

THE HEAT IS ON

BENCHMARKS AND TASKS

SC.A.1.1.2 The student recognizes that the same material can exist in different states.

SC.A.1.1.3 The student verifies that things can be done to materials to change some of their physical properties (e.g., cutting, heating, and freezing), but not all materials respond the same way (e.g., heating causes water to boil and sugar to melt).

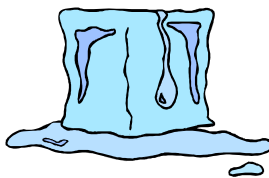
SC.B.1.1.4 The student knows that heat can be produced in many ways (e.g., by burning and rubbing).

SC.B. 2.1.1 The student recognizes systems of matter and energy.

- The student classifies matter as a solid, liquid, or gas, based on its properties and/or behaviors.
- The student demonstrates that some common materials, such as water and sugar, can be changed from one state to another by heating or cooling.

KEY QUESTION

How does heat cause a change in matter?



BACKGROUND INFORMATION

Matter is anything that takes up space and has mass. Matter on earth may exist in three states: solid, liquid, and gas. Adding or reducing heat causes matter to change from one state to another. A solid is something that maintains its shape. Its atoms vibrate in a fixed place. When heated to the melting point, the atoms vibrate out of their fixed space and become liquid.

A liquid maintains its volume but takes the shape of its container. When heat is applied, some atoms on the surface of the liquid vibrate enough to break away (evaporate).

A gas has no fixed volume. The atoms of a gas are spaced apart. When heat is lost, the matter changes from gas to liquid to solid states.

MATERIALS

Teacher

electric skillet with lid
cooler for storing ice
chalk

Student

plastic zipper-type bag with ice
1 ice cube in a cup
Solid, Liquid, Gas worksheet

TEACHING TIP

A good analogy to help students understand molecular motion is to compare the movement of particles in a solid to the movement of soldiers in a tight military formation; the particles of liquid to the movement of dancers on a crowded floor; and the particles of gas to the movement of popping popcorn.

ENGAGE

Give each student a cup with one ice cube. Tell the students to put the pieces of ice on their tongues but not to chew them.

Ask:

What is happening?

What is causing the ice to melt?

What are some other ways we could melt the ice?

EXPLORE Part 1

1. Give each student an ice cube in a plastic zipper-type bag.
2. Tell students to see if they can melt the ice cube without taking it out of the bag.

EXPLAIN

Ask the students to describe how they melted their ice cubes.

Record the responses on the board.

Help students to realize that they were applying a heat source by holding the ice bag in their hands, sitting on the bag, wrapping it up in their jacket, etc.

EXPLORE Part 2

1. Explain that they are now going to observe ice being melted at a higher temperature than they could produce themselves.
2. Place an ice cube in an electric skillet. **Caution students not to touch the electric skillet.** Ask students to observe the melting ice. Continue heating until most of the water has changed to a gas.
Ask:
What is the difference between melting the ice cube in a bag and melting it in a skillet?
Do you observe anything forming above the skillet?
What would you call this smoke-like substance forming above the skillet?
What do you think is going to happen to the liquid?
3. Explain to students that the increased heat not only caused the ice to melt quickly but that it also changed the liquid to a gas.
4. Ask students if they think we could reverse the process (change the gas back to liquid).
Ask:
If we added heat to change the ice to water and the water to steam, what do we now need to take away to reverse the change?
5. Have the students feel the lid of the skillet.
Ask:
How does the lid feel? (Since the lid has not been used on the skillet, it should feel cool to the touch.)
6. Put the lid on the skillet to collect the condensation. After a few moments, remove the lid to show the students the water droplets.
Ask:
How did these water droplets form? (When the steam came in contact with the cool skillet lid, the gas particles condensed into liquid particles.)

EXPLAIN

1. On an outside paved area, have the students stand as close to each other as they can while you draw a chalk circle around them. Tell them to move without getting out of the circle. Tell them that they are behaving as the parts of a solid. They stay in one spot and cannot move freely.
2. Now have the students step away from each other so there is at least an arm's length between them and they can no longer touch one another. Draw another chalk circle around the outside of the group. Tell them to move around within the circle again. Point out that they are now behaving as the parts of a liquid. They can move a little more freely but still tend to stay together.
3. Finally, have the students spread out in the entire area of a large given space (an area still has to be designated for the students). Tell them to move around the space.
Ask:
Do you feel more space?
Do you feel restricted or confined?
Tell them that they are behaving as the parts of a gas. They can move very freely and do not have to stay in one place.
4. Guide students to draw how the parts are arranged in a solid, a liquid, and a gas on the *Solid, Liquid, Gas* worksheet. Have students list some solids, liquids, and gases on the worksheet. (An excellent reference is Pg. 253 of *ScienceSaurus*, from Great Source Education Group.)

EXTEND/APPLY

Ask students to estimate how long it would take the ice cube to melt at room temperature, in the sunlight, in a cooler, or in a refrigerator. Invite other suggestions and explore as time allows.

Student Scientist _____

SOLID, LIQUID OR GAS

SOLID	LIQUID	GAS

