

Activity 12: Lewis Structures

Learning Objectives

Part 1 Establish the relationship between the number of valence electrons present in the period 1–3 nonmetals and number of bonds that the atom typically makes in a molecule

Part 2 Draw Lewis structures for covalent compounds containing C, O, N, and/or halogens.

Estimated Completion Time 45–60 Minutes

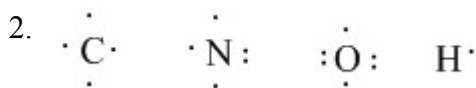
Instructor Information

The Lewis structures developed here are for neutral molecules with the exception of ammonium ion, which is introduced in the Skill Development. This structure and the structure of the functional groups protonated amine and carboxylate will be seen later. It is useful to assign the charge to the N atom versus using a bracket notation due to the later context.

ANSWERS TO QUESTIONS

Part 1. Electron Dots and Octets

1. Each dot represents an electron.



3. Each chlorine shares one of its electrons in the bond.

4. A covalent bond is made up of two electrons.

5.

Element	No. of Valence Electrons in the Atom	No. of Electrons Needed to Form Octet	No. of Bonds Formed to Form Octet	No. of Bonded Electrons in Molecule	No. of Lone Pair of Electrons in Molecule	Total No. of Electrons in Valence Shell in Molecule
H*	1	1	1	2	0	2
Cl	7	1	1	2	6	8
C	4	4	4	8	0	8
N	5	3	3	6	2	8
O	6	2	2	4	4	8

*Note: Hydrogen accommodates only two electrons in its valence shell due to its position on the periodic table.

6. C, N, and O can form double bonds. C and N can form triple bonds.

7. The number of valence electrons in the atom plus the number of bonds formed by the element in a molecule equals the stable number of 8. (Shell 1 is an exception with stability at 2.)

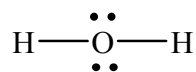
Activity 12: Skill Development—Electron Dots and Octets

- 4
 - 1
 - 3 (note, can extend octet)
 - 2
- 1
 - 4
 - 2 (note can extend octet)
 - 3

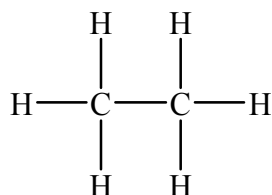
Part 2. Drawing Lewis Structures

- 8
- 8

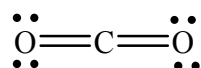
3.



4.

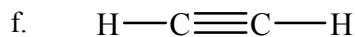
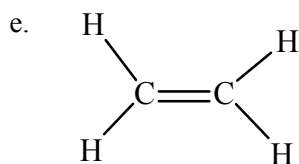
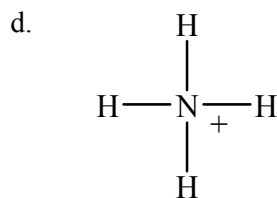
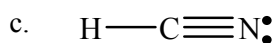
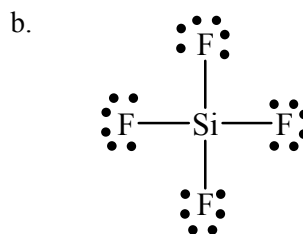


5.

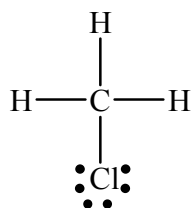


6. Answers will vary; however, students should start to recognize that C, N, O, and halogens are going to obey the octet rule and that H can only form one bond. In addition, neutral molecules will have no lone pairs on C, one lone pair on N, two lone pairs on O, and three lone pairs on halogens.

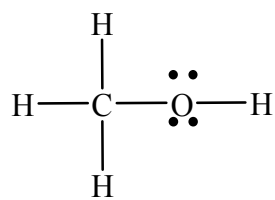
Activity 12: Skill Development—Drawing Lewis Structures



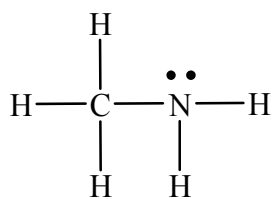
g.



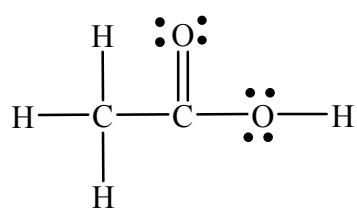
h.



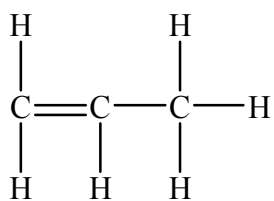
i.



j.



k.



l.

