

The Basic Lewis Structure Streamlined Algorithm

Here is a nicely streamlined algorithm for constructing a Lewis diagram. We'll use SO_2 as our example.

1 Count the total number of valence electrons in all the atoms in the chemical formula.	SO_2 S: $6 \times 1 = 6$ O: $6 \times 2 = 12$ total: 18 valence electrons
2 Distribute the terminal atoms around the central atom.	O S O
3 Multiply the number of Hydrogen Atoms by 2 and the number of all other atoms by 8. Add those numbers.	S: $8 \times 1 = 8$ O: $8 \times 2 = 16$ total: 24 needed electrons
4 Subtract the valence electrons from the needed electrons & divide this difference by 2. This is the number of covalent bonds you need	$\frac{1}{2}(24 - 18) = 3$ We need 3 bonds
5 Connect the central atom to the peripheral atoms with the required number of bonds. Then fill out each atom's octet with lone pairs.	$\text{:}\ddot{\text{O}}\text{--}\ddot{\text{S}}\text{=}\ddot{\text{O}}\text{:}$
6 If you have valence electrons left over, add them as lone pairs to the central atom. ▶ This allows for oddities like SF_4	$\begin{array}{c} \text{:}\ddot{\text{F}}\text{:} \\ \\ \text{:}\ddot{\text{F}}\text{--}\ddot{\text{S}}\text{--}\ddot{\text{F}}\text{:} \\ \\ \text{:}\ddot{\text{F}}\text{:} \end{array}$

Advanced Steps: Select Among Resonance Structures (Using Formal Charges)

Calculate Formal Charges

Formal charge (FC) is calculated on a per-atom basis; the FC of the molecule is the sum of the individual FC's.

Calculating formal charge (each atom)

$$\text{FC} = V - N - \frac{1}{2}B$$

V = Valence electrons in neutral atom

N = Non-bonding electrons (in lone pairs)

B = Bonding electrons (shared with other atoms)

Shortcut from Lewis Structure

$$\text{FC} = V - \text{dots} - \text{sticks}$$

Choosing among Resonance Structures

Select among resonance structures for your Lewis structure using the following guidelines:

- ▶ Minimize FC
- ▶ Minimize charge separation
 - ▷ Difference in positive and negative FC charges
- ▶ Negative FC's should be on more electronegative atoms

Note that for polyatomic ions, the total FC should equal the ion's charge.