Virtual Field Trips

Galactic Gizmos

Investigating Earth and Sky Virtual Field Trip

This is a supplementary educator guide to assist parents and teachers with the asynchronous portion of the virtual field trip.
To reserve your virtual exhibit exploration experience, please fill out the Virtual Field Trip Request Form.

All associated activity guides can be found with the attached documents found on our website.
Additional resources can be found at the end of this guide.

This virtual field trip experience was generously funded by the General Motors Company.

What technologies were created based on changes in the sky?

Humans have learned to read the sky to tell the time, track yearly cycles, and navigate the Earth based on observed changes in the sky. These observations have led to technologies and innovations that we still use today. Modern-day clocks and calendars eliminate the need for humans to actively interpret these changes to determine the time of day or year. Technology has advanced to a point where atomic clocks are used to regulate clocks and time relative to the Coordinated Universal Time (UTC). Atomic clocks use the resonance frequency of atoms to measure the precise length of a second. This provided a form of timekeeping that was both more stable and more convenient than astronomical observations. It also gave rise to the global positioning systems that rely on synchronized time for pinpointing precise locations on the Earth's surface. Clocks, calendars, and compasses are all very important tools that are still used today and continue to be improved upon as humans strive for an understanding of the universe.

Connection to the Next Generation Science Standards

During this virtual field trip, your young scientists will analyze the patterns in the sky to determine specific measurements of time that correspond to the observed changes of the sun, moon, and stars.

After this field trip, your 5th grader should be able to explain these endpoints in their own words:

- Daylight is determined by the sun's position along the ecliptic, can be measured by observing shadows, and can help us navigate east or west.
- The angle of the sun's position in the sky changes slowly over the course of the year – it is lower in the sky during the winter and higher in the sky in the summer.
- Changes in the moon's phases denote the passage of a discrete amount of time of 29.5 days, also known as a month.
- The appearance of certain constellations also indicates the passage of time and informs when seasonal changes will begin to occur. Additionally, constellations can be used for navigation.

5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Disciplinary Core Ideas: ESS1.B

Earth's position in space in relation to the sun, the moon, and the stars creates observable and predictable patterns in the daytime and nighttime sky. We can use these observations to track daily and yearly cycles at various locations around the world.

Science & Engineering Practices: Analyzing and Interpreting Data

With the aid of the virtual planetarium, students will **analyze** the path of the sun at different times of the day and year, as well as the appearance of seasonal constellations, and use this information to **interpret** the time of day and year at a particular location on Earth. Students will also **develop and use** a sundial to **model** how the sun's shadow can be used to determine the time of day and time of year.

Crosscutting Concepts: Patterns

Students will recognize the predictable **patterns** of celestial objects: the 24-hour cycle of day and night observed by the sun's path from eastern horizon to western horizon, the cycling of moon phases over a 29-day period or a month, and the cycling of the seasonal constellations over the course of a year.

Nearpod Field Trip Outline

1. Welcome and Introduction to your Virtual Field Trip - Galactic Gizmos (Slides 1-3)
    a. To start, we meet Paulette, the Michigan Science Center's staff astronomer, and she poses the Driving Question, "What technologies were created based on changes in the sky?" There are several examples of the sky changing that we can observe, and this virtual field trip seeks to provide students with the information to explain these changes in their own words. To explore these changes safely and relatively quickly, Paulette will use her virtual planetarium in Stellarium to set the scene for student observations.
    b. Students will be prompted to answer the Driving Question through a **Collaborate** board.
        - Students are asked to share their thoughts and think aloud about the technologies that they are familiar with. Other students who participate in the lesson can also leave their thoughts and compare their answers to the ones that are posted.
    c. Students will then respond to the first **Open Ended Question**:

        Without looking at a calendar or a clock, type out today's date and the current time in the box below. If you aren't sure, make a guess!

        What clues, or evidence, did you use to help you come up with your answer?

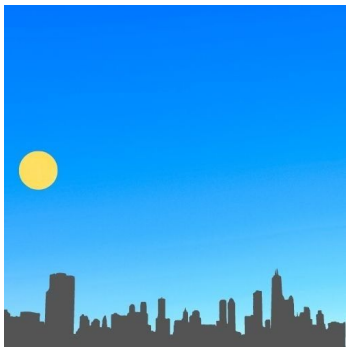
        - Student responses should purposefully show approximations of time and not an exact answer. Their answers are based on observations of the passage of time in their own terms (holidays, days of the week, daily routines, etc.)
        - Sample responses: It is close to 9:00 am because school started not too long ago; it is after 12:00 pm because I just had lunch; it is the first week of January because we just got back from winter break.
2. The Sun's Path (Slides 4-13)
    a. Reason for the Seasons
        - Paulette shows us where the sun will be at the same time of day on different days of the year.
            - What we can see is that the sun is in the sky LONGER during summer days, as its path throughout the day is HIGHER in the sky. Because of this the days of summer get more light and therefore more heat.

- Paulette explains that the Earth's axis of rotation is actually tilted slightly to 23.5° from center. The tilt of the Earth and its relative position to the sun gives us different seasons.

b. **Time to Climb**

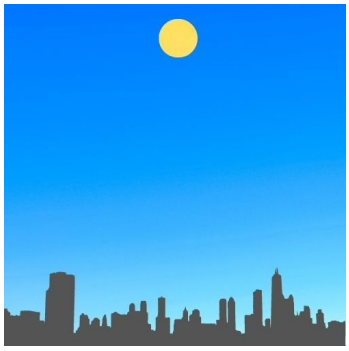
Students will match the time of day to the position of the sun as depicted in the picture.

- Q: What time of day is depicted in the picture?



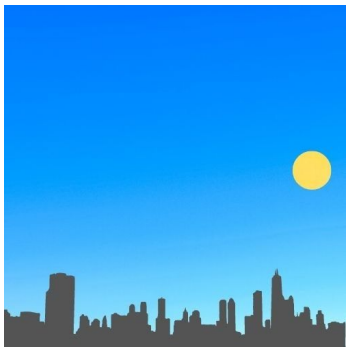
A: Morning

- Q: What time of day is depicted in the picture?



A: Afternoon

- Q: What time of day is depicted in the picture?

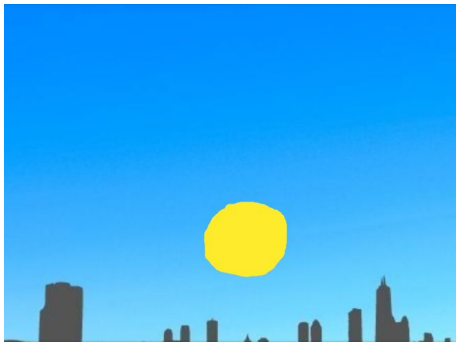


A: Evening

c. **Draw It**

- Students will draw the sun's relative positions at 12pm on the Winter Solstice and again on the Summer Solstice. The sun should be centered on the background in both images, lower in the sky on the Winter Solstice, and higher in the sky on the Summer Solstice.
- Some examples of acceptable work:

Winter Solstice



Summer Solstice

d. Shadows

- Paulette demonstrates how shadows form and how the sun's position in the sky changes the DIRECTION and LENGTH of the shadow.

e. Simple Sundial

- Paulette shows students how to make a working model of a sundial and how it is used to determine the relative time of day based on the sun's position in the sky. The placement of the sun's shadow can be interpreted as a specific hour of the day.
- It is encouraged that students follow along with the demonstration; however, students can explore the model separately after completing the lesson.
- The *Simple Sundial* activity guide can be downloaded from the Additional Resources under this Virtual Field Trip.

f. **Open Ended Question**

Can a sundial tell us what time it is at any time? Why or why not?

- This question is meant to get students thinking about how some technologies are only as good as how they can be used. Innovators seek to improve upon current technologies to become better at measuring or

depicting information. A sundial only works well when there is a proper amount of light that a shadow can be created, which can be difficult or impossible to use at night or on a really cloudy day.

- Sample responses: no, because it needs the sun's light to form the shadows that we use to figure out what time it is; no, sometimes clouds can block the sun's light and we can't see a shadow.

g. **Quiz**

Pick all that apply to the following statement: The changes we observe from the Sun allow us to use it like a....

- **A: clock; calendar**

h. **Open Ended Question**

Write down two observations that you have made today about the Sun.

- This question gives students a chance to summarize the discussion thus far. Answers may vary.
- Sample responses: the sun moves from east to west across the sky over the course of a day; the sun's shadow is in the opposite direction of where the sun is in the sky; the length of the shadow tells us how high or low the sun is in the sky.

Need a break?
This is a great time during the virtual field trip to take a break if you or your students need to get away from the screen. Don't worry, when you return, Paulette will recap what we've learned so far and jump back into the virtual field trip!

2. Celestial Objects (Slides 14-21)

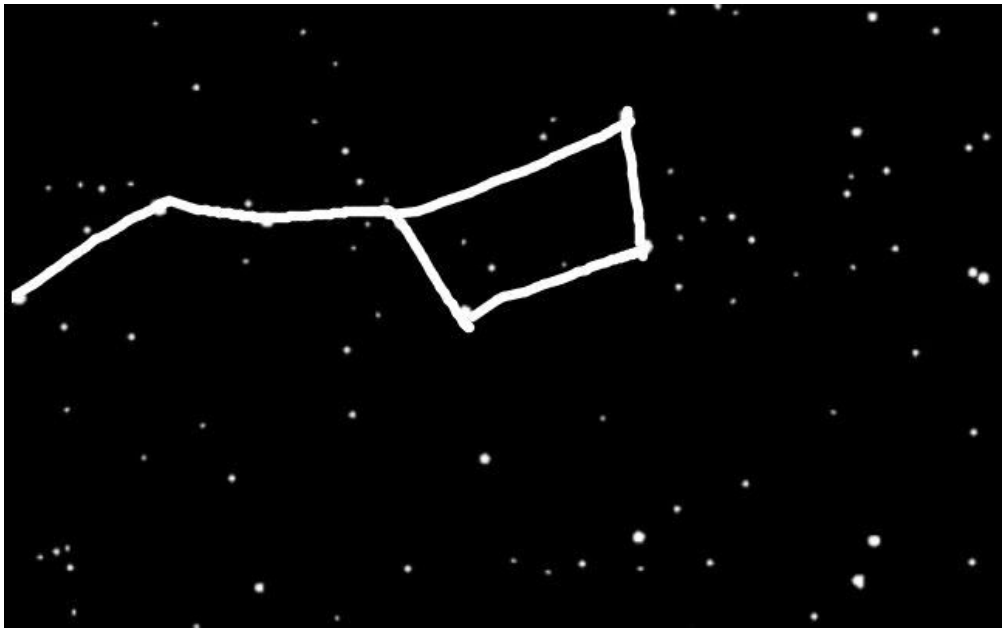
a. Seasonal Constellations

- Now that the students are familiar with the sun's different paths across the sky, we will now explore the patterns of other stars in the sky.

b. **Draw It**

- Students will practice recognizing a familiar circumpolar star pattern or asterism, the Big Dipper.
  - The Big Dipper appears in the previous video at 0:35.

- Sample response:



c. **Draw It**

- Students will practice recognizing a familiar seasonal star pattern or asterism, the Summer Triangle.
    - The Summer Triangle appears in the previous video at 2:30.
- Sample response:

d. **Matching Pairs**

- Students will match the image of the constellation to the name of the star(s) that are part of the Winter Circle.
  - The Winter Circle appears in the previous video at 4:05.

e. Zodiac Constellations

- Paulette explains how certain constellations lie along the ecliptic, or the path the sun follows across the sky throughout the year.

f. Planisphere

- Paulette shows us how to construct and use a planisphere. This tool helps us to find the stars and constellations that are visible throughout the year and at various times of the night.

g. Moon Phases

- Paulette takes us through one complete LUNAR CYCLE which takes 29.5 days to complete.
- A month, or moonth, is based on the complete cycle of the moon's phase.

h. **Matching Pairs**

- Students will match the period of time to its definition.

i. **Open Ended Question**

Name at least two time measurements that we can track using our observations of the daytime or nighttime sky and how we can measure them.

- This question gives students a chance to summarize what we have discussed today.
- Sample responses: a month is measured by how long it takes the moon to go through its phases; a day is when the Earth spins around once on its axis; we know what season it is by looking up at the sky and finding certain constellations; a year is how long it takes for the Earth to go around the sun once.

Additional Resources

Download Stellarium onto your computer, tablet or smartphone to explore the stars at home or on the go! Stellarium is a free, easy to use, planetarium software and includes a search function to locate anything in your sky.

Check the library of Astronomy Simulations and Animations from the University of Nebraska-Lincoln.

Learn more about how a sundial can be used as a Clock, Compass, and Calendar from Science Pickle.

Watch this segment from NOVA all about The Amazing Atomic Clock to learn more about how

The Old Farmer's Almanac is a resource that people have been using for hundreds of years! Visit the website to learn more about the moon phases and track when they will be happening.

For additional activities, information, and resources, check out MiSci's Junior Astronomer Educator Guide.

Activity Guides

The following Activity Guides have been included with the Virtual Field Trip. We recommend that you look through them and decide how and when to incorporate them within your schedule.

Simple Sundial 10 Minutes

Materials:

- Paper plate
- Pencil
- Crayons or markers
- Straw
- Compass
- Clock or watch (optional)

Make Your Own Planisphere 20 Minutes

Materials:

- Planisphere template
  - Visit In-The-Sky.org to download a template for
  - your location
- Scissors
- Tape
- Brass fastener or split pin (optional)
- *Constellation Scavenger Hunt* document

Curriculum Connections

This virtual field trip can be paired with the Mystery Science: Spaceship Earth curriculum.