Family edition

Phone Lab: Thin Has a Price

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

Your child makes a phone thinner and finds out what it costs: a smaller battery and cameras that stick out. Then they open the phone to see why.

What you need

- A computer or Chromebook with a current browser, and a mouse or trackpad.
- The lesson link: mytekdev.com/try/phonelab?lesson=thin-has-a-price&ref=fam-phonelab-1. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/phonelab?lesson=thin-has-a-price&ref=fam-phonelab-1. A short guide opens over the app. The phone is plain gray, 72 by 150 millimeters and 8.0 thick. The card on the right says the battery lasts about a day and holds 4,500 mAh, the phone weighs 166 grams, and the cameras stick out 2.0 millimeters.

1. **Make it thin.** Open Size and thickness and pull Thickness down to 6.0. The card reads "runs out by dinner", "holds 2,850 mAh", 140 grams, and "stick out 4.0 millimeters". Under each line that moved, the old value shows in orange for a short while.
2. **Open it up.** Press Open it up. The phone comes apart into cover glass, screen, battery, board, cameras, frame and back. The tag on the battery reads "3.4 millimeters thick".
3. **Make it thick.** With the phone open, pull Thickness up to 10.0. The battery tag reads 7.4 millimeters, and the card says the cameras are flush with the back, the battery holds 6,150 mAh and lasts more than a day, and the phone weighs 192 grams.
4. **The table.** At 8.0: 4,500 mAh, about a day, 166 grams, cameras out 2.0 millimeters, battery 5.4 thick. At 7.0: 3,650 mAh, about a day, 153 grams, 3.0 millimeters, battery 4.4 thick.

> The moment that lands is the battery tag. Children expect everything inside to shrink a little. One layer takes the whole change.

The ideas, in plain words

In the app a phone is a stack. The cover glass, the screen and the back each need a fixed thickness, and the board needs a little room of its own. Together they take 2.6 millimeters of any phone. The battery gets what is left: 5.4 millimeters of an 8.0 millimeter phone, and 3.4 of a 6.0 millimeter one. So a millimeter off the phone is a millimeter off the battery, and on this phone that is 800 to 850 mAh each time.

A camera needs depth behind its lens to focus light. The main camera here needs 10 millimeters of body to sit inside. In a thinner body it sticks out, a millimeter more for each millimeter the phone loses. The weight falls by 13

grams a millimeter, most of it battery.

The phone in the app is a model: a simple stack of layers. Real phones fit their parts together more cleverly, and a real thin phone holds more battery than this one does, because its makers spread the battery wider. How much a battery holds for its size and how heavy each material is come from published figures. How deep a camera is, how many hours a charge lasts and how a drop goes are estimates, set so that a normal phone comes out normal.

Do it together

1. Open mytekdev.com/try/phonelab?lesson=thin-has-a-price&ref=fam-phonelab-1 together. A short guide opens over the app. Read the card on the right: battery, weight, cameras.

   > **You'll know it worked when:** The card says about a day, 166 grams, and the cameras stick out 2.0 millimeters.

2. Open `Size and thickness` and pull `Thickness` down to 6.0.

   > **If you get stuck:** Click the words Size and thickness to open that part of the panel.
   >
   > **You'll know it worked when:** The card says runs out by dinner, and the battery holds 2,850 mAh where it held 4,500.

3. Ask: nobody touched the battery, so why is it smaller? Then press `Open it up`.

   > **You'll know it worked when:** The phone comes apart into seven layers, each with its name.

4. Read the tag on the battery. Pull `Thickness` up until the card says the cameras are flush with the back.

   > **You'll know it worked when:** The battery tag goes from 3.4 millimeters thick to 7.4. The glass, the screen and the back did not change.

5. Ask: what thickness would you pick for your own phone, and what would you give up?

   > **You'll know it worked when:** Any answer that names a thickness and a cost: thin and light with a short day, or thick and heavy with a long one.

Talk about it

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

- You changed one thing. How many numbers on the card moved?
- Which layer changed size when you made the phone thinner? Which ones did not?

- Why do the cameras stick out of the thin phone and not the thick one?
- The battery holds 2,850 mAh at 6.0. Does that number tell you how long it lasts? What does?
- What did you give up for the thickness you chose?

> The second question is the real test: a child who says the battery gets whatever room the other layers leave has the idea.

For younger and older kids

Younger: For a younger child, stop after the phone is open and ask them to point to the layer that changes size.

Older: For a teenager, set the level to High school and ask how much battery each millimeter of phone buys.

Keep going

- Keep the thickness at 8.0 and change the Frame to Steel, then Titanium. What moved on the card, and what did not?
- Under Screen, switch the Panel to LCD. The battery got smaller and nobody changed the thickness. Open it up and find out why.
- Find the thinnest phone that is still on at 10 at night. Which test tells you?

Bring it into other subjects

- Math: plot battery capacity against thickness from the table. Is it a straight line? Predict the capacity at 9.0, then check it in the app.
- Science: a battery stores energy. Why would a bigger battery of the same kind hold more?
- English: write the three sentences an honest advertisement for the 6.0 millimeter phone would have to include.
- At home: find how thick a phone in your house is, and ask its owner what they would trade for a longer day.

For your records

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

LESSON	Phone Lab: Thin Has a Price
SUBJECTS	Engineering design, Technology
TIME	45 minutes
WHAT WE DID	Used a 3D phone design model to change one variable, thickness, and record its effect on battery capacity, weight and camera fit, then explained the result from the phone's layers.
SKILLS PRACTICED	Trade-offs in design; Collecting data from a model; Explaining a result

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/phonelab?lesson=thin-has-a-price

Essential question: When a phone gets thinner, what does it give up, and why?

Warm-up: Would you rather have a thinner phone, or one that lasts longer? _____ Why not both?

1. **Vocabulary.** Trade-off, model, layer, capacity, data: write each in your own words.

2. **The data table.** Set Thickness to 10.0, 8.0, 7.0 and 6.0. For each, write: battery (mAh), how long it lasts, weight (grams), how far the cameras stick out, and how thick the battery is with the phone open.

3. **My thickness.** I chose _____ millimeters.

1. Which layer got thinner when the phone did? Why that one? Use what you saw in Open it up.

2. What did you gain with the thickness you chose, and what did you give up? Give a number for each.

Quick check

Name: _____

1. A trade-off is (A) a mistake in a design (B) getting more of one thing by giving up some of another (C) a test a design fails

2. When the phone got thinner, the battery shrank because (A) the battery was worn out (B) the glass, the screen and the back keep their thickness, so the battery gets what is left (C) a thin phone uses more power

3. Name one thing, besides the battery, that got worse when the phone got thinner.

Answers

QUESTION	ANSWER	WHY
1	B	Thin was paid for with battery. Nothing was a mistake.
2	B	The other layers need the same thickness in any phone, so every millimeter comes out of the battery.
3	The cameras stick out more	A camera needs depth behind its lens. "It runs out sooner" is the battery again; accept it only with a reason.

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

Terms of use

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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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