# Lesson 3: Molecules in Motion

## Objective:

Students will begin to understand how heat impacts the motion of molecules through the use of dramatic play.

## NGSC Standards:

PS3.A.1: The term “heat” as used in everyday language refers both to the thermal energy (motion of atoms or molecules within a substance) and the transfer of that thermal energy from one subject to another. In science, heat is used only for this second meaning; it refers to the energy transferred to the temperature difference between two objects.

PS1.A.3: Gases and liquids are made of molecules or inert atoms that are moving about relative to one another.

PS1.A.4: In a liquid, the molecules are constantly in contact with others.

## Essential Questions:

1. How does heat impact the motion of molecules?
2. How does the space between molecules change due to heat?

## Materials:

* Heat source such as a small room heater. Please note the heat source needs to be portable.

## Lesson Sequence:

1. Tell students that today they are going to be water molecules.
2. Ask students how a water molecule behaves when it is cold. [Cooling a substance decreases molecular motion, and the space between molecules decreases.]
3. As students what happens to water molecules when they are heated? [Heating a substance increases molecular motion and increases the space between the molecules.]
4. What about water at room temperature? [Water molecules move a little more than cold water but not as fast as hot water, and they have more space between the molecules than cold water but not as much as hot water.]
5. Now, tell students that each of them is a water molecule. They have to decide how they will act with the other water molecules around them. Tell them you will call out different temperatures, and they have to act out how the molecules will act given the temperature.
6. Begin calling out different temperatures:
7. Cold water: the students should not move much and be close together.
8. Hot water: the students should move a lot and move apart from one another.
9. Room temperature: They should not be as close as with cold water but not as spread apart as hot water, and they should move faster than cold water but not as fast as hot water.
10. Continue to call out the temperature names until all students understand the concepts.
11. Review with students the concepts learned about motion and heat in the lesson.

## Extension Activity:

Have students discuss the size of water molecules. Ask students whether hot water or cold water takes up more space than room temperature water [hot water takes up more]. You can physically do this by placing room temperature water into a graduated cylinder and then place hot water into the cylinder. The heated water will have a water line higher on the graduated cylinder than the warm water.

Adapted from Molecules in Motion: American Chemistry Society Middle School Chemistry Lesson Plans <https://www.acs.org/middleschoolchemistry/lessonplans/chapter1/lesson2.html>.