

Content: Students begin to understand the rationale for molecular structures, using the HONC 1234 rule that indicates the number of bonds that each element typically forms.

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 seen a number of functional groups and are now learning the skills needed to draw them on their own.

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

Bonding tendencies of hydrogen, carbon, oxygen and nitrogen: part of NSES Content Standard A/Structure and Properties of Matter

Pre-requisite Chemistry Concepts:

Structural formula

Inquiry Skills

Identify questions and concepts that guide scientific investigations (NSES)

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

Communicate and defend a scientific argument (NSES)

ACTIVITY Summary:

1. ChemCatalyst: Find bonding patterns in two sample molecules
2. Concept introduction: Introduce HONC 1234 rule.
3. Activity: Draw structures of three molecules in ChemSense
4. Discussion: Review structures, consider isomers

5. Check-in: Evaluate accuracy of structural formulas

ACTIVITY

1. ChemCatalyst

Examine the two following molecules. What patterns do you see in the bonding of hydrogen, oxygen, carbon and nitrogen?

2. Concept introduction

Discuss the ChemCatalyst question, focusing on the connecting patterns of the elements in those structural formulas.

Hydrogen forms one bond.
Oxygen forms two bonds.
Nitrogen forms three bonds.
Carbon forms four bonds.

Summarize the HONC 1234 mnemonic.

Double and triple bonds still follow the HONC 1234 rule.

3. Activity

Using ChemSense, create possible structural formulas for each of the following molecular formulas.



- Start with the carbon, oxygen and nitrogen atoms – connect them to each other.
- Fill in with the hydrogen atoms.
- Problem solve until you have the correct number of bonds for each element.

View and comment on at least two others students' structural formulas. Do they all follow the HONC 1234 rule?

Extension questions

- Is there more than one possible structural formula for each molecular formula?
- Which of these additional possible structural formulas are actually different molecules?

4. Check-in

Are the following molecules correct according to the HONC 1234 rule? If not, what specifically is wrong with them?

(structures in Living By Chemistry)

Rubric/s for scoring:

Activity	
Insufficient mastery	Bonding patterns violate the HONC 1234 rule. Only one possible structural formula is created for each molecular formula.
Basic mastery	Bonding patterns meet the HONC 1234 rule. More than one possible structural formula is created for each molecular formula.
Exemplary mastery	Bonding patterns meet the HONC 1234 rule. Different structural formulas are created for each molecular formula, and isomers are clearly distinguished from different molecules.

Links: Living By Chemistry, Lawrence Hall of Science, Unit 2, Investigation II, Lesson 2

Integrated Uses: may be used as part of introduction to organic chemistry, environmental chemistry, or biochemistry.