Grade

Name: _____ Period: _____

3 assignments due Thurs

2. Create a mind map for the following: How to determine types of bonds, including electronegativity, metal & non-metal, draw, and name their shape. ALSO... create a diagram that distinguishes characteristics between metallic, covalent, and ionic bonds. BE AS ORGANIZED AND DETAILED AS POSSIBLE! 50% of grade

- ☐ yellow
- ☐ orange
- ☐ back pg.

Explain to me the questions you ask yourself to determine what kind of bond it is and then what steps you take to draw that structure! See sample next page

Quiz Wednesday

- ☐ study

Grade

Name: _____ Period: _____

1. Draw the Lewis Dot Structure for each of the molecules listed below and determine the molecular geometry of the molecule:
   a. CO_2

   b. PF_3

   c. NH_3

   d. PBr_5

   e. BH_2Cl

   f. CH_4

   g. CH_2F_2

   h. N_2

Stamp

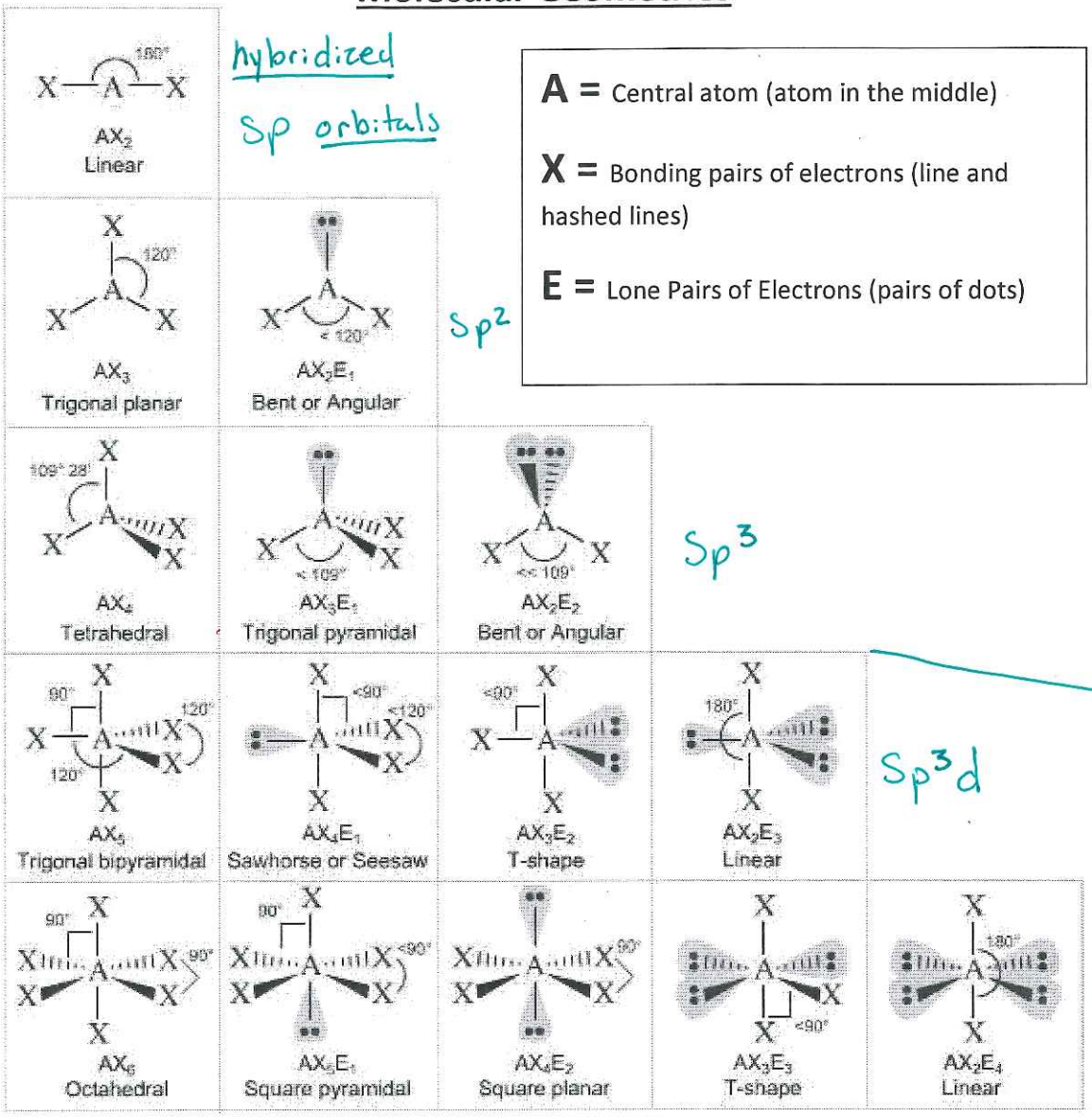
Lecture Questions

1. What was the main idea of the lecture? VSEPR
2. What were the vocabulary words I need to know? (make a list and one-by-one, need to go through a - c below)
   a. Can the value of this be changed?
      If yes, how [be specific about makes it higher or lower]?
   b. What other vocabulary words is this related to (if more than one list and explain all)?
   c. How does this term relate to the main idea of the lecture?
3. Was there a step-wise process explained?
   If yes, what were the steps and what was accomplished at each step?
4. How does the main idea of this lecture relate to other lectures in this unit?
5. Is this main idea applicable in every situation?
   If no, when does it apply and when does it not?

Now do hybridization, ↑ Expanded octet

Notes

Molecular Geometries



You will need to memorize:

- Molecular geometry
- Bond angles
- AXE designations

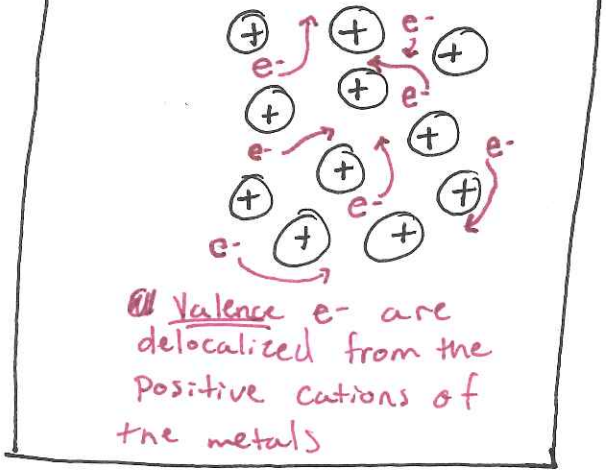
How do I decide to draw a compound?

Q: What is it made out of?

Metal + metal → Metallic Bond

Metallic Bond

Electron Sea Model



Valence e- are delocalized from the positive cations of the metals

Non-metal + non-metal → Covalent Bond

Covalent Bond

* Sample on back

To determine Structure

Total valence e-

− # of electrons used in bonds

− # of electrons used to satisfy octet of outer atoms

e- left go on central atom

*: if central atom does not have enough e- to satisfy octet form double or triple bonds

Determine AXE of Central atom → AXE gives Shape + name

Is compound polar Cov.

Electro negativity diff between .4 + 1.6 → yes, due to...

" " " less ≤ .4 → no

Metal + non-metal → Ionic Bond

Ionic Bond

(has large difference in electronegativity > 1.6) electrons are donated from the metal to the non-metal

1. Draw atoms w/ valence e-

2. Show transfer of e-

3. Write formula unit

$MgCl_2$

H_2O

Step 1) count valence electrons + write that # by T H· H· ·Ö:

Step 2) Write central atom + bond other atoms (central atom is never H)

a) draw

b) write # of e- used to bond by B

Step 3) give enough lone pairs to <u>outer</u> atoms to satisfy octet. (H, He => 2 B => 6 all others => 8) Write the # of atoms used by O

T = 8 e-

- B = 4e-

- O = 0 e-

4e-

AX_2E_2 Bent

Step 4) Subtract T - B - O = # ← this tells you the number of e- to add to your central atom

Step 5) Check central atoms octet. Create double/triple bond if necessary.

Step 6) write "AXE" + Shape name

Notes

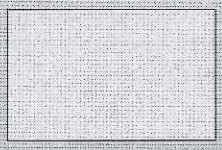
for orange highlighted question (try Ven diagram or columns)

11/17/2015

Bonding Foldable:

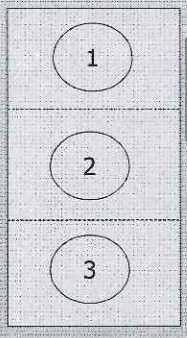
First, fold your paper in half like this.

Not this.



You need three "flaps."

To cut "flaps," cut only the top half of the folded paper.



Do not write these numbers on your flaps!

Ionic Bond

Covalent Bond

Metallic Bond

Label your flaps!

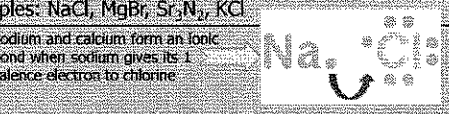
Ionic Bond – A bond (or force) that attracts electrons from one atom to another, which transforms a neutral atom to an ion.

Electrons in an ionic bond are transferred (**lost by cations** or **gained by anions**) when the bond forms.

Ionic Bond Properties

- A metal & a nonmetal bonded together forms ionic compound
- Metals lose electron(s), nonmetals gain electron(s)
- Forms a repeating ionic crystal (crystal lattice)
- Ionic compounds have high melting points
- An ionic compound's formula is called a ***Formula Unit***
- Ionic compounds generally conduct electricity when dissolved in solution.
- Examples: NaCl, MgBr, Sr_3N_2, KCl

Sodium and calcium form an ionic bond when sodium gives its 1 valence electron to chlorine

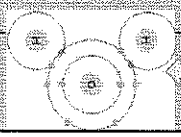


Covalent Bond – A bond is formed when atoms ***share*** one or more pairs of electrons.

Electrons in a covalent bond are shared when the bond forms. Both atoms get the octet.

Covalent Bond Properties

- Covalent bonds form between nonmetals and other nonmetals.
- Electron are shared to fill the octet (or duet, for H & He).
- Can share multiple pairs of electrons (double or triple bonds)
- Low melting points.
- Called a molecular compound or molecule.
- **Examples:** H_2O, H_2O_2, CH_4

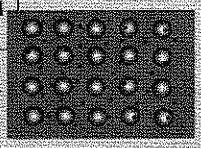


Two H atoms each share their 1 electron with and O atom. H fills outer shell with 2 (duet rule) and O fills outer shell with 8 (octet)

Metallic Bond – A bond (or force of attraction) formed by the attraction between positively charged metal ions and the electrons around them.

Electrons in a metallic bond are *delocalized*, meaning they no longer stay with their nucleus, but move freely around all the atoms. This is also called the *"sea of electrons."*

Sea of electrons



Metallic Bond Properties

- Occurs when many atoms of one type of element. (does not bond 2 or more metals.)
- Electrons are free to move in the "sea of electrons" and do not belong to one individual atom.
- Because of sea of electrons, metal atoms have high electrical and thermal conductivity.
- Strong absorbers and reflectors of light.
- Have luster, are malleable & ductile
- Examples: Fe, Mg

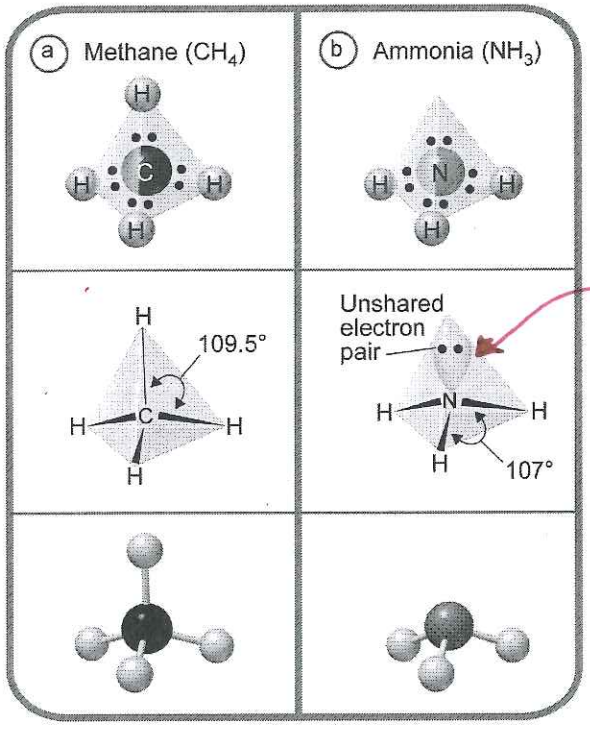
Notes

The VSEPR model

The **V**alence **S**hell **E**lectron Pair **R**epulsion model states that pairs of valence electrons on a central atom repel each other and are arranged so that repulsions are as small as possible.

* Spread apart as much as they can.

- The angle formed by any two terminal atoms and the central atoms is the bond angle
  - For example: the bond angle for H—C—H is 109.5° in the Methane compound CH_4 (shown below)



Bond angle is effected by the amount of covalently bonded electrons and lone pairs in the compound. When there are no lone pairs, bond angles are as far apart as possible to minimize the repulsions of the valence electrons. Unshared lone pairs do not share two nuclei, so they occupy a larger orbital. The lone pairs take up more space pushing the bonded pairs closer together. To determine molecular shape, one must look at both the bonded pairs and the lone pairs.

This will be easy, because you will learn how to gather this information by creating Lewis DOT structures, and the T-BO method

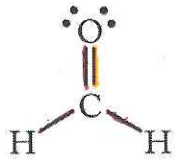
Relates to A X E ...

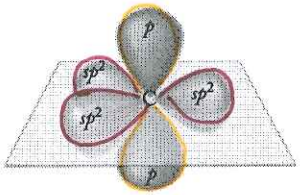
- A → Central atom
- X → # of bonded atoms
- E → lone pairs on the central atom

Explains σ and π bonds (Initial bond is σ, additional bonds are π) Notes

sp^2 Hybridization = Trigonal Planar

σ bonds
π bond

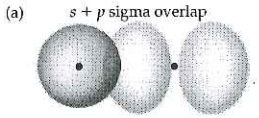




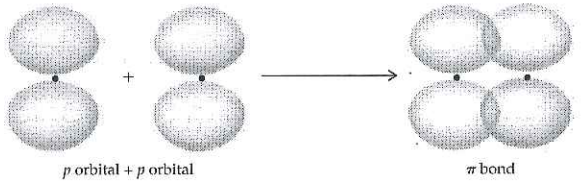
H_2CO

Multiple Bonds

Sigma (σ) bonds = end-to-end overlap



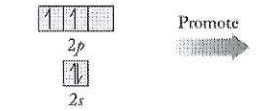
π-Bonds = side by side overlap



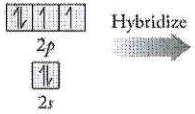
Hybridization Rules

(upgraded – more will be added)

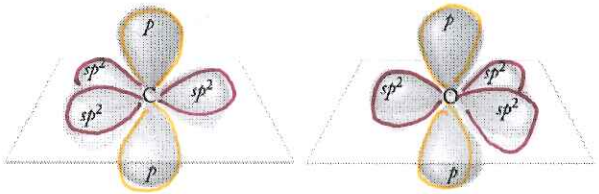
1. Hybrid orbitals get 1 electron for a σ-bond, 2 electrons for a lone pair.
2. Remaining electrons go into unhybridized orbitals = π bonds



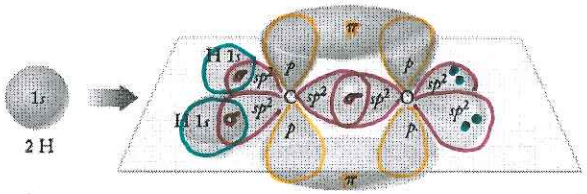
Unhybridized C



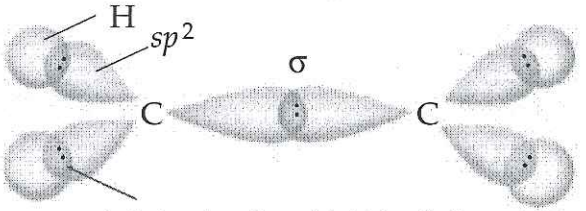
Unhybridized O



sp^2 hybridized C sp^2 hybridized O



σ bond = end-to-end overlap of the sp^2 hybridized orbitals



1 electron from the sp^2 hybrid on C, the other from the hydrogen 1s orbital