

Unit 2

Know the three types of bonds.

- a) What types of elements are involved in ionic bonds? **Ionic bonds happen between a metal and a nonmetal.** What happens to the electrons? **The electrons are transferred from a metal to the nonmetal and locked into place.** What are the properties for ionic bonds? **Ionic bonds have many properties: crystalline, solid structure (salts), high melting point, high boiling point, ability to dissolve in water, conduct electricity when dissolved**
- b) What types of elements are involved in covalent bonds? **Covalent bonds happen between two nonmetals.** What happens to the electrons? **The electrons are shared and locked into place between the elements/atoms bonding.** What are the properties of covalent bonds? **Covalent bonds have many properties: could be solid, liquid, or gas compounds, relatively low melting and boiling points, when dissolved do not conduct electricity.**
- c) What types of elements are involved in metallic bonds? **Metallic bonds are between two metals.** What happens to the electrons? **The electrons are shared between the metals – but are delocalized (creating a sea of electrons).** What are the properties of metallic bonds? **Metallic bonds have many properties: good conductors of heat and electricity, malleable, and ductile.**
- d) Why do elements bond? **Elements bond to become stable. They become stable by obtaining a full outer energy level or eight valence electrons.**
- e) What is the octet rule? What do we use it for?

The octet rule tells us that all atoms want to have a full octet, eight valence electrons, to be stable. We use the octet rule to help us decide what type of bond they may form, and if they will gain, lose, or share electrons.

- f) What type of bond would magnesium and fluorine make?
Magnesium is a metal and Fluorine is a non-metal. They would create an ionic bond – magnesium fluoride, MgF
- g) What type of bond would silicon and sulfur make?
Silicon is a non-metal and sulfur is a non-metal. They would create a covalent bond – silicon disulfide, SiS₂
- h) What type of bond would lithium and sulfur make?
Lithium is a metal and sulfur is a non-metal. They would create an ionic bond – lithium sulfide, Li₂S.
- i) What type of bond would potassium and chlorine make?
Potassium is a metal and chlorine is a non-metal. They would create an ionic bond – potassium chloride, KCl.

Know how to determine valence electrons.

- a) What are valence electrons?
Valence electrons are outer energy electrons and are the electrons that are involved in bonding.
- b) How do we determine valence electrons?
You can determine valence electrons by what group/family they are in or you could add up the last s and p sublevel electrons to determine valence electrons.
- c) Why are valence electrons important?
Valence electrons are important because they help determine the number of bonds and bond type that could be involved in bonding.

- d) How many valence electrons does sulfur have? Does it become a cation or anion? Did it gain or lose electrons?
Sulfur has 6 valence electrons (group 6). Sulfur will become an anion (closer to 8 than to 0). It will gain 2 electrons and become a S^{2-} ion.
- e) How many valence electrons does magnesium have? Does it become a cation or anion? Did it gain or lose electrons?
Magnesium has 2 valence electrons (group 2). Magnesium will become a cation (closer to 0 than to 8). It will lose both electrons and become a Mg^{2+} ion.

Know how to name compounds and write chemical formulas.

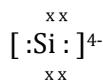
- a) How do you determine if a compound is ionic or molecular?
You determine the type of compound by identifying the atoms involved as either metals or non-metals.
- b) What do you need to keep in mind when writing chemical formulas for ionic compounds?
When writing chemical formulas, you need to remember to crisscross ionic charges to make neutral compounds. There should be no charges on your final answer.
- c) What do you need to keep in mind when naming molecular compounds?
When naming molecular compounds, you must remember to add a prefix for the first element (unless it's one, we don't write mono-) and you must add a prefix to the second element (ALWAYS) and change the ending to -ide.
- d) When a polyatomic ion is involved, what type of bond is occurring?
Polyatomic ions are involved in ionic bonding.
- e) Write the chemical formulas for the following compounds. *You should identify if they are ionic or molecular first*
- | | |
|----------------------------------|------------------------------------|
| copper (I) bromide (ionic) | magnesium oxide (ionic) |
| CuBr | MgO |
| ammonium sulfate (ionic) | diphosphorous trioxide (molecular) |
| $(NH_4)_2SO_4$ | P_2O_3 |
| sulfur trichloride | manganese (III) cyanide |
| SCl_3 | $Mn(CN)_3$ |
- f) Write the names for the following compounds. *You should identify if they are ionic or molecular first*
- | | |
|--------------------------|-------------------------------|
| AlF_3 | $Fe(ClO_4)_3$ |
| Aluminum Fluoride | Iron (III) Perchlorate |
| NO_3 | $Li(OH)$ |
| Nitrogen Trioxide | Lithium Hydroxide |
| $Sr(NO_2)_2$ | Cl_5 |
| Strontium Nitrate | Carbon Pentiodide |

Know how to draw Lewis dot structures for atoms, ions, ionic and covalent structures.

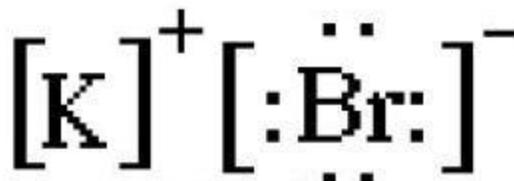
- a) What do you need to know in order to draw Lewis dot structures?
You need to know the chemical symbol and number of valence electrons.
- b) Draw the Lewis dot structure for calcium, xenon, and silicon.



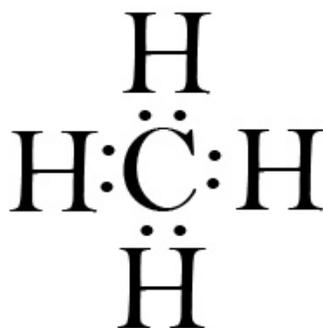
c) Draw the Lewis dot structure for a calcium ion and silicon ion.



d) Draw the Lewis dot structure for potassium bromide.



e) Draw the Lewis dot structure for carbon tetrahydride.



Know how to determine if a covalent bond or polar molecule.

a) What is happening when a bond is polar?

When a bond is polar, it means that the atoms sharing electrons are sharing unequally due to the differences in electronegativity.

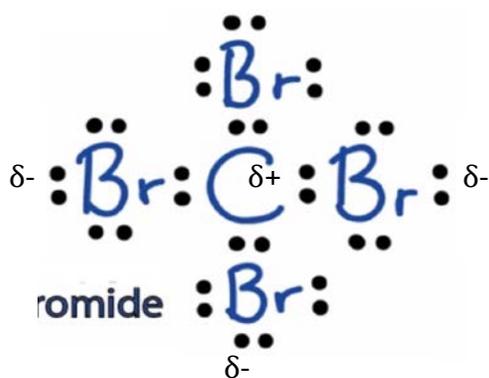
b) How do you determine if a bond is polar?

You determine if a bond is polar by identifying electronegativity and the differences between the two atoms electronegativity. If there is a difference in electronegativity is greater than .5 but less than 2 we would typically say the bond is polar covalent.

c) How do you determine if a molecule is polar?

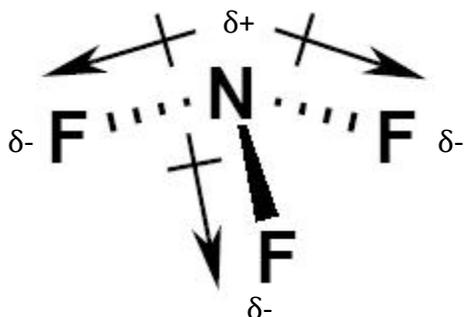
If you draw the structure properly, using VSEPR, you will be able to look at the shape of the structure and identify if the charge is symmetrically distributed. If it is symmetrically distributed we say it is non-polar, if there is a difference in distribution we say it is polar.

d) Draw (in a Lewis dot) CBr_4 . Include partial charges and determine if the molecule is polar or nonpolar.



Carbon tetrabromide is a nonpolar covalent compound – the charges are all the same around the outside which means the charges are symmetrically distributed.

e) Draw (in a Lewis dot) NF_3 . Include partial charges and determine if the molecule is polar or nonpolar.



Nitrogen trifluoride is a polar covalent compound – the charges are not evenly distributed, symmetrically around the outside.

Know the difference between the three intermolecular forces.

- What is an intermolecular force? **An attraction between molecules caused by opposite charges.**
- When would a molecular experience dipole-dipole forces? London dispersion? Hydrogen bonding? **Dipole-Dipole occurs when polar covalent molecules are attracted to each other and do not have hydrogen bonds (hydrogen bonded to O, N, F). London Dispersion occurs when nonpolar covalent molecules are attracted to each other. Hydrogen bonding occurs when polar covalent molecules that have Hydrogen bonded directly to N, O, F involved. This causes a very strong polar region in the molecule.**
- Which is the strongest IMF? **Hydrogen Bonding**
- Which is the weakest IMF? **London Dispersion**
- For a hydrogen bond to form, what three elements must be involved? **Hydrogen bonded directly to N, O, and/or F.**