Family edition

Insulation Lab: Predict, Then Build It

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

Your child builds an insulated box for real, tests it with an ice cube for 30 minutes, and compares the result with what the Insulation Lab simulation predicted.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/insulationlab?lesson=predict-then-build-it&ref=fam-insulationlab-3. No account, no email and nothing to install.
- A shoe box, tape, newspaper or other insulation, an ice cube, and a kitchen scale.

Before you start: try it once yourself

Open mytekdev.com/try/insulationlab?lesson=predict-then-build-it&ref=fam-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.

The ideas, in plain words

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.

Do it together

1. Open mytekdev.com/try/insulationlab?lesson=predict-then-build-it&ref=fam-insulationlab-3, build a box from what you have at home, and press `Test`.

   > **You'll know it worked when:** The app gives a prediction in grams.

2. Press `Print a build sheet for this` and build the same box for real.

   > **If you get stuck:** Cancel the print if you do not need paper; the sheet shows the list and steps.
   >
   > **You'll know it worked when:** The real box matches the app.

3. Weigh an ice cube, put it in, close the box and wait 30 minutes. Then dry it and weigh it.

   > **You'll know it worked when:** You have a real number in grams.

4. Type it under Built it for real and press Save. Talk about why it is different.

   > **You'll know it worked when:** Your child can name two reasons for the gap.

Talk about it

Ask these while you work together. A child who has understood it 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 child who says a model is a best guess that compares designs, not a promise, has the idea.

For younger and older kids

Younger: For a younger child, compare a bare cube on a plate with one in the box.

Older: For a teenager, repeat the real test twice and see how much it varies on its own.

Keep going

- 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.

Bring it into other subjects

- 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.

For your records

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

LESSON	Insulation Lab: Predict, Then Build It
SUBJECTS	Physical science, Engineering
TIME	45 minutes
WHAT WE DID	Built and tested an insulated box with a measured ice cube, compared the result with a simulation's prediction, and explained the difference.
SKILLS PRACTICED	Engineering design; Measurement; Comparing models with data

Activity sheet (optional)

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?

Quick check

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.

Answers

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.

If your state or umbrella school asks, this lesson covers NGSS MS-PS3-3, NGSS MS-ETS1-3, NGSS MS-ETS1-4.

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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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