Ch 5 Bonding & Nomenclature

Molecule: collection of atoms bonded together
usu. only nonmetals and/or (metalloids)
(metals & nonmetals combine by forming ions)
ionic compounds

Oxygen molecule: $O_2$ (because oxygen is a diatomic element)

O atom: highly unstable and reactive

Water molecule: $H_2O$

$H$ is a nonmetal!

Why do molecules form (how?)

The simplest molecule: $H_2$
H atoms unstable on own → combine to form an H₂ molecule

2 H atoms:

move towards each other

unstable
high in energy

lots of energy given off!

both electrons are shared between two atoms

sees 2 electrons

H₂ molecule very stable (lower energy)

Covalent bond 2 electrons shared between 2 atoms

\[ \text{H} \quad \text{H} \]

shared electrons

\[ \text{H} - \text{H} \]

covalent bond
often drawn as a line
(2 electrons shared)
methane (natural gas) \( \text{CH}_4 \)

- Each H has access to 2 electrons.
- C has access to 8 of those electrons.

Most elements are most stable when they have access to 8 valence electrons.

\( \text{H} \cdot \cdot \cdot \text{C} \cdot \cdot \cdot \text{H} \)

- Outermost shell: OCTET RULE (all subshells are full).
- 4 valence electrons.

H is an exception = Most stable when has access to 2 electrons (duet rule).

Covalent bonds.
Group #: I A IIA IIA IVA IVA VLA

Elements: H (C) Si N, P, S, O, As, Se, Te, Br, I

Valence electrons: 1 4 5 6 7

\# electrons needed to fill octet (duet for H): 1 4 3 2 1

\# covalent bonds: 1 4 3 2 1

Electron-dot diagrams (Lewis structures):
- Drawing of molecule
- Valence electrons shown as dots
- Covalent bonds shown as lines

\[ H_2O \]

Start with individual atoms:

\[ \text{H} \quad \text{O} \quad \text{H} \]

Draw valence electrons as dots:
- 2 pairs of e\(^-\), 2 unpaired e\(^-\)
- Draw dots alone first on 4 sides before pairing

Fulfills octet rule

Lone pairs (unshared pairs): 1 O

Covalent bonds: 2 H

O sees 8 v.e.