Loops in the Sky

Compare solar system motions and build an analemma calendar.

ESS.1B.2 "Compare and contrast celestial bodies (e.g., planets, natural satellites, comets, asteroids, and the Oort cloud) and their motion in our solar system (e.g., revolution and rotation). Build an Analemma calendar."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline five kinds of solar system objects or groups, circle phrases that describe rotation or revolution, and put a star beside two comparisons between them.

A Year at the Observatory

1. At a school observatory in the Northern Hemisphere, students compare what moves around what. Earth is a planet: it rotates on its axis about once every 24 hours and revolves around the Sun about once each year. Its Moon is a natural satellite, which revolves around Earth while Earth and the Moon together travel around the Sun. The Moon also rotates, taking about as long to turn once as it takes to orbit Earth, so nearly the same side faces us. Asteroids are smaller rocky or metallic bodies; many revolve around the Sun between Mars and Jupiter. They rotate, too.

2. Comets also revolve around the Sun, but many follow long, stretched-out orbits rather than the more nearly circular paths of planets and most main-belt asteroids. A comet's icy nucleus can release gas and dust when sunlight warms it, forming a coma and sometimes a tail. An asteroid is usually rock or metal and does not typically develop that display. Far beyond Neptune, the Oort cloud is a proposed, vast, roughly spherical region of icy bodies that orbit the Sun, not one solid object or a single satellite. Some long-period comets may come from there and take thousands of years or longer to orbit the Sun.

3. The observatory also builds an analemma calendar. On the same day each month, observers record the Sun's position from the same place at the same clock time, using standard time all year. They use a safely projected image rather than looking directly at the Sun. Over a year, the plotted positions trace a lopsided figure eight. In the Northern Hemisphere, June is near the top, December is near the bottom, and March and September are near the middle. Earth's rotation explains the Sun's daily apparent motion; Earth's tilted axis and changing speed as it revolves around the Sun shape the yearly pattern.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do Earth's and the Moon's paths differ, and what motion do they share?

2. How are a comet and a main-belt asteroid alike in their motion? Give one difference in their orbits or materials.

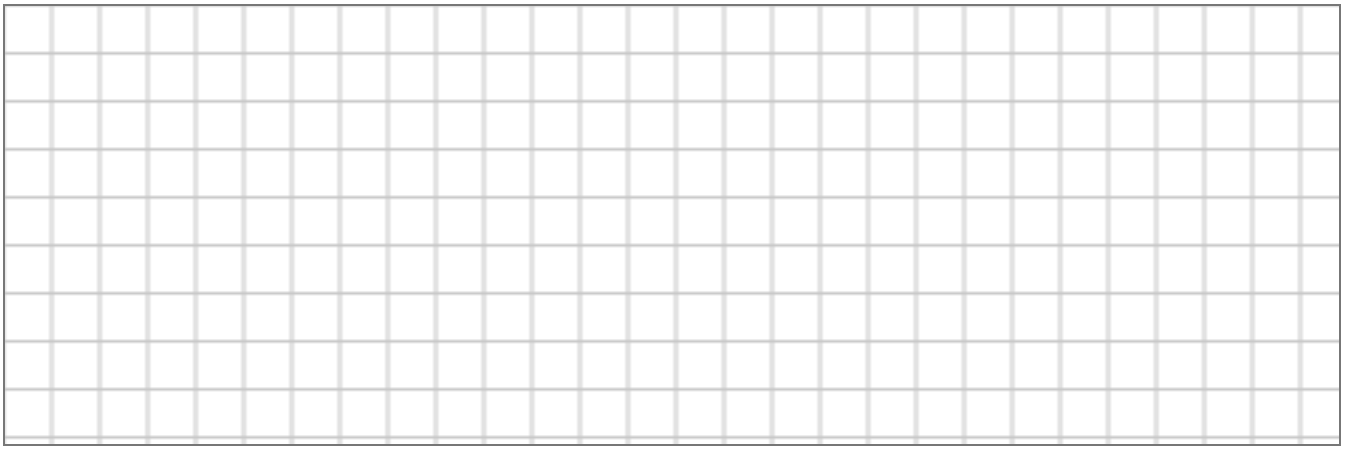
3. How does the Oort cloud differ from the Moon in what it is and what its members orbit?

4. Why must the observatory record the Sun at the same clock time to make an analemma, and what causes the positions to change across the year?

3 YOUR TURN

Your own words

On the grid, build a Northern Hemisphere analemma calendar: sketch a lopsided figure-eight path with 12 dots labeled in month order, placing June near the top, December near the bottom, and March and September near the middle. Write two sentences explaining how Earth's rotation and revolution relate to your calendar.



Loops in the Sky

PART 1 · READ AND MARK

Underline five kinds of solar system objects or groups, circle phrases that describe rotation or revolution, and put a star beside two comparisons between them. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do Earth's and the Moon's paths differ, and what motion do they share?	**Earth revolves around the Sun, while the Moon revolves around Earth. Both rotate, and both travel around the Sun.**
2	How are a comet and a main-belt asteroid alike in their motion? Give one difference in their orbits or materials.	**Both revolve around the Sun. Many comets have longer, more stretched-out orbits than most main-belt asteroids; comets also have icy nuclei, while asteroids are usually rock or metal.**
3	How does the Oort cloud differ from the Moon in what it is and what its members orbit?	**The Oort cloud is a proposed region of many icy bodies that orbit the Sun. The Moon is one natural satellite that orbits Earth.**
4	Why must the observatory record the Sun at the same clock time to make an analemma, and what causes the positions to change across the year?	**Earth's rotation makes the Sun appear to move during each day, so the clock time must stay fixed. Earth's tilted axis and changing orbital speed as it revolves around the Sun shape the yearly pattern.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Drawing: Twelve dots labeled January through December follow a lopsided figure eight in order, with June near the top, December near the bottom, and March and September near the middle. Writing: Earth's rotation makes the Sun appear to move across the sky each day. As Earth revolves around the Sun, its tilted axis and changing orbital speed help make the Sun's position at a fixed clock time change through the year.

Accept approximate month placement if the labels follow a continuous yearly path and the four specified months have the stated relative heights. The written explanation should distinguish daily apparent motion from the yearly change in position.