Connected Chemistry
Modeling Matter Unit
Lesson 2: Modeling the World

Student's Lesson at a Glance

Lesson Summary

Students are introduced to scientific models and should be allowed to explore CCC simulations that they will be using for subsequent units. Through comparing and contrasting the models, students will discover when models are used and the benefits and limitations that are associated with models. This lesson also serves as a time when teachers introduce protocols about making observations with CCC models. Teachers will also introduce the importance of using and developing keys that describe models. Your teacher will spend some time with scientific writing with specific attention to claims and evidence. Supporting claims with evidence is an essential element of all lessons in CCC.

SWBAT (Students Will Be Able To)

Identify different types of models used in chemistry, compare and contrast different models, identify benefits and limitations of different models

Essential Vocabulary

Keep a list of all important words from this lesson. This list, in addition to the lists from other lessons, will make studying easier and improve scientific communication skills. The essential vocabulary from the unit is in bold. Additional words that will expand your scientific vocabulary are in italics.

CCC Reminder

- In this lesson you will learn how to make good scientific observations. Follow the sketching and observation protocol; the more you practice these skills, the more accurate you will become.
- Develop your own language to write vocabulary definitions so that you can use scientific language with confidence in your writing.
- Use the vocabulary section and note section to take good notes so that studying for tests and quizzes is easier.
- Draw a key when you are sketching. Keys can help you and others decode your sketches at a later time.
- Pause the simulations when you are creating sketches.
- Support your claims with evidence.

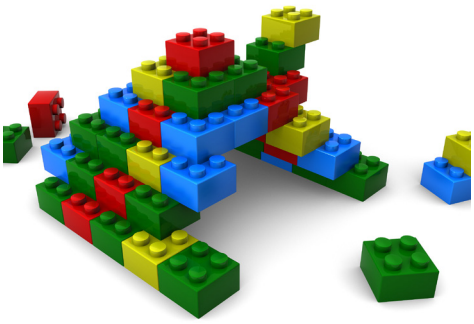
Notes

Homework

Upcoming Quizzes/ Tests

Activity 1: Connecting

Many students play with Lego® building blocks while growing up. With these blocks and their imaginations, children can build houses, skyscrapers, forts, or other designs. From this kind of play, children develop important skills to help them throughout the rest of their lives.



1. What skills did you gain by playing as a child?

One of the many skills children gain through play is modeling. Modeling is a skill used by scientists every day. Consider the following list:

- A picture showing the parts of an atom
- A volcano built as a science project
- A teacher demonstrating a formula on the chalkboard
- A recipe
- A map of the United States
- A diagram to hook up a car's sound system

2. What do all of these things have in common?

3. In your own words, what is a **model**?

4. Think about the examples of models in the reading above and how they are used. Why would we use models in chemistry?

Models can be used to represent complex or simple systems. A **system** is a part of a larger whole chosen for analysis in which all variables are defined, but independent of the **environment** (everything outside of the system). During analysis, the environment is ignored except for its effects on the system. The system may be separated from the environment by a boundary, such as a the walls of a container.

For example, when studying the human body, teachers may introduce one system at a time - skeletal, nervous, respiratory, etc. These systems are separated by tissues. All parts of each body system are defined as well as how environmental factors such as disease and nutrition can affect them.

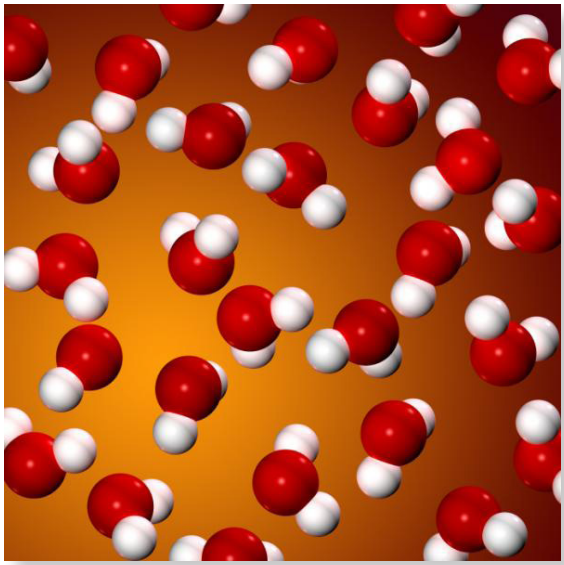
In CCC, closed and open systems will be explored. A **closed system** is like a jar with a lid: it cannot exchange matter with the outside environment. An **open system** is like a jar without a lid: it can exchange matter with the outside environment.

5. What are the benefits of studying a system as opposed to looking at the whole environment?

6. A sealed room is a system. Define the variables, boundaries, and the environmental factors that may affect it. Would you classify a sealed room as an open or closed system? *Support your claim with evidence.*

Activity 2: Facilitated Discussion: Are All Models the Same?

Models are helpful tools for understanding concepts in chemistry. In this activity, your teacher will show you several images. You will compare and contrast types of models.



Part 1

Use Simulation 1, ***Set 1***

Your teacher will project a simulation of water molecules.

1. Compare the simulation to the molecular picture of water molecules on the right. What are similarities between the two models?

2. What are differences between the two models?

3. When might it be helpful to use a simulation over a picture in a textbook?

Part 2

Use Simulation 1, ***Set 1***

Your teacher will project two simulations.

The CCC Simulation vs. Kral Visualization can be found at http://www.connchem.org/

4. Compare the two simulations. What are similarities between the two models?

5. What are differences between the two models?

6. Which model would be more useful for a scientist working in a lab? *Support your claim with evidence.*

7. Which model would be more useful for someone who is taking an introductory science class? *Support your claim with evidence.*

Part 3

Use Simulation 1, ***Set 1***

Your teacher will project a simulation of water molecules and a physical model of water molecules.

8. Compare the simulation to the physical models. What are similarities between the two models?

9. What are differences between the two models?

10. When would using a physical model be more beneficial than using a simulation?

Activity 3: Making Scientific Observations

Part 1

Use Simulation 1, ***Set 1***

In CCC you will be using simulations to explore substances and chemical reactions. It is important that you make detailed scientific observations of the simulations. Using the simulation provided by your teacher, complete the following questions. Your sketches are also a way to communicate like a scientist. Using shading or colored pencils as well as symbols (such as arrows) in your sketches will help you and others who look at your sketches to understand your observations.

Sketch what you see in the simulation	Observations

11. In your observations, you may have noticed the *appearance* of the molecules. How would you define appearance based on your experience with the simulation?

12. In your observations, you may have noticed the *location* of the molecules. How would you define location based on your experience with the simulation?

13. In your observations, you may have noticed the *interactions* of the molecules. How would you define interactions based on your experience with the simulation?

14. In your observations, you may have noticed the *motion* of the molecules. How would you define motion based on your experience with the simulation?

Part 2

As a class, share your observations with each other. Your teacher will write all the ideas on the board. Classify any observations that are different from your observations into the four categories in the chart below, using the definitions you made for guidance.

Appearance	Location	Interactions	Motion

Each time you use the simulations you will need to make observations of four characteristics:

- Appearance
- Location
- Interactions
- Motion

Chemists are able to classify, identify, and make predictions about substances using these four characteristics. Describing these four characteristics in the simulations is a form of qualitative scientific observations.

15. What problems could arise if you are not consistent in the way you make scientific observations?

16. Having good observational skills can be useful for many other careers. What other careers can you think of that might use observation as a skill? Explain why it would be important for that career.

17. How could your five senses limit your ability to make observations ?

18. What safety considerations are there when using your five senses to make scientific observations?

Part 3

Use Simulation 1, ***Set 1***

Your teacher will give you a few minutes to explore the simulation.

Once you are familiar with the controls, begin the activity.

The simulation allows you to adjust the size of your molecule by zooming in and out. Give it a try. Pay special attention to the functions of all the buttons, sliders, and data recorders. You will need to make your own key. Make sure to include all symbols and colors you use.

19. Can you adjust the size of molecules, without adding more atoms, in the real world? *Support your claim with evidence.*

20. How could the ability to adjust the size on the simulation help or hinder you as a student?

21. Do you think that the observations you made about the model would hold true for a real molecule of water? *Support your claim with evidence.*

22. Do real molecules have color? *Support your claim with evidence.*

Some simulations will allow you to work with substances such as concentrated acids and bases, such as hydrochloric acid and lithium hydroxide, as well as toxic gases and liquids, such as bromine and mercury.

23. Why is this a helpful feature of this kind of model?

Add one more water molecule to the screen.

24. Is adding one molecule the same as adding one milliliter of water? *Support your claim with evidence.*

You can control the velocity of the molecules in the simulation using the speed slider. Practice with your simulation.

25. Can you control the speed of molecules ***directly*** in real life? *Support your claim with evidence.*

26. How might you change the velocity of the molecules in a laboratory experiment? *Hint: Look at some of the other options provided by the simulation's interface.*

Add more molecules of water and observe any changes to the data measurement tools (for example, plots and monitors) on the screen.

27. What does the simulation allow you to do with data that a real experiment may not?

28. What are some of the benefits and limitations of using a simulation to model chemical interactions?