

Chapter 13 – Chemical Bonding

Section 3

Covalent and Metallic Bonds

Essential Questions

- How do covalent bonds form?
- Describe molecules.
- How do metallic bonds form?
- What are the properties of metals?

Definitions

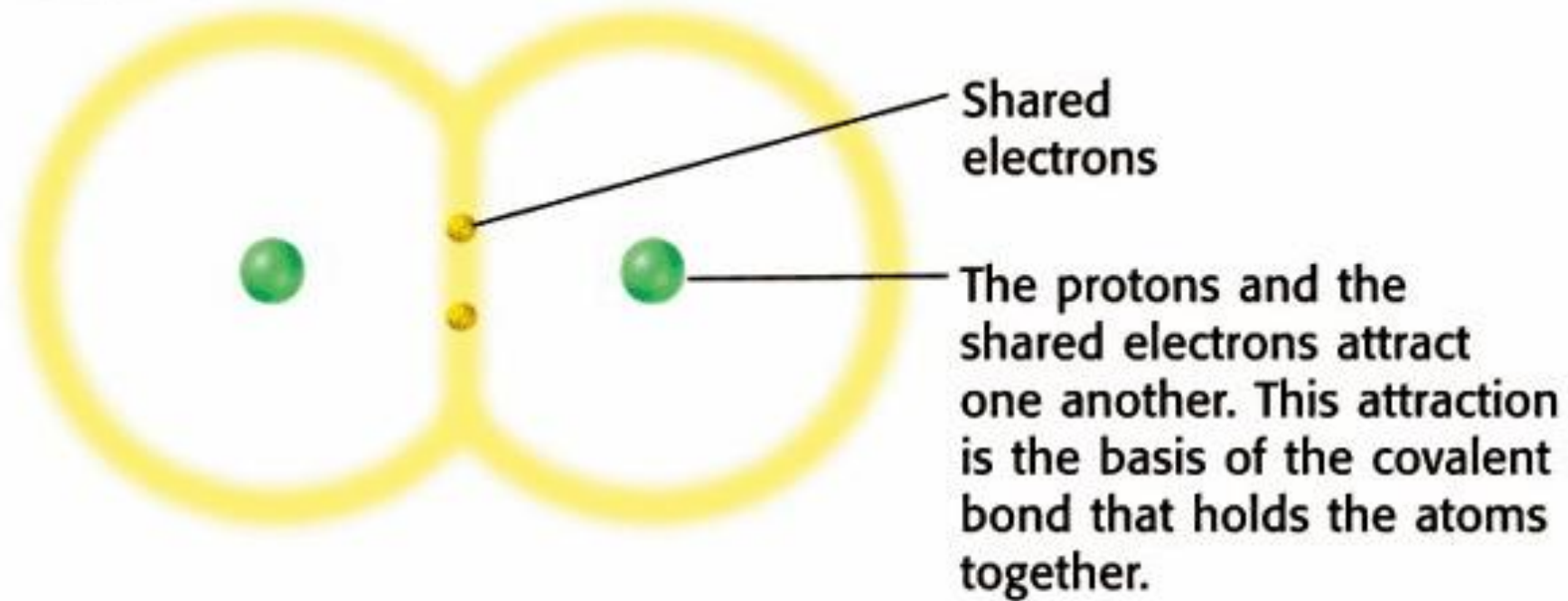
- Covalent bond – bond formed when atoms share one or more pairs of electrons
- Molecule – smallest unit of a substance that keeps all physical and chemical properties
- Metallic Bond – bond formed by attraction between positively charged metal ions and the electrons around them

Forming Covalent Bonds

■ Covalent Bonds

- Tend to have a **low melting and boiling point** and are **brittle** when solid
- Formed when atoms **share** one or more pairs of **electrons**
- Usually formed between atoms of **nonmetals**

Covalent Bond



Covalent Bonds and Molecules

- Most **molecules** are made of **two or more elements**
- **Electron-dot diagrams** – symbol of the **element** and dots representing **valence electrons**



Carbon atoms have 4 valence electrons. A carbon atom needs 4 more electrons to have a filled outermost energy level.



Oxygen atoms have 6 valence electrons. An oxygen atom needs only 2 more electrons to have a filled outermost energy level.

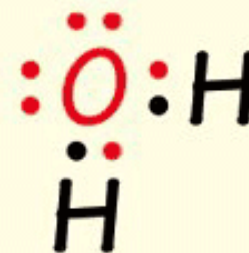
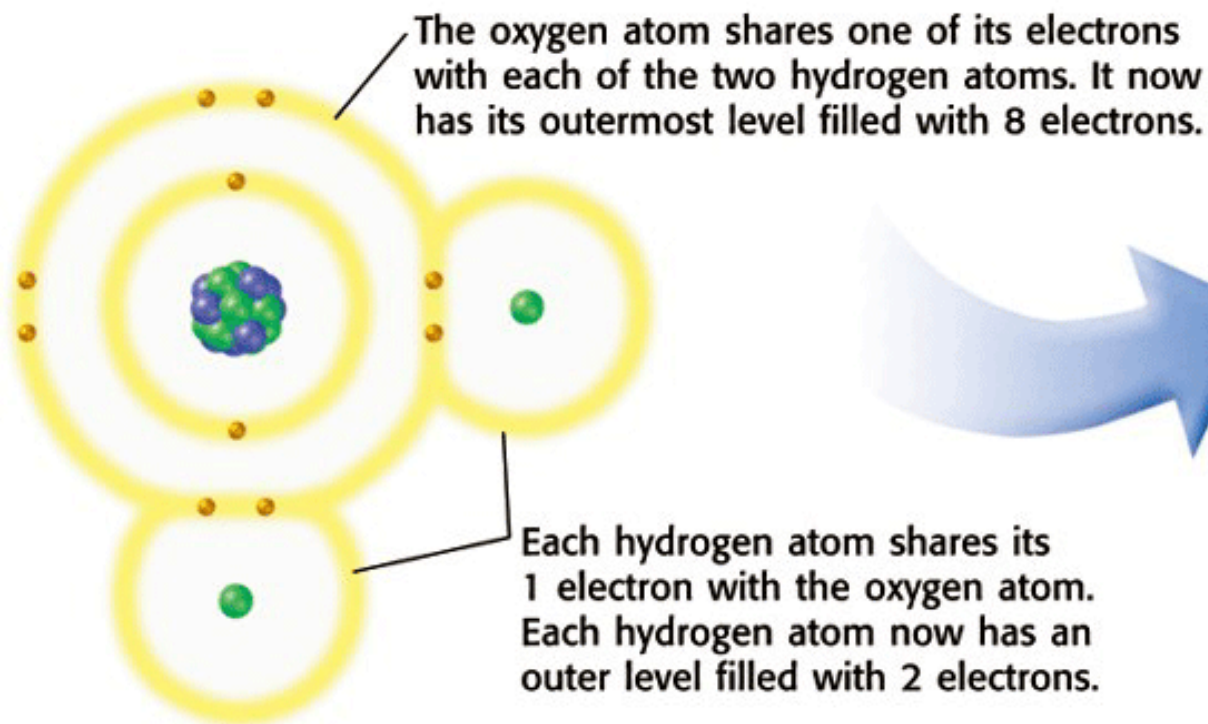


Krypton atoms have 8 valence electrons. Krypton is nonreactive. Krypton atoms do not need any more electrons.



This diagram represents a hydrogen molecule. The dots between the letters represent a pair of shared electrons.

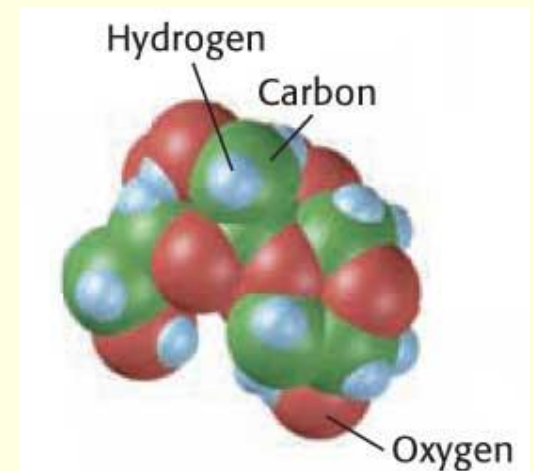
Covalent Bonds in a Water Molecule



This electron-dot diagram for water shows only the outermost level of electrons for each atom. But you still see how the atoms share electrons.

Covalent Compounds and Molecules

- **Simplest** Molecules – are called **diatomic molecules** and are made of **two bonded atoms**
 - Hydrogen is an example
- More **complex** molecules are made of **more than two atoms**
 - Carbon bonds with multiple atoms



Metallic Bonds

- **Metallic** Bond - formed by **positively** charged **metal ions** and the electrons in the metal
 - Positively charged metal ions are formed when **metal** atoms **lose electrons**
- Bonding of metal atoms comes from being so close they overlap
- Metallic bonds extend throughout the metal in all directions

Properties of Metals

- **Metallic bonding** give metals its' properties: electrical **conductivity**, **malleability**, and **ductility**
- **Atoms** in metals can be **rearranged** – this allows for the **shaping of metals**
 - **Malleability** – ability to be hammered into sheets
 - **Ductility** – ability to be drawn into **wires**

Bending without Breaking

- Moving **electrons** maintain the **metallic bonds** no matter what the **shape**
- This is why **metal** can **bend** without breaking