Family edition

Moon and Tides Lab: Why Does the Moon Change Shape?

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

Your child finds out why the Moon changes shape, in Moon and Tides Lab. The point is that the Sun always lights half the Moon, and the shape is how much of that half faces us. It is not Earth's shadow.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/moontideslab?lesson=why-does-the-moon-change-shape&ref=fam-moontideslab-1. No account, no email and nothing to install.
- Optional: a lamp with its shade off and a ball, for a real model.

Before you start: try it once yourself

Open mytekdev.com/try/moontideslab?lesson=why-does-the-moon-change-shape&ref=fam-moontideslab-1. A crescent Moon at 7 in the evening, low in the west over a beach in Boston. On the left, the Earth and Moon from far above the North Pole, with the Sun off to the right.

1. **Predict.** Pick one of the three answers in the guide. The yellow and blue arcs appear on the Moon.
2. **A half Moon.** Drag the Moon a quarter of the way round, to the top. The Moon over the beach becomes a half Moon, high in the south.
3. **A full Moon.** Keep dragging to the far side, opposite the Sun. The full Moon comes up in the east.
4. **The shadow.** Turn on `Earth's shadow`. It points straight away from the Sun. Press `Next` and answer the question again.
5. **Turn the Earth.** Drag the small person round, or press `Play`. The Moon moves across the sky; its shape stays the same.

> Nothing is to scale, and the app says so: the Moon is drawn much closer and bigger. Real distance shows it about 30 Earth-widths away.

The ideas, in plain words

The Sun always lights the half of the Moon facing it. As the Moon goes round the Earth, about once every 29 and a half days from new Moon to new Moon, we see more or less of that lit half. At new Moon the lit half faces away from us; at full Moon it faces us.

In one survey of 1,213 people, 48% chose "the shadow of Earth falling on the Moon" as the cause of the phases. Earth's shadow only reaches the Moon at a full Moon, and only some months: that is an eclipse of the Moon, the

next lesson.

The lit side of the Moon always points toward the Sun. That is why the evening crescent is lit on its lower right, toward the Sun that has just set.

Do it together

1. Open mytekdev.com/try/moontideslab?lesson=why-does-the-moon-change-shape&ref=fam-moontideslab-1 together. Ask your child what makes the Moon change shape, and pick that answer in the guide.

   > **You'll know it worked when:** Any answer is fine: it is saved and asked again later.

2. Drag the Moon a quarter of the way round its path, to the top.

   > **If you get stuck:** Grab the small Moon itself, not the Earth.
   >
   > **You'll know it worked when:** The Moon over the beach is a half Moon, high in the sky at sunset.

3. Keep dragging to the far side, then turn on Earth's shadow.

   > **You'll know it worked when:** The shadow points straight away from the Sun.

4. Drag back to a crescent with the shadow still on, and talk about what you see.

   > **You'll know it worked when:** Your child can say the shadow is nowhere near the crescent, so it cannot be what makes it.

Talk about it

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

- Which half of the Moon is lit right now? How do you know?
- Where is Earth's shadow when the Moon is a crescent?
- Where must the Moon be for a full Moon?
- You turned the Earth for six hours. What changed and what did not?
- Which way does the lit side of the Moon point?

> The second question is the real test: a child who can point to the shadow and the crescent at the same time has let go of the shadow idea.

For younger and older kids

Younger: For a younger child, do the lamp and ball in a dark room: hold the ball at arm's length and turn slowly. The ball shows every phase.

Older: For a teenager, solve the three Phases puzzles and explain why a waning crescent is a morning Moon.

Keep going

- Find where the Moon must be for a half Moon high in the south at 6 in the evening (Puzzles: Place the Moon).
- Turn on Real distance and say what the drawing gets wrong about the Moon's distance.
- Explain why a waning crescent is seen in the morning, not the evening.

Bring it into other subjects

- Math: the Moon goes from new to new in about 29.5 days. How many days between a new Moon and a first quarter?
- Art: draw the eight phases in a ring round a Sun, each one lit on the side facing the Sun.
- History: read how sailors and farmers used the Moon's phases as a calendar.
- English: write the shadow idea and the lit-half idea as two short claims, each with one piece of evidence.

For your records

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

LESSON	Moon and Tides Lab: Why Does the Moon Change Shape?
SUBJECTS	Earth and space science
TIME	45 minutes
WHAT WE DID	Used a model of the Earth, Sun and Moon to explain that the phases come from how much of the Moon's sunlit half faces Earth, and tested the idea that they are Earth's shadow.
SKILLS PRACTICED	Moon phases; Using a model; Testing an idea with evidence

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/moontideslab?lesson=why-does-the-moon-change-shape

Essential question: Why does the Moon look like a different shape on different nights?

Warm-up: Why does the Moon change shape? Write your best idea. _____

1. **Vocabulary.** Phase, waxing, waning, first quarter, orbit: write each in your own words.

2. **The phase table.** Put the Moon a quarter of the way round each time. For each place, draw what the beach sees and name the phase.

3. **The shadow test.** With the Moon a crescent and the shadow on, where is the shadow? _____

1. Is Earth's shadow what makes the Moon change shape? Use what you saw.

2. You turned the Earth for a few hours. What changed, and what stayed the same?

Quick check

Name: _____

1. The Sun lights (A) the side of the Moon facing Earth (B) half of the Moon, the half facing the Sun (C) the whole Moon at full Moon only

2. A full Moon is (A) between the Earth and the Sun (B) on the far side of the Earth from the Sun (C) in Earth's shadow

3. Why is a crescent Moon not Earth's shadow?

Answers

QUESTION	ANSWER	WHY
1	B	The Sun lights the half facing it, all the time.
2	B	Opposite the Sun, the whole lit half faces us. It is only in Earth's shadow during an eclipse.
3	The shadow points away from the Sun	At a crescent the Moon is nearly between the Earth and the Sun, nowhere near the shadow. A full answer says we see only a sliver of the lit half.

If your state or umbrella school asks, this lesson covers NGSS MS-ESS1-1.

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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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