Family edition

Insulation Lab: Does a Sweater Keep Ice Cold?

Ages 11-14 · about 45 minutes, in one sitting

Your child tests whether a sock keeps an ice cube cold and a jar of warm water warm, in Insulation Lab. The point is that a sweater does not make heat: it slows energy moving either way.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/insulationlab?lesson=does-a-sweater-keep-ice-cold&ref=fam-insulationlab-2. No account, no email and nothing to install.
- Optional: a sock and an ice cube for a real side-by-side.

Before you start: try it once yourself

Open mytekdev.com/try/insulationlab?lesson=does-a-sweater-keep-ice-cold&ref=fam-insulationlab-2. An empty shoe box and a 30 g ice cube on a kitchen scale.

1. **The empty box.** Press `Test`: about 22.4 g left.
2. **The sock.** Choose A sock in Wrap the ice and test: about 24.5 g.
3. **Swap the job.** Press `Swap the job: warm jar`. The same box now holds a 250 mL jar of 50 °C water. Test: the dots move out, and the card compares the jar with your ice tests in the same box.
4. **Foil.** Swap back, take the sock off and wrap the ice in foil. It helps a little, by reflecting the invisible glow of the warm box; in real life meltwater wets the foil and it often does no better than bare ice.

> The jar is bigger than the ice. If a child has packed the box, the jar may not fit, and the app says by how much: take the fill out.

The ideas, in plain words

Energy moves from warmer to cooler. Around an ice cube it moves in; around a warm jar it moves out. An insulator slows that movement either way, mostly by trapping still air. In one study only about 6 percent of children said foam suits keeping hot things hot and cold things cold; most thought each material does one job.

A sweater feels warm because your body is the warm thing inside it. On a chair, with nothing warm inside, a sweater reads the room's temperature. That is the warm-up's answer.

Foil is metal, so energy goes straight through it. It helps only with the invisible infrared glow that warm things give off: shiny foil reflects it and gives off very little itself, so it works facing an air gap or the sun.

Do it together

1. Open mytekdev.com/try/insulationlab?lesson=does-a-sweater-keep-ice-cold&ref=fam-insulationlab-2 together and press `Test` on the empty shoe box.

   > **You'll know it worked when:** About 22 grams of ice are left.

2. Ask: will a sock make the ice melt faster? Wrap it in A sock and test.

   > **You'll know it worked when:** More ice is left, about 24.5 grams.

3. Press `Swap the job: warm jar` and test.

   > **If you get stuck:** If the jar does not fit, take the fill out.
   >
   > **You'll know it worked when:** The dots move out of the jar, and the graph shows its temperature falling slowly.

4. Try foil pressed on the jar, and talk about why it does so little.

   > **You'll know it worked when:** Your child can say foil helps only when it faces air or the sun.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Which way are the dots moving now? Why did that change?
- Did the sock make heat? How do you know?
- Did the best wrap for the ice also work best for the jar?
- Why does foil do so little pressed on the jar?
- What would a thermometer read inside a sweater on a chair?

> The second question is the real test: the ice lasting longer is the evidence that the sock does not make heat.

For younger and older kids

Younger: For a younger child, do the real sock and ice cube on a plate side by side with a bare cube.

Older: For a teenager, find a wrap that ranks differently for the two jobs and explain it.

Keep going

- Find a wrap that ranks differently for the two jobs, and explain why it could.
- Put foil facing an air gap in Line the walls and compare it with foil pressed on the jar.
- Explain how your body is like the warm jar in a winter coat.

Bring it into other subjects

- Math: make a bar graph of the two jobs side by side for each wrap.
- Life science: how do penguins and polar bears stay warm? Find what traps the air.
- History: read about thermos flasks and why they keep both soup hot and lemonade cold.
- English: write the sock's side of the argument with a friend who says it makes heat.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Insulation Lab: Does a Sweater Keep Ice Cold?
SUBJECTS	Physical science
TIME	45 minutes
WHAT WE DID	Tested wraps on an ice cube and a warm jar in a simulation and explained that insulators slow thermal energy moving either way, from warmer to cooler.
SKILLS PRACTICED	Thermal energy transfer; Insulators; Using data as evidence

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/insulationlab?lesson=does-a-sweater-keep-ice-cold

Essential question: Can the same material keep something cold and keep something warm?

Warm-up: Will a thermometer inside a sweater on a chair read warmer than the room? Why?

_____

1. **Vocabulary.** Thermal energy, insulator, temperature, infrared: write each in your own words.

2. **The two-job table.** For each wrap: grams of ice left ____; the jar's temperature at the end ____ °C. Rank the wraps for each job.

3. **Foil.** Grams left with foil ____. Foil helps when _____.

1. Did the sock make heat? Use your data.

2. Which way did energy move with the ice? With the jar? Why?

Quick check

Name: _____

1. A wool sock is wrapped around an ice cube. Compared with a bare cube it will (A) melt faster (B) melt slower (C) melt the same

2. A warm jar sits in a foam box. Which way does energy move? (A) into the jar (B) out of the jar (C) it does not move

3. Your friend says a sweater makes heat. What would you tell them?

Answers

QUESTION	ANSWER	WHY
1	B	The sock traps still air, which slows energy from the room reaching the ice.
2	B	Energy moves from the warmer jar to the cooler room. The foam slows it.
3	It slows energy leaving	A sweater has no heat to give; your body is the warm thing. A full answer says the sweater traps still air.

If your state or umbrella school asks, this lesson covers NGSS MS-PS3-3, NGSS MS-PS3-4.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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