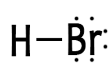
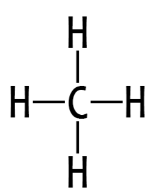
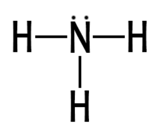
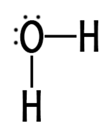
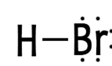
Lewis Structure Strategies

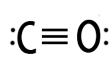
Method One: Trial & Error
The trial and error method involves counting the number of valence electrons available, and then drawing bonds until every atom satisfies the octet rule.

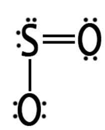
This method is how I learned to do this in high school. It will usually frustrate students, so it is not a good method for teaching because it will usually frustrate students.

Method Two: Looking for Patterns
The looking for patterns method focuses on how groups on the periodic table usually bond. The normal number of bonds for each group are shown in the table below. I also included a common example for each group that covalently bonds.

hydrogen	group 14	group 15	group 16	group 17
1 bond	4 bonds	3 bonds	2 bonds	1 bond
				

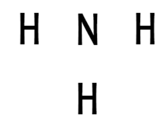
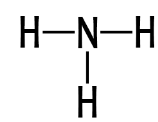
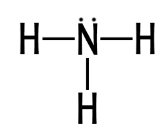
This is a good method to use as a starting point, but it is not the one I teach because exceptions definitely exist. Below are two exceptions that occur in common molecules. This is how I approach Lewis structures, but I find that the exceptions can make it confusing for students. I use this method for my more advanced students.





Method Three: Calculating Bonds
This method uses some basic arithmetic to determine the number of bonds and lone pairs. It always works, so it is a good way for students who need a structured step-by-step approach.

Step	Example with NH_3
1. Use the octet rule to determine how many valence electrons each atoms NEEDS. (everyone needs 8, except hydrogen needs 2)	Need: $8 + 3(2) = 14$
2. Use the periodic table to determine how many valence electrons each atom HAS.	Need: $8 + 3(2) = 14$ Have: $5 + 3(1) = 8$

Step	Example with NH_3
3. Subtract HAVE from NEED to find how many electrons are being SHARED. Dividing this number by two will give us the number of bonds since every bond is two shared electrons.	Need: 8 + 3(2) = 14 Have: 5 + 3(1) = 8 Shared: 6
4. Subtract SHARED from HAVE to find how many electrons are UNSHARED. This is the number of dots we will have to draw in our structure.	Need: 8 + 3(2) = 14 Have: 5 + 3(1) = 8 Shared: 6 Unshared : 2
5. Start the drawing by placing the element listed first in the center and arranging the other atoms around it. The only exception is that hydrogen can never be in the center. Do not focus on the arrangement and shape yet. That will be covered in VSEPR theory.	
6. Draw the bonds (shared divided by two) from the central atom out to the other atoms. A bond must always be between two atoms, and you will never draw a bond between the outer atoms.	
7. Use the octet rule to check and make sure that every atom has the electrons that they need. Each bond is counted as two electrons, and can be counted by both atoms that share the bond. Any atom that still needs additional electrons receives dots until it has all that it needs.	

I then repeat this method to introduce multiple bonds (more bonds than outer atoms) and resonance. I then follow up with a simple classwork assignment. I have volunteers put their work on the board to make sure that everyone has a decent understanding. I then follow up with a homework handout to help everyone practice this new skill.

For double bonds, I use CO_2 and show how we need to keep placing bonds until all of the bonds are accounted for. For resonance, I use SO_2 and show them how the third bond can be with either oxygen. I make them draw both possibilities with a double-headed arrow between them.