Essential Question

How do we show shared electrons in a molecule?

ZornScience | zornscience.org | CC BY-NC-SA 4.0

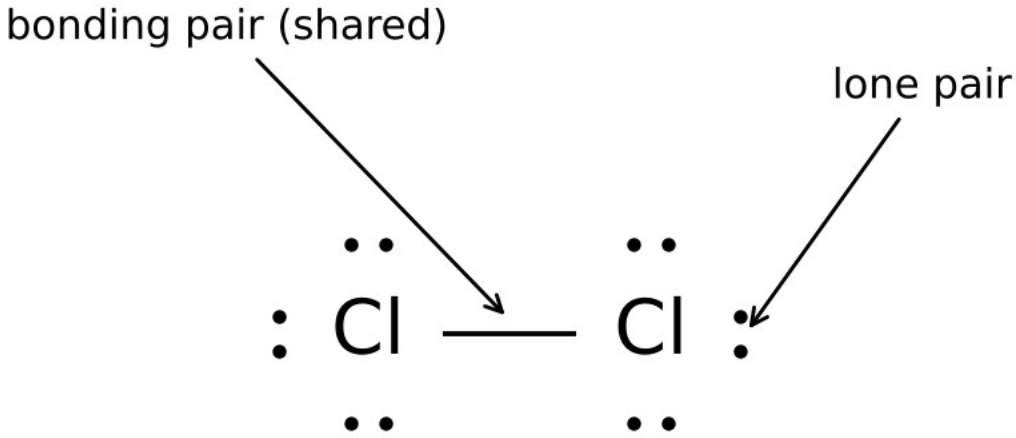
Covalent Bonds

- Covalent bond: a shared pair of electrons
- Forms between nonmetals
- Both atoms count both shared electrons
- One line = one shared pair = 2 electrons

ZornScience | zornscience.org | CC BY-NC-SA 4.0

Bonding Pairs and Lone Pairs

- Bonding pair: shared by two atoms
- Lone pair: belongs to one atom



each Cl: 6 in lone pairs + 2 in the bond = 8

ZornScience | zornscience.org | CC BY-NC-SA 4.0

The Octet Rule

- Atoms share until each has 8 valence electrons
- Hydrogen only needs 2
- Shared electrons count for both atoms

ZornScience | zornscience.org | CC BY-NC-SA 4.0

Counting Valence Electrons

- Group number → valence electrons
- Groups 13 to 18: drop the 1
- Add up every atom in the formula

Group	Valence e^-
1	1
2	2
13	3
14	4
15	5
16	6
17	7
18	8

ZornScience | zornscience.org | CC BY-NC-SA 4.0

The Central Atom

- The central atom goes in the middle
- It's usually the only atom of its kind
- H is always on the outside (only one bond)

ZornScience | zornscience.org | CC BY-NC-SA 4.0

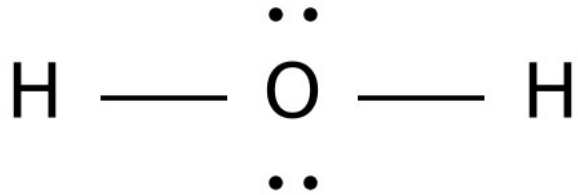
Steps for Lewis Structures

- 1. Count all valence electrons
- 2. Connect the atoms with single bonds (2 e^- each)
- 3. Give outer atoms lone pairs until they have 8 (H gets 2)
- 4. Put leftover electrons on the central atom
- 5. Central atom short of 8? Move lone pairs into multiple bonds

ZornScience | zornscience.org | CC BY-NC-SA 4.0

Check Your Count

- Each line = 2 electrons
- Each dot = 1 electron
- The total must match your count



2 bonds × 2 = 4

2 lone pairs × 2 = 4

total = 8, matches the count

ZornScience | zornscience.org | CC BY-NC-SA 4.0

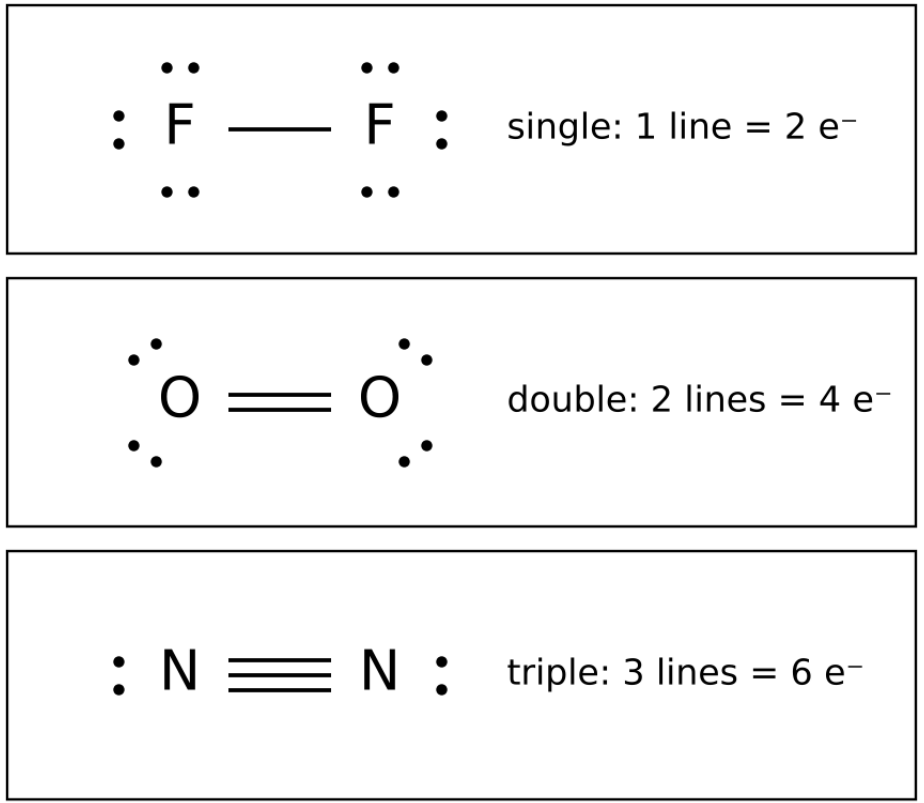
Double Bonds

- Double bond: 2 shared pairs (4 electrons)
- Use one when an atom is short of 8
- Move a lone pair into the bond
- O_2: 12 electrons, O=O with 2 lone pairs on each O

ZornScience | zornscience.org | CC BY-NC-SA 4.0

Triple Bonds

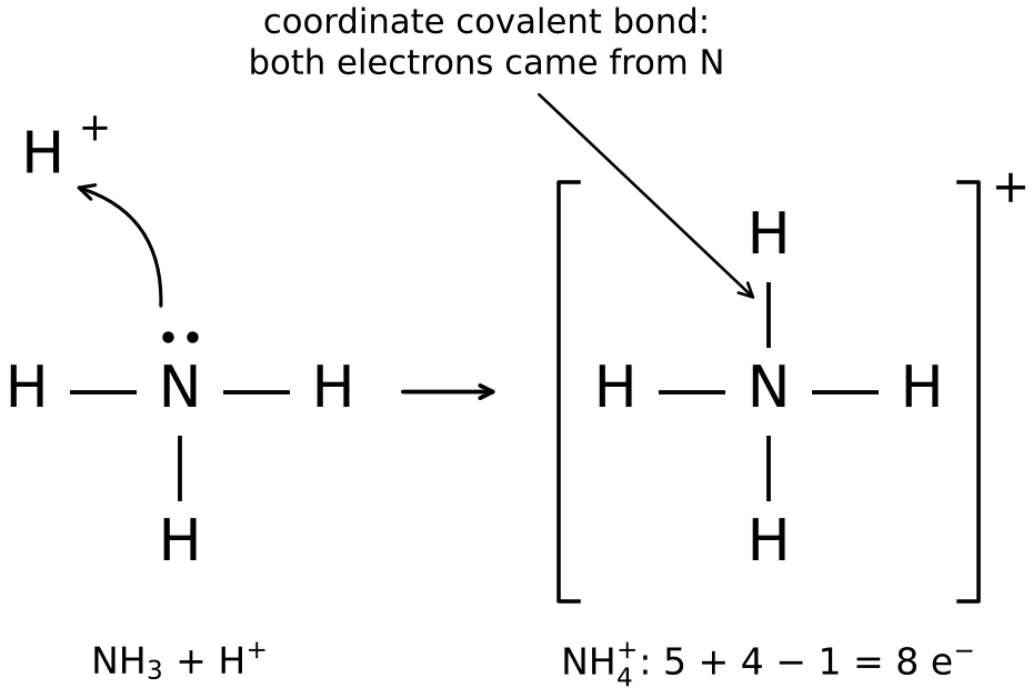
- Triple bond: 3 shared pairs (6 electrons)
- Short by 4? Move 2 lone pairs
- N_2: N≡N, one lone pair on each N



ZornScience | zornscience.org | CC BY-NC-SA 4.0

Coordinate Covalent Bonds

- Both shared electrons come from one atom
- A lone pair is shared with an atom or ion that has none
- Once formed, it's like any other covalent bond



ZornScience | zornscience.org | CC BY-NC-SA 4.0

Example: Ammonia

Draw the Lewis structure for ammonia, NH_3.

ZornScience | zornscience.org | CC BY-NC-SA 4.0

Example: Carbon Dioxide

Draw the Lewis structure for carbon dioxide, CO_2.

ZornScience | zornscience.org | CC BY-NC-SA 4.0

Example: Hydrogen Cyanide

Draw the Lewis structure for hydrogen cyanide, HCN. Carbon is the central atom.

ZornScience | zornscience.org | CC BY-NC-SA 4.0

Big Ideas

- A covalent bond is a shared pair of electrons
- Most atoms need 8 (H needs 2)
- Count valence electrons first
- Short of 8? Use double or triple bonds
- Coordinate covalent bond: one atom supplies both electrons

ZornScience | zornscience.org | CC BY-NC-SA 4.0