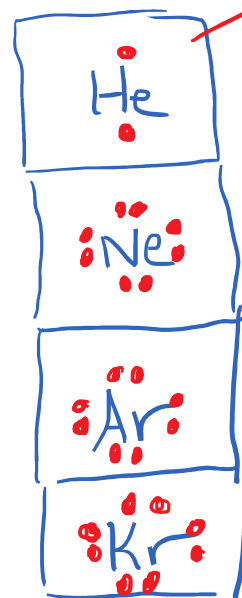


Chemical Bonding

Octet Rule - an atom will react so that its electron configuration resembles that of a noble gas.

→ either 2 or 8 valence electrons surround an atom.

Group 18



Electron Dot Structure → shows the distribution of valence electrons (outer shell electrons)

Review of atomic Structure :



energy levels
(or electron shells)
nucleus
valence electrons =

$p^+ = \text{protons}$
 $n^0 = \text{neutrons}$

Energy Level

e^-

1st

$2e^-$

2nd

$8e^-$

3rd

$18e^-$

4th

$32e^-$

:

7th

outer shell
electrons.

groups



← periods →

Atomic Structure for
Phosphorus

(group 15 on
periodic table)

Using the Periodic Table to Determine Valence Electrons

$1e^-$ $2e^-$ $3e^-$ $4e^-$ $5e^-$ $8e^-$
PERIODIC TABLE OF ELEMENTS

1 H Hydrogen	Not predictable.																2 He Helium																		
3 Li Lithium	4 Be Beryllium	Pub C hem										5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon																		
11 Na Sodium	12 Mg Magnesium	13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon	19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton										
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon	55 Cs Cesium	56 Ba Barium	*	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	**	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson																		
			57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium																		
			89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium																		

Group 16
↓



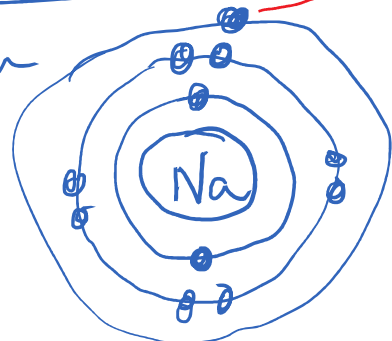
electron dot structure

2 Ways Atoms React to Become Stable (surrounded by 2 or 8 valence electrons)

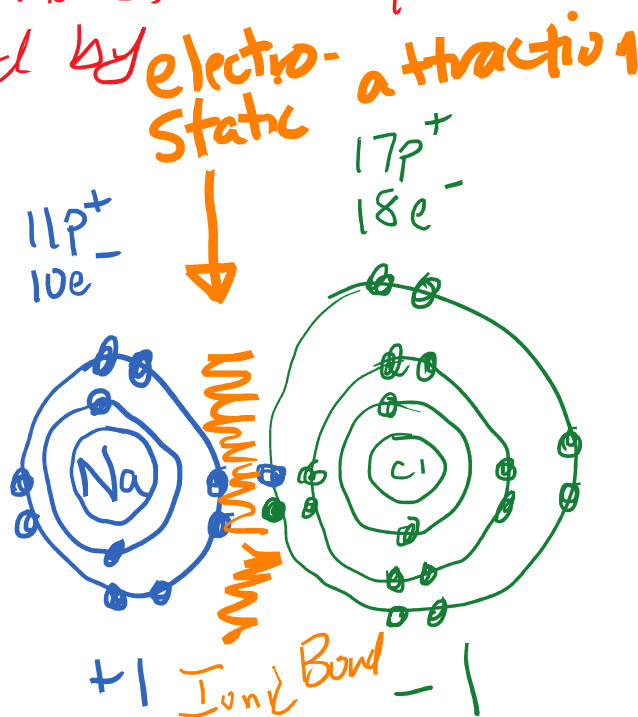
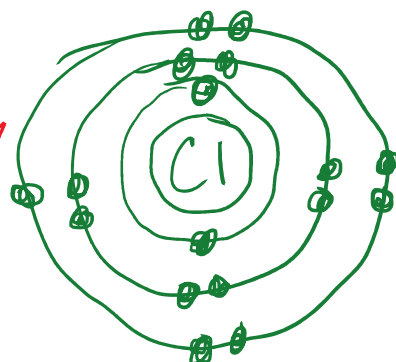
- 1) Ion Formation - electrons are gained or lost to form charged particles
- 2) Covalent Bonding - electrons are shared so that each atom is surrounded by 2 or 8 electrons.

Ion Formation

Sodium

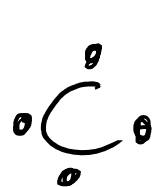


1 valence e^-



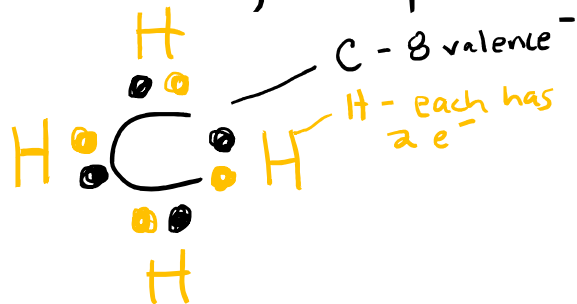
Covalent Bonding - electrons are shared.

Looking at electron dot structures helps to visualize covalent bonding.



← [Common Organic Elements]

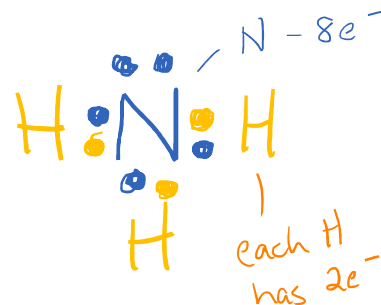
Methane, CH_4



Water, H_2O



Ammonia, NH_3



Single Covalent Bond - 1 pair of electrons
Shared



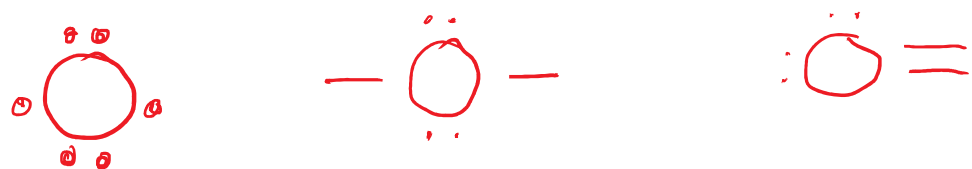
Double Covalent Bond - 2 shared pairs.



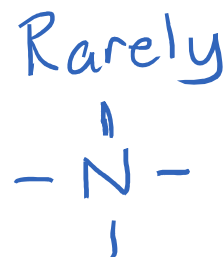
Triple Covalent Bond - 3 shared pairs



Common Bonding Patterns in Organic Chemistry



Never triple bonds
with oxygen!



2 types of Covalent Bonds

→ categorized because of electronegativity differences between atoms in a bond.

Electronegativity - the ability of an atom in a bond to attract electrons towards it.

Most electronegative element = Fluorine (4.0)

Oxygen - 3.5

Nitrogen - 3.0

Hydrogen - 2.1

Carbon - 2.5

Types

1) Nonpolar Covalent Bonds

→ electrons are shared equally between atoms with the same (or similar) electronegativities.



Note: nonpolar substances will not dissolve in water.

In organic chemistry, the C-H bond is considered Non-polar.

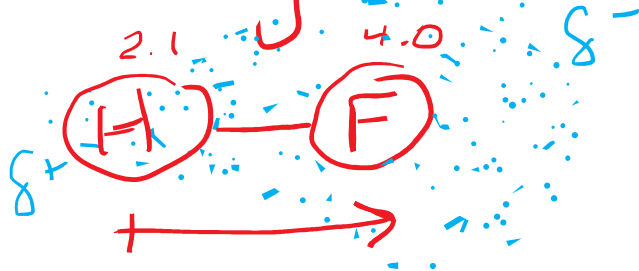
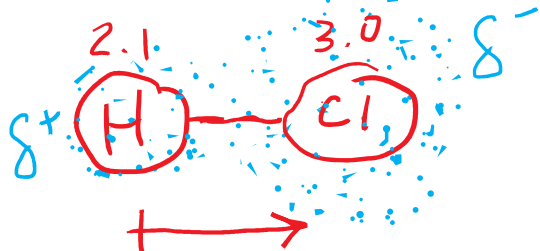
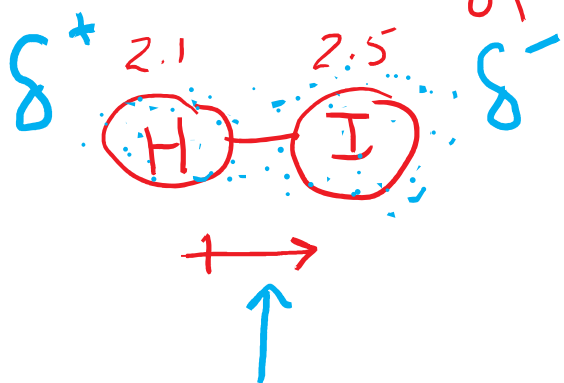
Examples of Nonpolar Substances

→ oils, fats, hydrocarbons (crude oil), fossil fuels, solvents like turpentine, kerosene

2) Polar Covalent Bonds

Note: water is the MOST polar substance!!

→ electrons are shared unequally because of different electronegativities -



- points to the more electronegative element (where the electrons are more likely to be)

δ^+ - partial positive

δ^- - partial negative



Nonpolar
(has no regions
of charge)

Note: molecules
with more
regions of charge
will be more
polar than
molecules with
fewer regions
of charge.



Polar
(has regions
of charge)

oil

Polarity

Water

Least Most substances fall in between Most

→ Increasing Polarity →