Patterns in Crystal Structures

STEM: The Math, Science, and Art of Water Molecules Using Magnetic Models

Student Handout

Pre-activity questions

1. Think of a snowflake. How many sides does it have? _____

2. Imagine you bring a snowball in the house and put it in a bowl. An hour later, you come back. What will be in the bowl?_____

Observations

1. What is a hexagon?

_____

_____

2. How many hexagons do you see in the ice you were given?

_____

3. How many water molecules are in this ice structure?

_____

4. Look at one water molecule. Draw a picture of what you observe. Color or label your water molecule to match the model.

The Math, Science, and Art of Water

Water is sometimes called H_2O. (We say "H - 2 - O".) This means there are 2 H, or hydrogen atoms, and 1 O, or oxygen atom.

5. In the model, what color is the H, or hydrogen? _____

6. In the model, what color is the O, or oxygen? _____

Models are similar to the real objects, but not ***exactly*** the same. These water models use magnets to show how water molecules interact. But in real water, there are no magnets.

Look at two water molecules. Explore how the two molecules act when you bring them close together. Consider what happens when you:

Bring 2 red oxygen atoms together.
Bring 2 white hydrogen atoms together.
Bring a red oxygen and a white hydrogen together.

7. Write a rule that describes your observations.

_____

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_____

States of Matter

8. Take 3 water molecules and slowly roll them between your hands. What do you feel and hear? Write your observations.

_____

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_____

9. With the water molecules in your hands, rub them together a little faster. What changes do you observe? _____

10. Now, slow down and stop rubbing your hands. Are the water molecules separated or stuck together? _____

You have just modeled what happens when you heat or cool down water. When you aren't rubbing your hands, there is little heat, and the water forms ice. When you heat it up (by rubbing your hands), you "melt" the ice and form water. If you heat it up a lot (rub your hands fast), you form water vapor or steam.

11. Write a description of the behavior of water when it is ice, water or steam in terms of how the molecules stick to each other.

_____

_____

_____

Reassembling the Ice

Follow the directions for building cubic ice.

12. How many hexagons do you see in this ice structure? _____

13. How many water molecules did you use to build this structure? _____

14. Is this the same ice structure you were given at the start of the activity? Explain your answer.

_____

_____

Modeling as a Practice of Science

15. How are the water molecule models like real water?

_____

_____

16. How are the water molecules models different from real water?

_____

_____

Extension

17. Compare the model of a sodium chloride crystal with the model of a hexagonal water crystal and write your observations. How are they similar? How are they different?

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