Online Supplement for
Engaging Grade 1 Students in Space Science:
Scientific Modeling, Observations, and Patterns

Formative assessment ideas and Sample Questions

Task (1) – Patterns in the Sky: East-West Movement of Sun and Moon

Formative assessment for daily motion of Sun and Moon in the sky

At the conclusion of the multiple experiences of exploring the pattern of daily motion of the Sun and Moon, a possible structured formative assessment task could be to ask students a series of questions at their desks, at the teacher's desk, or in a special comfortable spot within the classroom.

What you need for this assessment:

- Separate images of the Sun and/or Moon low in the eastern sky (rising), an image of each high in the sky, and an image of each low (setting) in the western sky. To show that it is low in the sky, include the horizon and objects like trees or buildings on the horizon. Label the direction as "East" or "West" in the picture so students know which way the photo is looking.
- Blank paper and markers/crayons

Assessment ideas:

1. Show an image of the Sun or Moon low in sky (labeled east or west).
    - Ask the student if the Moon is rising or setting, and how they know (*they should reference the East-to-West pattern they noticed throughout instruction*).
2. Repeat with image of Sun high in the sky. If you've already had students explore annual pattern of height of the midday Sun, you might also ask them to compare two pictures showing the Sun high and not so high (e.g. closer to the trees in the picture) and ask which is summer, which is winter.

3. Give the student a sheet of paper. It could be blank, have words (east and west), or have only the letters (E) on one side and (W) on the opposite side.
    - Ask the student to draw the Moon (or Sun) and use arrows to show the direction or path that it moves through the sky. If drawing the Sun, you could also ask them to label where the Sun would be in the morning, and where in the evening.

Task (2) – Earth Rotation and Movement Pattern in the Sky

Sample teacher questions for students in the surrounding circle or for the student in the swivel chair

- How do we know when it is daytime? (*we can see the Sun, or the Sun is up*)
- If you live on the nose (since the head is the Earth), when is that person in daytime? (*facing the Sun*) Nighttime? (*facing away from Sun*)
- How do we show one full day/night cycle with our model? (*the student rotates one time, or spins one time. You can ask students to demonstrate rather than tell.*)
- What time do you ride the bus to school (not exact, but a general time frame = morning or early)? How would you show that time in the model? (*the East side left hand – should just be arriving at the Sun to show sunrise or morning*)
- When you get ready for bed and sleep, what time of day is it? (*evening, or beginning of nighttime*) How would you show that time in the model? (*the West side right hand – should just be leavingt the Sun as the model student is beginning to face away from the Sun to show sunset.*)

Task (2) – Earth Rotation and Movement Pattern in the Sky

Sample assessment to evaluate students' knowledge of the Sun-Earth-Moon:

Provide your students with a variety of art supplies, including circles of different sizes (to represent the Sun, Moon, and Earth) and various shapes. Ask them to draw or make a picture using the supplies provided to model the interactions of these three objects. This could be completed in various ways:

- You could give them specific parameters on what you would like them to produce (adult-centered).
- Or, you could start off with broad, general instructions about using the materials to represent the Sun, Earth, and Moon, and then provide guidance as you see fit while watching them put their ideas to paper (adult-guided).
- The art assessment could be left unstructured by you other than the general instruction to "use these materials to represent the Sun, Earth, and Moon;" this approach will capture student thinking including what features they choose to focus on (see assessment possibilities below)(student-centered).

Student artwork could be assessed on:

- The use of or drawing arrows to show that objects are in motion (spinning Earth, orbiting around the Sun in one year. Moon is orbiting Earth.
- Showing that the Earth and Moon are ½ illuminated and ½ dark in relation to the Sun.
- If you included relative size in your instruction, you could assess the relative size of the circle they use or draw to represent each object (Sun = biggest and Moon = smallest).

Task (3) – Another Pattern in the Sky: East-West Movement of Stars

Sample teacher questions while discussing stars

1. How does star motion compare to the motion of the Sun and Moon?

- Teacher note: student observation of a common pattern of East-West naturally leads to wondering why. This can be addressed by revisiting task (2) and adding stars to the model, as suggested in task (3).

2. Same and different chart (two columns with those labels). In the responses below, you can judge how ready your students are in terms of sophistication of reasoning they are able to offer. This text here summarizes the reasons at an adult level.
    - How are the motions of the Sun, Moon, and stars the same? (*response=they all move from East to West in a day*)
    - How is the time the Sun, Moon and stars are visible different? (*response = Sun only visible during the day, because that is what we mean by 'day' – that the Sun is up. Stars are only visible at night. This is because the bright Sun washes them out during the day and we can't see them in the Sunlight. Moon is visible sometimes during the day, sometimes at night. The Moon reflects enough sunlight that it is still visible even in the bright Sun of day, and since the Moon orbits around the Earth it is at different locations (day/night) at different times*)

Task (4) – Annual Patterns: Observing Length of Day, Altitude of Sun

Sample teacher questions

- How does your shadow change throughout the day?
- How can you tell where the Sun is by looking at your shadow (or maybe a picture of something that shows shadows)?
- Is the Sun up on the way to school at the beginning of the school year? How does this change as you get closer to winter break in December?
- During the summer, what time do you come in from playing? Is it always dark when you go to bed?
- During the winter, does it stay as light for as long?
- How does the height of the Sun differ between summer and winter?
- When thinking about the length of a day and the height of the Sun, how does it connect with the temperature you experience?

Formative assessment idea

Using drawings or photographs of a building, tree, school mascot, or person with (or without) a shadow:

- Ask students where the Sun is located (*if shadow is provided*)
- Provide them with a timeframe such as 'early morning' and ask them to draw the shadow that would be produced (*image shows the Sun but NOT shadows*)
- Provide students with the image (which includes a picture of the Sun in it) and its shadow, ask if it is correct or not. If not, how would they change the shadow size or position?
- On a picture of a person standing, with East and West labeled, ask students to draw and label the shadow of the person at 5 different times of the day if that

person didn't move all day: early morning, mid-morning, noon, mid-afternoon, evening.

Task (5) – Earth Orbital Period and Change in Annual Daylight

Sample teacher questions while discussing Earth's orbit

- In what season do we have the longest days? Shortest days?
- In what season do we have the warmest temperatures? Coldest?