Steps for Determining Lewis Dot Structures
(Introduction to Chemistry)

Example: CCl₄

**Step 1:** Determine the total number of valence electrons in the molecule.

valence e⁻ for C + 4 (valence e⁻ for Cl) = total number of valence electrons

\[ 4 + 4(7) = 32 \text{ total electrons} \]

*Note: When determining the Lewis structure of a positive ion, subtract the charge from the total number of electrons.

\[ \text{NH}_4^+ = N + 4(H) - 1 = 5 + 4(1) - 1 = 8 \]

*Note: When determining the Lewis structure of a negative ion, add the charge to the total number of electrons.

\[ \text{SO}_4^{2-} = S + 4(O) + 2 = 6 + 4(6) + 2 = 32 \]

**Step 2:** Draw a skeleton for the molecule, which connects the atoms with single bonds. The atom with the most available bonding sites is the central atom.

![Skeleton for CCl₄](image)

**Step 3:** Subtract the number of electrons in the bonds from the total number of valence electrons. Remember that each bond has 2 electrons.

32 total electrons – 4 bonds (2 electrons/bond) = 24 electrons remaining

**Step 4:** Place the remaining electrons on the outside groups as lone pairs. Place lone pairs on the central atom last.

![Lewis Structure of CCl₄](image)

**Step 5:** Subtract the total number of electrons added as lone pairs from the number of electrons remaining.

24 electrons remaining – 24 electrons as lone pairs = 0 electrons left
Step 6: Determine whether all the atoms in the structure have eight total electrons around them.

C has 8 total electrons
each Cl has 8 total electrons

*Note: The following atoms are exceptions to the octet rule: H = 2 electrons, He = 2 electrons, Li = 2 electrons, Be = 4 electrons, B = 6 electrons, Al = 6 electrons

Step 7: If the atoms don’t all have 8 total electrons around them, add double bonds or triple bonds to accommodate the electron deficient atoms by moving lone pairs into bonds. See example below.

Example: CO$_3^{2-}$

Step 1: Determine the total number of valence electrons in the molecule.
$4 + 3(6) + 2 = 24$ total electrons

Step 2: Draw a skeleton for the molecule, which connects the atoms with single bonds. The atom with the most available bonding sites is the central atom.

Step 3: Subtract the number of electrons in the bonds from the total number of valence electrons. Remember that each bond has 2 electrons.

$24$ total electrons $-$ $6$ electrons in bonds $= 18$ electrons remaining

Step 4: Place the remaining electrons on the outside groups as lone pairs. Place lone pairs on the central atom last.
Step 5: Subtract the total number of electrons added as lone pairs from the number of electrons remaining.

18 electrons remaining – 18 electrons as lone pairs = 0 electrons left

Step 6: Determine whether all the atoms in the structure have eight total electrons around them.

C has 6 total electrons
Each O has 8 total electrons

Step 7: Carbon only has 6 electrons around it so you have to add one double by moving one lone pair. It does not matter where the double bond is located.