

Lesson 1: Why Model?

Prior Knowledge:

- Students will know that matter is made up of atoms bound together by forces.
- Students will be able to name the electron, proton, and neutron, their charge, and their location in the atom.

Objective:

- *I can make a model to represent something from real life.*

Activity:

- Students model their ideal pizza. Students answer the questions “What can my model represent?, What information can I not know from my model?”.

NGSS Standards:

- **HS-PS1-2:** *Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.*

Note: Pizza will be used to represent atoms and atomic forces. Make sure to include the “Cheese Force”, which holds the toppings to the pizza, as a stand in for coulomb forces holding the electrons to the nucleus. Heat from baking pizza binds everything together.

Lesson 2: Octet Rule as a Model

Prior Knowledge:

- This lesson should be taught after or concurrently with students learning about Lewis dot structures (usually the 3rd or 4th quarter).

Objective:

- *I can use a model to help me understand the octet rule.*

Activity:

- Use a jigsaw puzzle activity from Silva et. al. to model structural formulas and electron sharing, comparing them to Lewis structures.

NGSS Standards:

- **HS-PS1-1:** *Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level.*

Note: The puzzle comes from the following article:

Organic Connections: A Chemical Jigsaw Puzzle for Learning Structural Formulas

Valdinei S. Silva, Edimar P. Nunes, Luzia A. Moura, Cíntia L. S. Gomes de Sá, Vera L. S. Augusto Filha, and Anderson R. Albuquerque

Journal of Chemical Education **2022** 99 (11), 3797-3804

DOI: 10.1021/acs.jchemed.2c00249

Lesson 2.5: What Is a Stick and Ball Model?**Objective:**

- *I can understand and interpret a stick and ball model of a molecule.*

Activity:

- Teacher demonstration using molecular model kits or physical/digital models.

NGSS Standards:

- Not explicitly NGSS aligned.

Note: This is a mini lesson for my own student population, many of whom will not be familiar with stick and ball representations of molecules. Knowledge of this representation is necessary for understanding the videos made using VMD in the Kral research group.

Lesson 3: Visual Molecular Dynamics (VMD) in the Laboratory**Objective:**

- *I know what a model represents and how it can help me understand a phenomenon.*

Activity:

- Teacher presents VMD and lab experience. (Short slideshow).
- Students identify a phenomenon they would like to model and design a representation.
 - Students will choose something from their life they would like to model
 - Scaffolding ideas: modeling a recipe for a family dish, checklist for organizing a party, time table for scheduling a day out with friends
 - Push: can students represent some or all aspects in a drawing? If not a drawing how are they conveying their ideas to others.

NGSS Standards:

- **HS-PS2-6:** *Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*