Lewis Dot Structures

1. Methane – CH₄

Number of Valence Electrons: 4 from C and 1 each from 4 H = 8

Carbon is more electronegative than hydrogen, but hydrogen can never be the “central” atom, as it can only form 1 bond. Carbon always forms 4 bonds (2 electrons each).

2. Ammonia - NH₃

Number of Valence Electrons: 5 from N and 1 from each of the H = 8

The bonds account for 6 of the valence electrons, the 2 left over electrons are the lone pair of electrons on N.

3. Ethylene – C₂H₄

Number of valence electrons: 4 of each carbon (8 total) and 1 each from 4 H = 12

The single bonds account for 10 valence electrons. A double bond between the 2 carbon atoms is used to complete the octet rule for carbon and use all available valence electrons (12).
4. Ammonia ion - NH$_4^+$

Number of Valence Electrons: 5 from N and 1 from each of the H less one from the +1 charge (1 lost electron) = 8

![Diagram of NH$_4^+$]

5. Formaldehyde – CH$_2$O

Number of Valence Electrons: 4 from C, 1 each from 2 H, 6 from O = 12

![Diagram of CH$_2$O]

Carbon is central atom, as it is less electronegative than oxygen. The single bonds account for 6 valence electrons. Two additional valence electrons go into the second (double) bond between carbon and oxygen. The last 4 electrons go on the oxygen as 2 lone pairs. Both carbon and oxygen obey the octet rule in this structure.

6. Nitrite ion – NO$_2^-$

Number of Valence Electrons: 5 from N, 6 from each of the two oxygens (12 total), 1 additional electron from the -1 charge (gained electron) = 18

![Nitrite ion resonance structures]

The number of valence electrons in the bonds is 6. One lone pair electrons on N (2 total); 2 lone pairs of electrons (4 total) on one O; 3 lone pairs of electrons (6 total) on the other O.

With one double bond to oxygen and one single bond to oxygen, this structure for nitrite ion exhibits resonance. The actual structure is an average of the 2 resonance structures. The bond length of the nitrogen-oxygen bonds is identical, indicating that the double bond character of both bonds is the same.
7. Boron trichloride – $\text{BCl}_3$

Number of Valence Electrons: 3 from B and 7 each Cl (21 total) = 24

This is an example of an exception to the octet rule. Boron likes to form 3 bonds. Similarly, Be likes to form only 2 bonds ($\text{BeF}_2$, $\text{BeCl}_2$).

8. Sulfur Hexafluoride – $\text{SF}_6$

Number of Valence Electrons: 6 from S and 7 each F (42 total) = 48

This is an example of an exception to the octet rule. Because S is in the 3rd row of the periodic table, it can form an expanded valence shell in order to create the required 6 bonds.