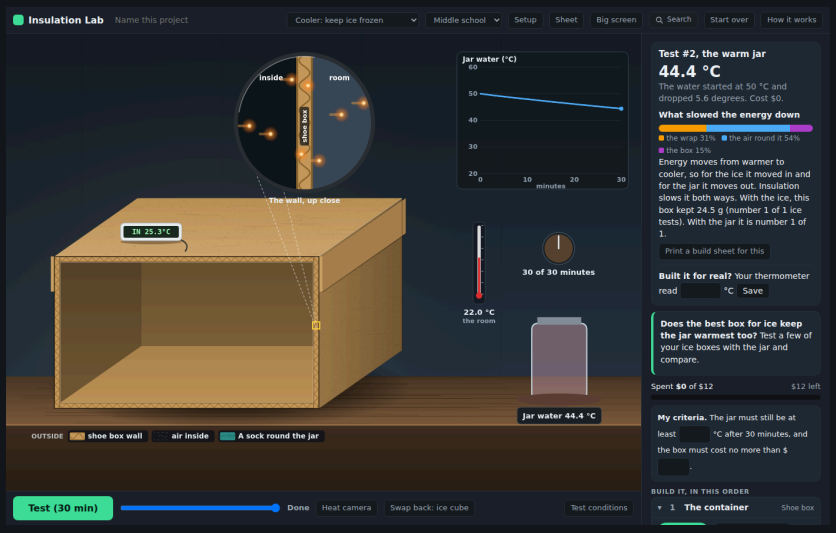
mytekDev

Insulation Lab: Does a Sweater Keep Ice Cold?

Grades 6-8 · 45 minutes

Physical science · Engineering



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a two-job results table
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 4 and 5 and in high school physical science
- Standards: NGSS

Insulation Lab: Does a Sweater Keep Ice Cold?

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Most students think a sweater makes heat and that a material keeps hot things hot but not cold things cold. They wrap an ice cube in a sock and it lasts longer. Then Swap the job puts a warm jar in the same box, and the same sock keeps it warm, because energy moves from warmer to cooler and the wrap slows it either way. Foil gets its own test.

At a glance

ESSENTIAL QUESTION

Can the same material keep something cold and keep something warm?

OBJECTIVES

Students will be able to:

- explain that a sweater or a sock does not make heat: it slows energy moving
- show with data that one material slows energy going in and coming out
- describe the direction of energy flow for a cold thing and a warm thing
- say when foil helps and when it does very little

VOCABULARY

Thermal energy, Insulator, Temperature, Infrared, Swap the job

STANDARDS

MS-PS3-3, MS-PS3-4

TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work
- Optional: a wool sock or sweater and a thermometer for the warm-up

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/insulationlab?lesson=does-a-sweater-keep-ice-cold&ref=tpt-insulationlab-2 once on a student computer: it opens on an empty shoe box with a 30 g ice cube. Test it, wrap the ice in a sock and test again, then press Swap the job and test the jar, about five minutes. A real sock and an ice cube make a good opening if you have them.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the sweater warm-up: will the thermometer read warmer? Take a vote and record it.	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app. Test the empty box: about 22 g. Ask: if a sock makes heat, what will a sock do to the ice? Wrap the ice in a sock and test: about 24.5 g, more ice. Show A sock on the ice and Same box, opposite job. > **It's working when:** Let the result sit before explaining. The ice lasting longer is the moment the "sweater makes heat" idea cracks.	Predict, watch, and fill in the vocabulary.
12 to 22	**Guided practice (We do)** The sock together	Students open the link or scan the QR code. The guide walks them through: the empty box, the sock, Swap the job, the jar. Ask which way the dots go with the jar. > **Watch for:** Students who say the sock "keeps the cold in". Ask them to point at a dot and say where it came from.	Run the four tests and fill in the first row of the two-job table.
22 to 38	**Independent practice (You do)** Both jobs	Students test three wraps with the ice and the same three with the jar, then foil last. Walk the room with the What to look for questions. > **If they ask:** "Foil pressed on the jar did very little. When would foil help?" Foil	Fill in the two-job table and rank the wraps for each job.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Go back to the sweater vote: a thermometer in a sweater on a chair reads the same as the room, because there is nothing warm inside it. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/insulationlab?lesson=does-a-sweater-keep-ice-cold&ref=tpt-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 student has packed the box, the jar may not fit, and the app says by how much: take the fill out.

Background for the teacher

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 students 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.

What to look for

Ask these while students work. A student who has understood the lesson 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.

Cross-curricular extensions

- 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 classmate who says it makes heat.

Vocabulary

Thermal energy	Energy that moves from warmer things to cooler things.
Insulator	A material that slows thermal energy, whichever way it is moving.

Temperature	How warm or cold something is, read on a thermometer.
Infrared	An invisible glow every warm thing gives off. Shiny foil reflects it.
Swap the job	In the app: the same box with a warm jar inside instead of ice.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the dots on the board as you say "energy": they always move from the warmer side to the cooler side.
- Pair each learner with a partner; the two-job table is numbers.
- Accept the explanation as a drawing with arrows for the energy in each job.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students, one choosing wraps and one recording.
- Zoom the browser to 150%.
- Allow two wraps instead of three where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "The sock slowed energy moving ___ the ice and ___ the jar."
- A check-in after the jar test: every table has two rows.
- Show the dots slide again before the independent work.

STUDENTS READY FOR MORE

- 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.

Adapting for other grades

Younger students: In grades 4 and 5, do the sock with the ice and the jar together and stop there; drop the third rubric row; total 8, and 6 meets the objectives.

Older students: In high school, compare the jar's temperature curve with Newton's law of cooling and estimate the time it takes to lose half its temperature difference.

Student worksheet

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?

Insulation Lab: Does a Sweater Keep Ice Cold?

Exit ticket

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?

Insulation Lab: Does a Sweater Keep Ice Cold?

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Name: _____

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Answer key: exit ticket

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.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
Data	Three wraps tested with both jobs, plus foil, recorded with numbers.	Three wraps with both jobs.	One job only, or missing numbers.	No data.
Direction of energy	Says energy moves into the ice and out of the jar, from warmer to cooler, with no mention of cold moving.	Says energy moves from warmer to cooler.	Mixes energy and cold moving.	Says cold moves.
Explanation	Explains with data that one material slows energy both ways because it traps still air, and when foil helps.	Explains that one material slows energy both ways.	Says the wrap helped with no reason.	No explanation, or says the wrap makes heat.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for MS-PS3-3, with the jar's temperature for MS-PS3-4.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**MS-PS3-3**	6-8	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.	One device is tested both minimizing energy into the ice and out of the jar.
NGSS	**MS-PS3-4**	6-8	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	Students relate the energy moving to the ice melting and the jar cooling.

Checked November 2026 against: NGSS MS-PS3-3, Energy, NGSS MS-PS3-4, Energy.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/insulation-lab/lessons/does-a-sweater-keep-ice-cold/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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