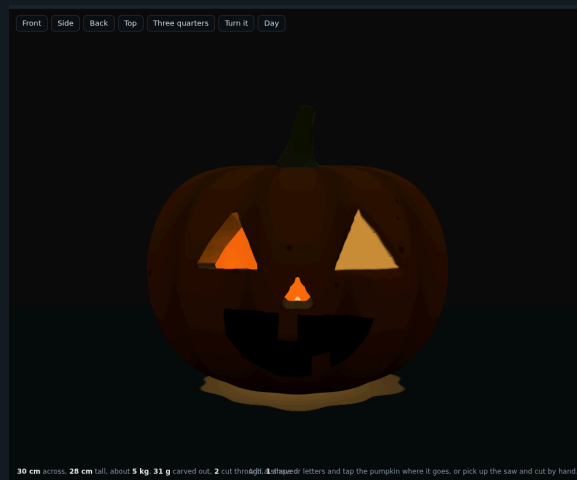


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# Pumpkin Lab: Light Through a Pumpkin

Grades 5-8 · 45 minutes

Science



Halloween science

Light and shadows

Slides, rubric and answer key

No student accounts

## What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A ten-minute walkthrough to rehearse before class, and background in plain words for the teacher
- 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
- 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 3-4 and in high school
- A homeschool edition for doing it together at home
- Standards: NGSS

# Pumpkin Lab: Light Through a Pumpkin

Grades 5-8 · 45 minutes · Science

A jack-o'-lantern is a light experiment everyone has seen. In this lesson students open a 3D pumpkin whose face is carved three different ways: the left eye and the nose are cut all the way through, the right eye is only shaved (the skin peeled off, the flesh left), and the grin is only painted on. Before turning the lights off, they predict what each mark will do in the dark. Then they press Night and find out: the holes blaze and throw their shape onto the far wall, the shaved eye glows through the thin flesh but throws no shape, and the painted grin stays dark. They change a mark from one kind to another and test again, then grow an eye and watch its shape on the wall grow with it. By the end, students can describe light that is transmitted, partly transmitted and absorbed, and explain with straight-line rays why the face on the wall is bigger than the hole.

## At a glance

### 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?**

### OBJECTIVES

Students will be able to:

- predict and test which marks on a pumpkin let light through, let some through, or stop it
- describe light that is transmitted, partly transmitted and absorbed, using the pumpkin as evidence
- explain with straight-line rays why the face on the wall is bigger than the hole
- change one thing at a time and record what happens

### VOCABULARY

transmitted, absorbed, translucent, opaque, ray, shadow, variable

### STANDARDS

MS-PS4-2

### TIME AND MATERIALS

45 minutes, grades 5-8.

- One computer or Chromebook per student or pair, with a mouse or a trackpad
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the project

### PREP

Make copies of the worksheet and exit ticket. Before class, open [mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin&ref=tpt-pumpkin-1](https://mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin&ref=tpt-pumpkin-1) once on a student computer to check that your school's filter allows it, and run the walkthrough in Before you teach once (about ten minutes). No

### ASSESSMENT

- Formative: the predictions on the worksheet, the questions under What to look for, and the exit ticket (answer key included).
- Summative: the worksheet's prediction and result table and the

### TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. The lab draws the pumpkin in 3D; the night view is the heaviest part, so on a slow Chromebook turn Flickers off on the Light bench. Students need no account and no email: the link works signed out, and nothing they make is stored on our

account is needed. If you want a real demonstration, a flashlight, a sheet of paper and a piece of cardboard with a hole in it show the same three results.

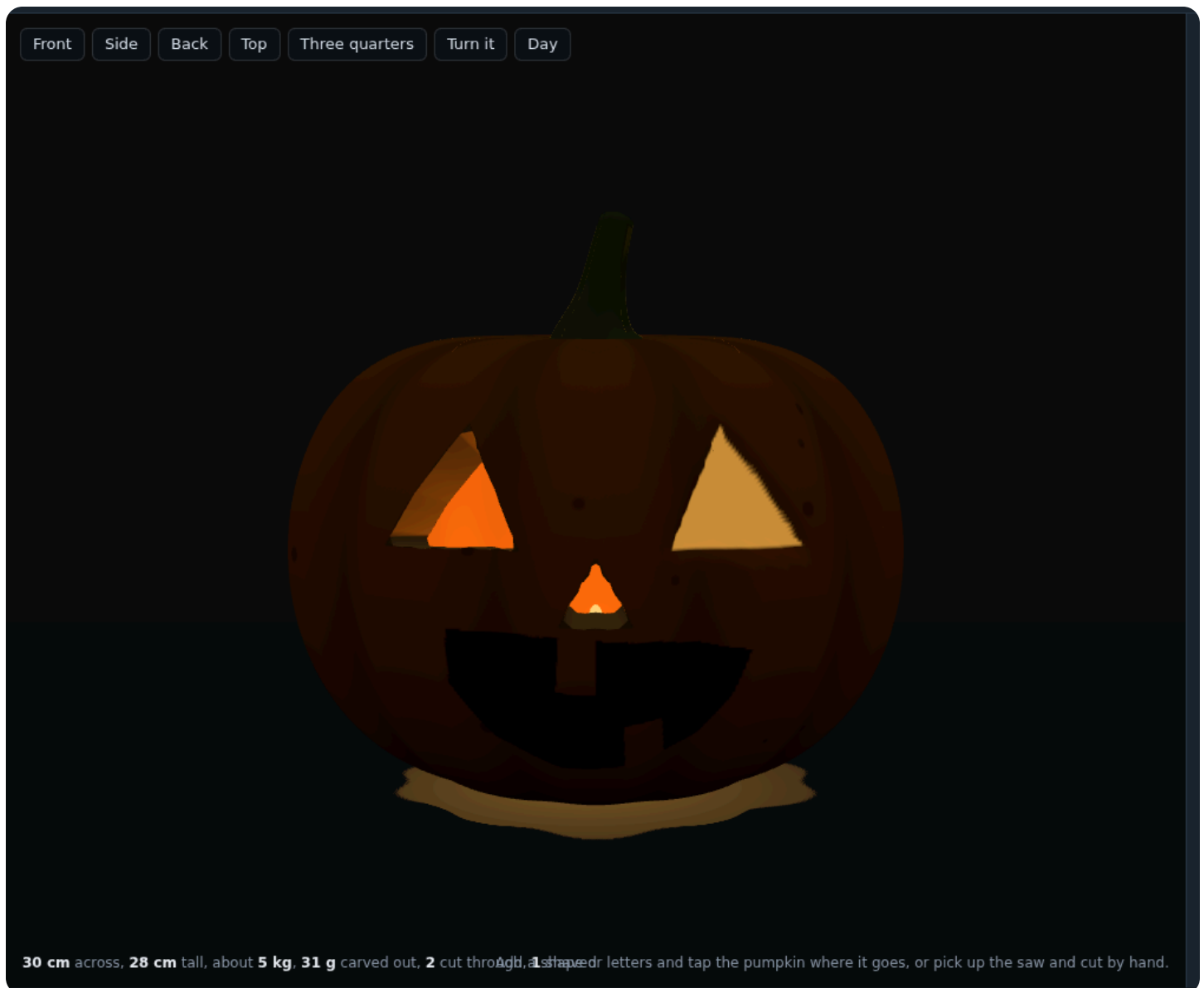
ray drawing, scored with the rubric out of 12.

server unless they choose to save it to an account. If your school blocks new sites, ask IT to allow mytekdev.com.

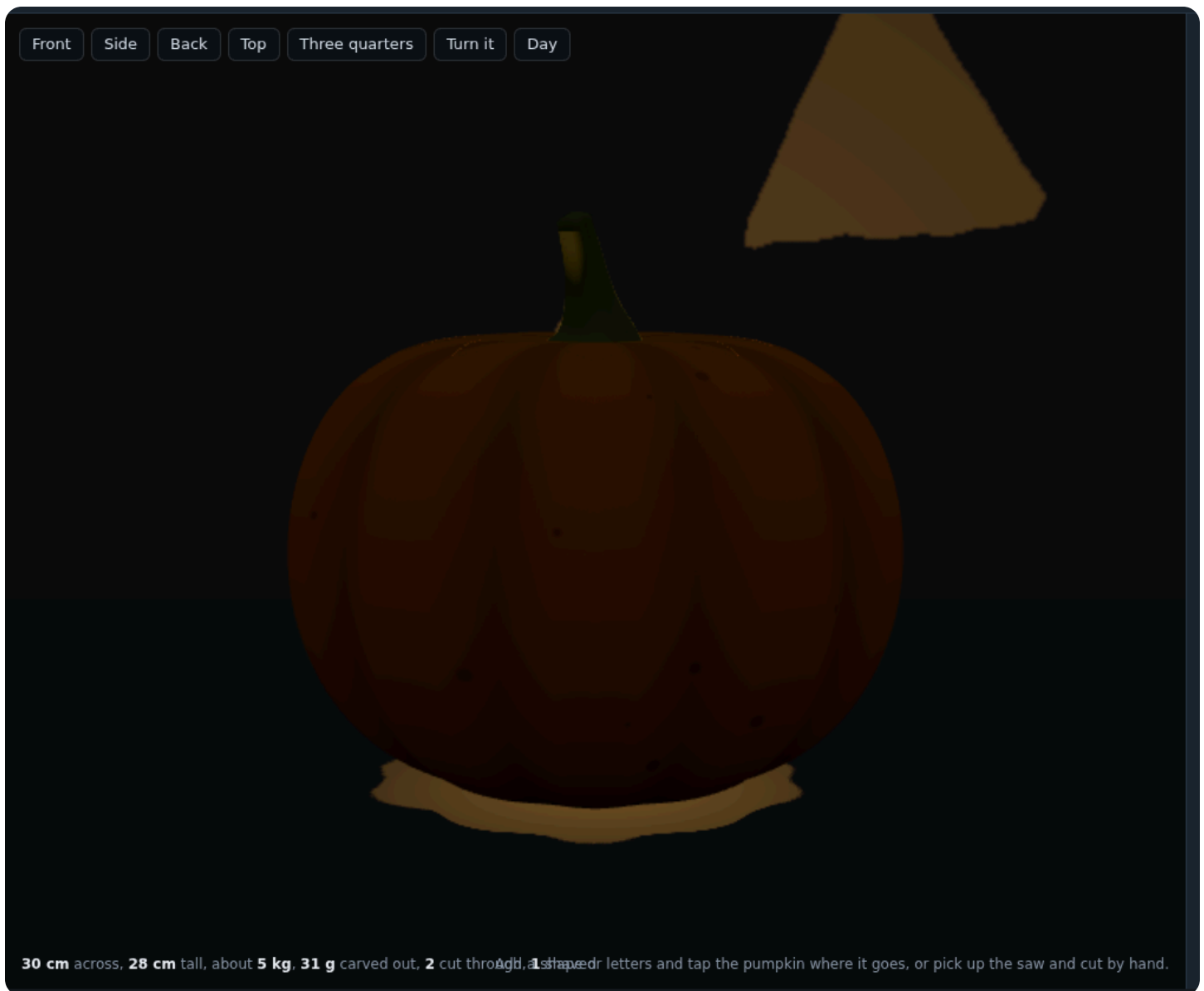
## Before you teach: do it once yourself

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

1. **Open the lesson.** Go to [mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin&ref=tpt-pumpkin-1](https://mytekdev.com/try/pumpkinlab?lesson=light-through-a-pumpkin&ref=tpt-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.

## Background 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.

| STUDENTS 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.                        |

## Lesson sequence

| MINUTES | STAGE                                                    | WHAT YOU DO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | WHAT STUDENTS DO                                                                 |
|---------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 0 to 7  | <b>Warm-up</b><br>Hook                                   | Show the title, essential question and Today I can slides (about 1 minute). Then have students open the link or scan the QR code on the worksheet. The pumpkin on the screen has a face carved three ways. Click Carve at the top and read the list under Your cuts: 1. Triangle cut through, 2. Triangle shaved, 3. Triangle cut through, 4. Grin painted. Ask: "When we turn the lights off, which of these will glow, and which will throw light on the wall?" Students write a prediction for each mark in the worksheet's table before anyone presses Night.                                                                                                                                                                                                                                                                                                                                                              | Open the pumpkin, read the four cuts, and predict what each will do in the dark. |
| 7 to 15 | <b>Direct instruction (I do)</b><br>Model it: lights off | Show the vocabulary and Three ways light meets a pumpkin. On the projector, press Night over the stage. The left eye and the nose blaze: they are holes, and the light from the candle is transmitted straight out. The right eye glows a duller orange: it was shaved, so the light comes through thin flesh, translucent, the way light comes through a hand held over a flashlight. The grin stays dark: paint on thick skin, and the skin absorbs the light. Point out the readout under the stage: 2 cut through, 1 shaved. Then press Back, the view button above the stage, to look past the pumpkin at the far wall: a bright shape lands there from the cut eye, much bigger than the eye.<br><br><b>It's working when:</b> Night is the button over the stage (it reads Day while it is night); the Light bench has the same switch. The view buttons Front, Side, Back, Top and Three quarters sit in the same row. | Compare each mark with their prediction and mark it right or not yet.            |

| MINUTES  | STAGE                                                        | WHAT YOU DO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | WHAT STUDENTS DO                                                             |
|----------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 15 to 25 | <b>Guided practice (We do)</b><br>Change one thing           | Together, change the painted grin to a hole: click Carve, tap 4. Grin in Your cuts, and press Cut through. Ask for predictions, then press Night: now the grin blazes too. Each pair then chooses one test of its own, changing only one mark from one kind to another (Cut through, Shave the skin, Paint only), predicts, tests at Night, and records it. Remind them that one change at a time is what makes a result mean something: that one change is the variable.                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Change one mark, predict, test at Night, and record the result in the table. |
| 25 to 38 | <b>Independent practice (You do)</b><br>The face on the wall | <p>Students press Night and then Back, to look at the far wall. They tap the cut-through left eye in Your cuts and move its Size slider, at night, and watch the shape on the wall. A bigger hole makes a bigger patch of light. Then they draw the worksheet's ray diagram: the candle as a dot, the eye as a gap in a line, the wall as a line, and straight rays from the candle through the top and bottom of the gap to the wall. The rays spread apart as they travel, so the patch on the wall is bigger than the hole. Walk the room and ask the questions under What to look for.</p> <p><b>Watch for:</b> Nothing glows: the light is set to No light on the Light bench; pick Candle again. A slow computer at night: turn Flickers off on the Light bench.</p> <p><b>Watch for:</b> The Front view hides the wall behind the pumpkin. The Back view looks past the pumpkin at the wall that the face shines on.</p> | Grow the eye at night, watch the wall, and draw the rays.                    |
| 38 to 45 | <b>Closure</b><br>Explain it, and exit ticket                | Show the last slide and ask: "The shaved eye glows, but it throws nothing on the wall. Why?" (Light comes through the thin flesh but is scattered in every direction, so it does not travel on as a beam in the shape of the eye. Only a hole lets the rays through in straight lines.) Ask the essential question again, then hand out the exit ticket.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Answer out loud, then answer the exit ticket on their own.                   |

## What to look for

Ask these while students work. A student 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 student who can explain why the glow makes no shape understands that only straight rays through a hole carry the shape.

## Cross-curricular extensions

- 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?

## Vocabulary

|                    |                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------|
| <b>transmitted</b> | Light that passes through something, like light through a window or a hole.               |
| <b>absorbed</b>    | Light that is taken in by a material and does not come out the other side.                |
| <b>translucent</b> | Letting some light through, but not a clear picture, like thin paper or a shaved pumpkin. |
| <b>opaque</b>      | Letting no light through, like the thick skin of a pumpkin.                               |
| <b>ray</b>         | A straight line showing the path light takes.                                             |
| <b>shadow</b>      | A dark area where light is blocked. Around a lit hole, the wall stays in shadow.          |
| <b>variable</b>    | The one thing you change in a test, while everything else stays the same.                 |

## Differentiation

### ENGLISH LEARNERS

- Post the vocabulary with a picture for each word: a window for transmitted, a sponge for absorbed, tissue paper for translucent.
- Point at each mark on the projector as you name it: hole, shaved, painted.
- Let students fill the prediction table with glows, dim, or dark.

### STUDENTS WHO NEED MORE SUPPORT

- Do the flashlight demonstration first: shine a flashlight through a hole in cardboard, through paper, and at cardboard with no hole.
- Give a sentence starter: "The \_\_\_\_ glowed because the light was \_\_\_\_ (transmitted, partly transmitted,

### STUDENTS WITH IEPs OR 504 PLANS

- Where the IEP allows a modified assignment, have the student test the three marks as given and skip the ray drawing.
- Give the worksheet with the four marks already written in the table.
- Pair students: one clicks, the other records predictions and results.
- Read the exit ticket aloud, or let students answer by pointing at the pumpkin on their screen.

### STUDENTS READY FOR MORE

- 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?

absorbed)."

- Check in at minute 20: did the student predict before pressing Night?
- Turn the pumpkin to Three quarters and find where the light from a cut on the side lands.

### **Adapting for other grades**

**Younger students:** For grades 3 and 4, run the night test together on the projector, use the words see-through, a little, and blocks, and score only the first two rubric rows (out of 8; 6 or more meets the objectives).

**Older students:** For high school physics, measure the patch on the wall against the size of the hole for two sizes, and use similar triangles to predict the patch from the distances of the candle to the hole and to the wall.

Student worksheet

Name: \_\_\_\_\_ Date: \_\_\_\_\_



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

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## Exit ticket

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?

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## Exit ticket

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?

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## Answer key: exit ticket

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. |

# Rubric

Score each row from 1 to 4.

Name: \_\_\_\_\_

| CRITERIA                             | 4 EXCEEDS                                                                                                                          | 3 MEETS                                                           | 2 APPROACHING                                                           | 1 BEGINNING             |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------|
| <b>Predicts and tests</b>            | Predicts every mark before testing, changes one thing at a time, and records each result.                                          | Predicts and records every mark.                                  | Records results without predictions, or changes several things at once. | Does not test.          |
| <b>Uses the light words</b>          | Explains each result with transmitted, translucent or absorbed, and says what about the material caused it.                        | Matches each mark to transmitted, partly transmitted or absorbed. | Uses the words without matching them to the marks.                      | Does not use the words. |
| <b>Explains the face on the wall</b> | Draws straight rays from the light through the hole that spread to a bigger patch, and explains why the shaved eye throws nothing. | Draws straight rays that show the patch is bigger than the hole.  | Draws the patch without rays, or with bent rays.                        | Does not explain.       |

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

## Standards

The NGSS performance expectation this lesson builds toward: students use a 3D model to describe light that is transmitted, partly transmitted and absorbed by different materials.

| FRAMEWORK | CODE     | GRADES | STANDARD                                                                                                          | HOW THE LESSON MEETS IT                                                                                                                                                                    |
|-----------|----------|--------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NGSS      | MS-PS4-2 | 6-8    | Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. | Students use the 3D pumpkin as a model, predicting and testing which carved marks transmit, partly transmit or absorb the candle's light, and draw rays to describe what reaches the wall. |

Checked October 2026 against: NGSS MS-PS4-2.

## 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. Work stays in the browser tab until it is closed.

To keep students' work, and see every student's pumpkin 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](https://mytekdev.com/tools/class-setup)

Students in a class open [mytekdev.com/tools/pumpkin-lab/lessons/light-through-a-pumpkin/start](https://mytekdev.com/tools/pumpkin-lab/lessons/light-through-a-pumpkin/start) instead of the worksheet link. Each one gets their own copy of the pumpkin, and the same link reopens it next time. A student who started at the worksheet link and then signs up keeps what they made.

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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