Connected Chemistry

Modeling Matter Unit

Lesson 4: Physical Changes

Student's Lesson at a Glance

Lesson Summary

Students will make macroscopic and submicroscopic observations as water freezes into ice or evaporates into vapor. By observing these phenomena through the simulation, students should be able to gain more insight into the nature of physical changes. Teachers may select an optional activity that requires the building of physical models of ice and liquid water so students have a hands-on approach to the states of matter.

SWBAT (Students Will Be Able To)

- Describe how water differs submicroscopically in the different phases
- Define what a physical change is
- Create physical models of water in solid and liquid stages
- Identify the difference in structure of solid and liquid

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

- Follow the sketching and observation protocol; the more you practice these skills, the more accurate you will become. Remember to draw a key when you are sketching.
- Pause the simulations when you are creating sketches.
- Use the vocabulary section and note section to take good notes so that studying for tests and quizzes is easier.
- Supporting your claims with evidence is not only a skill that scientists use, but a skill that will help you in other classes and everyday life.
- In the simulations in this lesson, you will adjust the heat to change the temperature. This will allow you to freeze or liquefy substances. The temperature of a system is changed by adding or removing heat energy. In later units, you will learn more about why temperature and heat are not the same thing.

Notes

Homework

Upcoming Quizzes/ Tests

Activity 1: Connecting

1. What do you think is the difference between a physical and chemical change?

Water becomes steam when heated and ice when cooled. As the water is heated and cooled, water undergoes a **physical change**. How do these changes look on the macroscopic level? How do the water molecules look on the submicroscopic level when they are heated? How do water molecules look on the submicroscopic level when they are cooled?

Use what you know about steam and ice to make prediction drawings below.

Sketch a **macroscopic** view of water in a cold freezer	Sketch a **macroscopic** view of water on a hot stove
Key	

Sketch a **submicroscopic** view of water in a cold freezer	Sketch a **submicroscopic** view of water on a hot stove
Key	

Activity 2: Physical Changes

Simulation

Use Simulation 3, ***Set 1***

Use the simulation to generate each of the three conditions below.

Step 1

Modify the simulation to generate liquid water. Record your observations..

Sketch submicroscopic view of liquid water	Observations
	Simulation Temperature
	Motion
	Appearance
	Interactions
	Location
Key	

Step 2

Modify the simulation to generate solid ice. Record your observations.

Sketch submicroscopic view of ice	Observations
	Simulation Temperature
	Motion
	Appearance
	Interactions
	Location
Key	

Step 3

Modify the simulation to generate vaporous water. Record your observations.

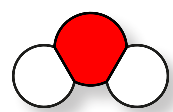
Sketch submicroscopic view of water vapor	Observations
	Simulation Temperature
	Motion
	Appearance
	Interactions
	Location
Key	

2. What is the relationship between the motion of the water molecules and the heat added to the system in the simulation?

3. On the submicroscopic level, did the composition and location of each water molecule change after you generated ice or water vapor?

Activity 3: Physical Modeling of Water

The previous activity using the simulation introduced one way of representing water. Another way to represent water is through the use of physical models that can be manipulated by hand. In this activity you will compare and contrast physical models and simulations.



To start, create physical models of solid ice and liquid water. Follow the steps below to create the two models.

Part 1: Creating Ice

1. Create a Y formation and a ring formation using the pattern shown in Figure 1A. Hint: Three white hydrogen should be flat on the table for both structures.

2. Without rotating the Y, place it on top of the ring that your created (see Figure 1B). Make sure the magnets click together so the whole structure can be picked up.

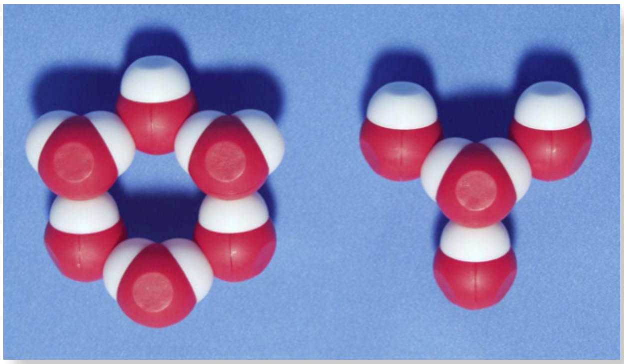


Figure 1A.

Part 2: Creating Liquid Water

3. Take the ice model you created and "squish" it together with your hands as shown in Figure 1C.

4. Are any of the atoms attracted to one another? If so, describe which atom(s).

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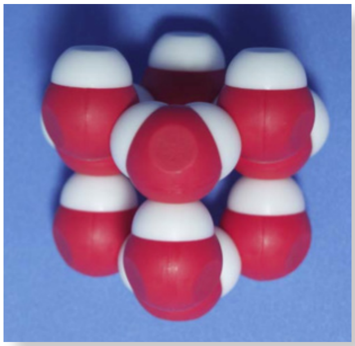

Figure 1B.

5. Are any atoms repelled by one another? If so, describe which atom(s).

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6. How would you compare the shape of your ice structure compared to your liquid structure?

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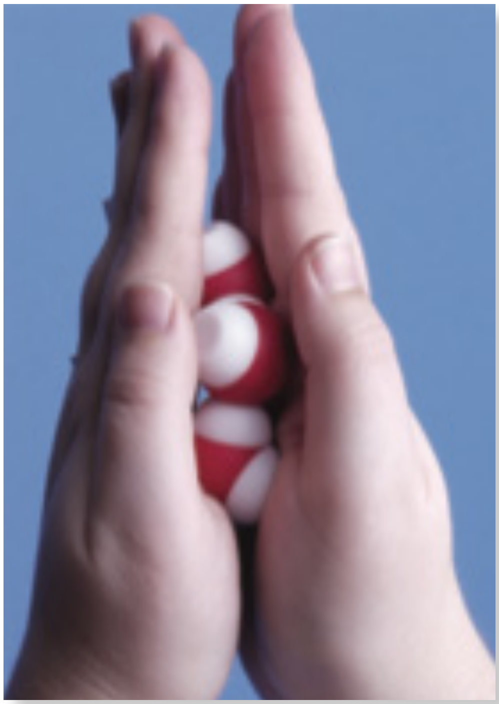

Figure 1C.

7. Are actual water molecules magnetic like the physical model? *Support your claim with evidence.*

8. How are the physical models similar to the liquid water simulation?

9. How are the physical models different from the simulation and from real molecules?

Part 3: Comparing Ice and Water

10. What is noticeably different about how the molecules are arranged when you compare the model of solid ice to the model of liquid water?

11. Using what you learned with physical models, describe what you think happens on the submicroscopic level to liquid in a soda can when it is placed in the freezer overnight.

Consider the following claim.

"The best model to explain how a liquid becomes a vapor is the CCC simulation."

12. Provide evidence from your observations and drawings of both the physical models and simulations to either support or reject the claim above.

13. The models you created were for water. Do you think other substances have similar submicroscopic arrangements of atoms as solid and liquid forms of water? *Support your claim with evidence.*

Your teacher will show you a model of sodium chloride, a solid salt, compared to ice.

14. Which solid (ice or sodium chloride) do you think is more representative of the submicroscopic structure of other solids, such as gold? *Support your claim with evidence.*

Lesson Reflection Questions

15. What makes ice different than other solids?

16. A student squeezes an orange and collects juice. Is the act of squeezing an orange a chemical or physical change? *Explain your answer using evidence.*