# Phases of the Moon

**Objectives: *Students will be able to...***
- Model why we see phases of the moon.
- Use message events to trigger another character's sequence.

**Prerequisites**
- Computer Science: Students should have experience with events and sequences.
- Science: Students should be familiar with different patterns in the sky, particularly the phases of the moon.

**Materials & Tools**
- Ready-to-Go Slides and Teacher-led Slides
- Phases of the Moon Video
- Flashlight (optional for review activity)

**Computer Science Explanation**
Messages are a type of event that allows characters to interact with each other. In this lesson, students will use messages to program the phases of the moon.

**Lesson Preparation**
- Give students access to the Interactive Activity to use during the lesson.
- To observe how the position of the moon in relation to the sun and earth changes what we see of the moon at night, view the video of the Earth and Moon.
- Prepare for 3 students to model the movement of the sun, moon, and earth. You may want to prepare paper signs that say "Sun", "Moon", "Earth". If you have the space, set up for all students to get into groups of 3 to model the movement of the sun, moon, and earth.

**Vocabulary**

| Word | Definition |
|------|------------|
| Event | Something that causes something else to happen in a program |
| Rotate | To spin on an axis |
| Revolve | To move around something in a circle |

# Lesson Agenda
- Review the Movement of Earth and the Moon (10 mins)
- Introduction to Message Events (5 mins)
- Program Creation (15 mins)
- Closing (5 mins)

# Lesson Details

## Review the Movement of Earth and the Moon (10 mins)

Review with students why we see sky patterns: The earth rotates on its own axis, the earth revolves around the sun, and the moon revolves around the earth.

Have 3 students come to the front of the room to model the movements of the earth and moon around the sun.
If your room allows, you may choose to have all students get in groups of 3 to model this.
- The student modeling the sun can just stand still.
- The Moon student should revolve around the earth student.
- The Earth student should carefully rotate and also revolve around the sun.

Review how the moon goes through phases depending on where it is in its revolution of the earth.
- Students may need to study the picture very carefully to see why the moon has phases.
- You can use a flashlight and the 3 students to model this in a dark classroom. If you have access to a white ball you may use this to take the part of the moon.
- Provide students with the link to the interactive activity to practice their new understanding. Students will drag each moon phase from the left to the correct spot around the earth. You may project this on the screen and complete it as a whole class or share the link with students to complete on their devices.

## Introduction to Message Events (5 mins)

Students will be creating an animation that shows some moon phases in order around the earth.  Guide students through the process for sending messages between characters.
- Emphasize that each separate message must be sent with a different colored envelope. Students will need to use different envelopes to send messages between each moon phase.
- Students will also use the "hide" and "show" blocks to make only one moon phase appear on the page at a time.
- Show the two moon phase codes to students. Ask them to predict what will happen when the full moon is tapped.

## Program Creation (15 mins)

Give students time to create their characters.
- Students will add a sun and earth character. They can use the draw tool to add rays to the sun.
- Students will also need to add a few moon characters to show 2-4 different moon phases. They can use the draw tool to cover up parts of the moon character for each phase or they can use the full moon and crescent moon provided in the character library.

Guide students in programming their moon phases.

- Start with the first moon phase; the new moon, which will be completely covered in shadow. This moon will send a message but not receive one.
- Program the second moon phase with students. This moon phase should be mostly covered in shadow, with a sliver of moon showing. Program this moon to "hide" when the program starts, then to respond to the message sent by the first moon phase.
- Every other moon will have this same code, but with different colored messages. You may continue to demonstrate coding the remaining moons or students can continue with the rest independently.

Common Challenges and Questions

| Question/Challenge | Answer |
|---|---|
| **Why are all the characters "Full Moon"?** | "Full Moon" is the default name of the character. This can be changed in the character editing mode. |
| **How do I edit the moon?** | Students may click the checkmark out of habit instead of a paintbrush. They can still tap the paintbrush on the character in the character list on the left. |
| **My moons are out of order.** | Students might accidentally connect the message colors in the wrong order. Remind them that the message colors need to be connected in the correct order. |
| **Can I copy code to another character?** | At this point, it's better that students get practice adding the right code blocks, but it is possible to drag code to copy it to another character if time is limited. |

Extensions
- Students can make the background black and add small stars. They need to create a new background with the draw tool in order to do this.
- Students can continue adding more phases of the moon, but will not be able to complete a full cycle because there are not enough different colored messages.
- Students can make the earth rotate with the turn block and a loop.

## Closing (5 mins)

Allow students to share their programs with one another. If any students have completed any of the extensions, you may want to showcase these for the class.

Discuss the reflection questions with students.

## Resources

[Phases of the Moon Video](#) - This is a video that can help you and/or students understand why we see the phases of the moon.

## Assessment Rubric

| Category | 4 Advanced: demonstrates superior performance | 3 Proficiency: demonstrates consistent performance | 2 Moving toward proficiency/expectations | 1 Experiencing significant difficulty |
|---|---|---|---|---|
| Use message events to trigger another character's sequence. | Student creates a program in which characters successfully send messages to one another, and completes an extension option. | Student creates a program in which characters successfully send messages to one another in order and each one shows and hides. | Student creates a program in which at least one character successfully sends a message to another character. | Student needs significant support to program a character to send a message to another character. |

Scratch is developed by the Lifelong Kindergarten Group at the MIT Media Lab. See [http://scratch.mit.edu](http://scratch.mit.edu).