Bonding

Power Standards

1. **OBJ: Students will be able to identify an ionic compound**
2. **OBJ: Students will be able to write out an ionic compounds in name and formula.**
3. **OBJ: Students will be able to characterize an ionic compound as ionic crystal.**
4. **OBJ: Students will be able to identify a covalent compound.**
5. **OBJ: Students will be able to write out a covalent compound in name and formula.**
6. OBJ: Students will be able to identify an acid.
7. OBJ: Students will be able to write out an acid in name and formula.
8. OBJ: Student will be able to calculate the percent composition of an atom based on atomic mass.
9. OBJ: Student will be able to calculate percent composition based on quantities.

Minor Standards (discuss but will not be the focus of a summative assessment)

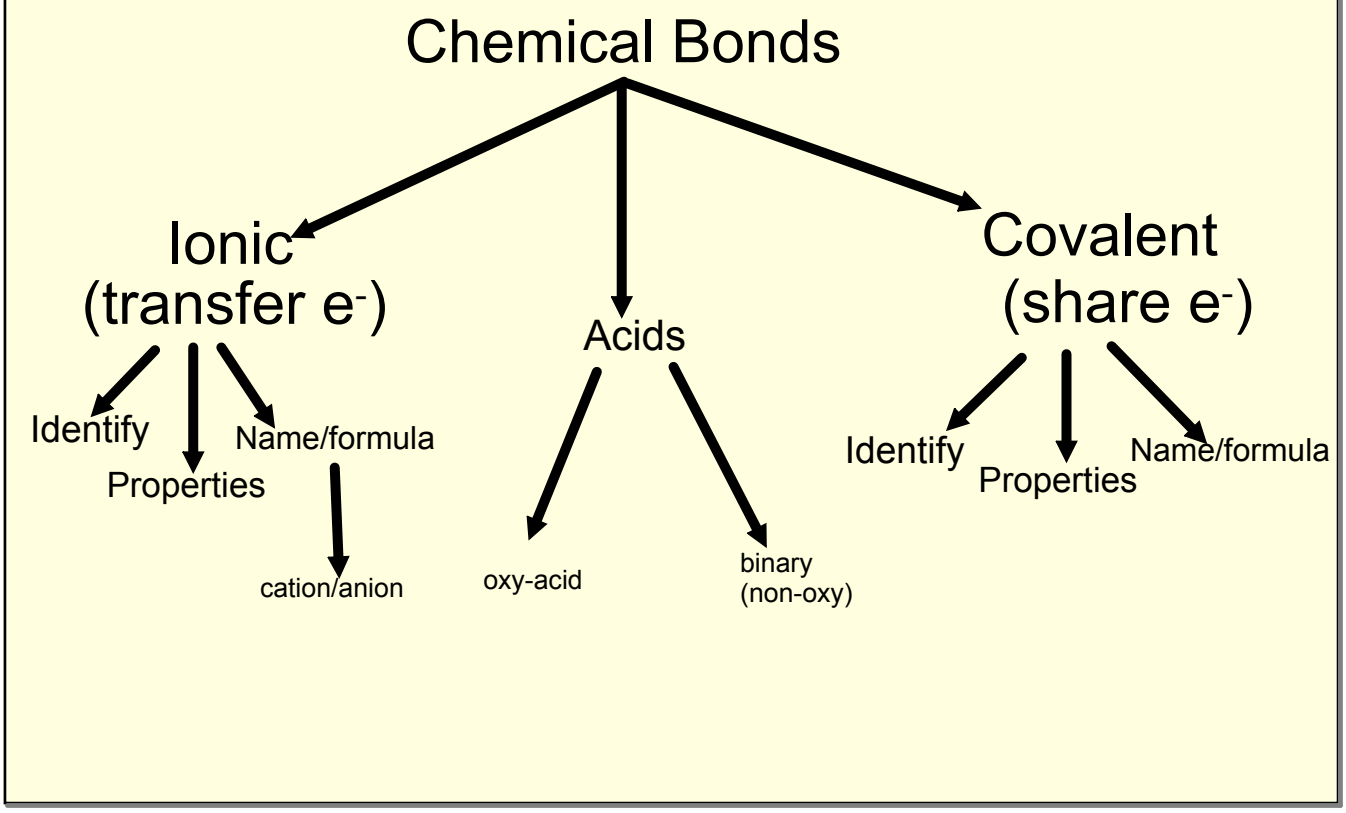
a. **OBJ: Properties of ionic compounds as a result of being a crystal. (Melting point, dissociation via dissolving)**
b. **OBJ: Students will understand properties of covalent compounds as a result of being a molecule (melting point, intermolecular forces)**
c. **OBJ: Write lewis structures.**
d. **OBJ: Students will understand polarity**

Oct 24-9:53 PM


Types of Bonds
DANIEL CRAIG
SKYFALL
007
JAMES BOND
007
AN OLD SPY
ANSWERS
of
WISDOM
DIE ANOTHER DAY

Jun 8 - 8:10 AM

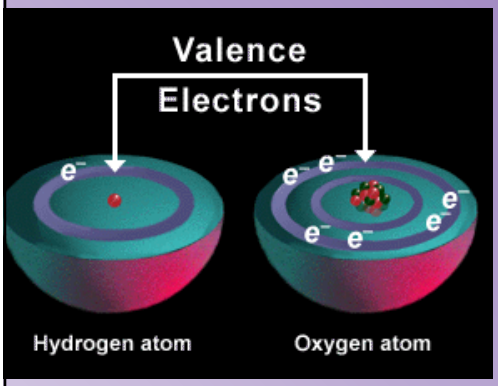
The Big Picture



Oct 19-2:56 PM

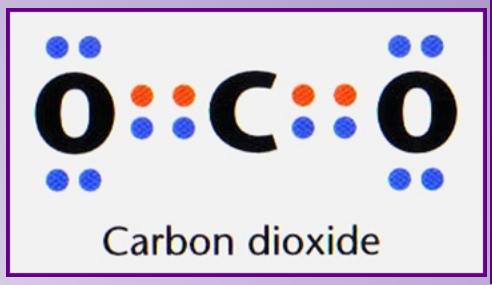
CHEMICAL BONDS

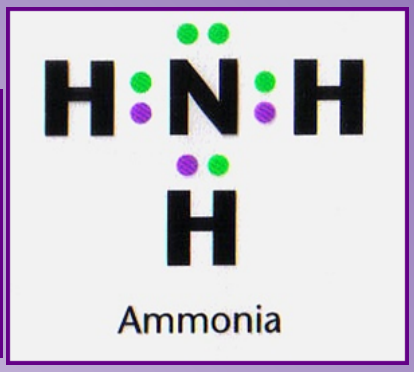
the mutual attraction between nuclei and valence electron of different atoms



Atoms react in a way that will

- **make them more stable**
- **full valence shell**
- **give lowest energy state**





compound- a pure substance of 2 or more elements chemically bonded

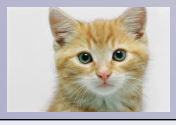
chemical bond

BJ: Students will be able to identify an ionic compound

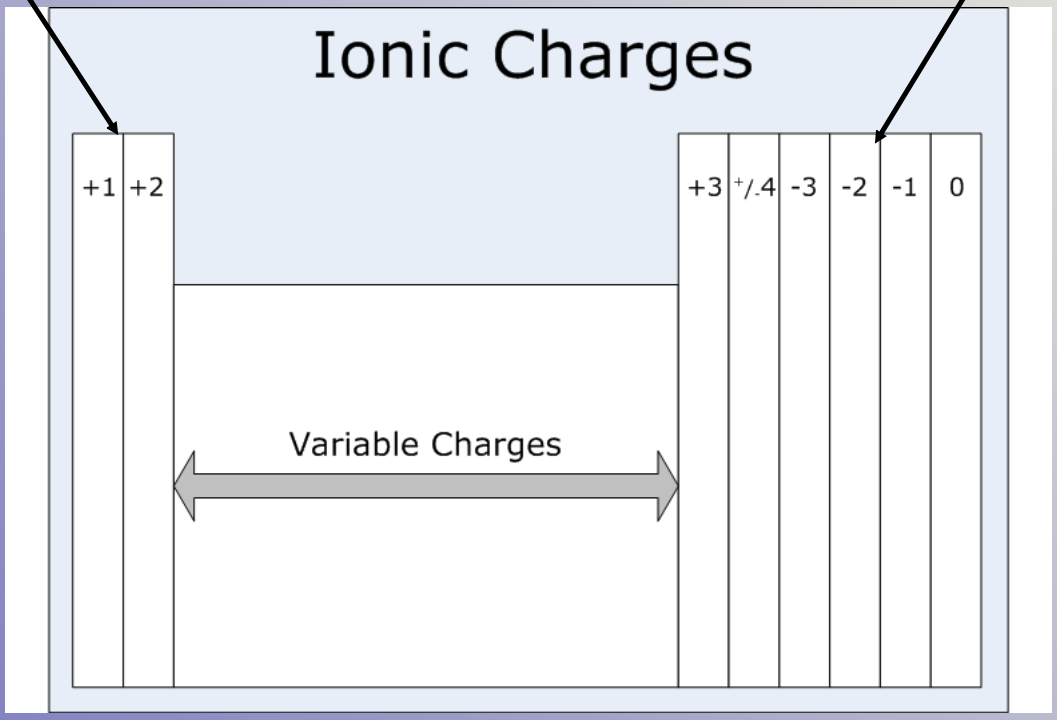
Ionic Bonds

--Chemical bond that holds **ions** together (opposites attract)

cation
- positive ion
- loss of e^-
- metal



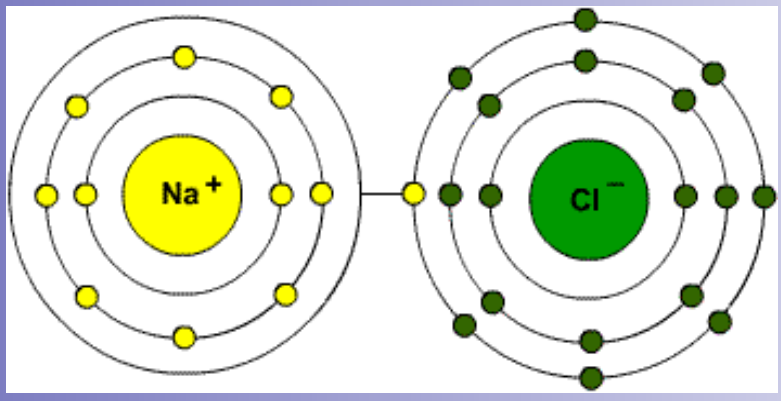
anion
- negative ion
- gain of e^-
- nonmetal



OBJ: Students will be able to identify an ionic compound

Ionic Bonds

- **metal to non-metal** bond
- valence e- are **transferred** (gained or lost)



ions

metal
cat**ion**

nonmetal
an**ion**

Exceptions:
H^{+1} and NH_4^{+1}

Ionic compounds

Examples: write electron dot and show transfer of e -

- you may need more than one atom

Na F

Mg O

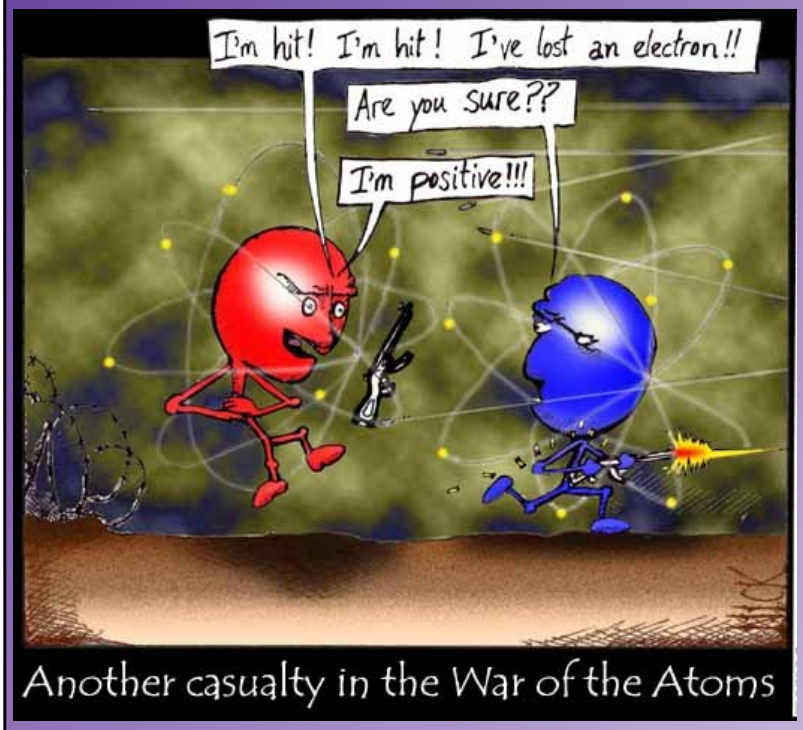
Li S

Ca N

H F

Examples of ionic bonds

OBJ: Students will be able to identify an ionic compound



Which of these are ionic (salts) compounds?

$CaBr_2$ CsF

H_2O FeO_3

C_6H_{14} $AgCl$

$NaC_2H_3O_2$ I_2

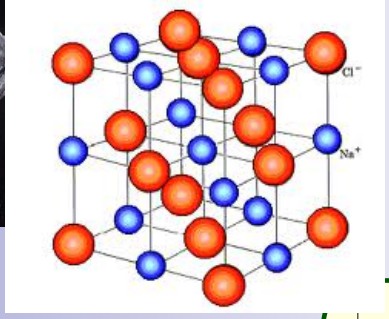
KNO_3 SO_2

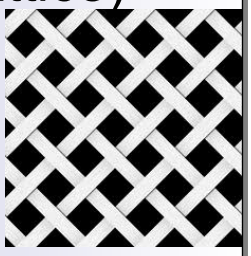
"I'm positive!" Determine ionic salts

BJ: Students will be able to characterize an ionic compound as ionic crystal.

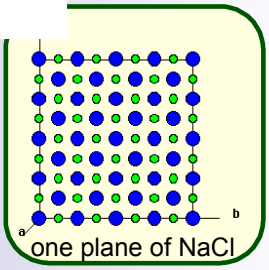
Ionic compounds

form uniform crystalline structures (lattice)





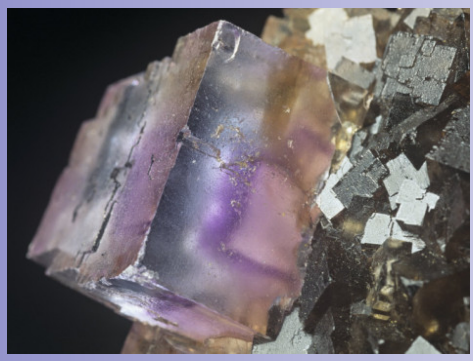
In NaCl,
there are **many** Na and **many** Cl

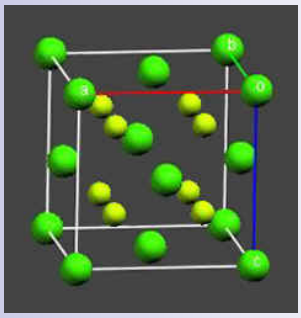


one plane of NaCl

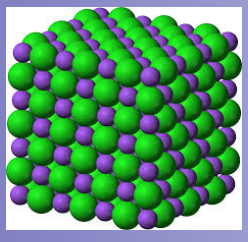
Ionic formulas

- always simplest ratio
- NaCl means there is 1 Na for every Cl
- CaF_2 means there is 1 Ca for every 2 F


CaF_2



CaF_2



Why don't we write
Na_2Cl_2 or $Na_{100}Cl_{100}$?

always simplest ratio

OBJ: Students will be able to write out an ionic compounds in name and formula.

Writing Formulas for ionic compounds

1. Translate name into ions

iron (II) chloride

Fe^{+2} Cl^{-1}

2. The charge on the compound must equal 0

Fe^{+2} Cl_2^{-1} = 0

need 2 chloride ions

$FeCl_2$

shortcut: crisscross method

+2 -1

Fe Cl

$FeCl_2$

criss cross numbers

no charges (no + or -)

do not need to write"1"

3. Keep polyatomics as a unit (family)

use parentheses if more than one unit

aluminum sulfate Al^{+3} SO_4^{-2}

must = 0: $2(+3)$ Al $3(-2)$ SO_4 = 0

criss cross: +3 Al -2 SO_4

either way: 2 Al to 3 SO_4

$Al_2(SO_4)_3$

use parentheses to keep as unit

4. Use simplest ratios (ionic only!!!)

magnesium carbonate

must = 0: (+2) Mg (-2) CO_3 = 0

criss cross: +2 Mg -2 CO_3

$MgCO_3$ correct

$Mg_2(CO_3)_2$ incorrect

simplify to $MgCO_3$

Cation

lithium carbonate Li^{+1} CO_3^{-2} Li_2CO_3

calcium hydroxide Ca^{+2} OH^{-1} $Ca(OH)_2$

aluminum phosphate

barium phosphate

iron (III) chloride

magnesium oxide

Oct 26-7:34 AM

OBJ: Students will be able to write out an ionic compounds in name and formula.

Naming ionic compounds

1. Name cation first, then anion

cation - same name as element

anion - mon-atomic (1 element)

end of element name is taken off, add -ide

chlorine → chlor**ide** Cl^{-1}

oxygen → ? O^{-2} oxide

CaF_2 calcium fluoride

MgO

AlP

2. Using polyatomics:

If more than 2 elements, then use polyatomic name

(count capital letters!)

Use your memory or ion chart!

$MgSO_4$ magnesium sulfate

DON"T Mess with the Family

$Ba(NO_3)_2$

Li_3PO_4

$Ca(C_2H_3O_2)_2$

NH_4ClO_3

3. transition metals with variable charges

(roman numerals) find on ion chart

Roman numeral must match charge on cation

I II III IV

+1 -1 =0

CuCl

copper(I) chloride

+2 2(-1) =0

$CuCl_2$

copper(II) chloride

Table 6.3

Formulas and Names of Common Metal Ions with

Formula	Stock name
Cu^{+}	Copper(I) ion
Cu^{2+}	Copper(II) ion
Fe^{2+}	Iron(II) ion
Fe^{3+}	Iron(III) ion
$*Hg_2^{2+}$	Mercury(I) ion
Hg^{2+}	Mercury(II) ion
Pb^{2+}	Lead(II) ion
Pb^{4+}	Lead(IV) ion
Sn^{2+}	Tin(II) ion
Sn^{4+}	Tin(IV) ion
Cr^{2+}	Chromium(II) ion
Cr^{3+}	Chromium(III) ion
Mn^{2+}	Manganese(II) ion
Mn^{3+}	Manganese(III) ion
Co^{2+}	Cobalt(II) ion
Co^{3+}	Cobalt(III) ion

*A diatomic elemental ion.

Oct 25-5:56 PM

OBJ: Properties of ionic compounds as a result of being a crystal. (Melting point, dissociation via dissolving)

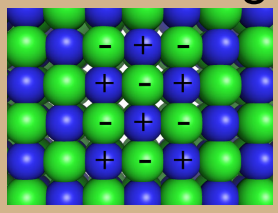
Properties of Ionic Salts

1.High melting and boiling points

a lot of energy holds cations and anions together

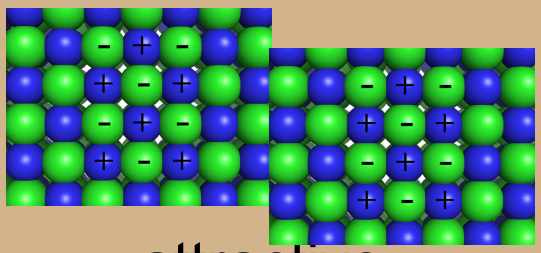
$$F = \frac{kq_1q_2}{r^2}$$

many opposite charges held close together

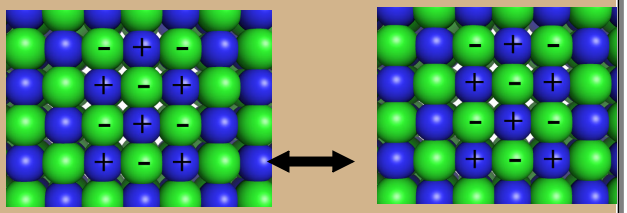


2.Hard but brittle

- Slight shift will line up repulsive forces
- Difficult to move (hard) but falls apart completely if shifted (brittle)



attractive forces



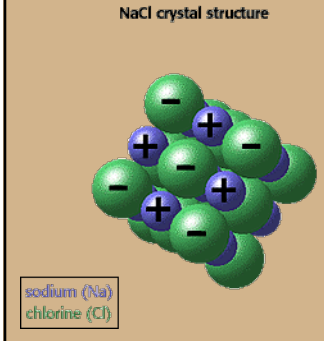
repulsive forces

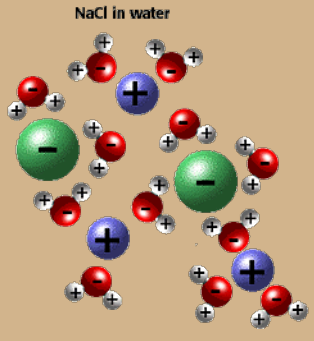
3. Solubility

salts

soluble-dissolves in water

- ions dissociate (separate)
- will conduct electricity

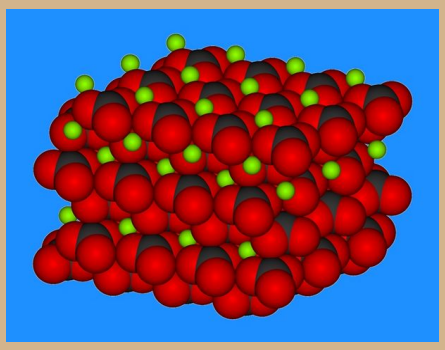




water "pulls" apart

insoluble-doesn't dissolve

- ionic attraction is greater than water's polarity
- does not conduct electricity



water can't "pull" this apart

POGIL Review-Naming Ionic Compounds

1. Which of the following is the correct name for PbO_2?

a. lead oxide

c. lead(II)oxide

b. lead (I) oxide

d. lead(IV)oxide

2. Which of the following is the correct chemical formula for iron(III) sulfide?

a. Fe_3S

c. FeS

b. FeS_3

d. Fe_2S_3

3. In a complete sentence, explain why the name magnesium chloride does not contain a Roman numeral.

Oct 30-10:05 AM

Review

1.Write the formula for the compound with the following ions:3

Ba^{+2} I^{-1}_____ Al^{+3} $C_2O_4^{-2}$ _____

NH_4^{+1} CrO_4^{-2} _____ Ba^{+2} S^{-2} _____

Sn^{+4} CO_3^{-2} _____

2.Write the formula for the compound with the following names: (hint—write ions first)

Nickel (II) Carbonate _____

magnesium cyanide _____

Iron (III) silicate _____

3.Write the correct compound name of the following:

$SnCl_2$ _____

Ag_2SO_3 _____

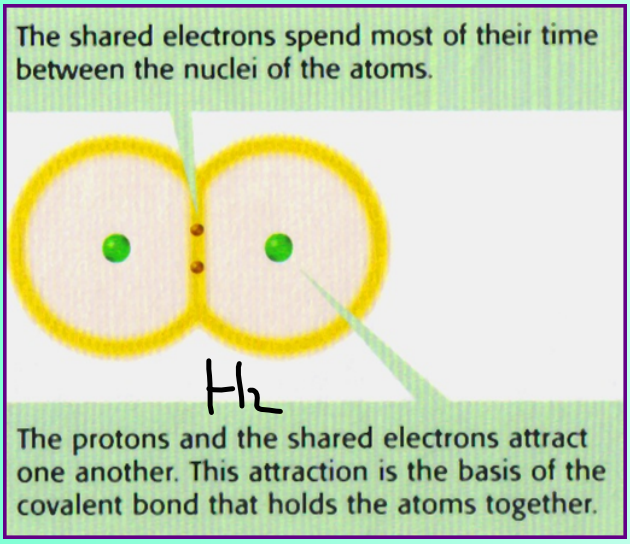
CuCl _____

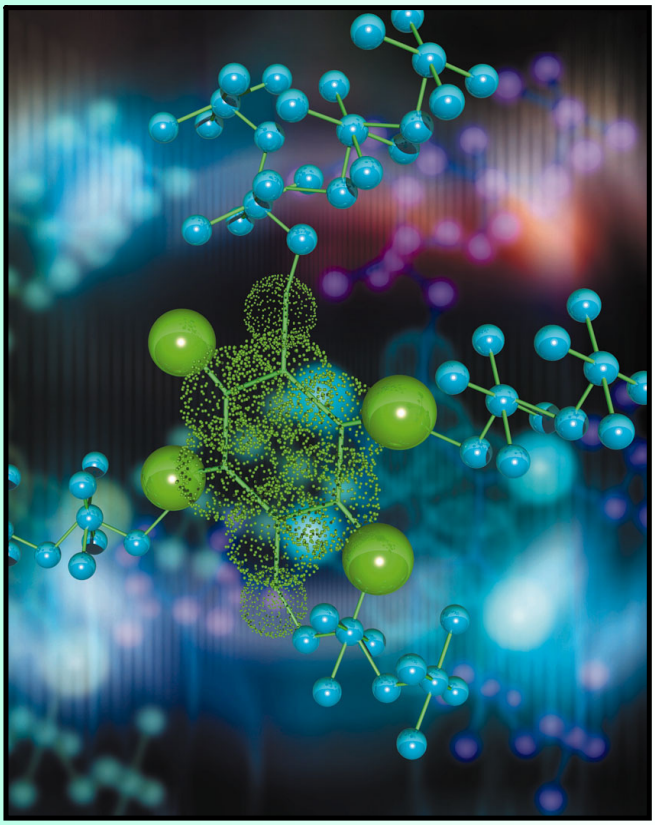
Oct 31-11:21 AM

BJ: Students will be able to identify a covalent compound.

Covalent Bonds

- Chemical bond formed by sharing a pair of e^-
- **Shared e^-**
- Forms between **2 non-metals**
- Forms <u>molecular</u> compounds (molecules)



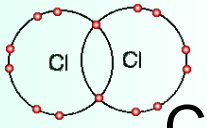


covalent bond

BJ: Students will be able to identify a covalent compound.

Diatomic Molecules:

contains 2 covalently bonded atoms



Cl_2

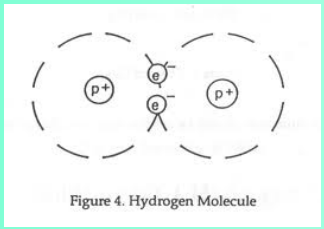
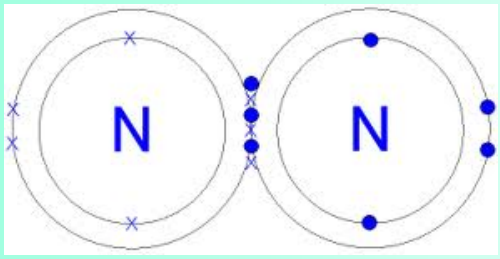
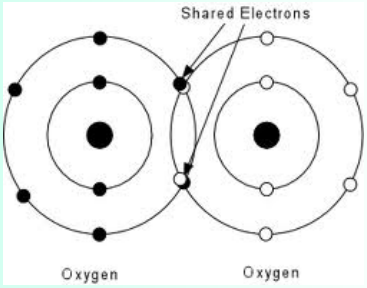


Figure 4. Hydrogen Molecule

H_2



N_2



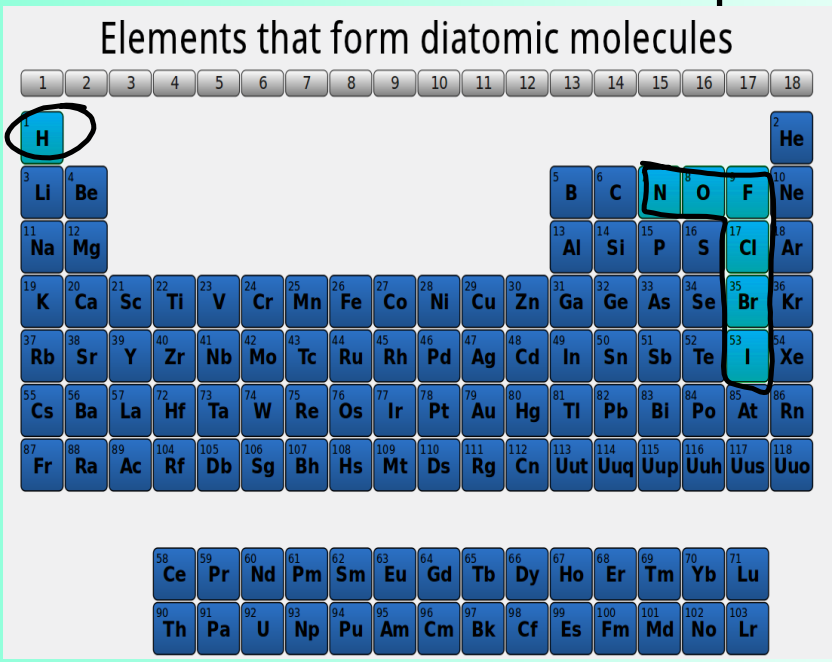
O_2

7 elements are diatomic in nature

H_2 O_2 Br_2 I_2 F_2 N_2 Cl_2

Know these!!!

H O Br F I N Cl "twins" or "Super 7"

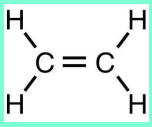


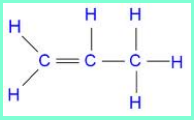
OBJ: Students will understand properties of covalent compounds as a result of being a molecule (melting point, intermol

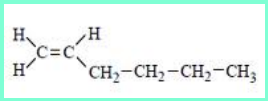
Molecular structure

(may not be simplest ratio)

boiling point

1:2 C_2H_4 ethene  -103.7°C

C_3H_6 propene  - 47.6°C

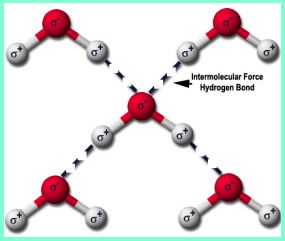
C_6H_{12} 1-hexene  63 °C

All 3 have same ratio but have different properties!

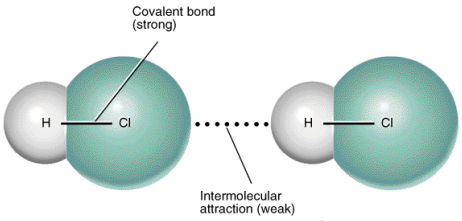
Not uniform crystalline structure

each molecule

- individual/independent
- interacts with other molecules through weaker intermolecular forces



water molecule



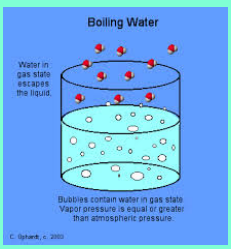
Intermolecular forces

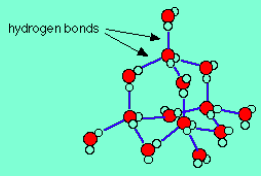
Strongest: Covalent
Ionic

Weakest: Intermolecular

Melting and Boiling points are lower than salts

intermolecular forces are weak





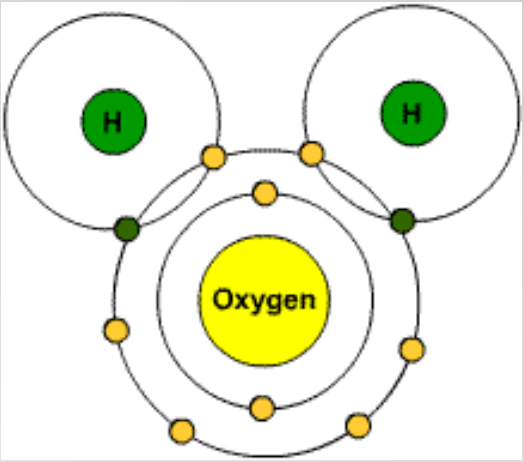
Oct 26-9:11 AM

OBJ: Students will understand polarity

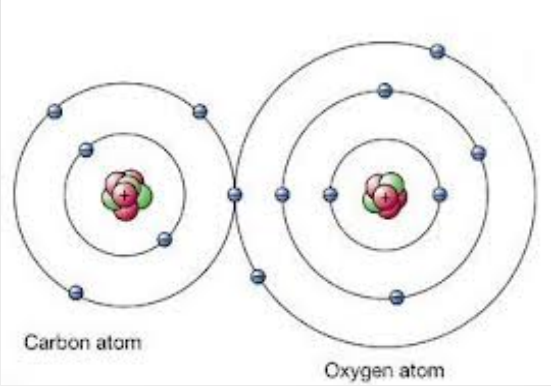
Polar Covalent Bonds

- **electrons are shared <u>unequally</u>**
- **atoms of some elements pull more strongly than others on shared electrons**

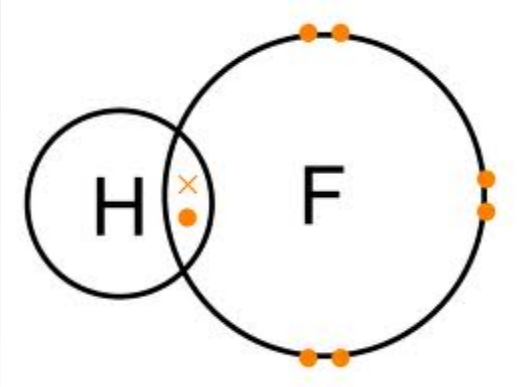
Example: H_2O



CO



HF



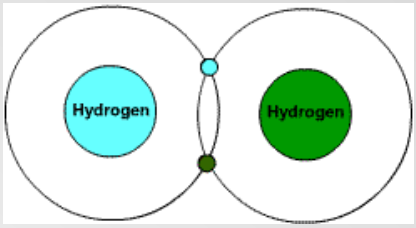
polar bonds

OBJ: Students will understand polarity

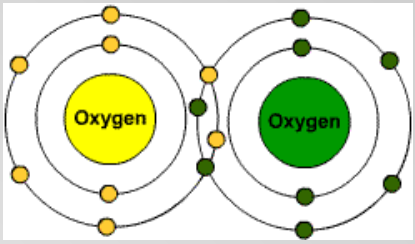
Nonpolar Covalent Bonds

- electrons are shared equally
- formed by atoms of the same element, Ex: H_2, N_2
  or in molecules that are the same on all sides, Ex: CH_4

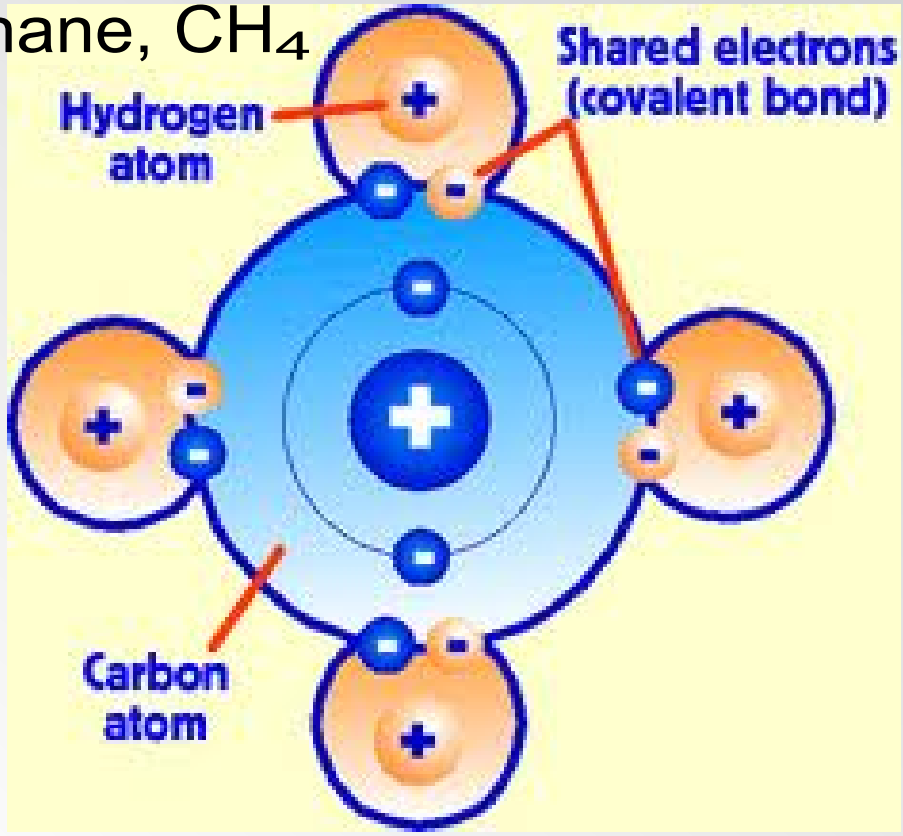
H_2



N_2



Methane, CH_4



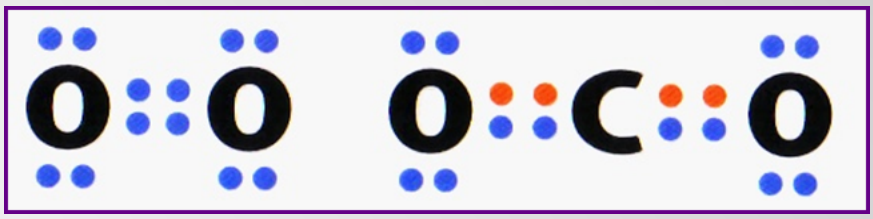
OBJ: Students will write lewis structures.

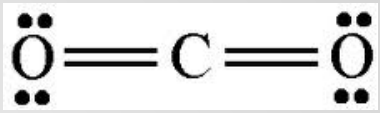
Covalent --Multiple bonding

Single bond-- occurs when 2 atoms share 1 pairs of e^-

Double bond-- occurs when 2 atoms share 2 pairs of e^-

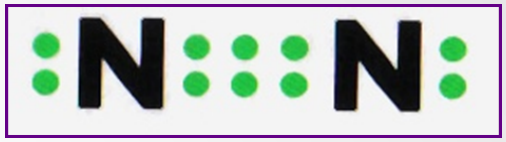
shown with 4 e^- or 2 dashes

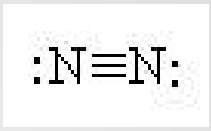




Triple bond-- forms when 2 atoms share 3 pairs of e^-.

shown with 6 e^- or 3 dashes





double and triple bonds

OBJ: Students will write lewis structures.

Lewis dot structures --show bonds

1. Write e^- dot for all atoms

Cl_2

2. Add up total valence e^-

3. Arrange atoms to form a skeleton structure for the molecule

C in center or least electronegative in center, H never central

4. Check for octets

H has 2 e^- , other nonmetals have 8 e^-

change e-dot pairs to dash

5. Count e-s to make sure number of valence e^- = number available

H_2

H_2O

CH_4

F_2

CO_2

N_2

NH_4^{+1}

Oct 19-5:03 PM

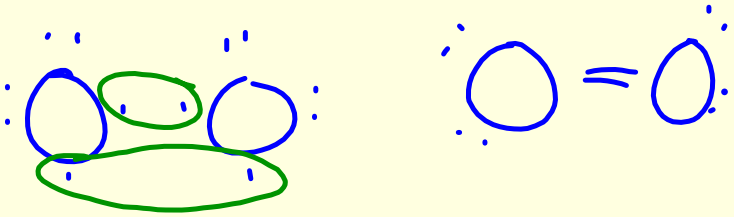
covalent

single, double or triple bond?

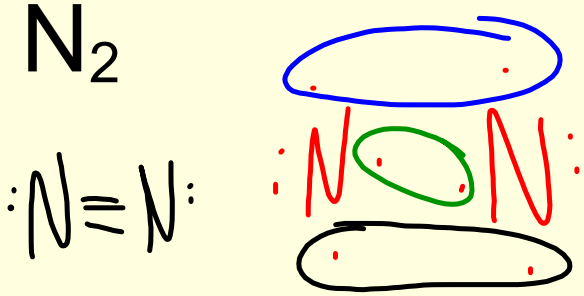
HCl

if you have 1 or 7 $\dot{e}$ in all atoms it is probably a single bond

O_2



N_2



Nov 19-10:42 AM