Radiated Marshmallows

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Target Grade: Grades 5-8

Time Required: 15 minutes

Standards/Topics Covered:

NGSS Standards

- MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Central Focus:

In this activity, students will discover conduction and radiation through melting marshmallows. This activity could be used as a discussion starter for lessons on heat transfer, thermal energy, and Earth's systems. Students can learn about convection currents through the Convection Currents activity.

Background Information:

Heat can be transferred three ways: conduction, convection, and radiation. Although this activity only deals with conduction and radiation, it can be used as an introductory activity for a lesson on all three modes.

Radiation occurs when heat is transferred without the direct contact between the two objects. The heat is transferred through electromagnetic waves traveling through the air. The emission and absorption of high energy electrons leads to the changing temperatures between objects.

Conduction occurs when two objects of different temperatures touch. In this case, conduction occurs when the foil-covered marshmallow is placed directly onto the hotplate. Energy moves from the hotter object (the hotplate) to the cooler object (the marshmallow), raising the temperature of the cooler object until they are equal.

Materials

- Extra-large marshmallows
- Skewers
- Hotplates
- Aluminum foil

Instructions

- Have the students place a large marshmallow on the end of a long skewer.
- To demonstrate radiation, hover the marshmallow directly above the hot plate (Stress to the students to not touch their uncovered marshmallow directly to the hot plate)
- After heating the marshmallow over the hot plate, have the students make observations about what happened to the marshmallow
- To demonstrate conduction, have students wrap another marshmallow in foil and touch it directly to the hotplate
- Have students record observations
- Students can eat marshmallows (be mindful of students who do not consume pork products as marshmallows contain gelatin)

Closure

1. What did you observe when the uncovered marshmallow was held over the hotplate?

When hovered over the hotplate, the marshmallow became warm, but did not melt. This is an observation of radiation. The electromagnetic waves move through the air from the high energy hotplate to the lower energy marshmallow, causing it to heat up.

2. What did you observe when the covered marshmallow was touched to the hotplate?

When wrapped in aluminum foil and touched directly to the hotplate, the marshmallow melted. This is an observation of conduction. The atoms move from the hotplate directly to the marshmallow, quickly raising the temperature.

3. Why did the marshmallow melt when directly touching the hotplate, but did not melt when hovered?

The heat is transferred via moving atoms in conduction, while the heat is transferred through electromagnetic waves in radiation. This makes radiation a less efficient method of heat transfer, causing the marshmallow to not heat as quickly when held over the hotplate.