Unit 6B – Molecular Structure
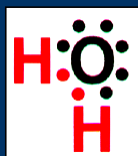
II. Lewis Diagrams
(p. 170 – 175)

H:O:H

:Cl:Cl:

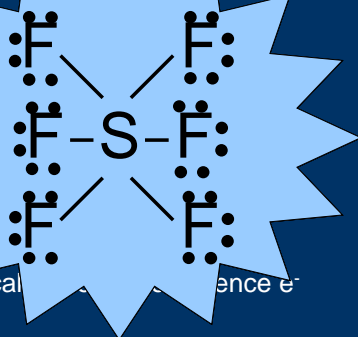| I | II | III |

A. Octet Rule

- Remember…
  - Most atoms form bonds in order to have 8 valence electrons.

A. Octet Rule

- Exce...
  - ...
  - ...val...
  - Radical... ...ence e⁻

(F–S–F structure with F atoms)

B. Drawing Lewis Diagrams

- Find total # of valence e⁻.
- Arrange atoms - singular atom is usually in the middle.
- Form bonds between atoms (2 e⁻).
- Distribute remaining e⁻ to give each atom an octet (recall exceptions).
- If there aren't enough e⁻ to go around, form double or triple bonds.
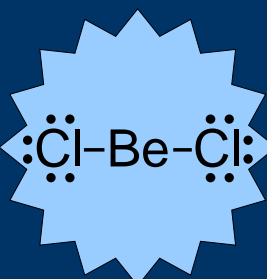

B. Drawing Lewis Diagrams

- CF_4

$1\ C \times 4e^- = 4e^-$
$4\ F \times 7e^- = \underline{28e^-}$
$32e^-$
$\underline{-\ 8e^-}$
$24e^-$

(F–C–F with F above and below)
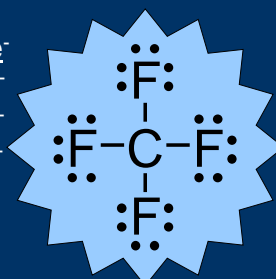
B. Drawing Lewis Diagrams

- $BeCl_2$

$1\ Be \times 2e^- = 2e^-$
$2\ Cl \times 7e^- = \underline{14e^-}$
$16e^-$
$\underline{-\ 4e^-}$
$12e^-$

:Cl–Be–Cl:

B. Drawing Lewis Diagrams

■ CO_2

1 C × 4e⁻ = 4e⁻
2 O × 6e⁻ = 12e⁻
    16e⁻
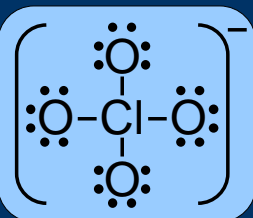   - 4e⁻
    12e⁻

:Ö=C=Ö:
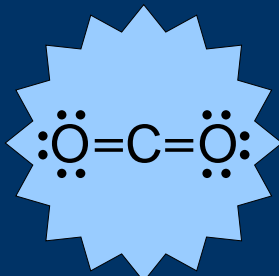
C. Polyatomic Ions

■ To find total # of valence e⁻:
  • Add 1e⁻ for each negative charge.
  • Subtract 1e⁻ for each positive charge.
■ Place brackets around the ion and label the charge.
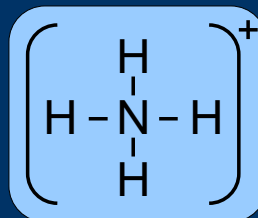
C. Polyatomic Ions

■ ClO_4^-

1 Cl × 7e⁻ = 7e⁻
4 O × 6e⁻ = 24e⁻
    31e⁻
    + 1e⁻
    32e⁻
    - 8e⁻
    24e⁻

[:Ö: ¯
:Ö–Cl–Ö:
  :Ö:]

C. Polyatomic Ions

■ NH_4^+

1 N × 5e⁻ = 5e⁻
4 H × 1e⁻ = 4e⁻
    9e⁻
    - 1e⁻
    8e⁻
    - 8e⁻
    0e⁻

[H   ]⁺
   H – N – H
       H

D. Resonance Structures

■ Molecules that can't be correctly represented by a single Lewis diagram.
■ Actual structure is an average of all the possibilities.
■ Show possible structures separated by a double-headed arrow.

Ö=Ö—Ö: ⟷ :Ö—O=Ö

D. Resonance Structures

■ SO_3

:Ö: :Ö:
 | |
:Ö–S=Ö   ⟷   Ö=S–Ö:

         :Ö:
          ‖
        :Ö–S–Ö:

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