

Key

Regents Chemistry Bonding Unit Review

INTRODUCTION TO BONDING

Elements are the simplest form of matter and cannot be decomposed. Compounds can be formed between two or more elements. They can be decomposed chemically.

- a. Which of the following is a compound? Ne H₂O Be F
↳ 2 or more diff. elements
- b. Which of the following cannot be decomposed by chemical means? Li CS₂
— element



Atoms bond in order to obtain a stable electron configuration, like noble gases, called the **octet**. Most atoms will gain or lose electrons in order to have eight valence electrons. However, small elements such as H, Li, and Be will settle for two valence electrons. Obtaining an octet makes the atoms more stable and they can release energy. The electrons obtain the octet by sharing or transferring electrons.

- a. Draw the Lewis dot diagram of the following elements:



- b. Draw the Lewis dot diagram of the following ions:



- c. Explain why the metals lost electrons but the nonmetals gained electrons.

Metals have a low ionization energy + low electroneg.
Nonmetals have high ionization energy + electroneg.

- d. Fill the blanks with release or absorb: "When atoms bond they release energy. In order to break a bond, energy must be absorbed"

IONIC BONDING

Compounds that form between a **metal and a nonmetal** contain **ionic bonds, transferring electrons**. Ionic bonds are strong. Ionic compounds have high melting points, are generally solids at room temperature, and conduct in the liquid phase, as well as when dissolved in aqueous solution.

a. Which of the following has ionic bonds?

NaCl

NH₃

Mg

b. Which of the following transfers electrons?

MgBr₂

Li

CO₂

c. Which of the following has a lower melting point?

Cu

C₆H₁₂

LiF

d. Which of the following can conduct in the aqueous phase? NO

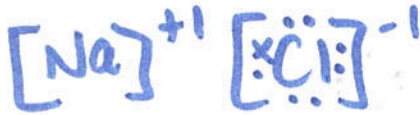
KI

Ne

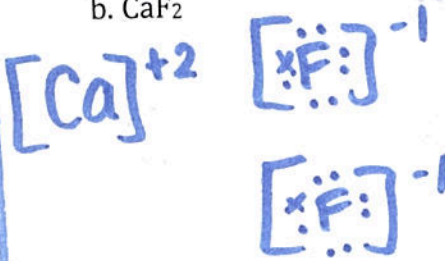
e. Dot diagrams for ionic compounds should have the following two features: brackets and charges. The metal ion is shown with 0 valence electrons surrounding its symbol, and will always have a + charge. The nonmetal ion is shown with 8 valence electrons surrounding its symbol, and will always have a - charge.

f. Draw ionic dot diagrams for each of the following compounds:

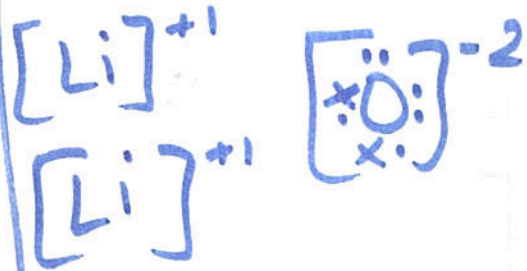
a. NaCl



b. CaF₂



c. Li₂O



COVALENT BONDING

Compounds that form between **two nonmetals** have **covalent bonds, sharing electrons**. Covalent bonds are weaker than ionic bonds. Covalent compounds have low melting points, are generally gases, liquids, or powdery solids at room temperature, and never conduct. These are also known as molecular compounds.

a. Which of the following has covalent bonds?

HF

LiCl

Rb

b. Which of the following shares electrons?

H₂O

Ag

CaCl₂

c. Which of the following can never conduct electricity?

Kr

Rb₂O

H₂O

d. Which of the following has both ionic and covalent bonds? Li

NH₃

CaCO₃

e. Which of the following is a molecular compound?

H₂O

Mg

LiBr

↳ means covalent

METALLIC BONDING

Metallic bonds form when a metal loses their valence electrons and a "sea of mobile electrons" form that allows the metal to conduct electricity in the solid or liquid phase.

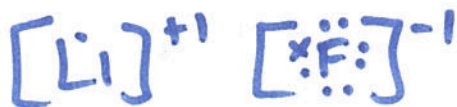
- a. Which of the following is metallic? NaCl NH₃ **Mg**
- b. Which of the following has a sea of mobile electrons? **Cu** C₆H₁₂ LiF
- c. Which of the following can conduct in the solid phase? Ne **Ag** CaCl₂

COVALENT LEWIS STRUCTURES AND MOLECULAR GEOMETRY

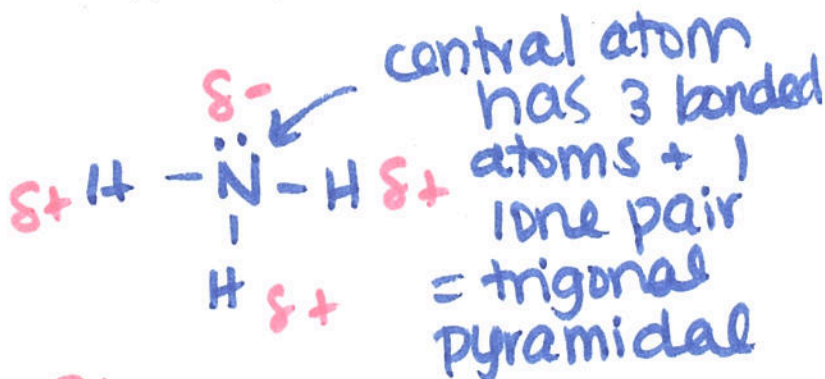
Ionic Lewis diagrams show the ions involved in the bond, but no arrangement. Covalent Lewis diagrams show the sharing of electrons with lines representing two electrons. They form shapes such as **linear, bent, pyramidal, and tetrahedral**.

Draw the following and determine the shape.

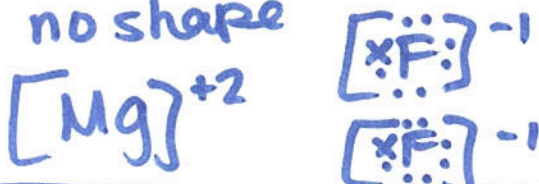
LiF **Be careful! Ionic so no shape.**



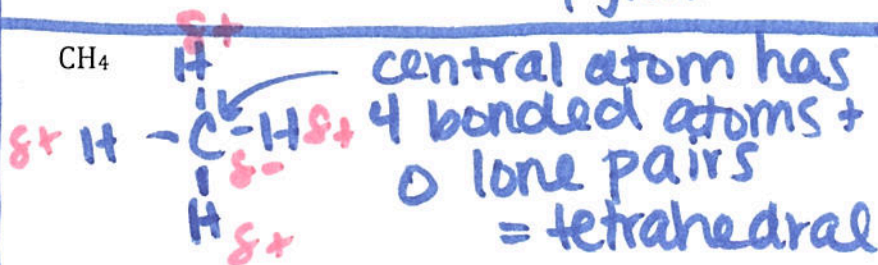
NH₃



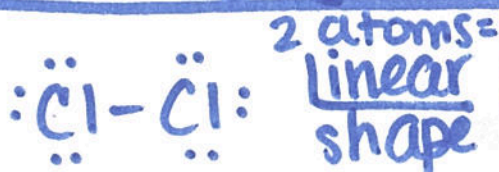
MgF₂ **Be careful! Ionic so no shape**



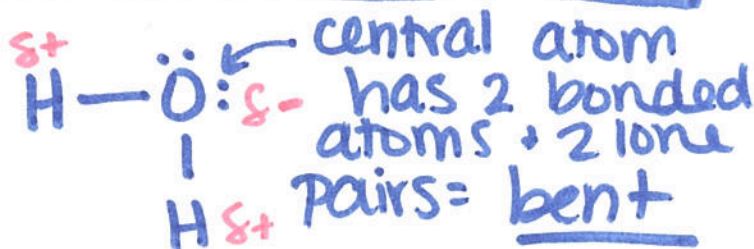
CH₄



Cl₂



H₂O



BOND POLARITY

Bonds are polar when two atoms have different electronegativities and share electrons unevenly. The more electronegative atom has the electrons more of the time. **Nonpolar bonds** form when two atoms have the same electronegativity values and share equally.

Label the bonds as polar or nonpolar:

H₃
polar bonds

CH₄
polar bonds

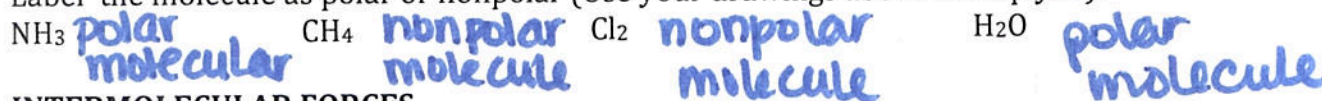
Cl₂
nonpolar bonds

H₂O
polar bonds

MOLECULAR POLARITY

Molecules are polar when the molecule is asymmetrical, and has an uneven distribution of charge. Molecules are nonpolar if the molecule is symmetrical and has an even distribution of charge.

Label the molecule as polar or nonpolar (Use your drawings above to help you):

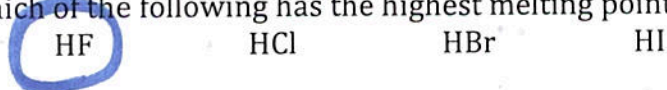


INTERMOLECULAR FORCES

Intermolecular forces are **what keeps molecules together** (not atoms-that's bonds) and are responsible for phases, phase changes, surface tension and various other properties. **Nonpolar molecules have the weakest attractive forces dependent on their size (the bigger the stronger).** **Polar molecules have stronger forces dependent on their polarity.** **Hydrogen bonds are a special case of polar forces between H and either F, O, or N.** **Molecules that are hydrogen bonded have high melting and boiling points, strong surface tension, and have closely packed particles.**

THE STRONGER THE INTERMOLECULAR FORCES BETWEEN ATOMS, THE HIGHER THE MELTING AND BOILING POINTS!

Which of the following has the highest melting point?



HF - why? Has hydrogen bonds which are strongest IMF
HI
↳ least polar

Which of the above has the lowest boiling point?

MOLECULE-ION ATTRACTION:

Molecule-ion attraction is the process by which ionic compounds dissolve in water. Because water is a polar molecule and has partial charges, the partially negative oxygen of a water molecule will be attracted to and surround the positive ion. The partially positive hydrogen will be attraction to and surround the negative ion. This separates the ions from one another, causing the ionic substance to dissolve.

Using the key, draw two water molecules in the box, showing the orientation of each water molecule toward the calcium ion.

Key	
●	= hydrogen atom
○	= oxygen atom
●●○	= water molecule

