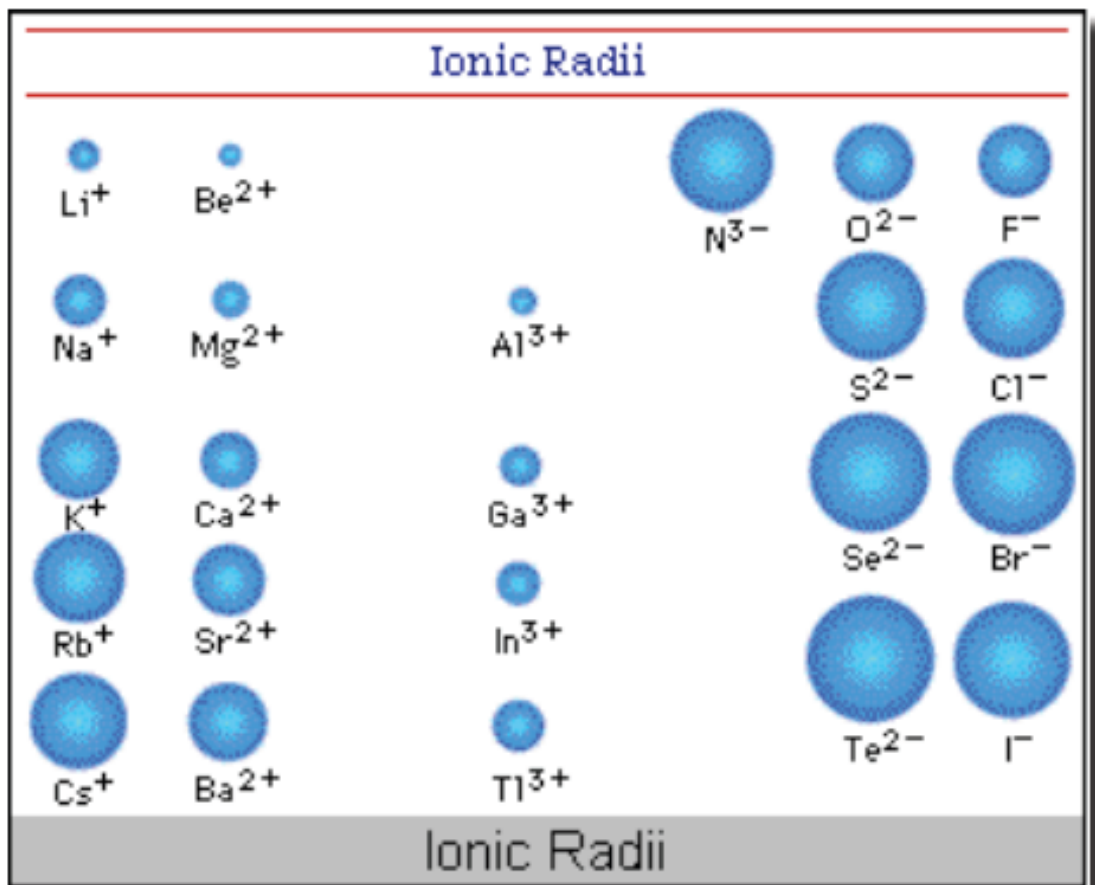


One e- is added to the outer shell.

Nuclear charge is reduced and the e- cloud expands.



Ionic Radius



Notice that the anions are larger than the cations!

Example of Ionic Radius Trend

- Arrange the following ions in order of increasing ionic radii:

