(2) **Today**

Sections 1.1 – 1.3
electrons, valence vs core electrons

Review Periodic Trends

Next Class (3)

Section 1.4
Introduction to Chemical Bonding Theories
octet rule etc

Sections 1.5-1.10
Valence Bond Theory

(4) **Second Class from Today**

Sections 1.5-1.10
Valence Bond Theory

Skipping Section 1.11 for now
An introduction to Molecular Orbital Theory

Sections 1.12
Drawing Chemical Structures

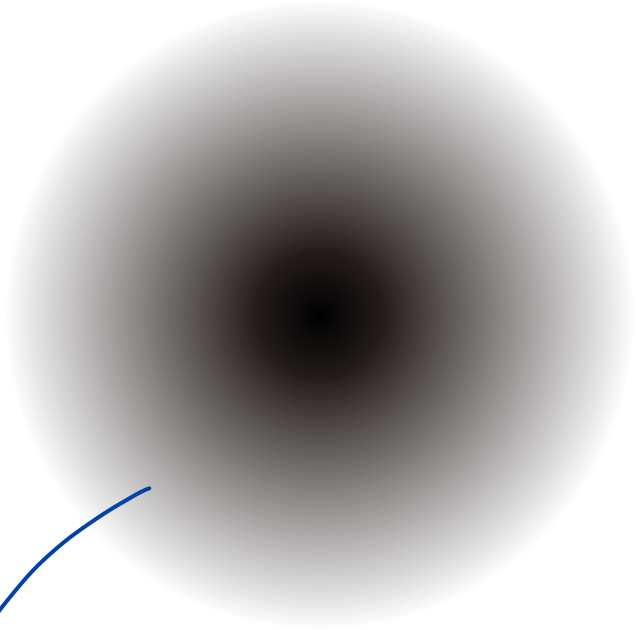
Third Class from Today (5)

Sections 1.12
Drawing Chemical Structures

Lab starts on Monday, September 8

Goggles and lab coats will be required starting Monday, September 22.

Wave/Quantum Mechanical Model



1 Å = 100 pm

Bohr had 1 quantum number.

the electron is in the n = 1 or 2 or 3 or 4… shell

Quantum Mechanics requires four quantum numbers to describe an electron: n, l, m_l, and m_s.

n is the principal energy level
l describes the shape of the orbital
$\mathbf{m}_l$ describes the orientation of the orbital and
$\mathbf{m}_s$ indicates the spin of the electron.

Fuzzy because the exact path + location of an e^- can't be know
We can only know the probability of finding an e^- somewhere in space

Further, as ***n*** gets larger more orbital shapes (***l***'s) become available and as more shapes become available, those shapes have more possible orientations ($\mathbf{m}_l$'s).

Image derived from 1https://en.wikipedia.org/wiki/Atom#/media/File:Helium_atom_QM.svg

And Where Are the Electrons Again? The Quantum Mechanical Model

The H atom's only electron:

$n = 1, l = 0, m_l = 0, \text{and } m_s = +1/2$

electron configuration

$1s^1$

He's two e⁻'s:

$n = 1, l = 0, m_l = 0, \text{and } m_s = +1/2$
$n = 1, l = 0, m_l = 0, \text{and } m_s = -1/2$

$1s^2$

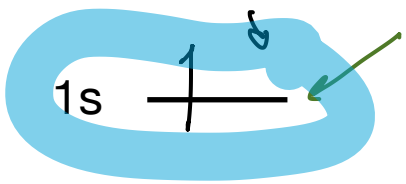
B's five e⁻'s:

$n = 1, l = 0, m_l = 0, \text{and } m_s = +1/2$
$n = 1, l = 0, m_l = 0, \text{and } m_s = -1/2$
$n = 2, l = 0, m_l = 0, \text{and } m_s = +1/2$
$n = 2, l = 0, m_l = 0, \text{and } m_s = -1/2$
$n = 2, l = 1, m_l = 1, \text{and } m_s = +1/2$

$1s^2\ 2s^2\ 2p^1$

H n = 1, l = 0, m_l = 0, and m_s = $^1/_2$

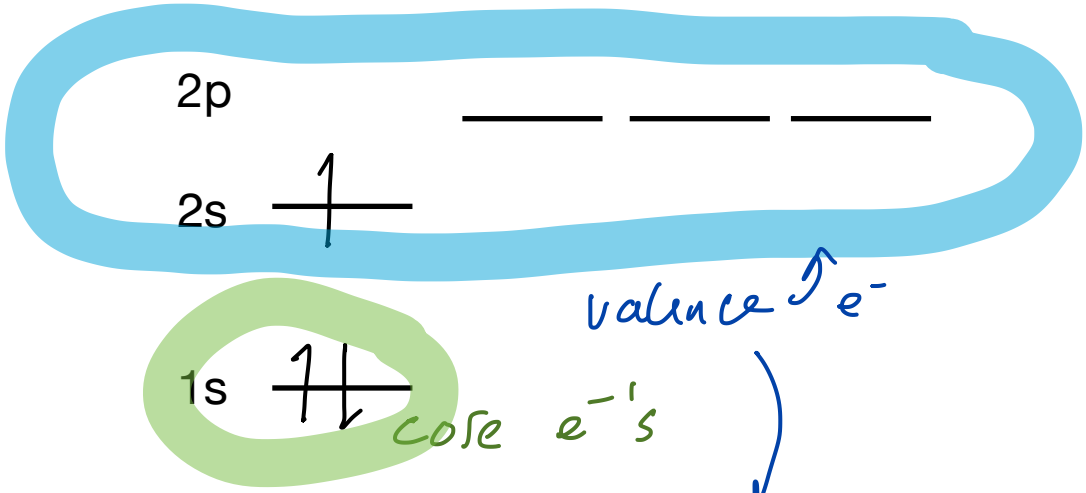
$1s^1$



the line represents the orbital/energy level

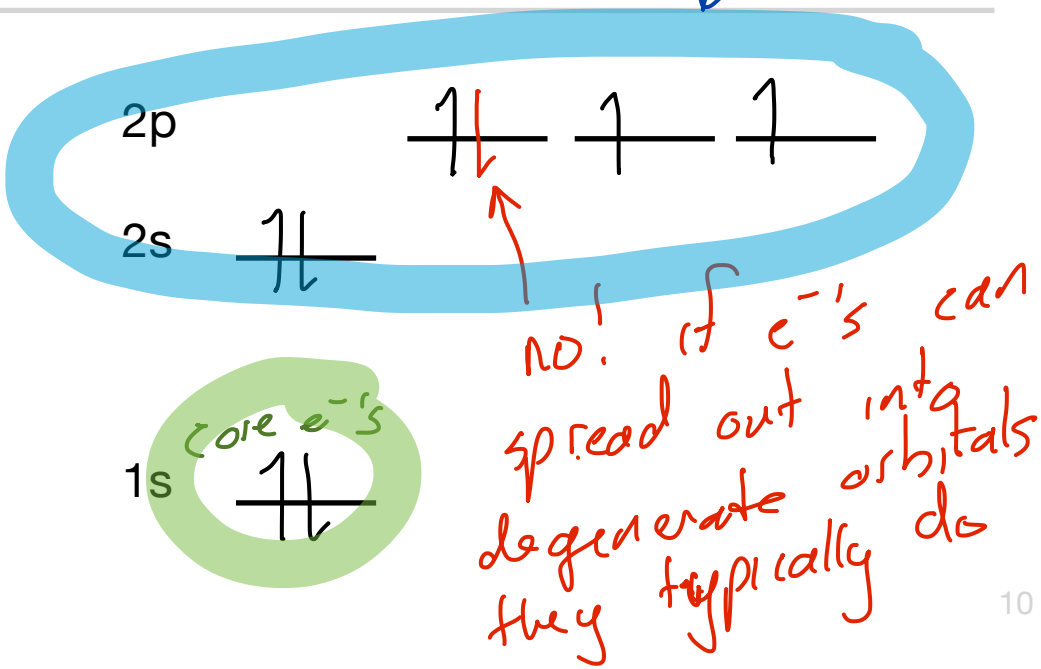
Li n = 1, l = 0, m_l = 0, and m_s = $^1/_2$
n = 1, l = 0, m_l = 0, and m_s = $^{-1}/_2$
n = 2, l = 0, m_l = 0, and m_s = $^1/_2$

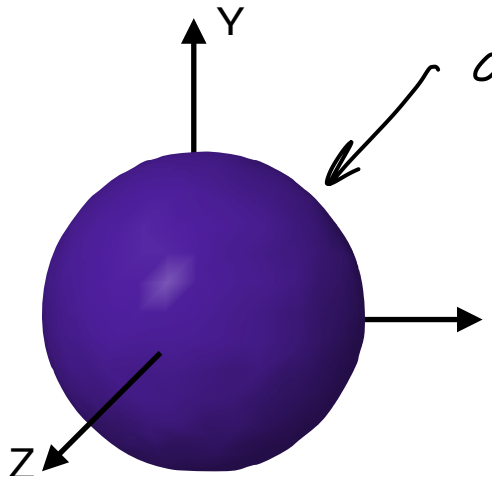
$1s^2 2s^1$



N n = 1, l = 0, m_l = 0, and m_s = $^1/_2$
n = 1, l = 0, m_l = 0, and m_s = $^{-1}/_2$
n = 2, l = 0, m_l = 0, and m_s = $^1/_2$
n = 2, l = 0, m_l = 0, and m_s = $^{-1}/_2$
n = 2, l = 1, m_l = 1, and m_s = $^1/_2$
n = 2, l = 1, m_l = 0, and m_s = $^1/_2$
n = 2, l = 1, m_l = -1, and m_s = $^1/_2$

$1s^2 2s^2 2p^3$

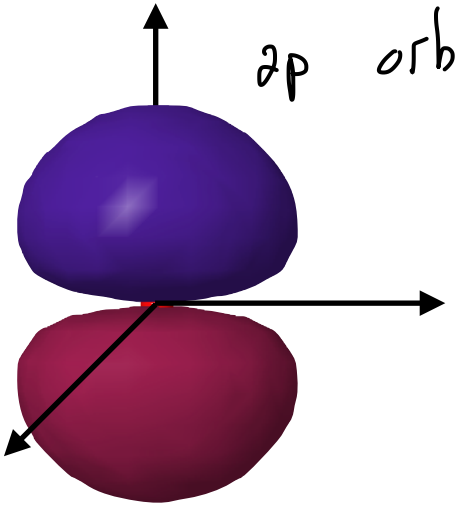


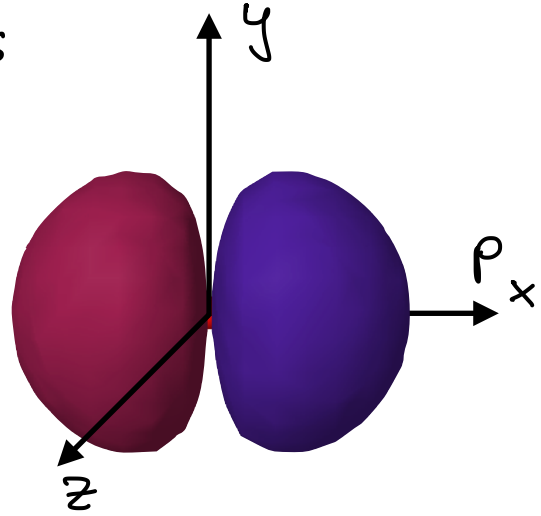


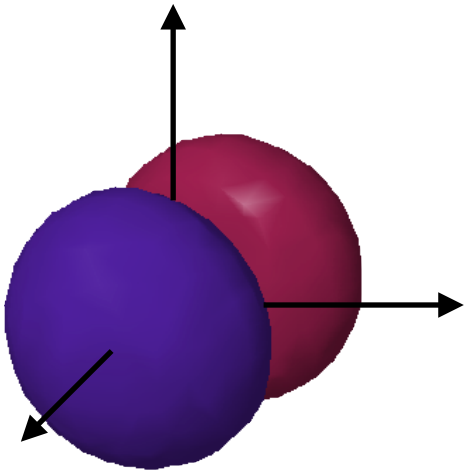
all s orbitals are spherically symetrical

x the 2s ($n=2$ $l=0$) is larger and has a nodal surface inside the sphere

2p orbitals







3 & 4 p orbitals are bigger versions of the same shape

But 3+4 p orbitals have 1 & 2 nodal surfaces in them

Use the periodic table to determine electron configurations

Use the periodic table to determine the number of valence electrons

Use the periodic table to identify metals and non-metals

Use the periodic table to remember trends in size

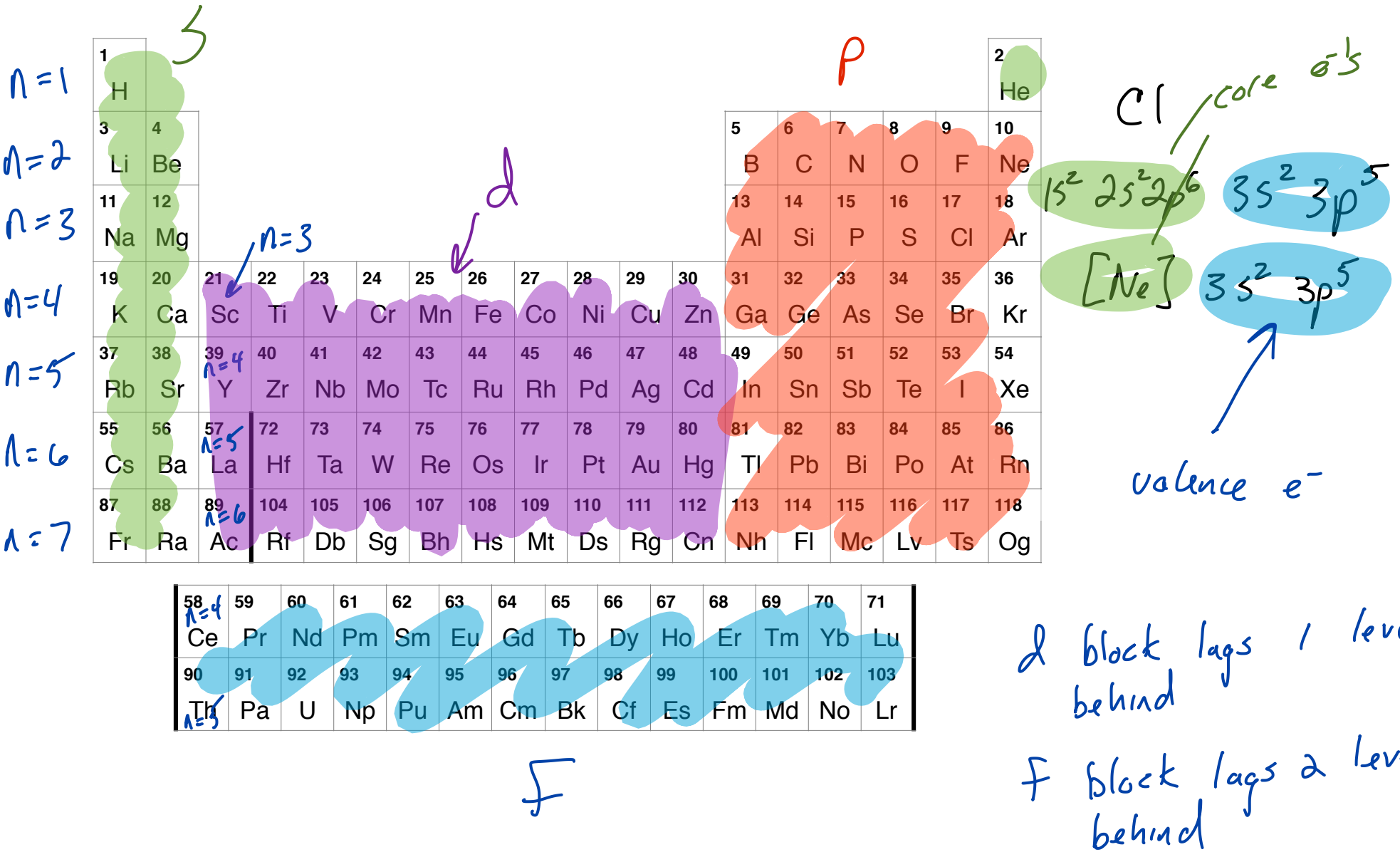
Use the periodic table to remember trends in electronegativity

Use the periodic table to predict likely charges of ions

Use the periodic table to predict likely bond formation

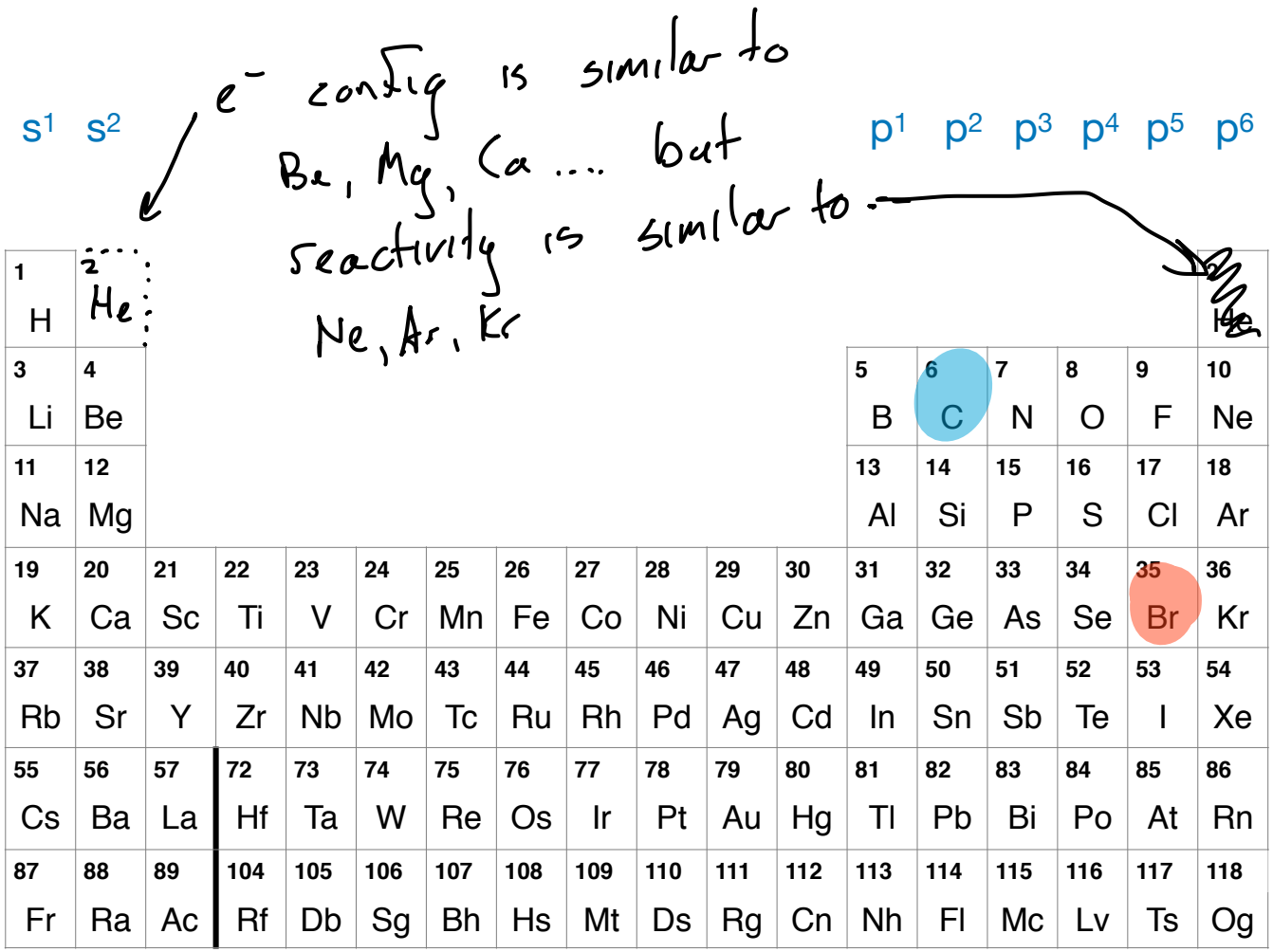
Use trends in size, electron configuration, and nuclear charge to explain electronegativity trend

Introduce Valence Bond Theory (hybridization)



Remember how electrons are distributed/electron configuration
Remember the importance of valence electrons/the valence shell

Example Electron configurations



C electron config and # of valence e⁻'s?

$1s^2\ 2s^2 2p^2$

4 v e⁻'s

Br electron config and # of valence e⁻'s?

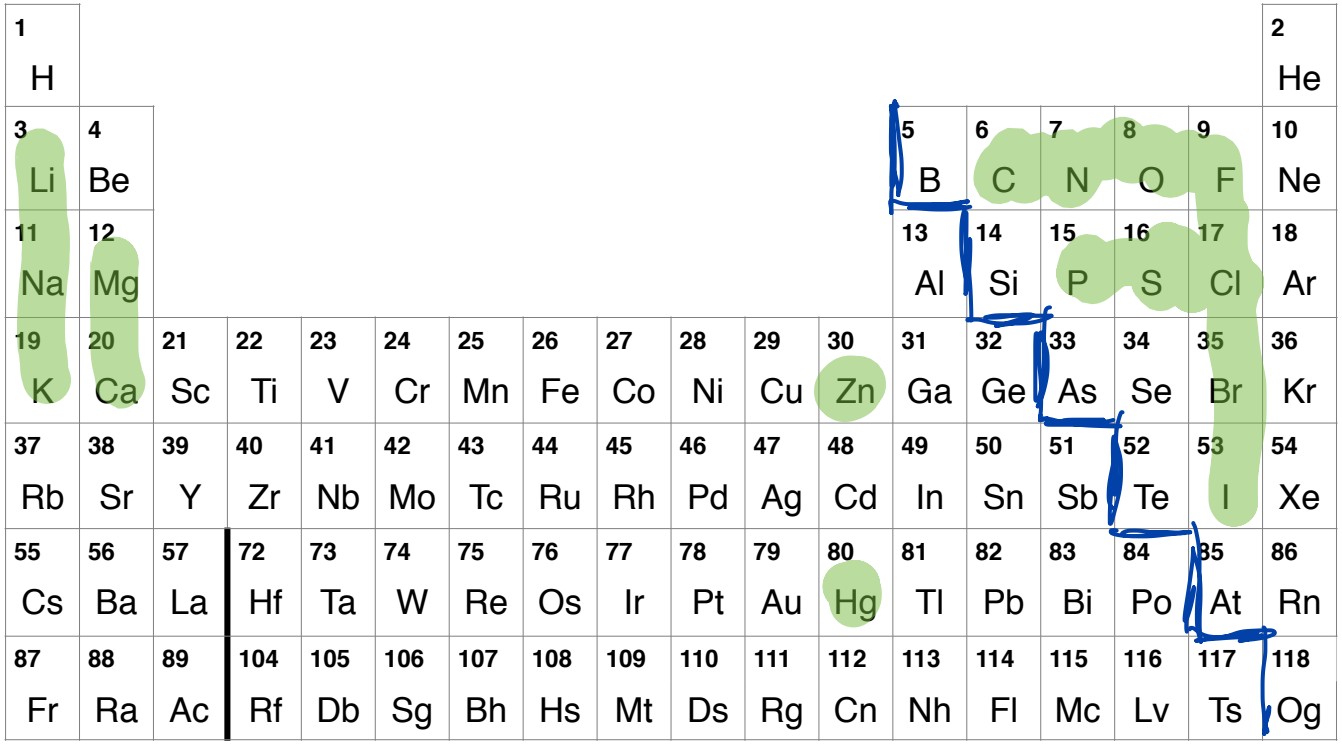
$[Ar]\ 4s^2 3d^{10} 4p^5$

7 v e⁻'s

metals tend to lose

NaCl is an ionic compound

Na^+ Cl^-



1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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
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	54 Xe
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 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Non metals tend to gain or share

Identify metals and non-metals

The Periodic Table Is Your Friend: Metals tend to gain and nonmetals tend to lose electrons

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	2										31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	3										49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	5										81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	8										113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

58 Ce												68 Er	69 Tm	70 Yb	71 Lu		
90 Th												100 Fm	101 Md	102 No	103 Lr		

11+ core e⁻'s shield valence e⁻'s from nuclear charge

Na $1s^2\ 2s^2\ 2p^6\ 3s^1$ F $1s^2\ 2s^2\ 2p^5$

Valence e⁻'s don't experience the full ⊕ of the nucleus

Why

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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 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
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Identify metals and non-metals

The Periodic Table Is Your Friend: Size

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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Remember periodic trends

The Periodic Table Is Your Friend: Electronegativity

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
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Remember periodic trends

Why does electronegativity or the size of the atom matter? Review

High energy electrons are reactive

low energy electrons are less reactive