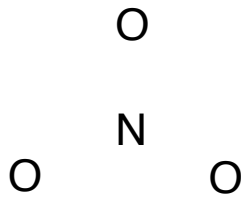
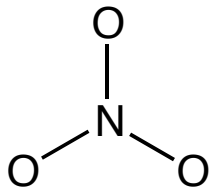
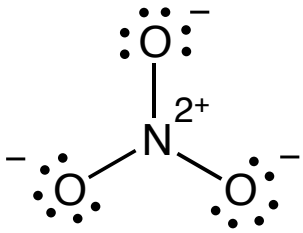
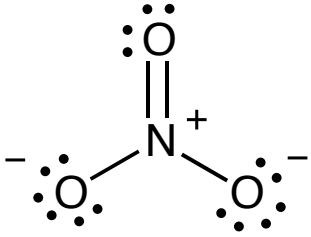
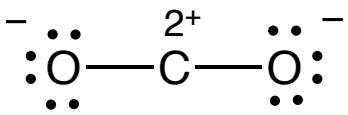
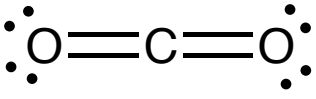
DRAWING SIMPLE LEWIS STRUCTURES

Example One: Draw the Lewis structure for nitrate (NO_3^{1-})

Step	Structure	Valence Electron Counts (Total – Bonds – Pairs = Remaining)			
		Total	In Bonds	In Lone-Pairs	Remaining
1. Write the central atom, which is the least electronegative atom in the formula other than hydrogen (H). Hydrogen is never the central atom. Hydrogens are usually bonded to surrounding atoms. 2. Write the remaining atoms surrounding the central atom. 3. Determine the total number of valence electrons (VE) for all atoms. Add electrons to the total for negatively charged species; subtract electrons from the total for positively charged species (e.g., add two electrons for a species with a charge of -2).	 N = 5 O = 6 x 3 Charge = 1 (add an e^-) Total = 24	24	0	0	24
4. Draw single bonds from the central atom to all remaining atoms. Then, subtract two electrons from the total VE for each bond drawn.		24	6	0	18
5. Distribute remaining electrons around atoms in the most pairs as possible to satisfy the octet rule. Start with the most electronegative atoms. Then, calculate all formal charges.		24	6	18	0
6. Draw a resonance structure that maximizes the number of atoms that obey the octet rule and minimizes the number of formal charges. Do this by changing an electron lone-pair to a multiple bond. 7. Recalculate formal charges.		24	8	16	0

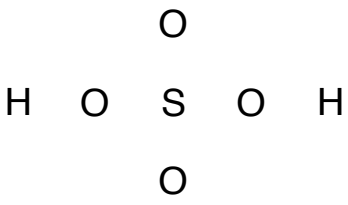
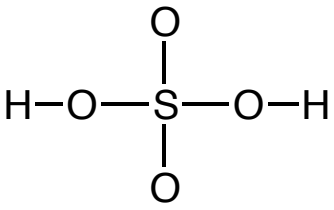
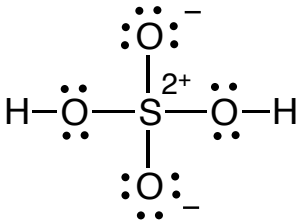
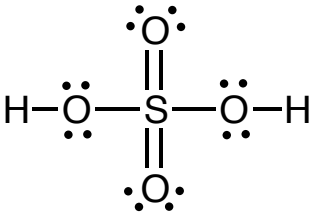
DRAWING SIMPLE LEWIS STRUCTURES

Example Two: Draw the Lewis structure for carbon dioxide (CO_2)

Step	Structure	Valence Electron Counts (Total – Bonds – Pairs = Remaining)			
		Total	In Bonds	In Lone-Pairs	Remaining
1. Write the central atom, which is the least electronegative atom in the formula other than hydrogen (H). Hydrogen is never the central atom. Hydrogens are usually bonded to surrounding atoms. 2. Write the remaining atoms surrounding the central atom. 3. Determine the total number of valence electrons (VE) for all atoms. Add electrons to the total for negatively charged species; subtract electrons from the total for positively charged species (e.g., add two electrons for a species with a charge of -2).	O C O C = 4 O = 6 x 2 Charge = 0 Total = 16	16	0	0	16
4. Draw single bonds from the central atom to all remaining atoms. Then, subtract two electrons from the total VE for each bond drawn.	O—C—O	16	4	0	12
5. Distribute remaining electrons around atoms in the most pairs as possible to satisfy the octet rule. Start with the most electronegative atoms. Then, calculate all formal charges.		16	4	12	0
6. Draw a resonance structure that maximizes the number of atoms that obey the octet rule and minimizes the number of formal charges. Do this by changing an electron lone-pair to a multiple bond. 7. Recalculate formal charges.		16	4	12	0

DRAWING SIMPLE LEWIS STRUCTURES

Example Three: Draw the Lewis structure for sulfuric acid (H_2SO_4)

Step	Structure	Valence Electron Counts (Total – Bonds – Pairs = Remaining)			
		Total	In Bonds	In Lone-Pairs	Remaining
1. Write the central atom, which is the least electronegative atom in the formula other than hydrogen (H). Hydrogen is never the central atom. Hydrogens are usually bonded to surrounding atoms. 2. Write the remaining atoms surrounding the central atom. 3. Determine the total number of valence electrons (VE) for all atoms. Add electrons to the total for negatively charged species; subtract electrons from the total for positively charged species (e.g., add two electrons for a species with a charge of -2).	 S = 6 O = 6 x 4 H = 1 x 2 Charge = 0 Total = 32	32	0	0	34
4. Draw single bonds from the central atom to all remaining atoms. Then, subtract two electrons from the total VE for each bond drawn.		32	12	0	20
5. Distribute remaining electrons around atoms in the most pairs as possible to satisfy the octet rule. Start with the most electronegative atoms. Then, calculate all formal charges.		32	12	20	0
6. Draw a resonance structure that maximizes the number of atoms that obey the octet rule and minimizes the number of formal charges. Do this by changing an electron lone-pair to a multiple bond. 7. Recalculate formal charges.	 Octet exception: Sulfur can have an expanded octet!	32	16	16	0