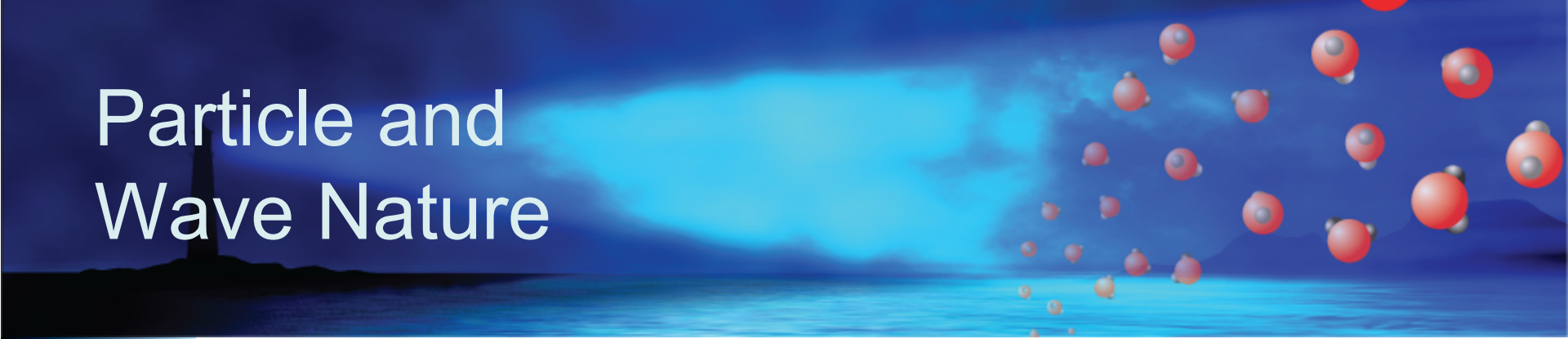
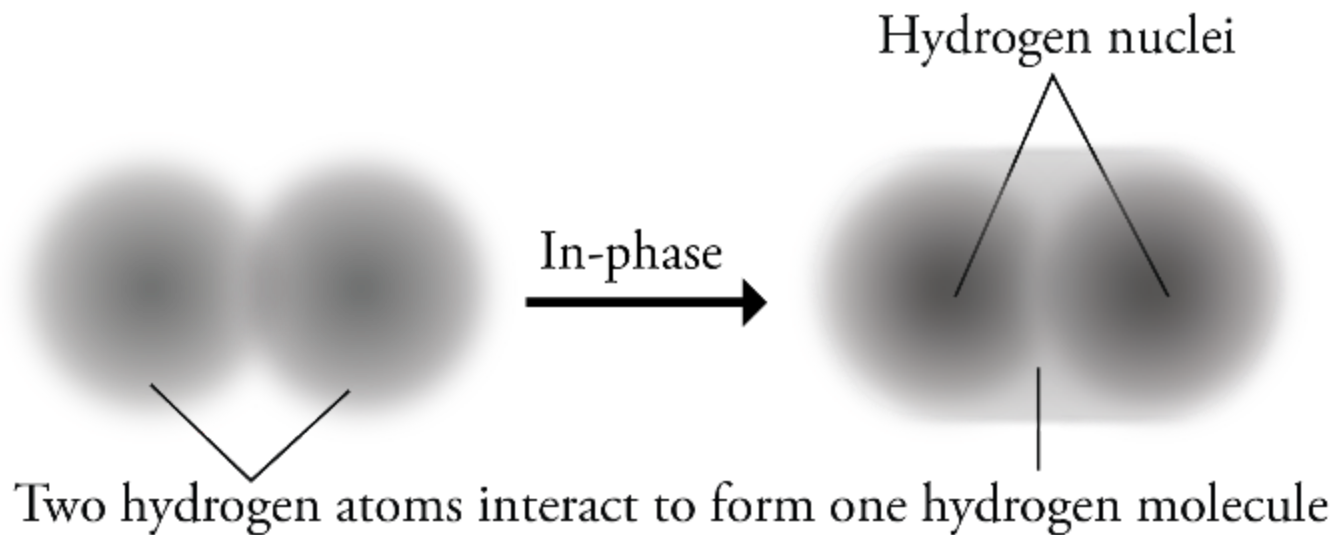
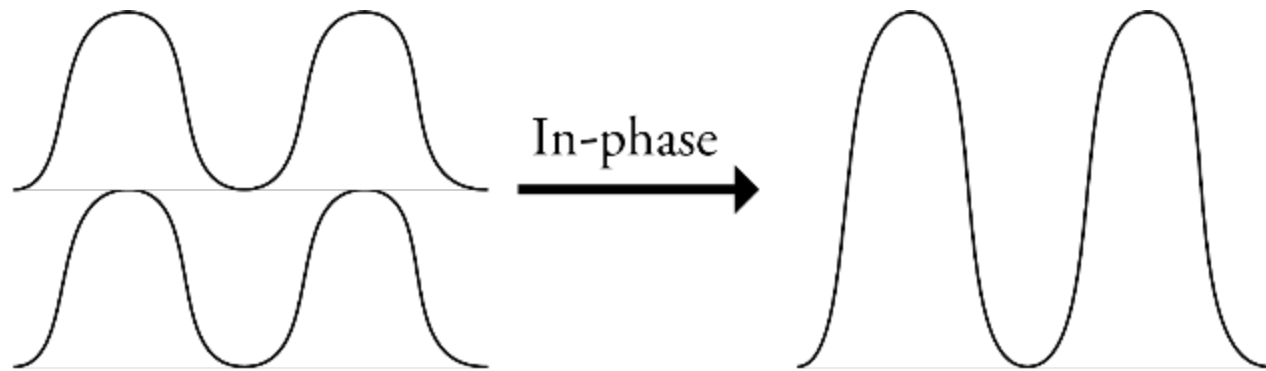


Particle and Wave Nature



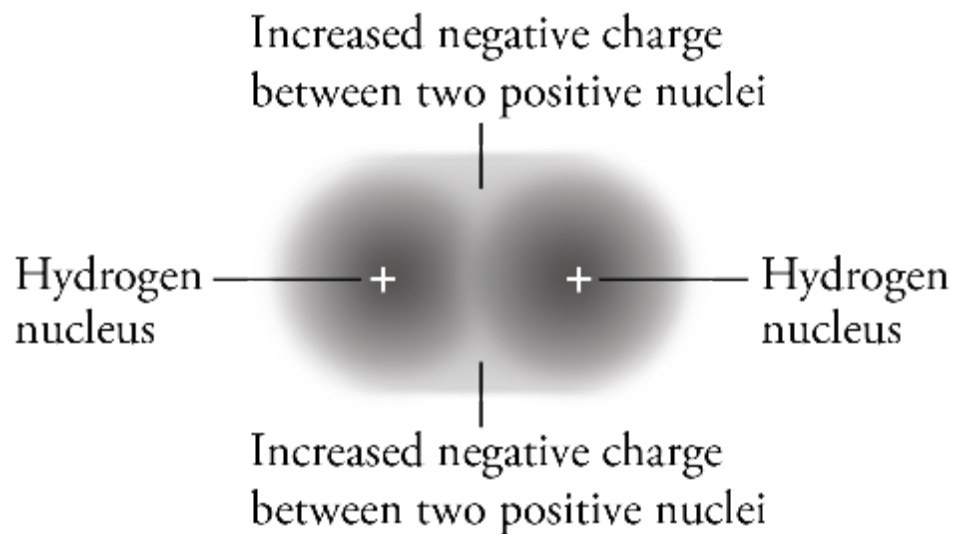
- All matter has both particle and wave character.
- The less massive the particle, the more important its wave character.
- The electron has a very low mass, low enough to have significant wave character.

Covalent Bond Formation



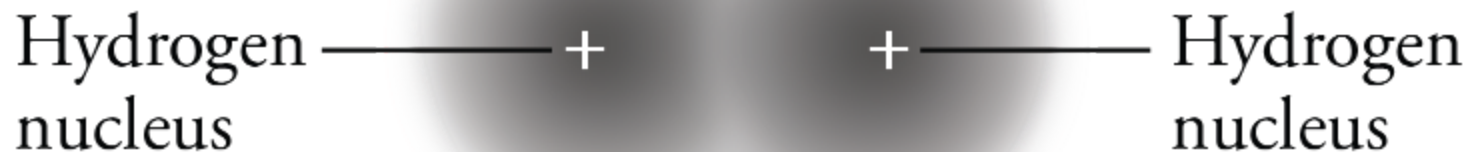
Covalent Bond Formation

- Increased negative charge between the two positive nuclei leads to increased +/- attraction and holds the atoms together.
- **Covalent bond** = a link between atoms due to the sharing of two electrons



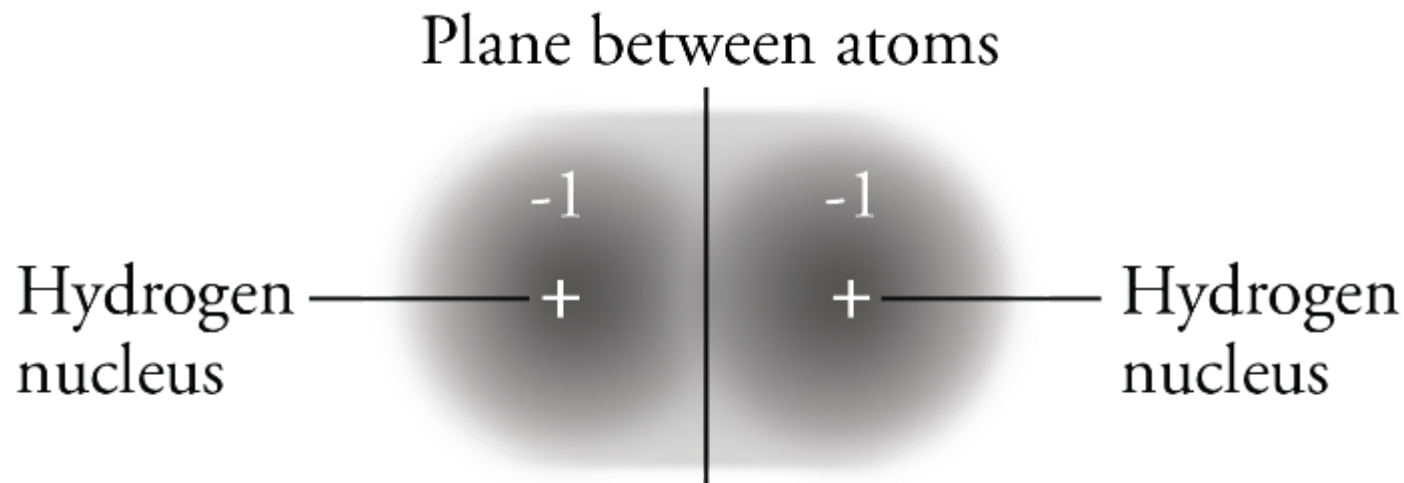
Molecule

- **Molecule** = an uncharged collection of atoms held together by covalent bonds.
- Two hydrogen atoms combine to form a hydrogen molecule, which is described with the formula H_2 .



Nonpolar Covalent Bond

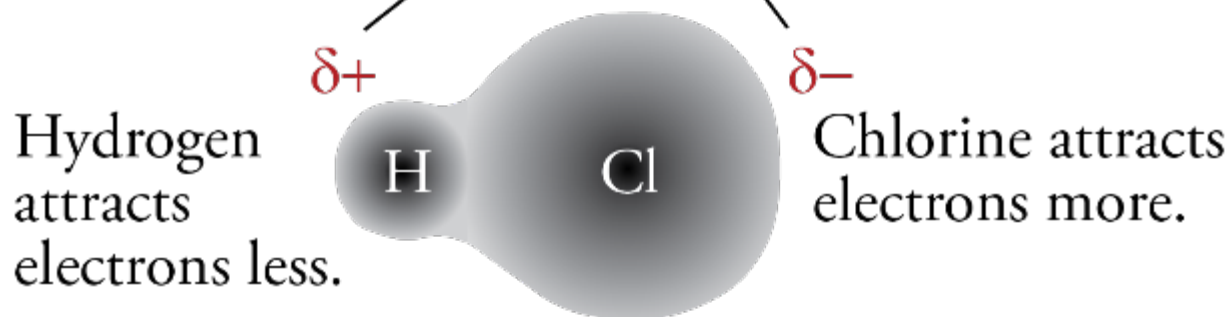
- If the electrons are shared equally, there is an even distribution of the negative charge for the electrons in the bond, so there are no partial charges on the atoms. The bond is called a ***nonpolar covalent bond***.



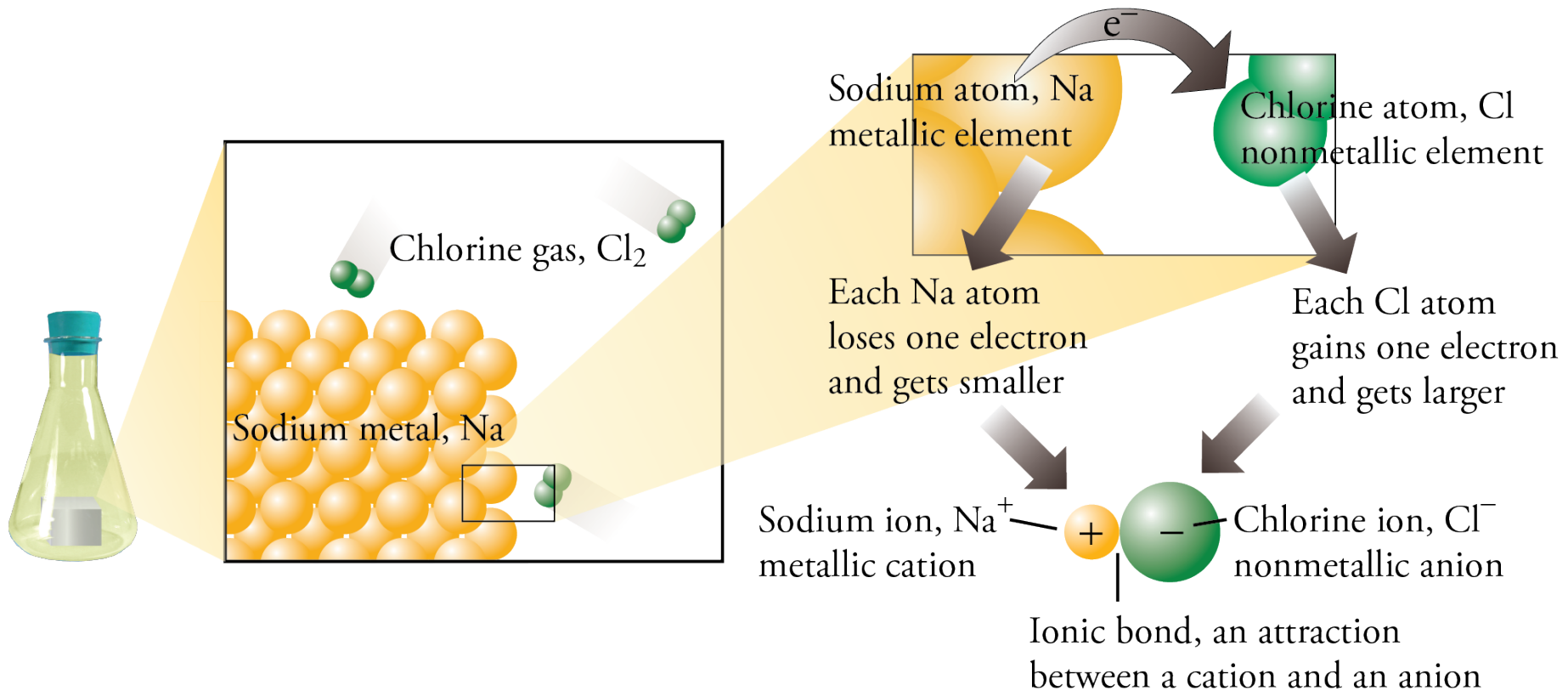
Polar Covalent Bond

- If one atom in the bond attracts electrons more than the other atom, the electron negative charge shifts to that atom giving it a partial negative charge. The other atom loses negative charge giving it a partial positive charge. The bond is called a **polar covalent bond**.

Electrons shift toward the chlorine atom, forming partial plus and minus charges.



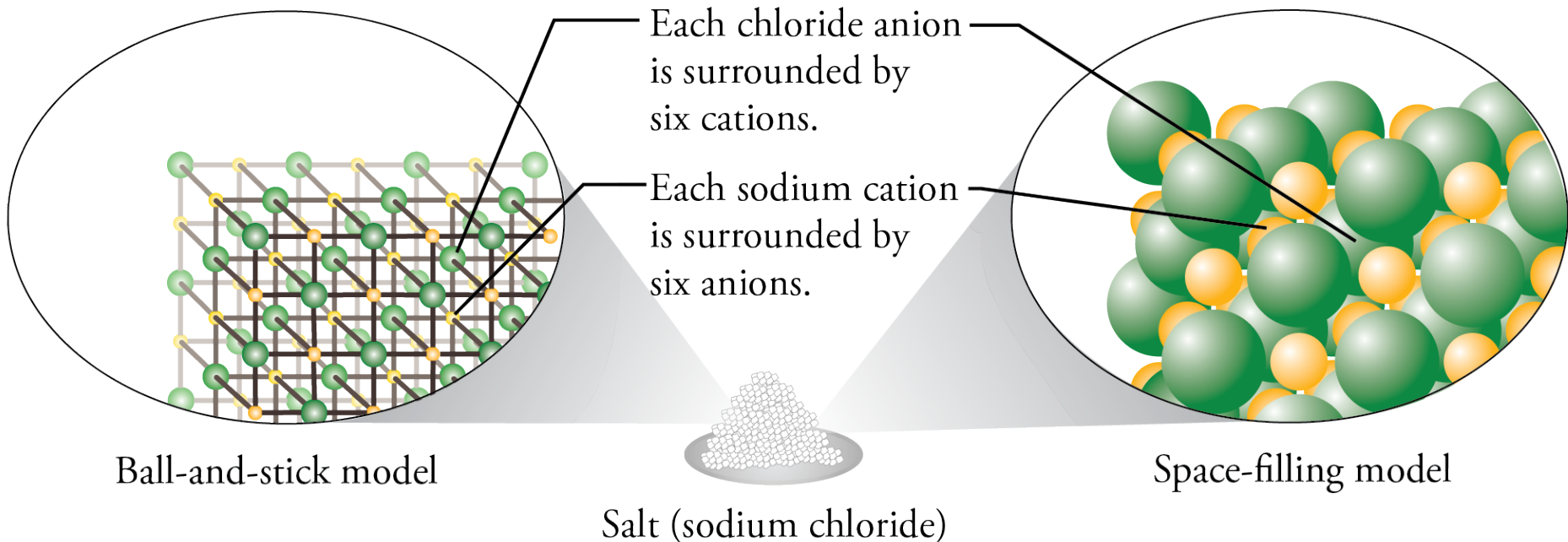
Ionic Bond Formation



Ionic Bond

- The attraction between cation and anion.
- Atoms of nonmetallic elements often attract electrons so much more strongly than atoms of metallic elements that one or more electrons are transferred from the metallic atom (forming a positively charged particle or ***cation***), to the nonmetallic atom (forming a negatively charged particle or ***anion***).

Sodium Chloride, NaCl, Structure

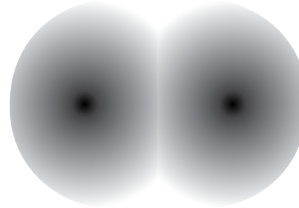


Bond Types

Nonpolar Covalent Bond

Equal sharing of electrons

Both atoms attract electrons equally (or nearly so).

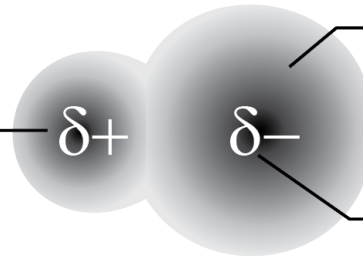


No significant charges form.

Polar Covalent Bond

Unequal sharing of electrons

Partial positive charge



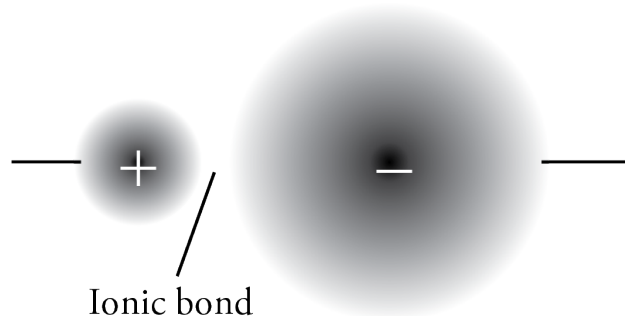
This atom attracts electrons more strongly.

Partial negative charge.

Ionic Bond

Strong attraction between positive and negative charges.

This atom loses one or more electrons and gains a positive charge.



This atom attracts electrons so much more strongly than the other atom that it gains one or more electrons and gains a negative charge.

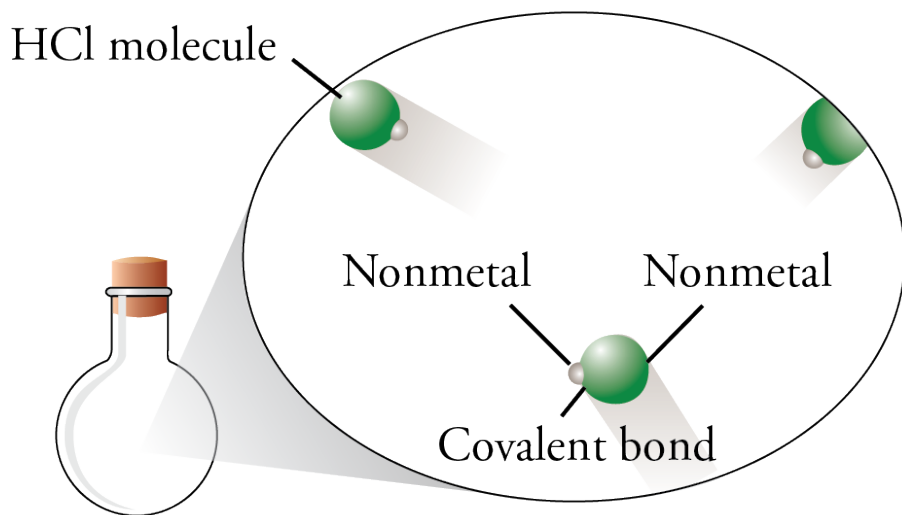
Types of Compounds



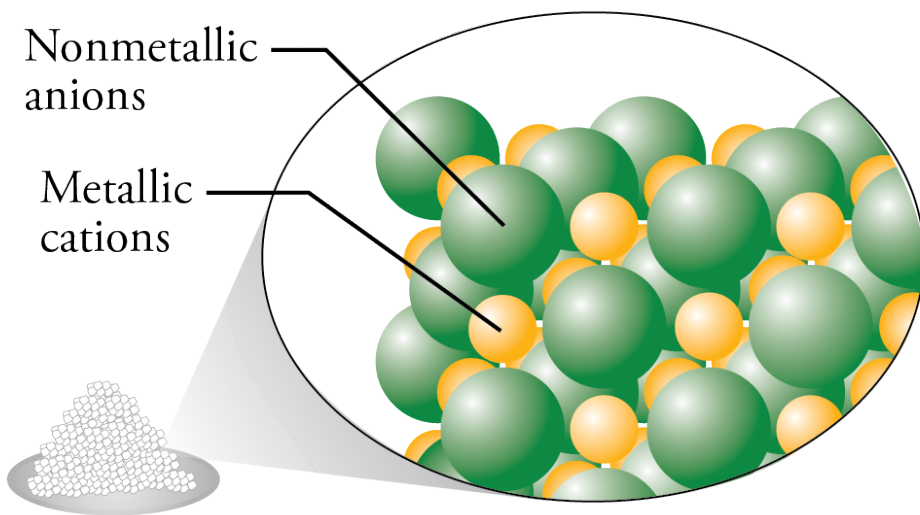
- All nonmetallic atoms usually leads to all covalent bonds, which form molecules. These compounds are called ***molecular compounds***.
- Metal-nonmetal combinations usually lead to ionic bonds and ***ionic compounds***.

Classification of Compounds

Molecular compound
Hydrogen chloride, HCl, gas



Ionic compound
Sodium chloride, NaCl, solid



Summary



- **Nonmetal-nonmetal** combinations (e.g. HCl)
 - Covalent bonds
 - Molecules
 - Molecular Compound
- **Metal-nonmetal** combinations (e.g. NaCl)
 - Probably ionic bonds
 - Alternating cations and anions in crystal structure
 - Ionic compound