

🕒 Shadow Clock

Mission: The school garden is building a sundial. Move the Sun across the sky, mark the stick's shadow at different times and seasons, and discover the pattern that makes a shadow clock work.

Big question: Why do shadows change length and direction during the day and across the seasons?

★ Warm-up: Quick sketch

Sketch and label, then answer.

Draw a flagpole and its shadow at 8 AM if the Sun is in the east. ✓ **Shadow points west (away from the Sun) and is long.**

When is your own shadow shortest: morning, noon, or evening? ✓ **Around noon, when the Sun is highest.**

Key vocabulary

Rotation	Earth spinning on its axis, once every 24 hours.
Shadow	A dark area where an object blocks light.
Sun height (altitude)	How high the Sun is above the horizon, in degrees.
Pattern	Something that repeats in a predictable way.
Solar noon	When the Sun is highest in the sky.

1 Box 1

Predict

PREDICTION In the morning the Sun is in the east. Which way will the shadow point?

☐ West, away from the Sun ☐ East, toward the Sun ☐ Straight down, no shadow

Morning shadow

In the simulator: Set the time to **9:00 AM** in **March**.

Which way does the 9:00 AM shadow point?

☐ Northwest ☐ Southeast ☐ South ☐ East

✓ **Northwest**

2 Box 2

Record shadow data

Shadow data for a 1-meter stick

Time	Shadow length (m)	Points
7:00 AM	from simulator	from simulator
12:00 PM (noon)	from simulator	from simulator
3:00 PM	from simulator	from simulator

3 Box 3

Find the pattern

Use your table. When is the shadow shortest, and why?

- ☐ At noon, because the Sun is highest in the sky ☐ At 7 AM, because the Sun is closest
☐ At 3 PM, because it is warmest ☐ It never changes

✓ **At noon, because the Sun is highest in the sky**

4 Box 4

Try a different season

In the simulator: Mark the noon shadow in June and in December.

How much LONGER is the December noon shadow than the June noon shadow?

Answer: _____ m ✓ **varies: check the student's simulator readout**

Show your thinking:

Explain seasons and shadows

Why are winter shadows longer at noon?

- ☐ The Sun is lower in the winter sky ☐ The Sun is farther from Earth in winter ☐ The stick shrinks in the cold
☐ There is less daylight

✓ **The Sun is lower in the winter sky**

5 Box 5

Legend: tell time by shadow 🏆 Legend only

In March, a shadow points northeast and is about 1.4 m long. About what time is it?

- ☐ 3:00 PM ☐ 9:00 AM ☐ 12:00 PM ☐ 6:00 PM

✓ **3:00 PM**

6 Box 6

Final claim (CER)

Why do shadows change length and direction during the day?

Claim

Look for: Names the cause (Earth rotating / Sun position); at least 6 words

Evidence

Look for: Uses the noon data; Describes length; a number from the simulator; at least 12 words

Reasoning

Look for: Explains the east-to-west motion; Connects Sun height to shadow length; at least 12 words



Exit ticket: answer the big question in your own words

Why do shadows change length and direction during the day and across the seasons?

Look for: Earth's rotation makes the Sun appear to move from east to west, so shadows point west in the morning, north at noon, and east in the afternoon. Shadows are shortest when the Sun is highest. The Sun is higher in summer, so summer shadows are shorter.



Completion codes

Students see a code like **ABC-I3** when they finish. The first part must match below. The letter is the level (E = Explorer, I = Investigator, L = Legend), and the number at the end is how many stars they earned.

Level	Code starts with
 Explorer	1M1-E
 Investigator	19G-I
 Legend	1JY-L



Watch for these misconceptions

- "Seasons happen because Earth is closer to the Sun in summer." It is the tilt, not the distance.
- "Earth's shadow causes Moon phases." Phases come from our viewing angle of the lit half. Earth's shadow causes lunar eclipses.
- "The Sun moves across the sky." The Sun only appears to move because Earth rotates.