**Today** (3)

Sections 1.1 – 1.3
atomic structure
electrons, valence vs core electrons

Section 1.4
Introduction to Chemical Bonding Theories
octet rule etc

Sections 1.11
An introduction to Molecular Orbital Theory

**Next Class** (4)

Sections 1.11
An introduction to Molecular Orbital Theory

Sections 1.5-1.10
Valence Bond Theory

**Second Class from Today** (5)

Sections 1.5-1.10
Valence Bond Theory

**Third Class from Today** (6)

Sections 1.5-1.10
Valence Bond Theory

# The Periodic Table Is Your Friend

$1s^2 2s^2 2p^5$ Review

slightly larger ... not a particularly important change in ~~size~~ volume

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

n=2

+9

the e⁻'s are relatively close to the nucleus (n=2) and the nucleus is very positive

atoms get much larger as we go down the table. This change in volume is significant.

electronegativity - ability of an atom to attract e⁻'s in a bond to itself increases from lower left to upper right

as e⁻'s occupy higher shells (principle energy levels)

Remember periodic trends

The Periodic Table Is Your Friend



+1 (Group 1)   +2 (Group 2)

Metals tend to lose $e^-$

Metaloids

nonmetals tend to gain

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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K

$[Ne]\,3s^2\,3p^6\,4s^1$

↓

$K^+$

$[Ne]\,3s^2\,3p^6\,4s^0$

core $e^-$'s aren't typically lost

metal + nonmetal } ionic compound
Na Cl

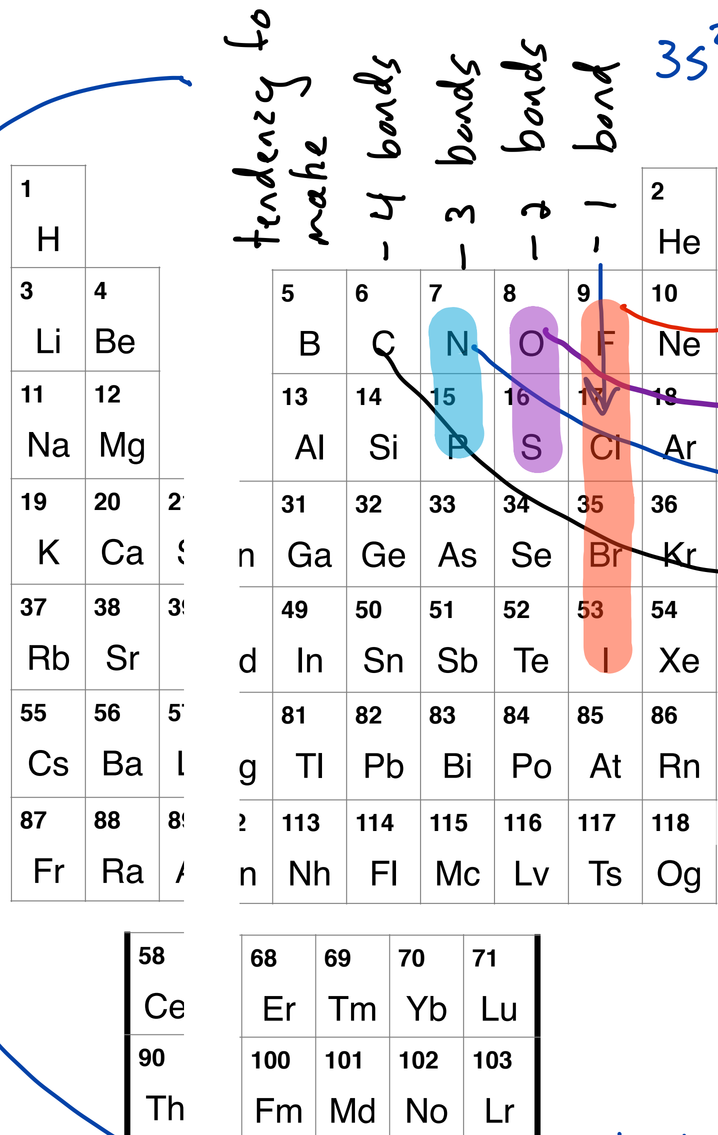
nonmetal + nonmetal .... covalently bonded

$NH_4^+$ $OH^-$

$NH_4OH$

can also make ionic compounds from non-metal polyatomic ions

Identify metals and non-metals




$3s^2 3p^5$ room for 1 $e^-$ ... $Cl^-$ $3s^2 3p^6$

~~$Cl^{2-}$~~ $3s^2 3p^6 4s^1$

can fit 1 additional $e^-$ — too far away!

$2 e^-$'s "

$3 e^-$'s... "

$4 e^-$ .... carbon will not become $C^{4-}$ too negative

carbon has to share 4

$H^\bullet$ needs to share 1 $CH_4$

H–O–H (O: needs 2; H: needs 1)

F–O–F

F 1 $e^-$ O 2 $e^-$

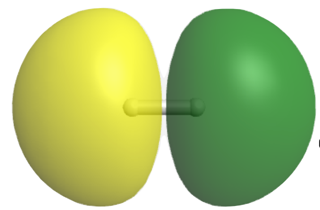
This is a good starting point but it doesn't mean all predictions are possible (e.g. $OF_2$) or that the predicted numbers of bonds is the only one

Predict the number of electrons or bonds needed for an element to form a stable compound possible (for exaple $OH^-$ + $NH_4^+$).

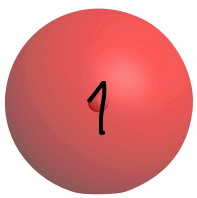
$H_2$

In the LCAO method atomic orbitals are combined through addition + subtraction to make molecular orbitals

AO's come together we add + subtract them to make MO's



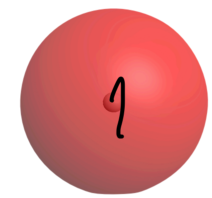
1s − 1s



H 1s[1]

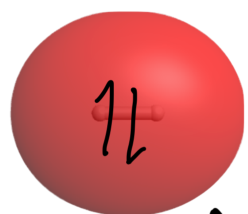
AO

e⁻'s fill low E orbitals first



H 1s[2]

AO



1s + 1s

MO's

2 AO's go in...

2 MO's must come out.

Molecules have orbitals just like atoms have orbitals