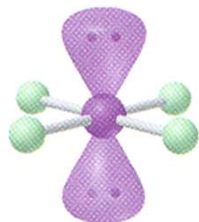
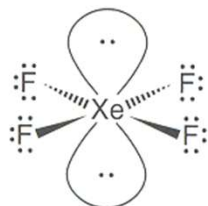


Chapter 10

The Shapes of Molecules

1. Lewis Dot structures



2. Valence Shell Electron Pair Repulsion Theory (VSEPR)

3. Molecular Polarity



Lewis Dot Structures

Molecules



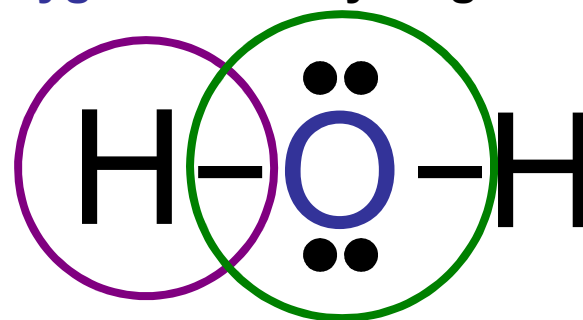
1. Determine the total number of valence electrons using the periodic table
2. Write down the molecule's skeleton structure with the least electronegative atom in the center
3. Add single bonds and keep track of electrons used (2 e⁻ per bond)
4. Distribute remaining electrons (octet & duet rules).
*(**Extra electrons on center atom)*
5. Check your answer (octet and duet rules) *and make multiple bond adjustments as necessary.*

Group IA

Group 6A

$$1 \text{ valence e}^- \times 2 + 6 \text{ valence e}^- = 8 \text{ valence e}^-$$

Oxygen E.N. > Hydrogen E.N.



2 electrons

Duet: Okay

8 electrons

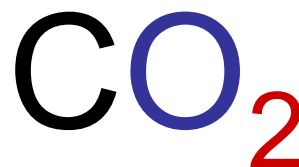
Octet: Okay



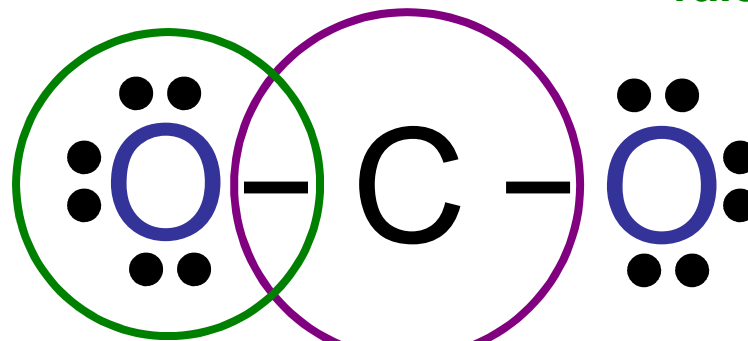
Lewis Dot Structures: Molecules

1. Determine the total number of valence electrons using the periodic table
2. Write down the molecule's skeleton structure with the least electronegative atom in the center
3. Add single bonds and keep track of electrons used (2 e⁻ per bond)
4. Distribute remaining electrons (octet & duet rules).
*(**Extra electrons on center atom)*
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...and make multiple bond adjustments as necessary.

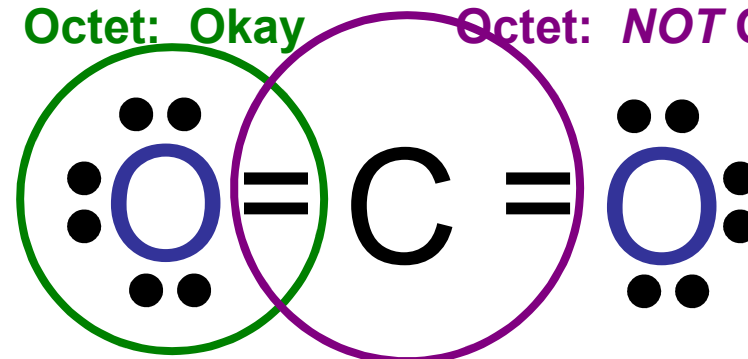


$$\begin{array}{ccc} \text{Group 4A} & & \text{Group 6A} \\ 4 \text{ valence e}^- & + & 6 \text{ valence e}^- \times 2 = \text{16 valence e}^- \end{array}$$



8 electrons
Octet: Okay

4 electrons
Octet: NOT Okay



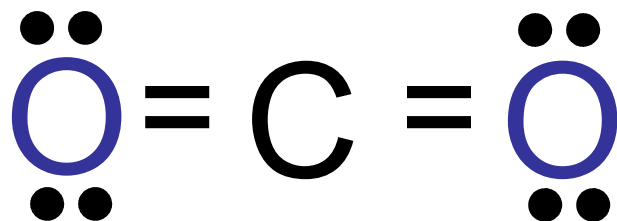
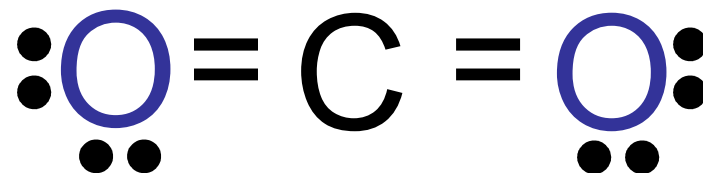
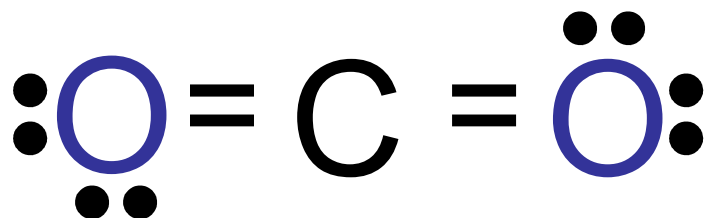
8 electrons
Octet: Okay

8 electrons
Octet: Okay



CO₂: The correct Lewis Dot Structure

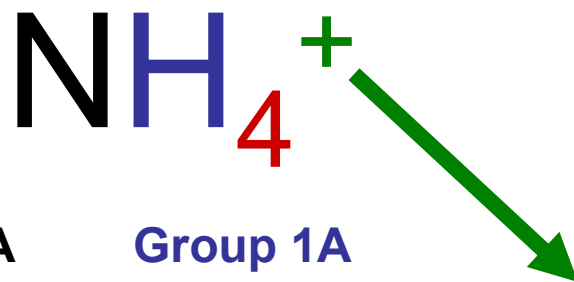
There are many correct Lewis dot structures for CO₂ :



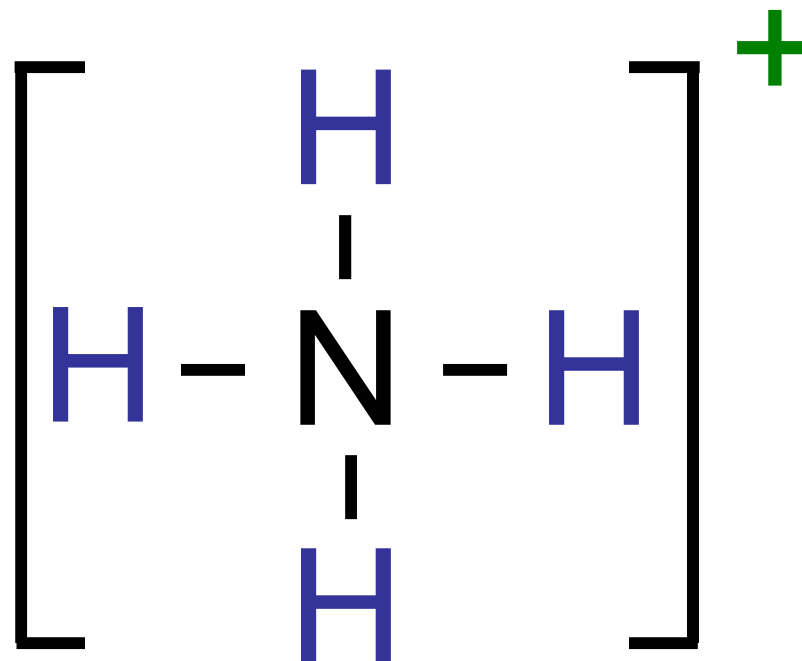
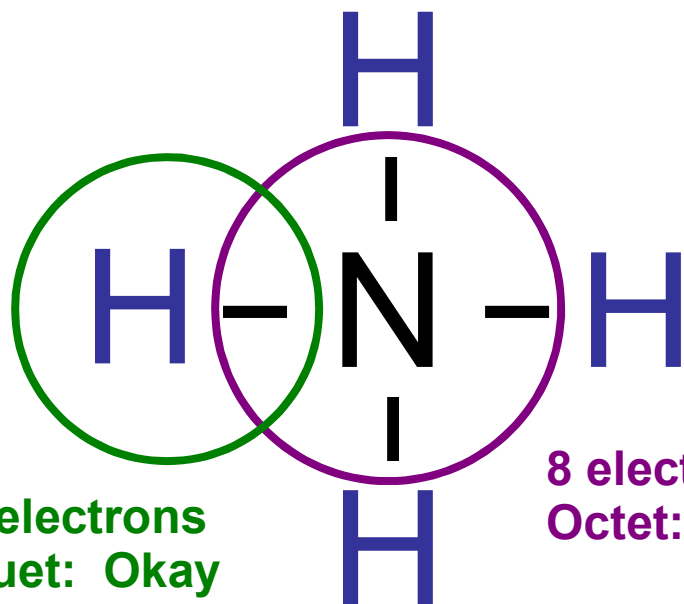
etc....



Lewis Dot Structures: Molecules



$$\begin{array}{l} \text{Group 5A} \qquad \text{Group 1A} \\ 5 \text{ valence } e^- + 1 \text{ valence } e^- \times 4 - 1 \text{ electron} = 8 \text{ valence } e^- \end{array}$$



Use brackets and indicate the charge on polyatomic ions...



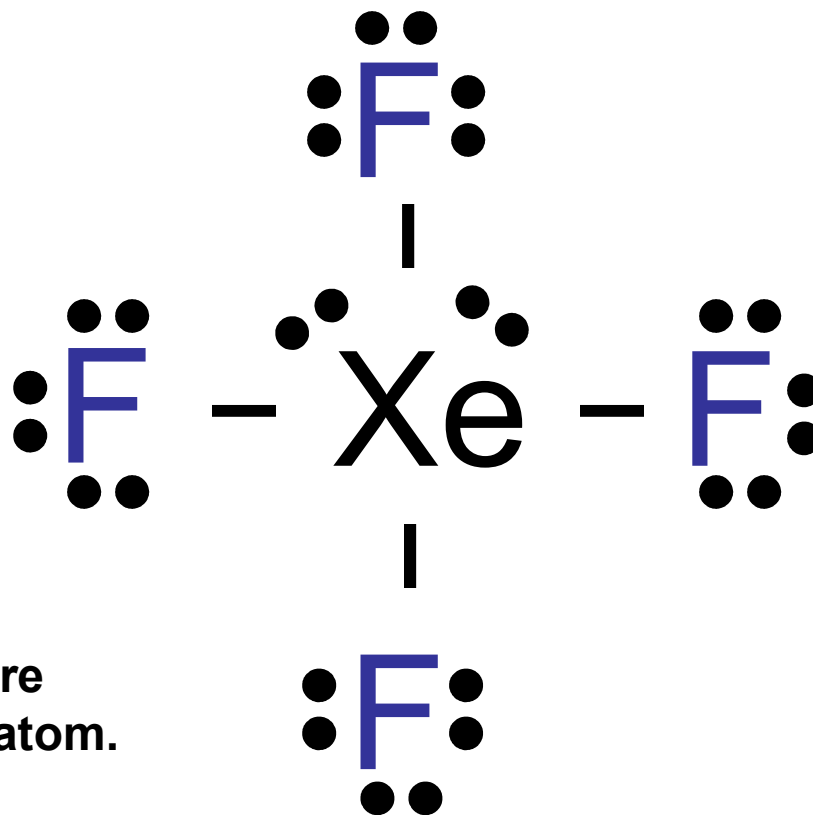
Lewis Dot Structures: Molecules



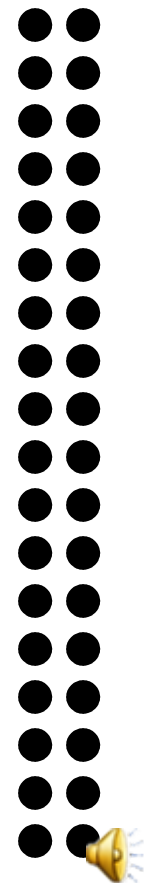
Group 8A

Group 7A

$$8 \text{ valence } e^- + 7 \text{ valence } e^- \times 4 = 36 \text{ valence } e^-$$



Extra electron pairs are placed on the center atom.



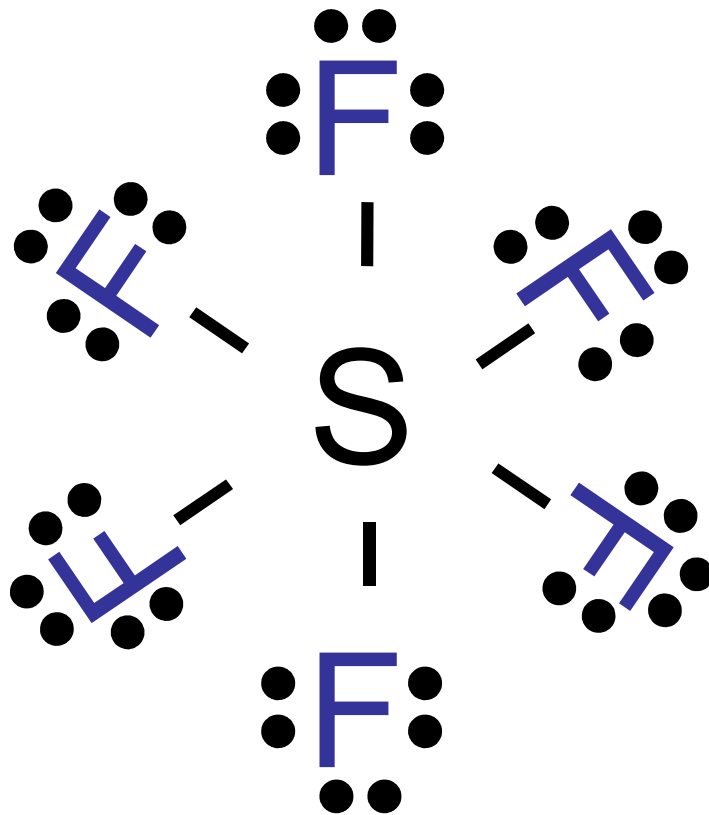
Lewis Dot Structures: Molecules



Group 6A

Group 7A

$$6 \text{ valence } e^- + 7 \text{ valence } e^- \times 6 = 48 \text{ valence } e^-$$

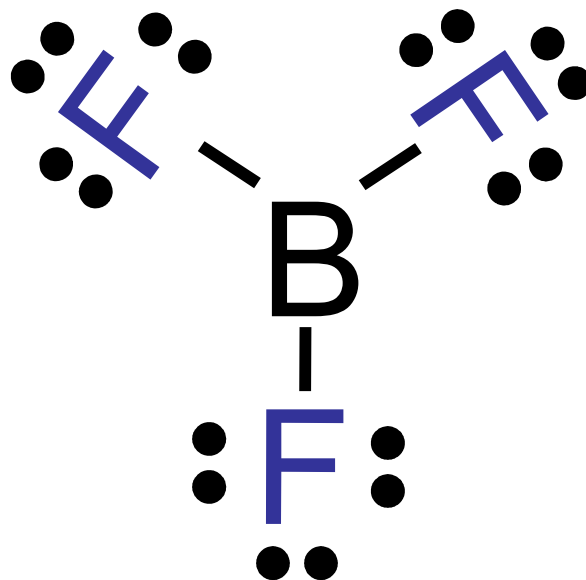


Lewis Dot Structures: Exceptions

Boron (B) ...frequently forms 3 bonds



24 total valence electrons

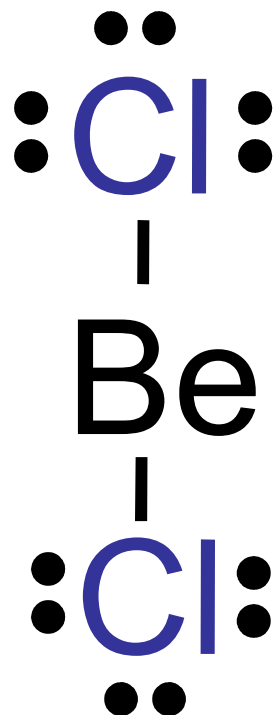


Lewis Dot Structures: Exceptions

Beryllium (Be) ...frequently forms 2 bonds



16 total valence electrons



Lewis Dot Structures: Useful Information

The following are guidelines only. Exceptions exist!

Hydrogen & Fluorine: Form 1 bond.

Oxygen: Often forms 2 bonds.

Carbon: Often forms 4 bonds.

Nitrogen: Frequently (exception NH_4^+) forms 3 bonds.

