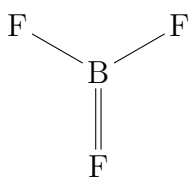# Chapter 7 − Covalent Bonds

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- Lewis Structures:

  1. Sum Valence Electrons
  2. Connect atoms with lines
  3. Arrange remaining e$^-$ to satisfy octet rule

- Resonance − Being able to draw more than one Lewis structure

- Halogens will almost never have double bonds

- Molecular Shapes:

  1. Linear

     − Bond angle equals 180°
     − Usually non-polar
     − Ex:

     $$\ddot{\underset{\cdot\cdot}{O}} = C = \ddot{\underset{\cdot\cdot}{O}}$$

  2. Triangular Planar

     − Bond angle equals 120°
     − Usually non-polar
     − Ex:

     F and F bonded to B, with B double-bonded to F below

  3. Bent

     − Bond angle equals 109.5°
     − Appears as a linear, but bent
     − Always polar

– Ex:

$$\overset{\displaystyle \ddot{\underset{\displaystyle \cdot\cdot}{O}}}{\underset{\displaystyle H \qquad\qquad H}{\diagup\quad\diagdown}}$$
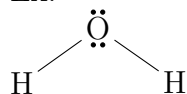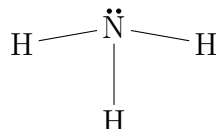
4. Tri-Pyramid

   – Bond angle equals 109.5°
   – Appears as a three dimensional, triangular pyramid
   – Always polar
   – Ex:

$$H\!-\!\!\overset{\displaystyle \cdot\cdot}{N}\!-\!H$$
$$|$$
$$H$$
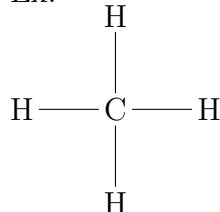
5. Tetrahedral

   – Bond angle equals 109.5°
   – Appears as a three dimensional, square pyramid
   – Usually non-polar
   – Ex:

$$H$$
$$|$$
$$H\!-\!\!C\!-\!H$$
$$|$$
$$H$$

- Expanded Octets: $5\,e^-$ pairs

   1. Tri-Bipyramid (5 atoms)

      (a) Usually non-polar

   2. Seesaw (4 atoms)

      (a) Always polar

   3. T Shape (3 atoms)

      (a) Always polar

   4. Linear (2 atoms)

      (a) Usually non-polar

- Expanded Octets: $6\,e^-$ pairs

   – Octahedral (6 atoms)

      1. Usually non-polar

   – Square Pyramid (5 atoms)

      1. Always polar

– Square Planar (4 atoms)

    1. Usually non-polar

- VESPR − e$^-$ pairs repel, and double and triple bonds count as one pair.

- Molecular Polarity − The negative side is what repels branching atoms, while the branching atoms are attracted to the positive side.

- Exceptions − NF_3 has a bond angle of 102°, CF_4 has a bond angle of 109.5°. This is because lone pairs repel more than bonding pairs.

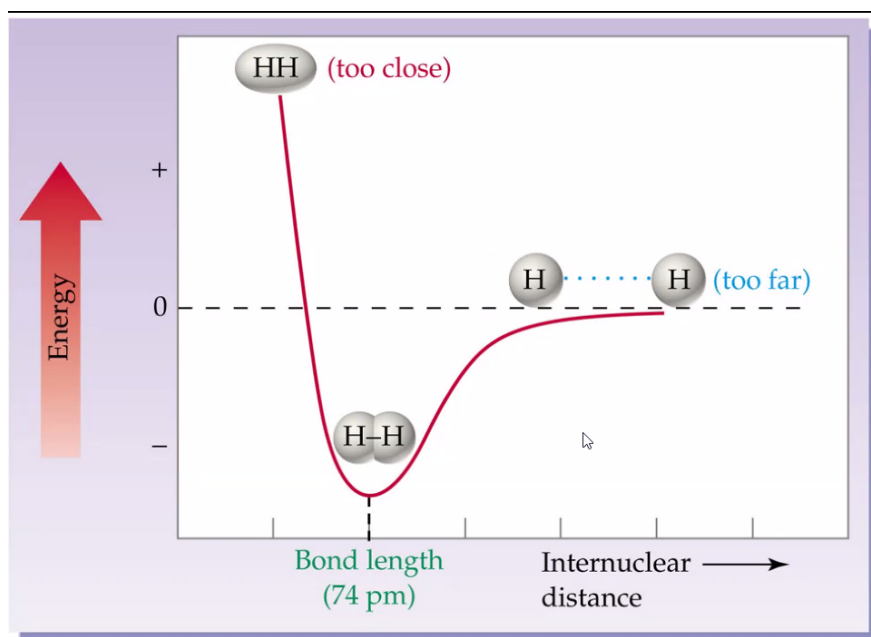- These types of graphs show the appropriate bond distance between two atoms:

Figure 1: Best Bonding Distance For H_2

- The AP Exam will show a graph like the following and ask what is incorrect. Horizontal is determined by protons, while vertical is determined by size of the atom. In this case, F_2 should be left of I_2
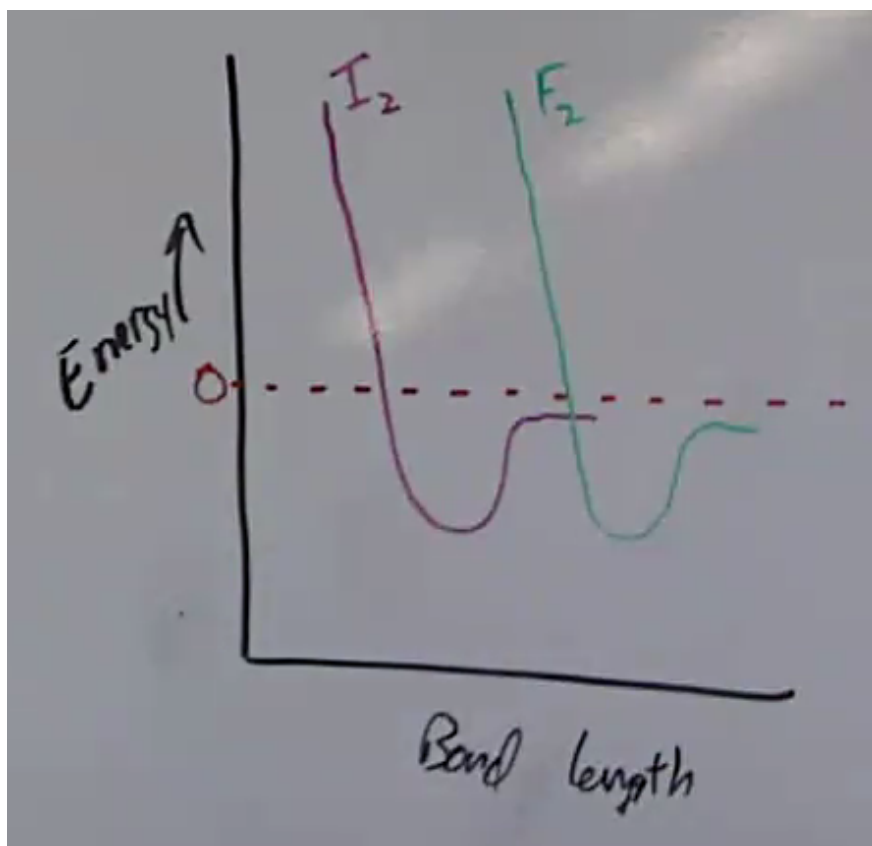

Figure 2: Incorrect Energy Required to Break I_2 and F_2 Bonds