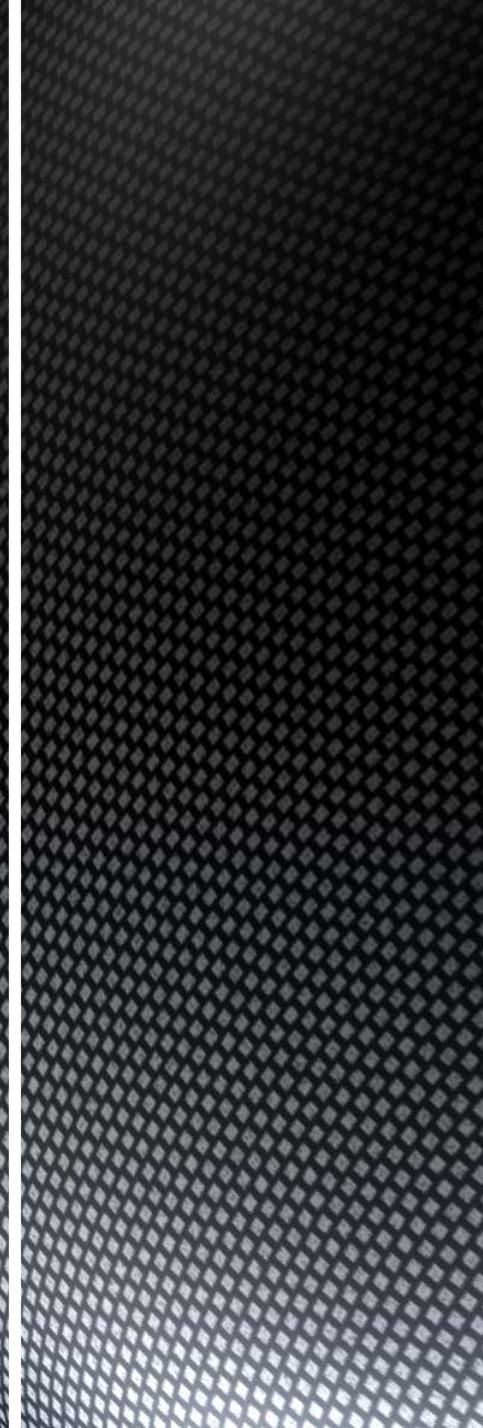


Intro to Bonding



- A chemical bond is a mutual electrical attraction between the nuclei and valence electrons of different atoms that binds the atoms together.
- There are three types of bonding
 - Metal + Nonmetal = **ionic bonding**
 - Nonmetal + Nonmetal = **covalent bonding**
 - Metal + Metal = **metallic bonding**

Bonding

- They are trying to get their number of valence electrons to either 0 or 8.
 - Group 1: 1 valence electron
 - Group 2: 2 valence electrons
 - Group 13: 3 valence electrons
 - Group 14: 4 valence electrons
 - Group 15: 5 valence electrons
 - Group 16: 6 valence electrons
 - Group 17: 7 valence electrons
 - Group 18: 8 valence electrons (except for helium, which has 2)
- **Octet Rule:** Chemical compounds tend to form so that each atom, by gaining, losing, or sharing electrons, has an octet of electrons in its highest energy level.
- **Often times we represent atoms and their electrons with Lewis Dot Structures.**

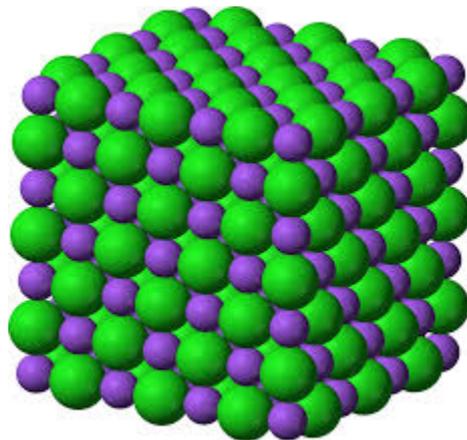
Why do atoms
bond?

- Ionic bonding is between a metal and a nonmetal.
- The metal gives up its electrons to the nonmetal, forming a positive metal cation and a negative nonmetal anion.
- The cations and anions are attracted to each other.
- The numbers of positive and negative charges are equal.

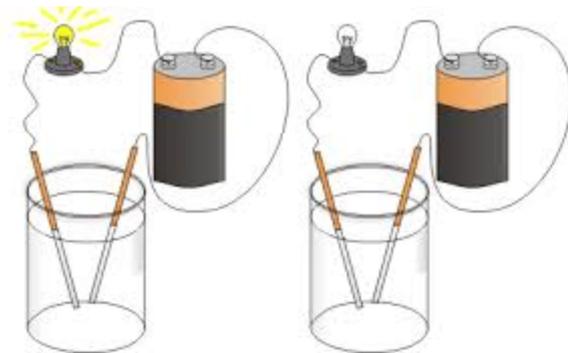
Ionic Bonding

Atoms that want to gain electrons
and atoms that want to lose
electrons can work together and
form an ionic bond.

- Crystalline solids (salts)
- Ions sit “shoulder to shoulder”
- High melting points
- High boiling points
- Break easily (brittle)
- Many dissolve easily in water
- Many conduct electricity in solutions
- Ionic compounds have the greatest ionic character with full on charged ions. The further the ions are apart electronegativity, the more the ionic character.



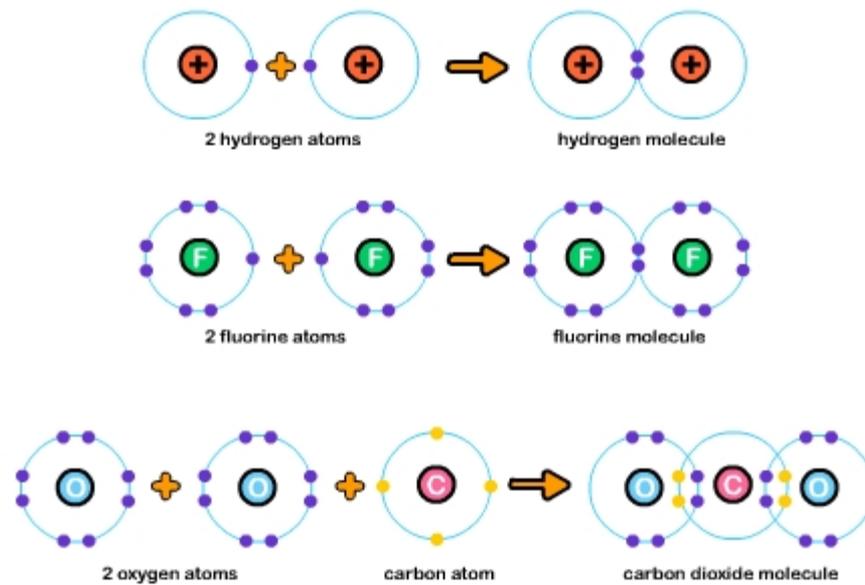
Ionic Compound Properties



- Ionic Bond/Compound is composed of a metal and nonmetal (cation & anion)
 - Positive charge must equal and cancel the negative charge.
- Complete transfer of electrons = neutral compound charge
- They are electrically neutral salts
- Formula Unit – a chemical formula of the smallest sample of an ionic compound.
 - NaCl
- Have specific chemical properties

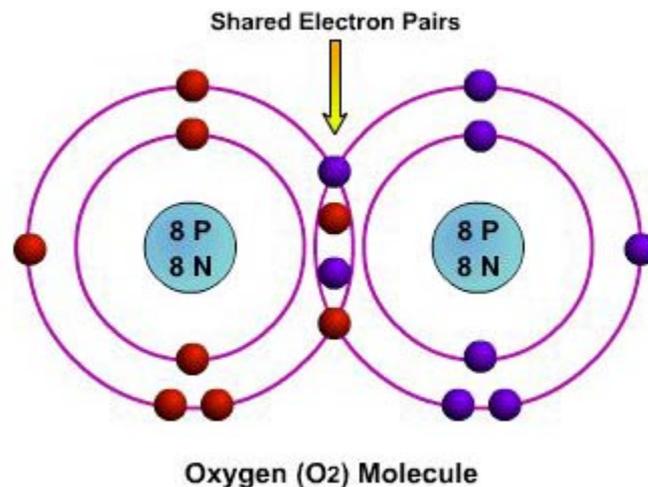
Summary of Ionic Compounds

Molecular Compounds & Covalent Bonds



- Electrons are shared between nonmetal atoms.
- The goal is to attain eight valence electrons to reach stability (act like a noble gas)
 - Do not forget that hydrogen is a nonmetal
- Most atoms achieve complete octets.
- Molecular compounds contain only nonmetals.
- Numbers (subscripts) tell us that actual number of each atom – do not reduce them!

Molecular Compounds – Covalent Bonds



- Do not conduct electricity
- Solids, liquids, and gases
- Low melting points
- Low boiling points

Properties of Molecular Compounds

- Certain nonmetals bond with atoms of the same element to form diatomic molecules.

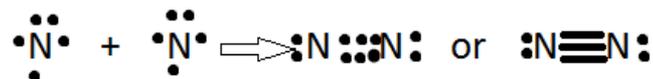
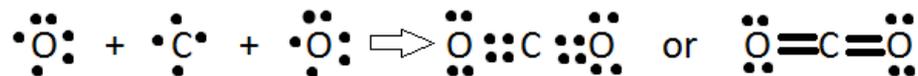
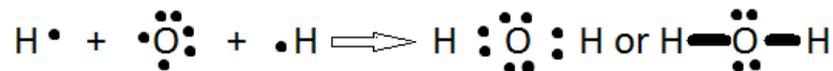
- Nitrogen - N₂
- Oxygen - O₂
- Fluorine - F₂
- Chlorine - Cl₂
- Bromine - Br₂
- Iodine - I₂
- Hydrogen - H₂
- All end in -ine or -gen!

Diatomic Molecules



- Single Bonds – formed when one pair of electrons is shared between two atoms.
 - H₂O
- Double Bonds – involves two shared pairs of electrons.
 - CO₂
- Triple Bonds – involves three pairs of shared electrons.
 - N₂

Multiple Covalent Bonds



All these diagrams show the formation of covalent bonds as electrons from elements are shared to form single, double, and triple bonds

- Where are the valence electrons in an ionic compound?
 - Valence electrons are localized to the anion (brings in all of the electrons to have 8)
 - “Locked” in by the crystal structure
- Where are the valence electrons in metals?
 - The valance electrons are mobile
 - Electrons are delocalized
 - Creating a “sea of electrons”
 - This is why metals can produce a “shock” when you are “charged”

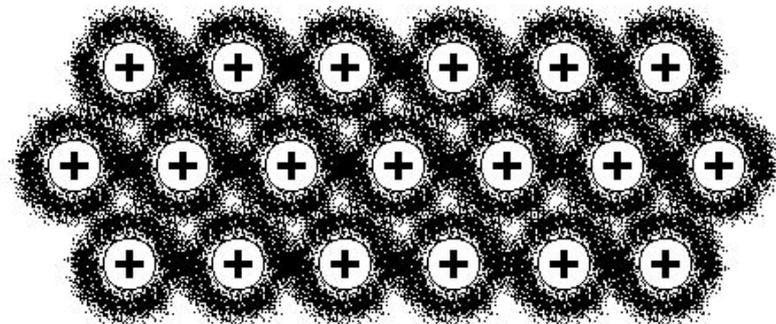
Metallic Bonds

Groups of closely packed cations.

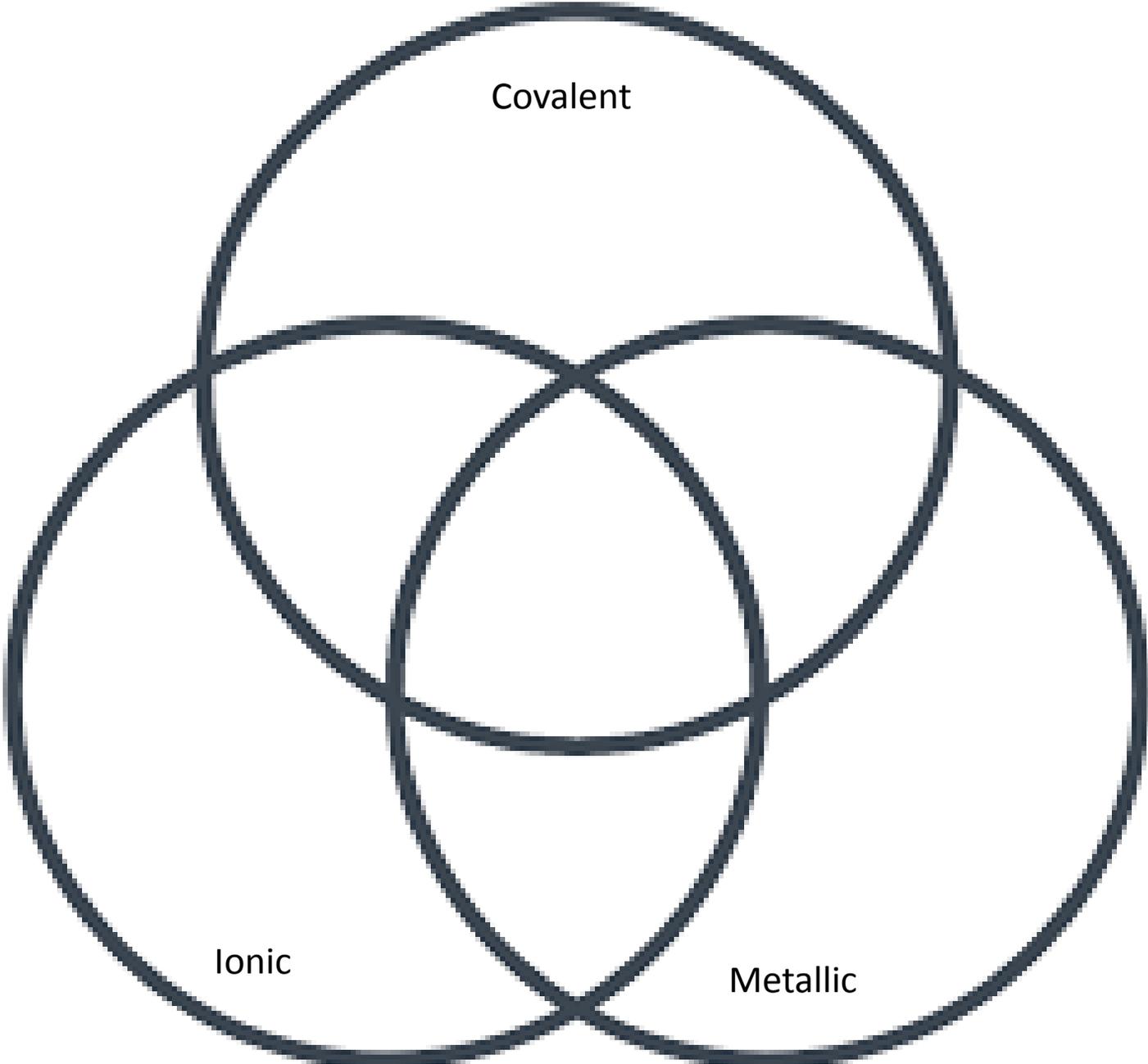
- Conduct electricity
- Conduct heat
- Lustrous: shiny
- Malleable – ability to be hammered into a sheet
- Ductile – ability to be drawn or pulled into a thin wire

Metallic Properties

Metallic Sea of Electrons



Electrons are not bonded to any particular atom and are free to move about in the solid.



Covalent

Ionic

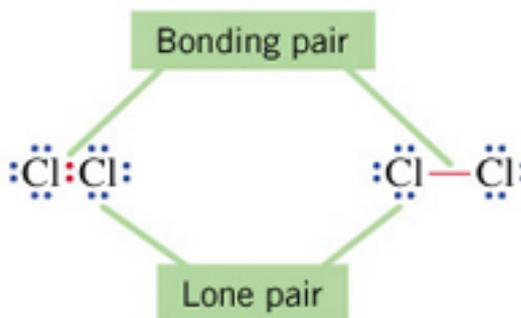
Metallic

- A visual representation of the valence electrons of the atom.
- The inner electrons and the nuclei are represented by the elements symbol.
- The dots representing the electrons are arranged symmetrically around the symbol.
- Chemical bonds are formed between atoms using the unpaired valence electrons.

Lewis Dot

- Bonds are made of 2 electrons that are shared between two atoms.
- Each atom gets to “count” both electrons towards its complete valence shell.
- Unshared pairs (pairs of electrons that are not shared between atoms) are called lone pairs.
 - Example: Cl₂

Lewis Structures



Let's Review...and
learn a little more!

<https://youtu.be/S08qdOTd0w0>