

Content: Students practice translating between structural formulas and Lewis dot structures. Students are introduced to double and triple bonds.

Time Required: 45 minutes

Target student audience: Year 1

College prep chemistry

ChemSense User Level: Beginning

ChemSense Tools used: Drawing tools

Text notes - summarize

Context: Students have learned the relationships between Lewis dot structures, the octet rule, and structural formulas.

Chemistry Concepts in Activity (linked to CA stds, NSES, Benchmarks, ChemSense 5 themes):

Double and triple bonds: part of NSES Content Standard A/Structure and Properties of Matter

Pre-requisite Chemistry Concepts: Lewis dot structures, structural formulas, octet rule

Inquiry Skills:

Formulate and revise scientific explanations and models using logic and evidence (NSES)

Communicate and defend a scientific argument (NSES)

ACTIVITY Summary:

1. ChemCatalyst: Draw Lewis dot structures for molecules containing double and triple bonds.
2. Concept introduction: How molecules containing double and triple bonds satisfy the octet rule.
3. Activity: Application of Lewis dot structures to a variety of molecules, some containing double and triple bonds.
4. Discussion: Strategies for creating Lewis dot structures that satisfy the octet rule.
5. Check-in: Use clues about a molecule to come up with possible Lewis dot structures.

ACTIVITY

1. ChemCatalyst

Draw Lewis dot structures for N_2 , O_2 , F_2

2. Concept introduction

Double and triple bonds are represented in Lewis dot structures by two pairs and three pairs of electrons, respectively.

Use CO_2 as an example to show how unpaired electrons can be moved around a Lewis structure to form double and triple bonds, so that molecules satisfy the octet rule.

3. Activity

Using the ChemSense drawing tool, students draw Lewis dot structures for molecules that contain specific numbers of central atoms. The number of hydrogen atoms is not specified, allowing students to come up with multiple possible structures for each item, if they use double and triple bonds.

Students are provided with a “cut and paste” library of Lewis symbols for carbon, hydrogen, oxygen, and nitrogen, allowing them to quickly focus on the arrangement of these atoms, rather than the creation of the individual Lewis dot symbols.

The items are:

- 2 carbon atoms bonded together
- 1 carbon atom and 1 oxygen atom
- 1 carbon atom and 1 nitrogen atom
- 1 carbon atom and 2 oxygen atoms

Student work is organized by the following questions:

- Draw the Lewis structure for the starting atoms.
- Add hydrogen atoms to satisfy the octet rule.
- How many H's are needed?
- Draw the structural formula for the molecule.
- Write the molecular formula for the molecule.

4. Discussion

Focus the student discussion on how multiple possible structural formulas satisfy the octet rule. The use of double and triple bonds when drawing structures reduces the number of hydrogen atoms used in each molecule to satisfy the octet rule.

5. Check-in

We know two things about a certain molecule. We know that its molecular formula is $C_2H_4O_2$ and we know that it has one $C=O$ in it. Using Lewis dot symbols and the octet rule to guide you, draw at least one possible structure for this molecule. (There are a total of three possible.)

This exercise may be completed on paper or using ChemSense.

Rubric/s for scoring:

Activity

Insufficient mastery	Structures do not satisfy the octet rule or contain an incorrect total number of valence electrons. Some activity items are left blank.
Basic mastery	Structures satisfy the octet rule and contain the correct total number of valence electrons. All activity items are completed. Multiple structures containing double and triple bonds are shown for at least one item.
Exceptional mastery	Structures satisfy the octet rule and contain the correct total number of valence electrons. All activity items are completed. Multiple structures containing double and triple bonds are shown for all question items.

Links: Living By Chemistry, Lawrence Hall of Science, UC Berkeley, Unit 2 Investigation II, Lesson 5.

Integrated Uses: