MODELING MOLECULES

Prep Time: 15 minutes
Teaching Time: 1.5 hours

INSTRUCTIONS
Grade 8

Science Teacher Education Program

Science Concept:

Molecules consist of combinations of certain atoms.

Objectives:

The student will:

- create a model of a small molecule;
- verbally explain the model;
- explain the model in writing; and
- apply modeling principles to a large molecule.

GLEs Addressed:

Science

[8] SB3.2 The student demonstrates an understanding of the interactions between matter and energy and the effects of these interactions on systems by exploring through a variety of models (e.g., gumdrops and toothpicks) how atoms may bond together into well defined molecules or bond together in large arrays.

[8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

Materials:

- Toothpicks
- Mini-marshmallows, in several colors
- Science journals/notebooks*
- OVERHEAD: "Ammonia Molecule"
- OVERHEAD: "Molecules to Model"

Activity Procedure:

Gear Up

Process Skills: observing and modeling

1. Ask students to define a molecule and explain how a molecule differs from an atom.
2. Show students OVERHEAD: "Ammonia Molecule." Discuss how the molecule is composed of two different atoms, hydrogen (H), and nitrogen (N).
3. Illustrate how a model of a molecule can be created using one color of mini-marshmallows to represent a certain kind of atoms, and another color of mini-marshmallows to represent another kind of atoms (for example white for oxygen and blue for hydrogen.)

Teacher's Note: If mini-marshmallows are not available in multiple colors, gumdrops are a suitable substitute.

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*A science journal/notebook is a place to record observations, write down questions, and organize thoughts. It acts as a primary source document for students and as a record of procedures followed while working. The science journal/notebook allows students to work and think like a scientist while doing an investigation and/or experiment. There is no single way to organize a science journal/notebook. Fore more information on science journals/notebooks, refer to the following books:

Klentschy, M. (2008). *Using science notebooks in elementary classrooms*. Arlington, VA: NSTA Press.

Fulton, L., and Campbell, B. (2003) *Science notebooks: Writing about inquiry*. Portsmouth, NH: Heinemann.

Explore

Process Skills: classifying, modeling, and communicating

4. Display OVERHEAD: "Molecules to Model." Ask students to work in pairs to model one molecule from the list. Students should be able to name the elements/atoms represented by the model, and explain which atoms are represented by which color mini-marshmallows.

Generalize

Process Skills: inferring and communicating

5. As a class, compare and discuss students' models. Instruct students to sketch their molecule in their science journals or on blank sheets of paper and write answers to the following questions:
   a. Can marshmallows and toothpicks be used to represent larger molecules? Explain.
   b. How many different colors of marshmallows will be needed and why? Explain.

Apply/Assess

Process Skill: communicating

6. Instruct each pair of students to select a larger molecule to model.
7. Ask students to draw a picture of their completed molecule in their science journals or on blank sheets of paper.

Extension Ideas:

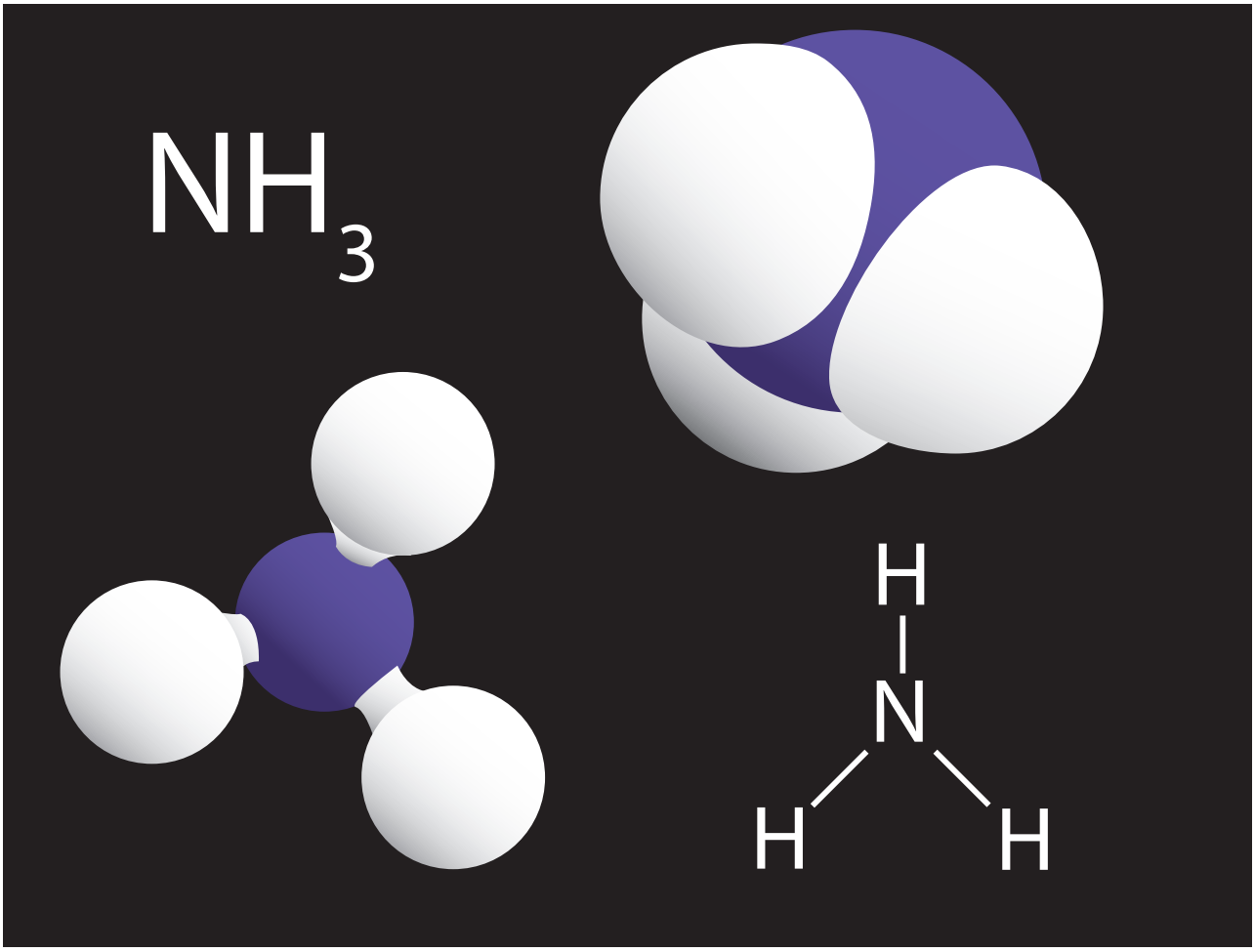
Process Skill: modeling

Model DNA helixes with various colors of licorice to represent the different types of bonds.

MODELING MOLECULES

RUBRIC

Objective	GLE	Emergent	Developing	Proficient	Advanced
The student successfully models a molecule.	SB3.2	No attempt was made to model atoms or molecules.	Student is beginning to demonstrate mastery of modeling atoms.	Student can model molecules accurately in most applications.	Student has mastered replication of all elements in given molecules.
The student explains model accurately and clearly.	SB3.2	The student does not explain model.	The student explains model, but does so inaccurately.	The student explains model accurately and clearly.	The student explains model accurately and clearly and is able to answer supporting questions.
The student applies modeling principles to a larger molecule.	SA1.1	No attempt was made to apply molecular modeling techniques to a larger molecule.	An attempt at modeling molecules was made, but done incorrectly.	Student successfully models a larger molecule with assistance.	Student successfully models a larger molecule without assistance.



Ammonia Molecule

- What does "N" mean?
- How many "N's" are in this molecule?
- What does "H" mean?
- How many "H's" are in this molecule?

$CaCO_3$	(calcite)
$NaA1Si_3O_8$	(albite-sodic feldspar)
SiO_2	(quartz)
$C_6H_{12}O_6$	(sugar)
CO_2	(carbon dioxide)