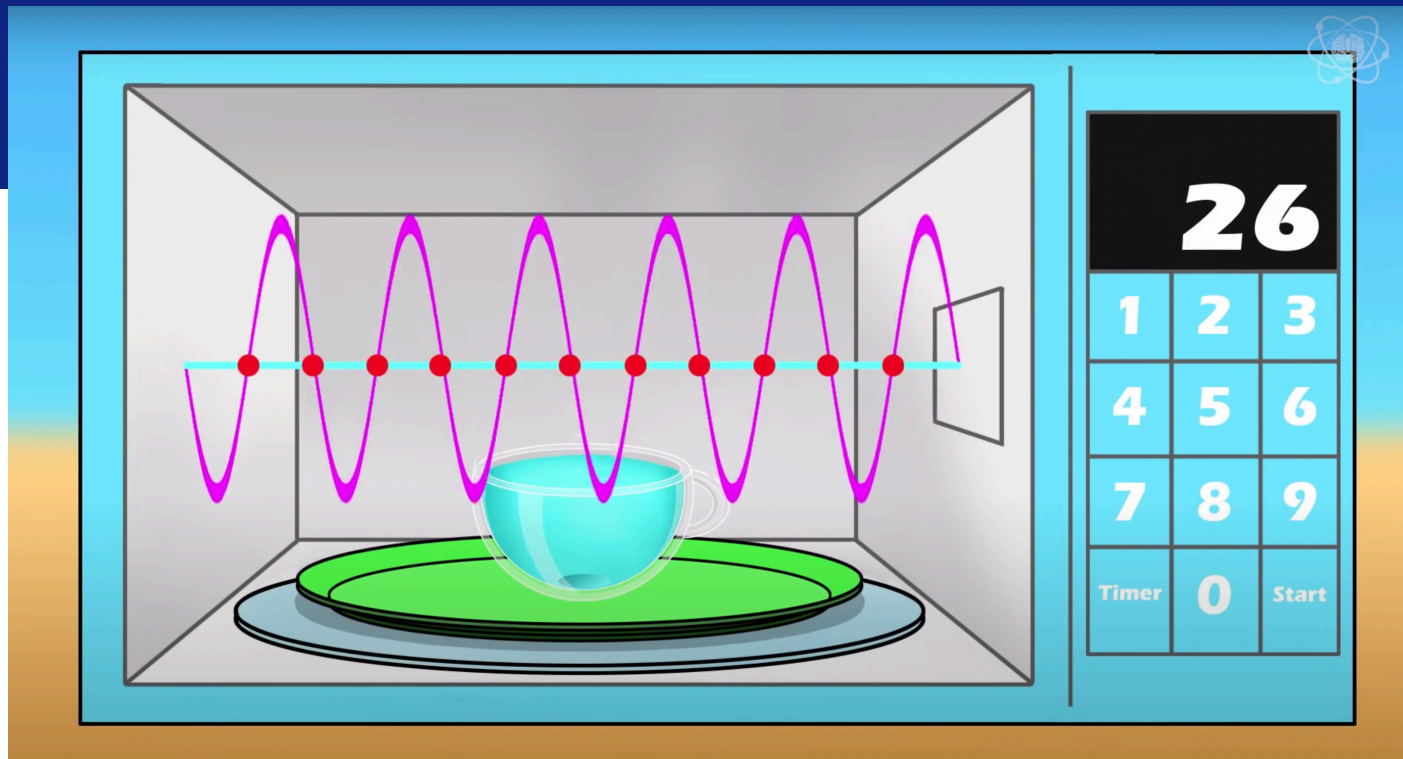


Microwave Mystery



Goal: Students will be able to demonstrate how water must be in a liquid state in order to be heated by microwaves.

**IMPOSSIBLE
SCIENCE**



Background Information

Water molecules are polar, meaning one end has a positive charge, and the other end has a negative charge.

In a microwave, the molecules rotate to line up with the electromagnetic field produced by the microwaves. The rotating molecules spin at different rates, making the water absorb energy and create heat.

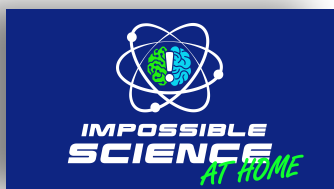
With ice, the electromagnetic field flipping back and forth is not strong enough to break the hydrogen bonds in the ice. Since it's not rotating, it's not absorbing energy, so it remains frozen.

Materials:

- Two containers
- Ice
- Water
- A microwave oven
- Infrared thermometer (optional)

Procedure

1. Ask: How long do you think it will take to melt an ice cube in the microwave? Write down a few guesses.
2. Fill one container about halfway with ice cubes and another about halfway with water.
3. Record the temperature of the ice and the water. Remove the glass tray from the microwave.
4. Put both containers in the microwave for one minute.
5. Record the temperature of the ice and the water.
6. Invite students to discuss observations.
7. Watch Impossible Science Video, pausing to discuss and jot down notes. See background information for added notes.
8. Give students fresh ice, and have them heat the ice in thirty second increments, recording temperature and observations as it slowly melts.
9. Explain to students that the defrost setting on the microwave actually works by turning the oven on and off during the cook time. It begins by heating the water that accumulates from a small bit of melted frost from food at room temperature. When it turns off, the heated water has time to soak into the surface of the food, melting a little more and creating more liquid. When it turns back on, the accumulated liquid heats up, and the cycle continues as the defrost setting turns the microwave off and on throughout the cook time.
10. Ask: What would happen if a frozen dish was put on a full power setting instead of the defrost setting? How would continually pausing the cooking through using the defrost setting help? Discuss and if needed, explain that the pause gives the heated surface liquid time to saturate the food so that it does not just heat, and potentially burn, one spot.





Assessment:

Have students write down an explanation of how water in a liquid state becomes heated in the microwave, and why ice does not melt easily in a microwave.

Challenge

Tell students to design a work-around for quickly melting ice in the microwave.

*Most should realize that adding some water to the cup of ice will speed up the process, as the heated water is what melts the ice.

Safety Note:

- Adult Supervision Recommended

Watch the companion video here:



Lesson Plan by Whitney Gallagher based on the “Impossible Science” series.

Find more at impossiblescience.com

