Family edition

Sun and Seasons Lab: Is Summer When We Are Closer?

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

Your child tests the most common wrong idea in science, that summer comes when Earth is closer to the Sun, in Sun and Seasons Lab. The point is that Earth is closest to the Sun in early January, in the northern winter: the Sun's height and the length of the day make the seasons.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/sunseasonslab?lesson=is-summer-when-we-are-closer&ref=fam-sunseasonslab-1. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/sunseasonslab?lesson=is-summer-when-we-are-closer&ref=fam-sunseasonslab-1. A schoolyard in Denver on June 21 at 10 in the morning, with a stick and its shadow. On the right, Earth going round the Sun; along the bottom, Denver's year.

1. **Predict.** Pick one of the four answers in the guide. Nothing is marked right or wrong.
2. **Sun noon.** Press `Play`. When the shadow is shortest, a note says sun noon in Denver is at 1:02 pm and the shadow points north.
3. **December.** Press `December solstice`. The Sun's path is low: at noon it is 27 degrees up, the shadow 1.97 m, and the day 9 hours 21 minutes.
4. **The closest day.** Open `Tilt and Orbit` and drag Earth round, or press `Closest to the Sun`. Early January, 147.1 million km. The heading says Winter in Denver.
5. **Sydney.** Pick Sydney, Australia in the Town list: the same day, the same distance, and it is summer. Read the card, press `I see`, and answer again.

> Dragging Earth forward from December lands on January 2, 2027; the Closest to the Sun button goes to January 3, 2026, the closest day of the year on screen. Both are about 147.1 million km.

The ideas, in plain words

Earth's orbit is nearly a circle. Earth is about 147.1 million km from the Sun in early January and 152.1 million km in early July, a change of about 3 percent. Light spreads out as it travels, so that changes the sunlight by about 7 percent, for the whole planet at once.

What changes with the season is the angle and the length of the day. Earth's axis is tilted about 23.4 degrees and keeps pointing the same way, toward the North Star. In June the north end leans toward the Sun: in Denver the noon Sun climbs to 74 degrees and the day lasts 14 hours 59 minutes. In December it leans away: 27 degrees and 9 hours 21 minutes. In the Sunlight chapter, a summer day in Denver gets 3.1 times the sunlight of a winter day.

Many children who say "tilt" mean that the half leaning toward the Sun is closer. In Trumper's study of 378 high schoolers in Israel, 62% named the tilt, and 13% of those then chose "closer in summer" to explain it. The lean moves a town only a few thousand kilometers, and the guide's card gives the town's own number.

Do it together

1. Open mytekdev.com/try/sunseasonslab?lesson=is-summer-when-we-are-closer&ref=fam-sunseasonslab-1 together. Ask why it is warmer in summer, and pick that answer in the guide.

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

2. Press `Play` and watch the stick's shadow until it is shortest, then press `December solstice`.

   > **You'll know it worked when:** In December the noon Sun is low and the shadow is about twice the stick's height.

3. Open `Tilt and Orbit` and drag Earth round its path until it is closest to the Sun.

   > **If you get stuck:** Grab Earth itself, the small globe, not the Sun. Or press `Closest to the Sun`.
   >
   > **You'll know it worked when:** Early January, about 147.1 million km: winter in Denver.

4. Pick Sydney, Australia from the Town list, read the card, then answer the question again.

   > **You'll know it worked when:** Your child can say why one Earth at one distance has winter in Denver and summer in Sydney.

Talk about it

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

- When is Earth closest to the Sun? What season is it in Denver then?
- What is the season in Sydney on that same day?
- What changes about the noon shadow from June to December?
- Leaning brings a town a few thousand kilometers closer. Why does that not matter?
- If distance made summer, which months would be summer everywhere?

> The last question is the real test: a child who answers "January, for the whole Earth at once" can see why distance cannot be the cause.

For younger and older kids

Younger: For a younger child, stop after December: compare the noon shadow and the day length in June and December, and leave the cause for later.

Older: For a teenager, open Sunlight and compare the size test: about 3 times from the angle and day length, about 1.07 times from distance.

Keep going

- Open Sunlight and read the size test: how much more sunlight does a summer day in Denver get than a winter day, and how much does distance change it?
- Turn on The wrong axis in Tilt and Orbit and say what seasons Denver would have if the axis turned to face the Sun.
- Solve the puzzle Explain it, then compare the answer with the one in the app.

Bring it into other subjects

- Math: 147.1 and 152.1 million km. What percent farther is July than January? Divide and square to find the change in sunlight.
- Geography: find three cities in the southern half of the world and say which months are summer there.
- History: read about "A Private Universe", the 1987 film in which new Harvard graduates explain the seasons by distance.
- English: write the distance idea and the tilt idea as two short claims, each with one piece of evidence from the model.

For your records

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

LESSON	Sun and Seasons Lab: Is Summer When We Are Closer?
SUBJECTS	Earth and space science
TIME	45 minutes
WHAT WE DID	Used a model of the Sun, Earth and its tilted axis to test the idea that summer comes when Earth is closer to the Sun, and found that Earth is closest in early January.
SKILLS PRACTICED	Reasons for the seasons; 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/sunseasonslab?lesson=is-summer-when-we-are-closer

Essential question: Is summer the time of year when Earth is closest to the Sun?

Warm-up: Why is it warmer in summer? Write your best idea. _____

1. **Vocabulary.** Axis, tilt, orbit, solstice, sun noon: write each in your own words.

2. **The evidence table.** Denver on June 21 and on December 21: the noon Sun ____ and ____ degrees up, the noon shadow ____ and ____ m, daylight _____ and _____.

3. **The distance test.** Earth is closest to the Sun on _____, _____ million km away, and farthest on _____. On the closest day it is _____ in Denver and _____ in Sydney.

1. Is summer the time when Earth is closest to the Sun? Use two pieces of evidence from the model.

2. The lean card said leaning brings the town about _____ km nearer the Sun. Why is that too small to matter?

Quick check

Name: _____

1. Earth is closest to the Sun in (A) early July (B) early January (C) late March

2. On the day Earth is closest to the Sun, Sydney, Australia has (A) summer (B) winter (C) no seasons at all

3. Why is Denver colder in December? Use the words angle and day length.

Answers

QUESTION	ANSWER	WHY
1	B	About 147.1 million km in early January, against 152.1 million km in early July.
2	A	The south end of the axis leans toward the Sun then. One Earth, one distance, two opposite seasons.
3	Low angle and short days	The noon Sun is low (27 degrees in Denver), so its light is spread over more ground, and the day lasts only about 9 hours 21 minutes. A full answer says distance is not the reason.

If your state or umbrella school asks, this lesson covers NGSS MS-ESS1-1, Texas TEKS 112.26(b)(9)(A).

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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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