

Pumpkin Lab: Light Through a Pumpkin

Ages 10-14 · about 45 minutes, in one sitting

Your child opens a 3D jack-o'-lantern whose face is carved three different ways, predicts which parts will glow in the dark, and turns the lights off to find out. It is a real light experiment: what passes through, what glows, what stays dark, and why the face on the wall is bigger than the face on the pumpkin.

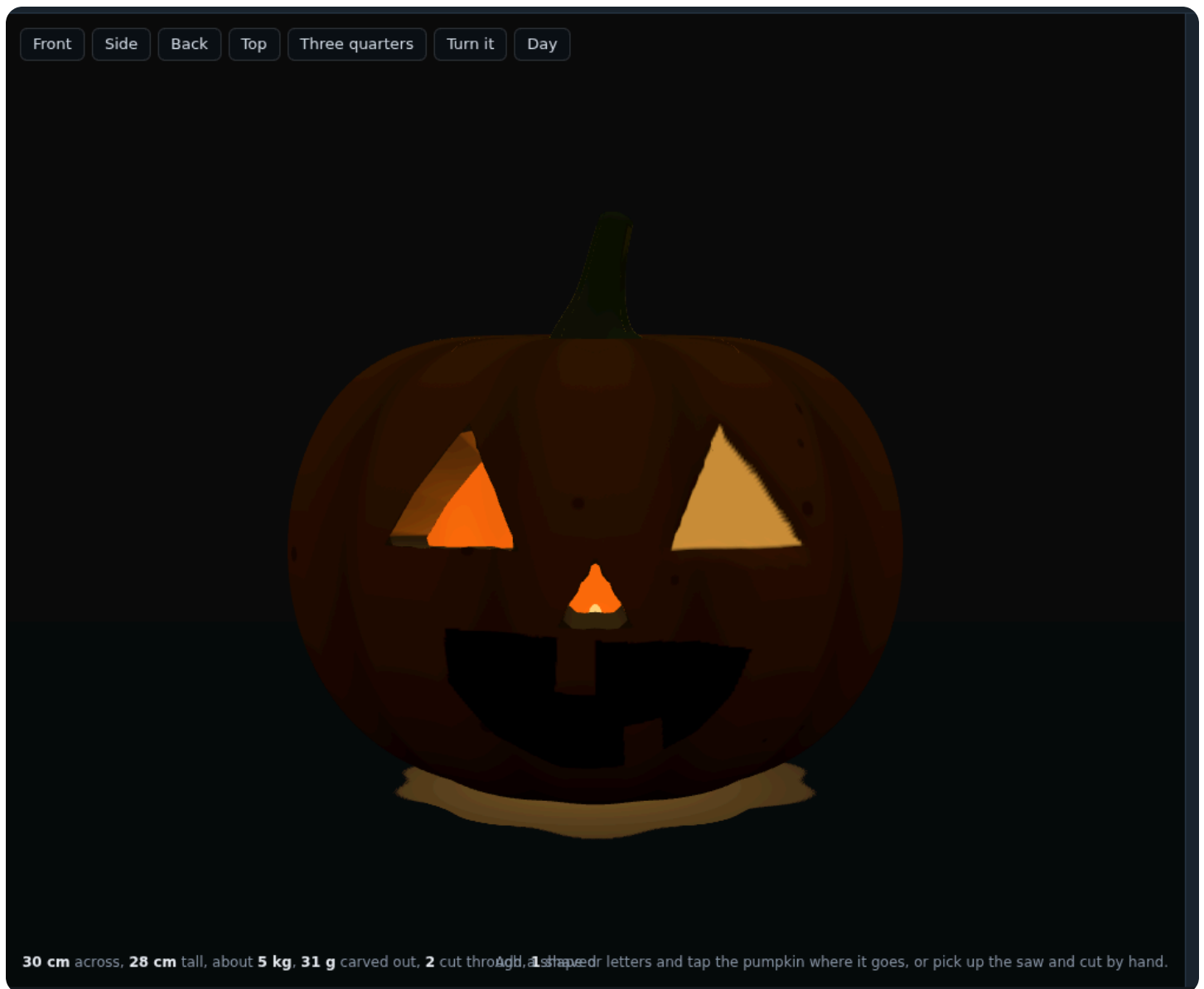
What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin&ref=fam-pumpkin-1. No account, no email and nothing to install.
- Optional: a flashlight, a sheet of paper and a piece of cardboard with a hole in it, to try the same thing for real.
- Optional: the activity sheet at the end of this plan, printed, and a pencil.

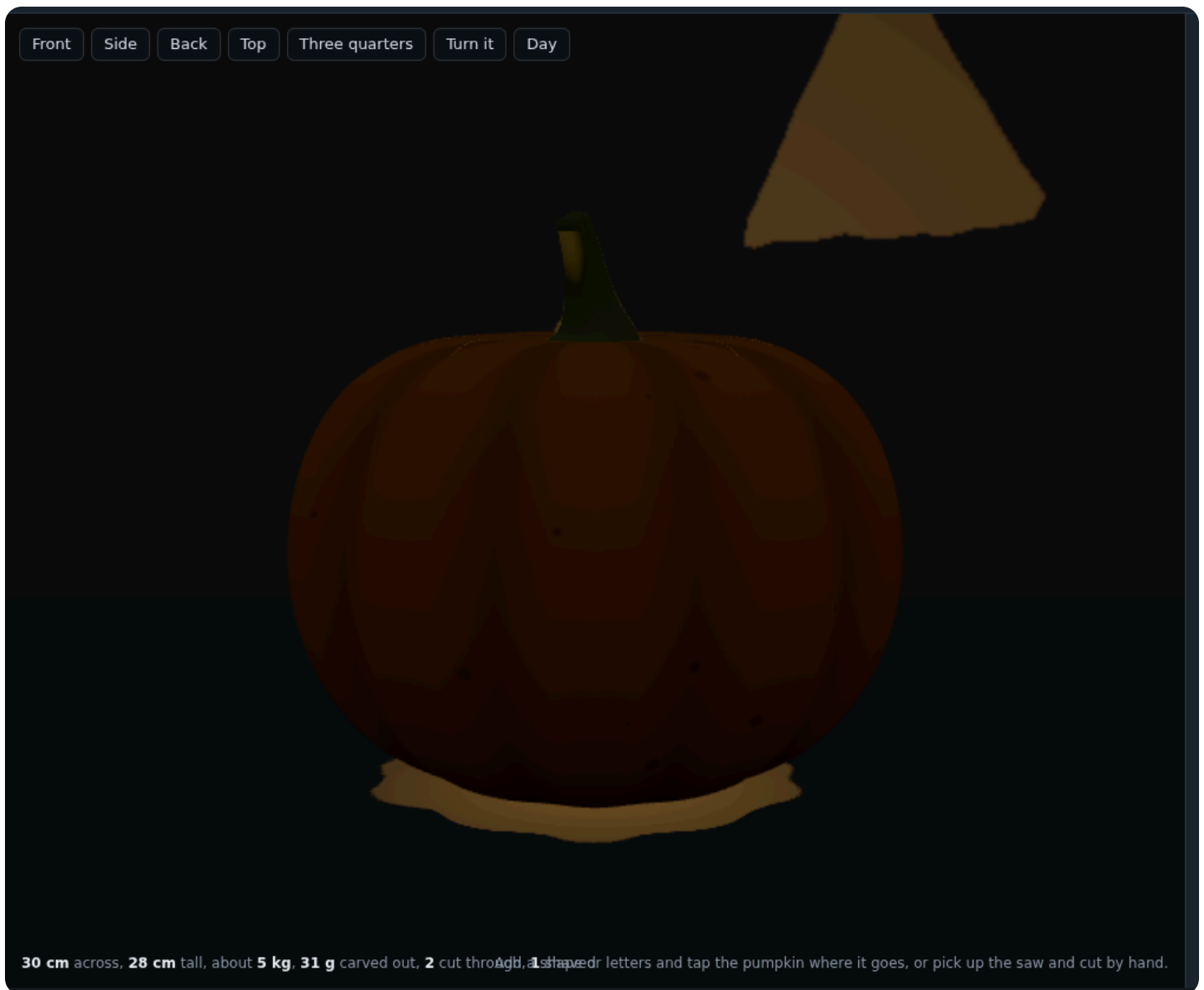
Before you start: try it once yourself

Turn the lights off on the starter pumpkin and look at the wall yourself once before you start, about ten minutes.

1. **Open the lesson.** Go to mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin&ref=fam-pumpkin-1. Click Carve: the four cuts are 1. Triangle cut through, 2. Triangle shaved, 3. Triangle cut through, 4. Grin painted. The readout under the stage says `2 cut through, 1 shaved`.
2. **Lights off.** Press Night over the stage. The left eye and the nose blaze, the right eye glows dimmer, the grin stays dark.
3. **The wall.** Press Back in the row of view buttons. The cut eye's light lands on the far wall, bigger than the eye.
4. **Change a mark.** Tap 4. Grin in Your cuts and press Cut through. At night it now blazes too.
5. **Grow an eye.** Tap 1. Triangle and move Size. The patch on the wall grows with it.



Three ways to carve, at night.



The Back view: the cut eye's light on the far wall.

Everything happens on screen, and nothing is cut for real. If you carve real pumpkins afterward, an adult does the cutting.

The ideas, in plain words

When light meets a material, it can be transmitted (it passes through), absorbed (it is taken in and goes no further) or reflected. A pumpkin's skin and thick flesh absorb almost all of a candle's light, so a jack-o'-lantern is dark except where it is carved. A hole transmits the light completely. A shaved patch, where only the skin is peeled off, leaves a thin layer of flesh: some light gets through, scattered in every direction, so it glows without showing a clear shape. That in-between material is called translucent; the thick, unshaved skin is opaque.

Light from a small source travels in straight lines. The rays that get through a hole keep going in straight lines and spread apart as they travel, so the patch of light they make on a far wall is the shape of the hole, only bigger. The

farther the wall, the bigger the patch. That is the same geometry as a shadow cast by a small light. The scattered light from a shaved patch does not travel on as a beam, so it makes no shape on the wall.

In the lab, Night turns the room dark around the pumpkin and lights the candle inside it; the room has walls that catch the light that leaves each cut. The Back view looks past the pumpkin at the wall the face shines on.

YOUR CHILD MIGHT ASK	A GOOD ANSWER
Why does the shaved eye glow at all?	The flesh left behind is thin, so some light gets through it, like light through your hand over a flashlight.
Why is the face on the wall so big?	The rays spread apart from the candle, so they are farther apart when they reach the wall.
Does the color of paint matter?	Not on thick skin: the skin absorbs the light before the paint is reached.
Would a brighter candle make the face on the wall bigger?	No, brighter. The size comes from the hole and the distances, not from the brightness.

Do it together

1. Open mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin&ref=fam-pumpkin-1 together. A short guide runs along the bottom; follow it. Click Carve at the top and read the four cuts under Your cuts.

You'll know it worked when: 1. Triangle cut through, 2. Triangle shaved, 3. Triangle cut through, 4. Grin painted.

2. Before turning the lights off, your child predicts what each mark will do in the dark: glow brightly, glow a little, or stay dark.

If you get stuck: Cut through is a hole. Shave the skin peels the skin off and leaves the flesh. Paint only is a drawing on the skin.

3. Press Night, over the pumpkin. Compare with the predictions.

You'll know it worked when: The two holes blaze, the shaved eye glows a duller orange, and the painted grin stays dark.

4. Press Back, in the row of view buttons, to look past the pumpkin at the wall.

You'll know it worked when: A bright shape lands on the wall from the cut-through eye, much bigger than the eye. The shaved eye throws nothing.

5. Change one thing: tap 4. Grin under Your cuts, press Cut through, and look again at night.

You'll know it worked when: Now the grin blazes too.

6. Tap the left eye and move its Size slider at night, watching the wall. Then draw it on paper: a dot for the candle, a gap for the eye, a line for the wall, and straight lines from the dot through the edges of the gap.

If you get stuck: The lines spread apart as they go, so they hit the wall farther apart than the edges of the eye.

7. Finish with one question: why does the shaved eye glow but throw nothing on the wall?

You'll know it worked when: Your child explains that light gets through the thin flesh but spreads out every way, so only a hole sends straight rays in the eye's shape.

Talk about it

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

- Which marks transmit the light, and which absorb it?
- Why does the shaved eye glow but throw no shape on the wall?
- What did you change in your test, and what did you keep the same?
- What happens to the patch on the wall when the eye gets bigger?
- Draw one ray from the candle through the top of the eye to the wall.

The second one is the real test. A child who can explain why the glow makes no shape understands that only straight rays through a hole carry the shape.

For younger and older kids

Younger: For ages 8 and 9, do the night test together, use the words see-through, a little, and blocks, and skip the drawing.

Older: For older teens, measure the patch on the wall for two eye sizes and explain the pattern with similar triangles.

Keep going

- Change the candle for a Light bulb and a color on the Light bench. Does the color change what is transmitted?
- Shave a whole word with + Letters. Why can you read it at night but not on the wall?
- Turn the pumpkin to Three quarters and find where the light from a cut on the side lands.

Bring it into other subjects

- Math: measure the eye and its patch on the wall in two sizes. Is the patch always the same number of times bigger?
- Art: design a face that uses all three kinds of mark, so it reads two ways: by day and at night.
- History: find out what people carved before pumpkins (turnips in Ireland and Scotland). The lab has a turnip under Style.
- Engineering: on the Light bench, try the Tea light and the Light bulb. Which would you choose for a real pumpkin, and why?

For your records

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

LESSON	Pumpkin Lab: Light Through a Pumpkin
SUBJECTS	Science
TIME	45 minutes
WHAT WE DID	Investigated light with a 3D jack-o'-lantern: predicted and tested which carved marks transmit, partly transmit or absorb light, changed one variable at a time, and drew straight-line rays to explain why the lit face on the wall is bigger than the hole.
SKILLS PRACTICED	transmitted, translucent and absorbed light; light travels in straight lines; predicting and testing one variable

Activity sheet (optional)

Name: _____ Date: _____



Open the lab: scan the QR code, or go to mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin

Essential question: Why does light come out of a jack-o'-lantern in some places and not others, and why is the face on the wall bigger than the face on the pumpkin?

Predict first, then test at Night. Write glows, dim, or dark.

MARK	HOW IT IS CARVED	MY PREDICTION	WHAT HAPPENED	ON THE WALL?
1. Left eye	cut through			
2. Right eye	shave			
3. Nose	cut through			
4. Grin	paint			
My test: _____				

Draw the rays: the candle as a dot, the eye as a gap in a line, the wall as a line. Draw straight rays from the candle through both edges of the gap to the wall.

1. Which word fits each kind of mark: transmitted, translucent or absorbed?

Quick check

Name: _____

1. Which mark throws its shape onto the wall at night? (A) painted, (B) shaved, (C) cut through.

2. A shaved eye at night: (A) glows, but throws no shape on the wall, (B) stays dark, (C) throws a bigger shape than a hole.

3. Why is the face on the wall bigger than the face on the pumpkin?

Answers

Seen in the lab: at Night the cut-through left eye and nose shine brightly and the cut eye throws a bright patch on the far wall (Back view), the shaved right eye glows dimmer and throws nothing, and the painted grin stays dark. Changed to Cut through, the grin shines too.

QUESTION	ANSWER	WHY
1	C	Only a hole lets the rays through in straight lines, so only a hole carries its shape to the wall.
2	A	Thin flesh lets some light through but scatters it, so it glows without a shape.
3	The rays spread	A good answer says light travels in straight lines from a small candle, and the rays spread apart, so they are farther apart when they reach the wall.

If your state or umbrella school asks, this lesson covers NGSS MS-PS4-2.

Pumpkin Lab is built on the mytekDev lab kit. Pumpkins are for carving with an adult: the lessons cut nothing real unless a grown-up does the cutting.

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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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