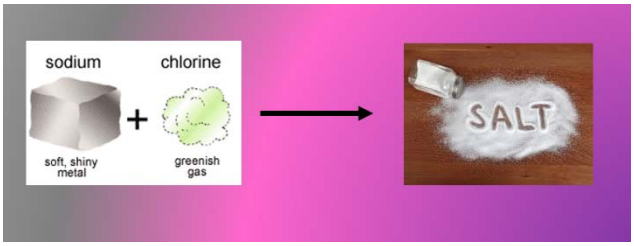
Hemingway Name:

How do Elements Combine to Form Compounds?

ACTIVITY

- What is it made of?



- Compounds account for the huge variety of matter on Earth

All the compounds that exist on Earth are built from elements

- 118 elements are on the periodic table; only 80 commonly form compounds
- 10 million known compounds; billions of possible

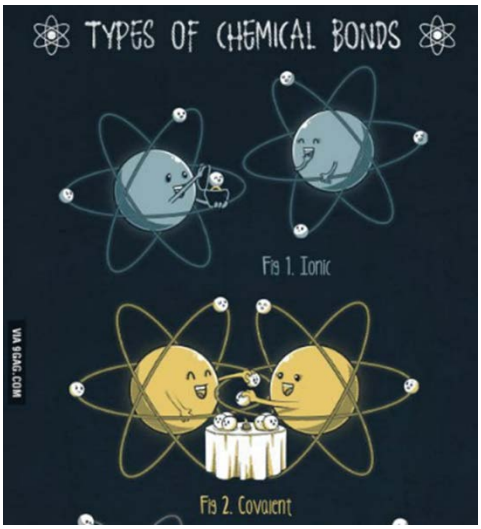
Discussion

1. **Distinguish between elements and compounds.**

2. **Compare the number of elements with the number of compounds on Earth.**

Lab

- **Comparing Atoms and Ions**
  - **In partners of 2, I have chosen for you so check the list**
  -



Types of Compounds

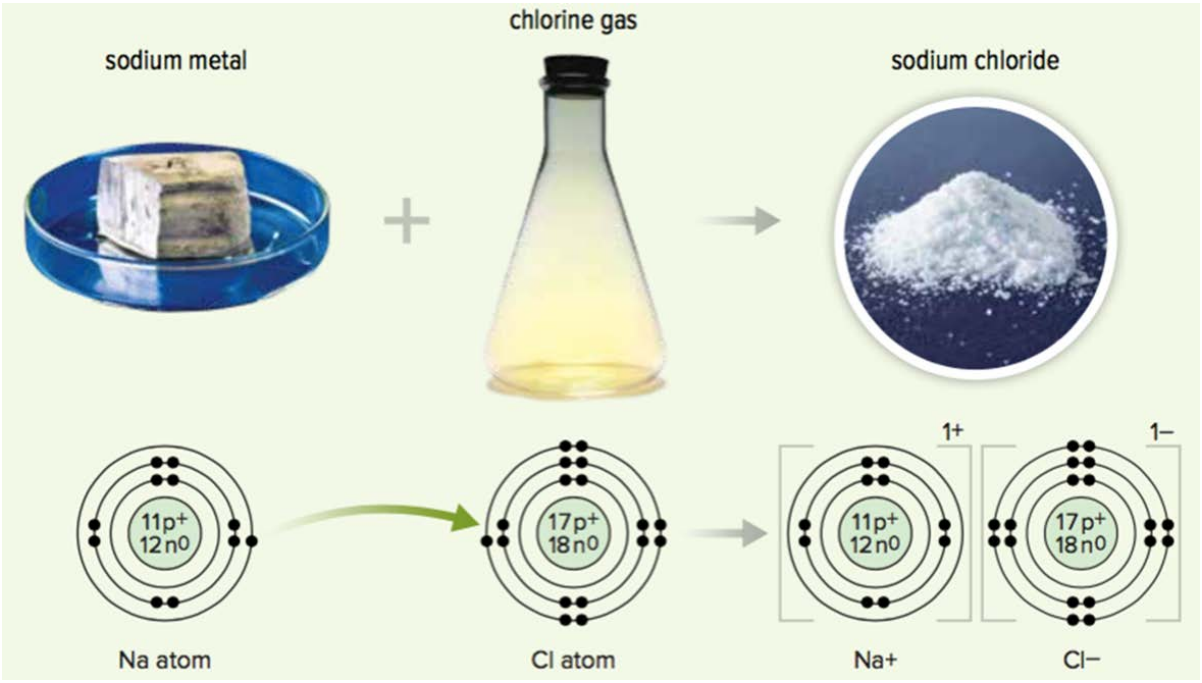
- _____Compounds
- _____ compounds

Ionic compounds are made of ions

- _____**compound**: a compound made of oppositely charged ions
    - Ions are held together with **ionic bonds** (a _____attraction between oppositely charged ions)
- Ionic bonds are very strong

Formation of Ionic Compounds

- Binary ionic compounds:
    - Contain _____ elements (metal and a non-metal)
    - Form when atoms of the metal element _____to atoms of the non-metal element
    - Results in the formation of ions that have_____valence shells
    - Stability of a full valence shell drives the formation of compounds



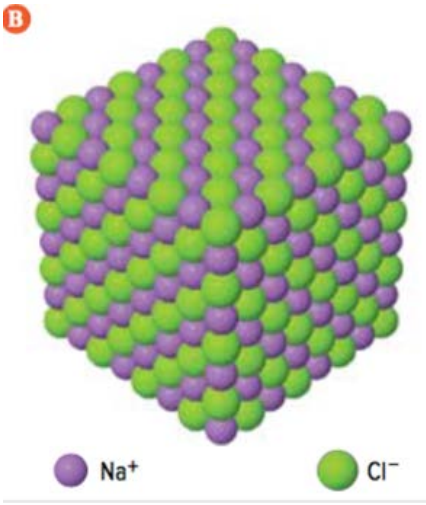
Example of an Ionic Compound

Sodium chloride (salt)

- Sodium (metal) reacts with chlorine (gas)
- Forms when sodium atoms each _____ one electron to chlorine atoms

- Each sodium atom becomes _____ ion (Na^+)
- Each chlorine atom becomes a _____ ion (Cl^-)
- Valence shells of both the sodium ion (Na^+) and chlorine ion (Cl^-) are full

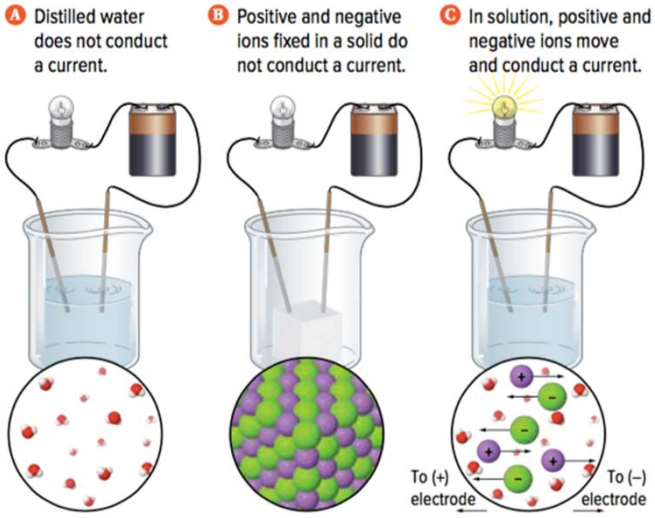
The Structure of Ionic Compounds



- Ionic compounds consist of positive and negative ions arranged in regular repeating _____ called *lattices*
- Example: Sodium chloride
  - Sodium chloride crystals consist of sodium and chloride ions arranged in a lattice

Properties of Ionic Compounds

- Ionic compounds have_____melting points
  - Melting requires breaking ionic bonds: the strong forces holding the ions together in the lattice structure
  - A large amount of _____ is required to break ionic bonds
  - Example: Melting point of sodium chloride is 801°C
- Ionic compounds are _____
  - Ionic solids are hard because ionic bonds are very strong
  - When enough force is applied, ions will shift
    - Causes ions with the same charge to be close together
    - Results in repulsive forces that break the solid apart
- Ionic compounds _____ electric current when liquid or dissolved
  - Electric current: the flow of charged particles



- Solid form: do not conduct electric current since ions are held rigidly in place
- Dissolved or liquid form: ions are free to move, and can conduct electric current

Discussion

1. **What is an ionic bond?**

2. **Describe the formation of magnesium oxide from magnesium and oxygen. Draw the Bohr Diagram for before and after**

3. **Binary ionic compounds form when which two types of elements react?**

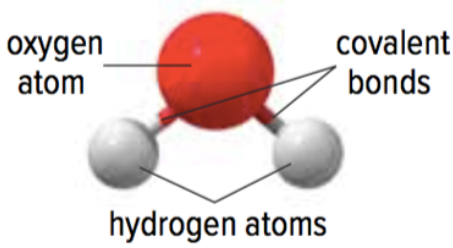
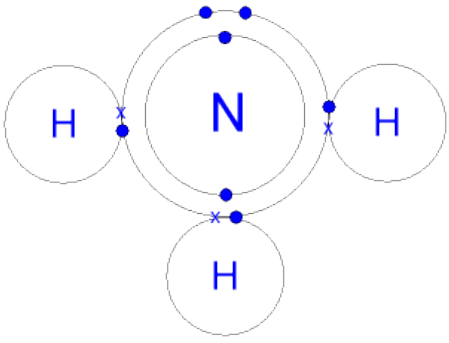


Figure 2.27: Water molecules consist of two hydrogen atoms bonded to one oxygen atom.

Covalent compounds are made of molecules

- **Covalent bond**: a strong attraction between atoms that forms when atoms_____valence electrons
- **Covalent compound**:
  - Made of_____
  - **Molecule**: a particle made up of two or more neutral atoms (usually _____) bonded together by covalent bonds

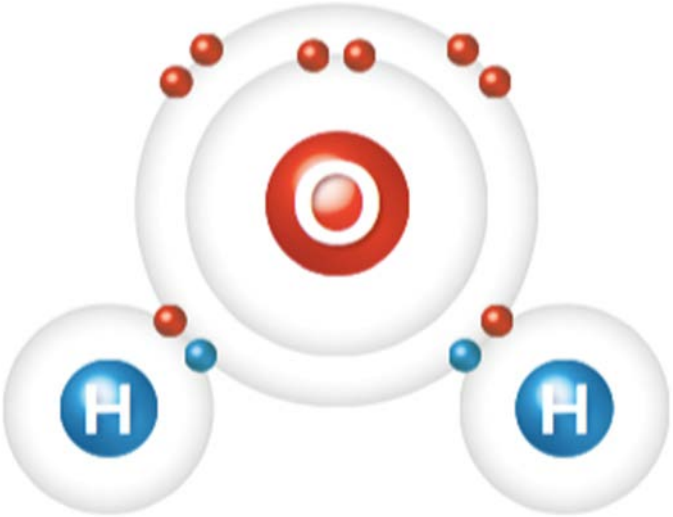


Covalent Bonds: Tug of War

- Covalent bonds are similar to a game of tug of war
  - Each team (atom) tries to pull the rope (shared electrons) toward itself
  - _____ side wins, and the bond is the rope that connects them
  - Achieving Stability by _____Electrons

Formation of a covalent compound is based on achieving stability with a full valence shell

- Instead of transferring electrons (ionic) Non-metals in covalent compound _____electrons to get a full valence shell
  - **Example: Water**
    - Covalent bond is formed from a single pair of shared electrons
    - Each hydrogen atom contributes a single electron to the shared pair of electrons
    - Each oxygen atom contributes a single electron to the shared pair of electrons
      - Hydrogen atoms achieve a full valence shell of _____ electrons
      - Oxygen atom achieves a full valence shell of _____ electrons



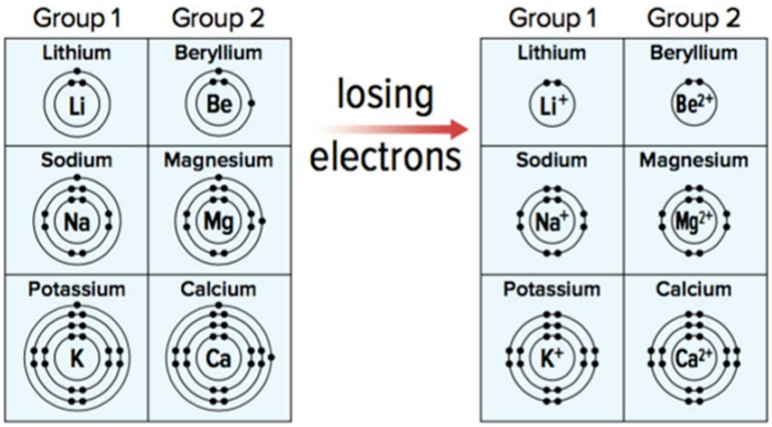
Three Ways That Atoms Become Stable (Achieve a Full Valence Shell)

- Metal atoms can lose electrons to achieve a full valence shell
- Non-metal atoms can gain electrons to achieve a full valence shell
- Non-metal atoms can share electrons with other non-metal atoms to achieve a full valence shell

Hemingway Name:

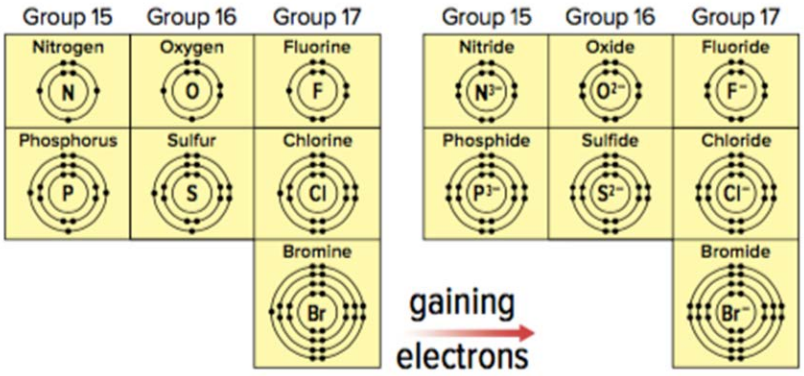
Metal atoms lose electrons

- Metals can _____to achieve a full valence shell
  - Form positive ions because they lose electrons
  - Retain the same number of protons in the nucleus
  - Example:
    - Group 1 metal ions have a 1+ charge because they have lost one electron
    - Group 2 metal ions charge: 2+
    - Group 3 metal ions charge: 3+



Non metals gain electrons

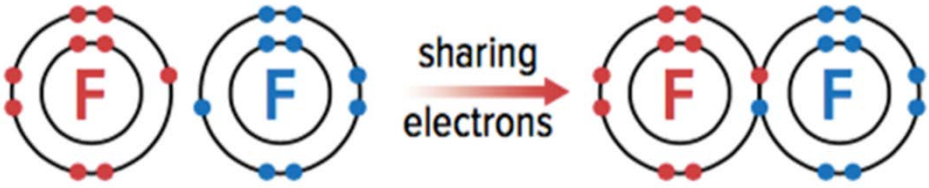
- Non-metal atoms can _____to achieve a full valence shell
  - Form negative ions because they gain electrons
  - Non-metal ions end in *–ide*



- Example:
- Group 17 non-metals ion charge is 1- because they have gained one electron
- Group 17 non-metal ions charge: 2-
- Group 18 non- metal ion charge: 3-

Non metals share electrons

- Non-metal atoms can _____with other non-metal atoms to achieve a full valence shell



Hemingway Name:

Properties of Covalent Compounds

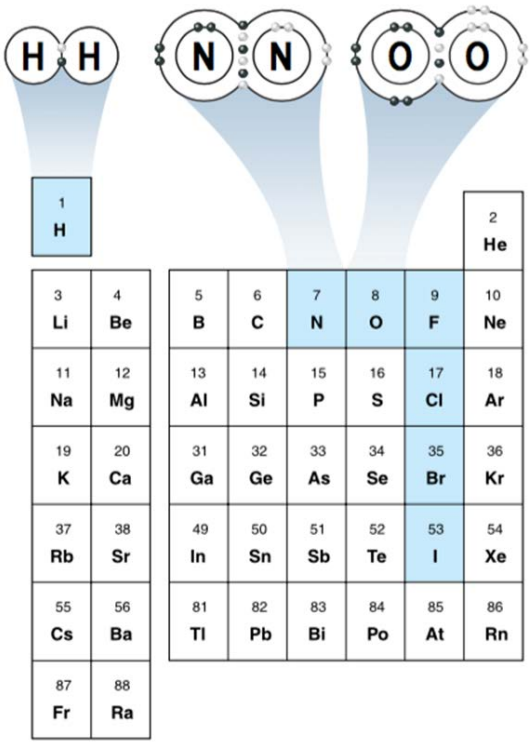
- Have _____melting points:
  - Forces holding atoms together in a molecule are strong
  - Bond that attract molecules to one another are relatively weak; therefore, not as much energy is needed to "break" the weak bond melt at low temperatures
- Relatively_____: Weak forces between molecules mean that it's easier for molecules to move and shift
- _____conductors: covalent compounds do not have free electrons, and they are poor conductors of electric current and heat

Discussion Questions

1. **What type of bond is formed when two non-metal atoms share electrons?**

2. **What is a molecule?**

3. **Why do covalent compounds tend to have low melting points?**



Covalent bonding also occurs in elements:

HOFBrINCl

- Seven elements are made up of molecules held together with covalent bonds in their _____ state
  - These elements are known as _____(two atoms)
  - They do not exist _____, they are either bonded to itself or another atom.

HOFBrINCl

- H_2, F_2, Cl_2, Br_2, I_2: _____ atoms share one electron in a covalent bond
- O_2: Two atoms share two pairs of electrons to form two covalent bonds (*double bond*)
- N_2: Two nitrogen atoms share three pairs of electrons to form three covalent bonds (*triple bond*)
- **Time out**
- **Pg 87-88, 90-92**