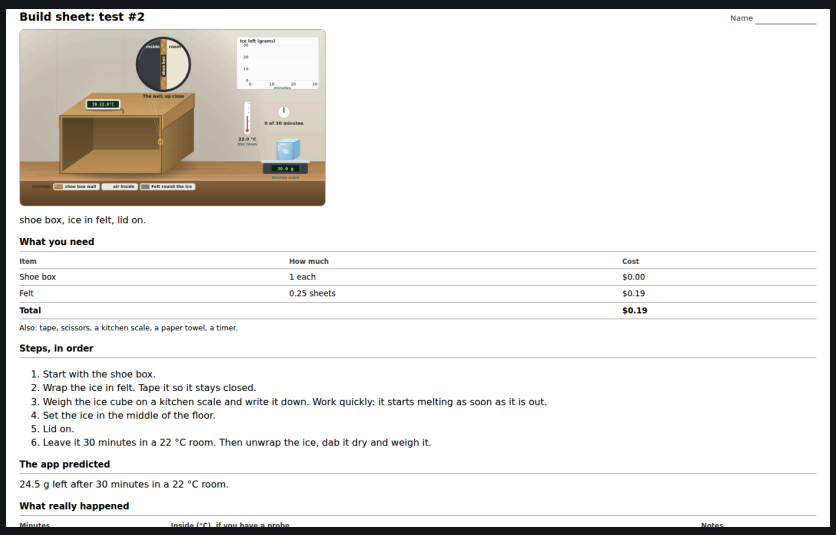
mytekDev

Insulation Lab: Predict, Then Build It

Grades 6-8 · 45 minutes

Physical science · Engineering



Build sheet: test #2

Name _____

shoe box, ice in felt, lid on.

What you need

Item	How much	Cost
Shoe box	1 each	$0.00
Felt	0.25 sheets	$0.19
Total		**$0.19**

Also: tape, scissors, a kitchen scale, a paper towel, a timer.

Steps, in order

1. Start with the shoe box.
2. Wrap the ice in felt. Tape it so it stays closed.
3. Weigh the ice cube on a kitchen scale and write it down. Work quickly: it starts melting as soon as it is out.
4. Set the ice in the middle of the floor.
5. Lid on.
6. Leave it 30 minutes in a 22 °C room. Then unwrap the ice, dab it dry and weigh it.

The app predicted

24.5 g left after 30 minutes in a 22 °C room.

What really happened

Minutes | Inside (°C), if you have a probe | Notes

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 prediction and result 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: Predict, Then Build It

Grades 6-8 · 45 minutes · Physical science, Engineering

Teams arrive with their best design from The $12 Cooler. They build it for real from a build sheet in ten minutes, put in a weighed ice cube, and wait 30 minutes. While it waits they rebuild it in the app, record the prediction, and list what could make the real box differ. Then they weigh the ice, type the real grams beside the prediction, and explain the gap.

At a glance

ESSENTIAL QUESTION

How close can a model get to the real thing, and why is it never exact?

OBJECTIVES

Students will be able to:

- build a design from a build sheet and test it with a measured ice cube
- compare a measured result with a model's prediction
- name reasons a real test differs from a model
- decide what to change next from both results

VOCABULARY

Model, Prediction, Measurement, Variable, Constraint

STANDARDS

MS-PS3-3, MS-ETS1-3, MS-ETS1-4

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
- For each team: a shoe box, tape, the insulation on its build sheet (newspaper, cotton, felt, bubble wrap, foam, packing peanuts), and one ice cube of about 30 g
- A kitchen scale that reads tenths of a gram, and paper towels

PREP

Make copies of the worksheet, exit ticket and each team's build sheet (from The $12 Cooler, or printed from the app). Gather the materials on the build sheets, a kitchen scale that reads tenths of a gram, a paper towel per team, and ice cubes of about 30 g in a cooler, so they start near 0 °C. Before class, open mytekdev.com/try/insulationlab?lesson=predict-then-build-it&ref=tpt-

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.

insulationlab-3 once on a student computer.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 3	**Warm-up** Hook	Show the title, essential question and the weather warm-up (about 3 minutes). Hand out the build sheets and materials.	Answer the warm-up on the worksheet.
3 to 12	**Direct instruction (I do)** Build	Show The build sheet and Real test rules. Teams build from their sheet. At minute 10, bring the cooler of ice round: each team weighs its cube, writes the grams, puts it in and closes the box. Start a 30-minute timer. > **It's working when:** Weigh every cube: different sizes are the biggest source of noise between teams. A cube of 25 to 35 g is fine, as long as the grams are written down.	Build, weigh the cube, close the box.
12 to 22	**Guided practice (We do)** Predict	Students open the link or scan the QR code and rebuild the same box in the app. A short guide walks them through testing it and printing the build sheet. If their cube was not 30 g, set Ice in Test conditions to the nearest size. > **Watch for:** Teams whose app build is not what they built. Ask them to read the build sheet against the box.	Rebuild the box in the app, test it, and write the prediction in the table.
22 to 42	**Independent practice (You do)** While it waits	Teams list what could make the real box differ and answer the questions. At minute 42, everyone unwraps the ice, dabs it dry and weighs it. > **If they ask:** "What is different about your real box that the app cannot know?" Reasons	Fill in the reasons, then weigh the ice and type the real grams under Built it for real.
42 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two teams give the gap and a reason. Hand out the exit ticket to finish at home if time runs out.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/insulationlab?lesson=predict-then-build-it&ref=tpt-insulationlab-3. Build a box: wrap the ice in cotton batting, pack crumpled newspaper round it, tape the lid. Press `Test`: about 28 g.

1. **The build sheet.** Press `Print a build sheet for this` on the test's card: a picture, what to buy, the steps in order, the prediction, a results table and the safety lines.
2. **Ice size.** If your cubes are not 30 g, Test conditions has 15, 30 and 60 g cubes. Use the nearest.
3. **The real result.** Type the real grams under Built it for real and press Save. A diamond marks it on the graph.

> Expect real boxes to keep a gram or a few less than the app says when they are packed: paper next to the ice gets damp and carries energy better, and a cube resting on the floor melts from below. Foil-wrapped cubes often do worse for real. The gap is the lesson, not a failure.

Background for the teacher

A model is useful because it is simpler than the real thing. The app treats each wall as one, the air inside as one temperature, and its numbers for newspaper and bubble wrap are estimates. It compares designs well, which is what an engineer uses a model for, and it is never exact.

The biggest causes of a gap: cubes that are not the same size; a warmer or cooler room; hands on the box; gaps in the tape; damp wraps; and reading the scale late, while the ice keeps melting.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- Is your real box exactly what you tested in the app?
- Why do we weigh the cube before it goes in?
- What is different about your box that the app cannot know?
- Was the app wrong, or was it a good guess?
- What would you change next, and why?

> The fourth question is the real test: a student who says a model is a best guess that compares designs, not a promise, has the idea.

Cross-curricular extensions

- Math: put every team's prediction and result on one scatter plot. How close are they to the line where they match?
- Science: weather forecasts and climate models are also models. How do scientists check them?
- English: write a short lab report: question, prediction, method, result, conclusion.
- Careers: find out what a building energy auditor does with a heat camera.

Vocabulary

Model	A simpler version of something real, used to test ideas. The app is a model of the box.
Prediction	What the model says will happen, before the real test.
Measurement	A number read from a real tool, like a kitchen scale.
Variable	Anything that can change a result, like the room's temperature or the size of the cube.

Constraint	A limit on the design, like the budget or the materials you have.

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.
- Give each team a role card: builder, weigher, timer, recorder.
- Accept the reasons as a list of single words with a drawing.

STUDENTS WITH IEPS OR 504 PLANS

- Assign roles so every student has one clear job.
- Pre-cut the insulation pieces for teams that need it.
- Allow the prediction to be read from a partner's screen.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "Our real box kept ___ g, ___ g less than the app, maybe because ___."
- Give a list of possible reasons to choose from.
- Build one team's box together at the front as a demonstration.

STUDENTS READY FOR MORE

- Work out the percentage difference between the prediction and the result.
- Test the same box twice for real and see how much the result varies by itself.
- Change one thing in the app that would make the prediction match, and say whether it is honest to do that.

Adapting for other grades

Younger students: In grades 4 and 5, build one class box together and weigh the ice as a class; drop the third rubric row; total 8, and 6 meets the objectives.

Older students: In high school, add a thermometer probe inside the box and record the inside temperature every 5 minutes on the build sheet's table, against the app's inside reading.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/insulationlab?lesson=predict-then-build-it

Essential question: How close can a model get to the real thing, and why is it never exact?

Warm-up: A weather app said 20 percent chance of rain, and it rained. Was the app wrong?

_____

1. **Vocabulary.** Model, prediction, measurement, variable: write each in your own words.

2. **The table.** The cube before ____ g. The app predicted ____ g left. The real cube after ____ g. The gap ____ g.
3. **Reasons.** Three things that could make our real box differ from the app:

1. Was the app's prediction close? Explain with your numbers.

2. What one change would you make next time, and what do you predict?

Exit ticket

Name: _____

1. Why do we weigh each ice cube before the test? (A) to see if it is cold (B) because cubes are different sizes (C) the scale needs warming up

2. The app predicted 28 g and the real box kept 26 g. The app (A) is useless (B) gave a close prediction (C) must be broken

3. Name one thing about a real box that the app cannot know.

Insulation Lab: Predict, Then Build It

Exit ticket

Name: _____

1. Why do we weigh each ice cube before the test? (A) to see if it is cold (B) because cubes are different sizes (C) the scale needs warming up

2. The app predicted 28 g and the real box kept 26 g. The app (A) is useless (B) gave a close prediction (C) must be broken

3. Name one thing about a real box that the app cannot know.

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	Cubes differ in size, so the grams before are needed to compare fairly.
2	B	A model gives a best guess; 2 g is close for a real build.
3	Any specific one	For example: gaps in the tape, a wet wrap, a warmer room, hands on the box, a different cube size.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The build and the test	Built exactly as the build sheet, cube weighed before and after, timed, hands off.	Built as the sheet, weighed before and after.	Built roughly, or one weighing missing.	No real test.
The comparison	Prediction and result both recorded, the gap worked out, and both typed into the app.	Prediction and result recorded.	Only one recorded.	Neither.
Explanation	Gives two or more specific reasons for the gap tied to this box, and one change for next time.	Gives one specific reason.	Gives a general reason like "mistakes".	No explanation.

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

Standards

The lesson is built for MS-PS3-3 and the engineering design standards.

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.	Teams construct and test their device with a measured ice cube.
NGSS	**MS-ETS1-3**	6-8	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	Teams compare the real result with the prediction and with other teams.
NGSS	**MS-ETS1-4**	6-8	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	The app generated the prediction the real test checks.

Checked November 2026 against: NGSS MS-PS3-3, Energy, NGSS MS-ETS1, Engineering Design.

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/predict-then-build-it/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

Terms of use

Thank you for downloading this lesson. The plan, the handouts and the art were made by mytekDev.

You may:

- print and copy it for your students
- change it for your own classes
- post it on your class website or learning management system
- share this file with other teachers, whole and unchanged, with this page included

You may not:

- sell it, or put it in a product you sell
- share a changed copy
- claim it as your own

The app this lesson uses is free and runs in the browser. Students need no account. It is at mytekdev.com.

Questions, or found a mistake? Ask on the Teachers Pay Teachers Q&A for this resource, or write to us at mytekdev.com/contact.

© 2026 mytekDev. All rights reserved.