Family edition

Insulation Lab: Where Does the Shelter Lose Energy?

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

Your child keeps a small cardboard house warm on a cold porch in Insulation Lab, with a jar of hot water as its heater, and uses a heat camera to find where the warmth escapes.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/insulationlab?lesson=where-does-the-shelter-lose-energy&ref=fam-insulationlab-4. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/insulationlab?lesson=where-does-the-shelter-lose-energy&ref=fam-insulationlab-4. A 30 cm cardboard house on a 5 °C porch, with a window and a door in its right wall and a 1 liter jar of 60 °C water inside.

1. **Test it.** Press `Test`. Two hours play in about forty seconds. Inside: about 9.6 °C.
2. **The heat camera.** Press `Heat camera`. The box is drawn closed, colored by how warm each outside surface is; the window and door are outlined.
3. **Line it.** Add Pink foam board, 25 mm in Line the walls and test: about 18.6 °C, but over the $12 budget: a whole house is a lot of wall.
4. **The door.** In Roof, window and door press Door open and test: about 13.6 °C.
5. **The jar.** Close the door, wrap the jar in cotton batting and test: the house gets colder.

> The wrapped jar result depends on time: at two hours the house is colder, but over a whole night the wrapped jar keeps giving off energy after a bare one has cooled. Worth asking the strongest children about.

The ideas, in plain words

A house stays warm when energy from its heater leaves slowly. Energy leaves through every surface and with every bit of air that escapes. In a thin cardboard house the walls let so much through that an open door hardly matters; once the walls are insulated, the door becomes one of the biggest leaks. Real homes are the same: sealing air leaks matters most once the walls and attic are insulated.

The jar is the only heat source. Insulating it slows the energy leaving the jar, so less of it warms the air: insulation keeps energy where it is.

Do it together

1. Open mytekdev.com/try/insulationlab?lesson=where-does-the-shelter-lose-energy&ref=fam-insulationlab-4 together and press `Test`.

   > **You'll know it worked when:** The house is about 9.6 °C inside after two hours.

2. Press `Heat camera` and find what glows.

   > **You'll know it worked when:** The window and the door stand out.

3. Line the walls with pink foam board and test, then open the door and test.

   > **If you get stuck:** The guide opens Line the walls.
   >
   > **You'll know it worked when:** About 18.6 °C lined, about 13.6 °C with the door open.

4. Guess, then wrap the jar and test.

   > **You'll know it worked when:** The house is colder, and your child can say why.

Talk about it

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

- What does a bright color mean on the heat camera?
- Where does most of the energy leave this house? How do you know?
- Why did the open door matter more once the walls were lined?
- Where does all the energy in the house come from?
- Why did wrapping the jar make the house colder?

> The fifth question is the real test: a child who says the wrap keeps the energy in the jar instead of letting it warm the air has the idea.

For younger and older kids

Younger: For a younger child, walk round your own home and guess where the cold comes in.

Older: For a teenager, look up the insulation your climate zone recommends for an attic.

Keep going

- Find the warmest house you can build for $12, and explain your choices.
- Explain why the wrapped jar would leave the house warmer over a whole night.
- Research the R-values the US recommends for attics in your climate zone.

Bring it into other subjects

- Math: make a bar graph of the inside temperature for each build.
- Social studies: how do homes in very cold or very hot places keep their temperature? Look up igloos and adobe.
- Careers: what does a home energy auditor do, and what tools do they use?
- English: write a letter to a landlord explaining what to fix first, with evidence.

For your records

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

LESSON	Insulation Lab: Where Does the Shelter Lose Energy?
SUBJECTS	Physical science
TIME	45 minutes
WHAT WE DID	Used a simulated heat camera to find where a small house loses energy, tested insulation, doors and windows, and explained why insulating the heat source made the house colder.
SKILLS PRACTICED	Thermal energy transfer; Using evidence; Home energy

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/insulationlab?lesson=where-does-the-shelter-lose-energy

Essential question: Where does a house lose its energy, and what keeps it in?

Warm-up: Your house feels cold in winter. Where do you think the warmth escapes? _____

1. **Vocabulary.** Thermal energy, heat camera, air leak, heat source, insulation: write each in your own words.

2. **The shelter table.** For each test: what I changed _____; inside after two hours ____ °C; over budget? yes / no.

3. **The heat camera.** The brightest part of the house was _____.

1. Why did the open door matter more once the walls were lined?

2. Why did wrapping the jar make the house colder?

Quick check

Name: _____

1. On a heat camera picture of a warm house on a cold night, a bright spot means (A) energy is leaving there fastest (B) the paint is lighter (C) cold is coming in

2. A house has thin walls and an open door. What should you fix first to keep it warmest? (A) the walls (B) the door (C) the jar

3. Why does wrapping the heater make the room colder?

Answers

QUESTION	ANSWER	WHY
1	A	A warm surface outside means energy is coming through fast. Cold does not move in.
2	A	With thin walls, they let out far more than the door. Once the walls are good, the door matters.
3	The wrap keeps energy in the heater	Less energy reaches the air in the room. A full answer says insulation slows energy leaving the jar.

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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