Chemistry IV

1. Ionic Compounds
2. Covalent Compounds

Ionic Compounds

Ionic compound: a compound made up of oppositely charged ions (positive ion + negative ion).

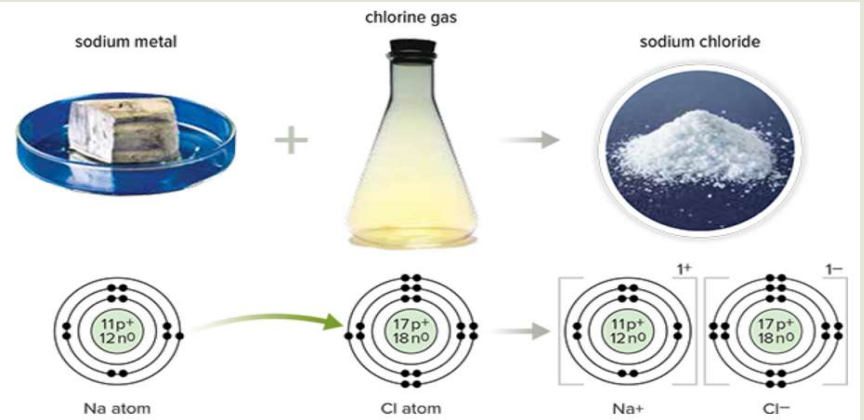
- They are made up of two types of elements: a metal and a non-metal.
  - Ionic compounds that contain just two elements are called binary ionic compounds.
- Ions are held together by forming ionic bonds. These bonds are very strong.

How do ionic compounds form?

- Atoms of the metal element will lose one or more electrons and give the electrons to the non-metal atoms.
- The amount of electrons that elements can gain or lose depends on the element's ion charge.
- Elements will want to gain/lose their electrons in order to achieve full valence shells. The stability of a full valence shell is what drives the formation of compounds.

Example: Sodium Chloride

- Sodium atoms (the metal) will transfer one electron to the chlorine atoms (the non-metal).
  - Sodium will become <u>positively</u> charged (because it is losing one electron): Na^+
  - Chlorine will become <u>negatively</u> charged (because it is gaining one electron): Cl^-



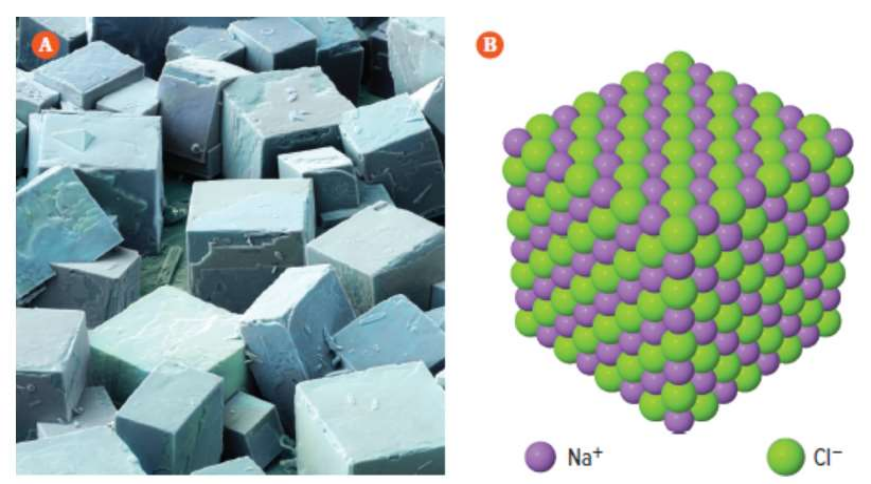
Ionic Compound Examples

- Example: Magnesium fluoride (MgF_2)
- Example: Lithium oxide (Li_2O)

Structure of Ionic Compounds

Ionic compounds are arranged in lattices.

- A lattice occurs when the positive and negative ions are arranged in regular repeating patterns.



Properties of Ionic Compounds

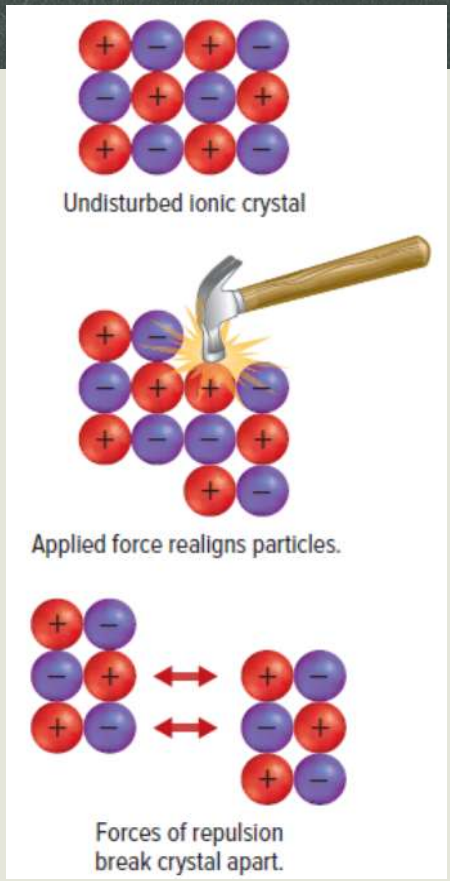
Common properties of ionic compounds:

- High melting points
  - In order to melt an ionic compound, the strong ionic bond between the ions have to be broken.
  - As the bonds between the ions are very strong, it takes a lot of energy to break them. This results in ionic compounds needing very high temperatures in order to be melted.

Properties of Ionic Compounds

Common properties of ionic compounds:

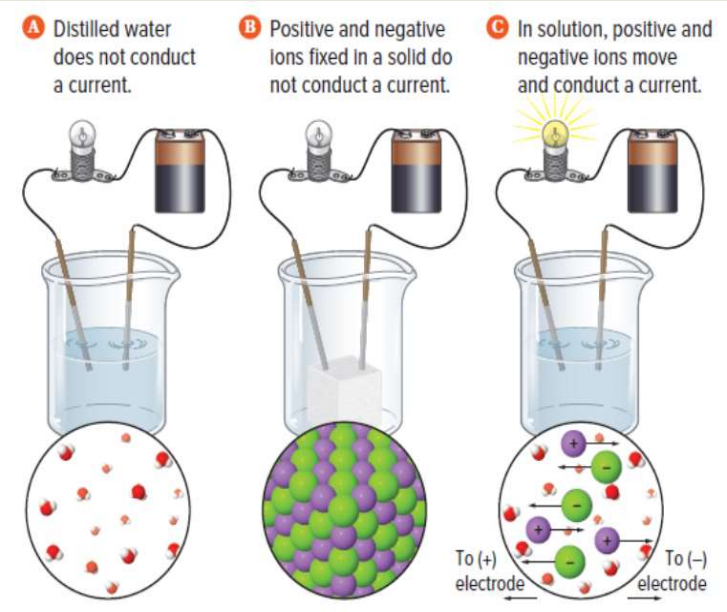
- Hard and brittle
  - Due to the strength of the ionic bonds, ionic solids are very hard.
  - If enough force is applied, the ions will shift out of alignment from their lattice structure. This causes ions of the same charge to be close together and will result in the ions repelling each other.



Properties of Ionic Compounds

Common properties of ionic compounds:

- Good conductors of electricity when melted or dissolved
  - Ionic compounds are NOT good conductors when they are in the solid state.
  - If ionic compounds are dissolved in water, they are good conductors. In this form, the ions in the compound are free to move around and conduct electricity.



Practice

- Draw the “Before Bonding” (atoms) and the
- “After Bonding” (IONS)
- Of LiCl, MgO, and $MgCl_2$

Covalent Compounds

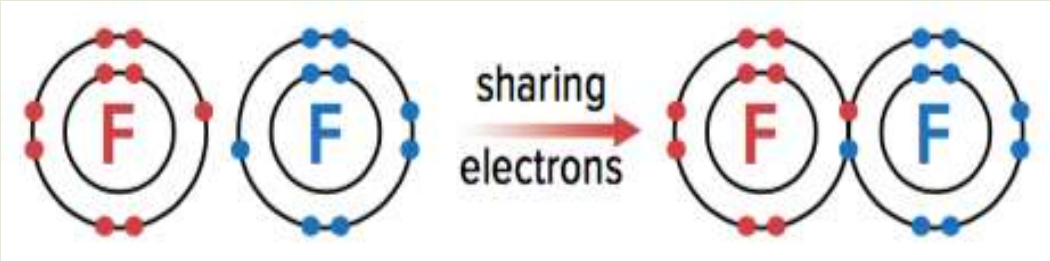
Covalent Compounds

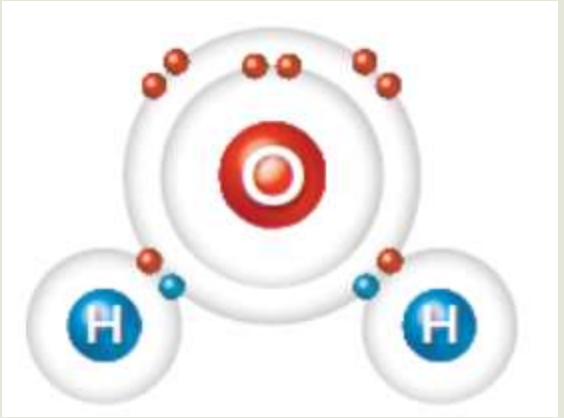
Covalent compounds: a compound that forms when two or more elements share electrons.

- They are made up of non-metals.
- These elements are held together by forming covalent bonds. These bonds are very strong.
- Covalent compounds are also known as molecules. A molecule is a particle made up of 2 or more neutral atoms bonded together by covalent bonds.

How do covalent compounds form?

- Non-metals in covalent compounds achieve a full valence shell by sharing electrons. The stability of a full valence shell is what drives the formation of compounds.
- A covalent bond is a result of a single pair of shared electrons.



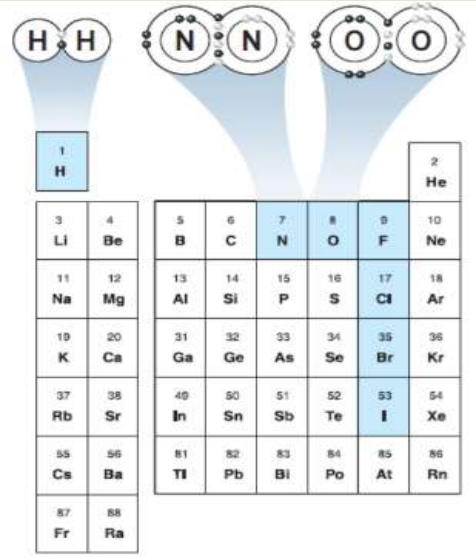


Covalent Compound Examples

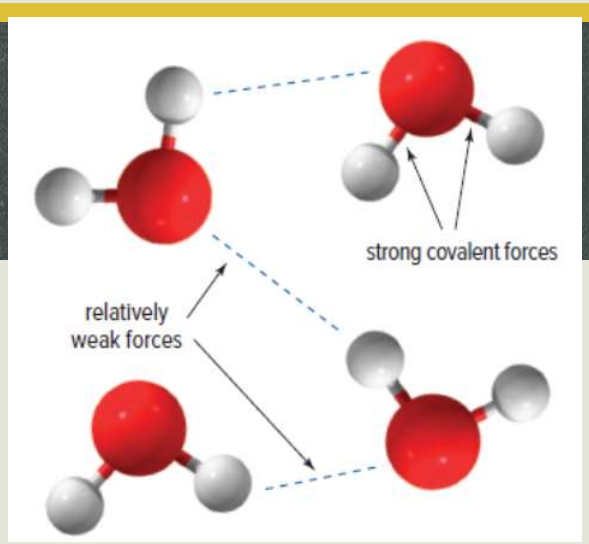
- Example: Hydrogen gas (H_2)
- Example: Methane (CH_4)

Covalent Compound

- Covalent bonds can also occur between individual elements. These elements are called diatomic molecules.
- Elements that form diatomic molecules: $\underline{H_2}$, $\underline{N_2}$, $\underline{O_2}$, $\underline{F_2}$, $\underline{Cl_2}$, $\underline{Br_2}$, $\underline{I_2}$



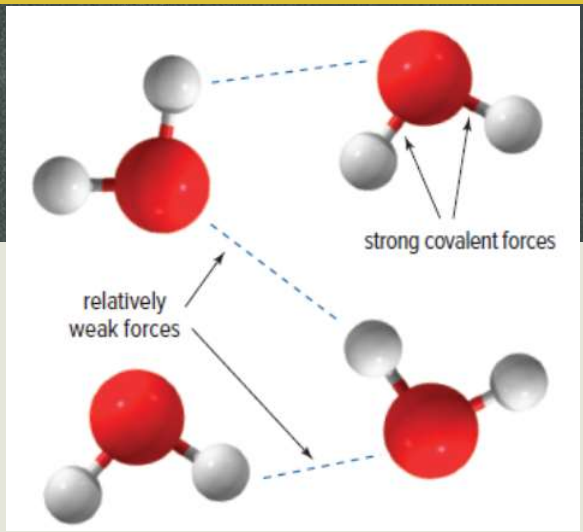
Properties of Covalent Compound



Common properties of covalent compounds:

- Have <u>low melting points</u>
  - The forces that hold atoms together in molecules are very strong (strong covalent bonds). However, the <u>bonds</u> that <u>attract</u> one <u>molecule</u> to another are relatively <u>weak</u>.
  - When melting covalent compounds, you only need to provide enough energy to break the bonds between molecules. As the bonds between molecules are weak, most covalent compounds boil and/or melt at low temperatures.

Properties of Covalent Compound



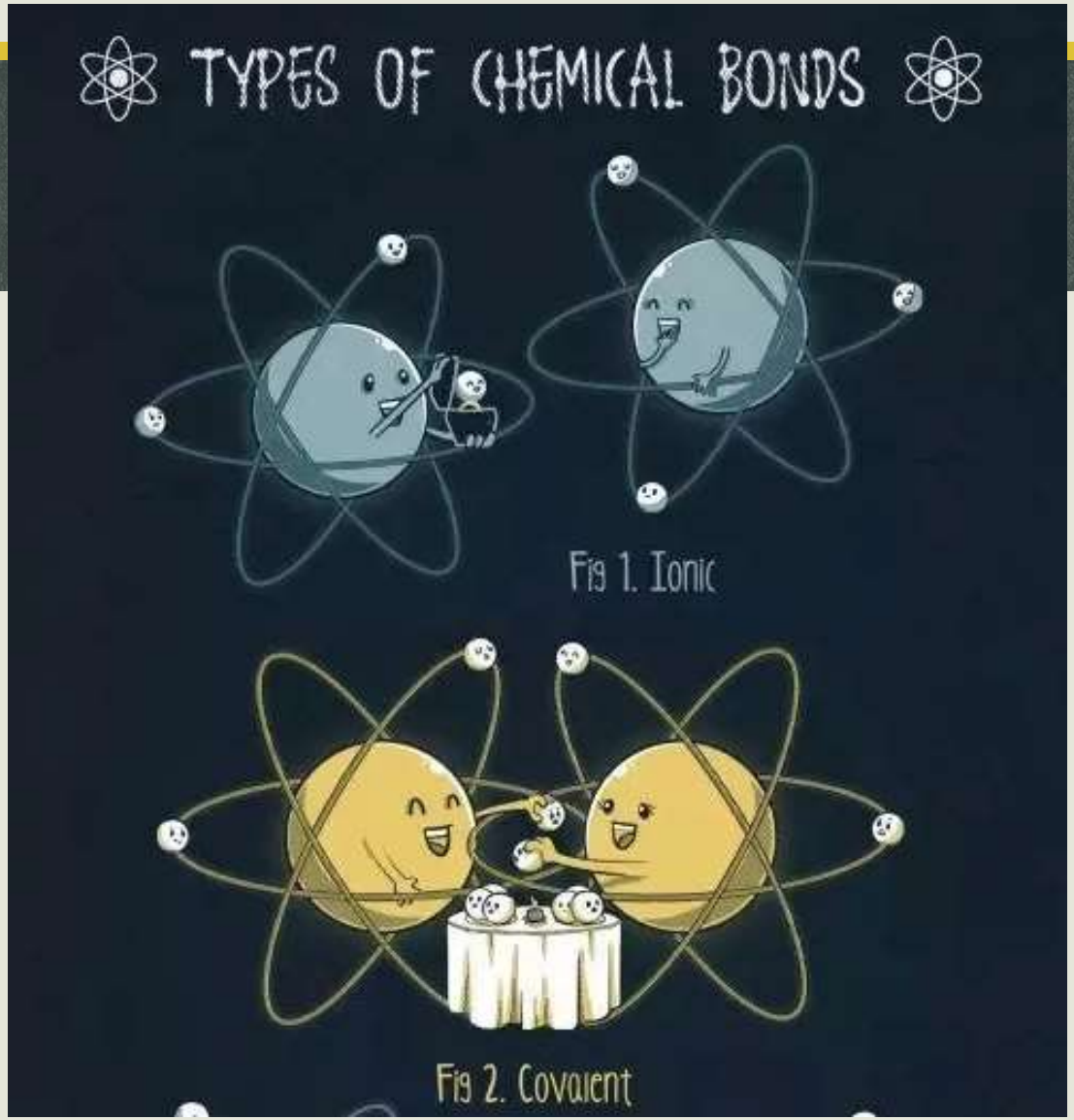
Common properties of covalent compounds:

- Are relatively <u>soft</u>
  - The forces between molecules are weak. Due to this, it is easier for molecules to shift and move relative to one another.

Properties of Covalent Compound

Common properties of covalent compounds:

- Are poor conductors
  - Covalent compounds do not have free electrons or ions (they DO NOT form ions). Due to this, they are not good conductors of heat and electricity.


TYPES OF CHEMICAL BONDS
Fig 1. Ionic
Fig 2. Covalent

Practice

- Draw the “Before Bonding” (atoms) and the
- “After Bonding” (IONS)
- Of H_2O and OF_2