

STARS RESOURCES

Teacher resources

Phases of the Moon

ACTIVITY

Observe the Moon's orbit around the Earth to see how its appearance changes in the night sky. The activity can be done with or without a telescope.

By the end of this activity students will:

- be familiar with collecting and accurately recording observational data
- be able to explain the positioning of the Earth, Moon and Sun at different phases
- recognise that the phases are cyclical and predictable.

Note: This activity takes about a month of data collection to complete. Teacher supervision is required at all times.

BACKGROUND INFORMATION

Here are some suggested resources to familiarise yourself with the Moon and its motion around the Earth.

Read more on the phases of the Moon:

'Moon phases', NASA/JPL website, <https://www.jpl.nasa.gov/edu/teach/activity/moon-phases/>

'Moon phases', NASA website, <https://moon.nasa.gov/moon-in-motion/moon-phases/>

'Moon phases and tides', University of Melbourne, <https://indigenouknowledge.unimelb.edu.au/curriculum/resources/mathematics,-moon-phases,-and-tides>

Watch videos about the phases of the Moon:

'Tidal Locking | Why Do We Only See One Side of the Moon?', MinuteEarth (2:27 mins), <https://www.youtube.com/watch?v=6jUpX7J7ySo> (1 March 2015)

'Phases of the Moon', ABC Education by Sydney Observatory (1:40 mins), <https://www.abc.net.au/education/phases-of-the-moon/13705754> (14 January 2022)

Lunar phase simulator, NAAP Lunar Phases Lab, Astronomy Education at University of Nebraska-Lincoln website. <https://astro.unl.edu/nativeapps/>. (The simulation is downloaded as a native app. Click on 'NAAP Labs' for your operating system.)

All websites accessed 8/3/2022

Teacher resources

Phases of the Moon

PLAN AHEAD

It is suggested that you look up the Moon phases and start your observing during a new Moon (i.e. when there is no Moon in the sky). Use a website such as Time and Date, <https://timeanddate.com> to work this out.

Each night, observe the Moon at the same time. It is important that you go out roughly the same time every night. Moon rise or the 6.30 - 8pm window is optimal.

CURRICULUM LINKS

AUSTRALIAN CURRICULUM: YEAR 7 SCIENCE

Science Understanding

Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the sun, Earth and the moon (ACSSU115)

Science as a Human Endeavour

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119)

Science Inquiry Skills

Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (AC SIS125)

Measure and control variables, select equipment appropriate to the task and collect data with accuracy (AC SIS126)

Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (AC SIS129)

Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (AC SIS130)

Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements (AC SIS131)

Teacher resources

Phases of the Moon

RECOMMENDED PRE-LAB ACTIVITY

The concepts in this activity require students to think spatially, so start with a physical representation of the celestial bodies by running through an activity such as this one from Stanford University using a torch and a ball.

'Drive-by Science', Stanford Solar Center website, <http://solar-center.stanford.edu/activities/MoonPhases/Drive-By-Science-Moon-Phases.pdf> (2015)

Museums Victoria have a similar activity using cartoon pictures and prompting questions to engage and explain the phases of the Moon. This may be a useful alternative for your planned observing time. <https://museumsvictoria.com.au/learning/little-science/teacher-support-materials/phases-of-the-moon/>

HOW TO SET UP THE TELESCOPE

Watch these tutorials.

'How to set up a Dobsonian Telescope', ASTRO 3D YouTube (5:37 mins), https://youtu.be/pvb-_WqNkPQ (31 March 2020)

'Tools and Accessories for a Dobsonian Telescope', ASTRO 3D YouTube (11:06 mins), <https://youtu.be/M7kDzUK7ZHE> (31 March 2020)

All websites accessed 8/3/2022.

Teacher resources

Phases of the Moon

SUGGESTED ANSWERS

1. Describe the changes in the Moon's appearance over the course of your observations.

Expected answers should include descriptions of the shape of the Moon, the amount of shadow, and any extra features on the surface of the Moon that may be more, or less, prominent depending on the phase of the Moon.

2. Why do we see phases of the Moon? What causes the shadow?

The far side of the Moon is always in shadow. We see different shapes (phases) of the Moon because as the Moon orbits the Earth, we see different amounts of the illuminated part of the Moon from our position on Earth. Sometimes we see more of the Moon lit up and only a slim crescent at other times. The Sun's position is also important.

3. If the Moon was further away from the Earth, would a month be longer or shorter? Explain your reasoning.

Theoretically, a month would be shorter (if the length of a month was still based on the lunar cycle). The further out the Moon is, the slower it would move.

4. Imagine that you are now standing on the Moon looking back at the Earth.

a) How would the Earth change over the course of 24 hours?

You would see the entire Earth complete a rotation on its axis and see night and day for a full hemisphere of the planet.

b) If you stayed on the Moon in the same spot for a week, would the Earth's position in the Moon's sky change?

The Earth would be perpetually in the same position in the Moon's sky.

Teacher resources

Phases of the Moon

SUGGESTED ANSWERS cont'd

5. Apply your knowledge how the Sun, Moon and Earth move to complete this table. Remember to think about both how they move individually and together.

What causes Earth day/night	Similarities between Earth day/night and phases of Moon	What causes phases of the Moon
The rotation of the Earth around its own axis	<i>Both involve the motions of the Moon and the Earth</i>	The Moon's motion around the Earth
The light from the Sun shining on the Earth	The Moon and Earth are all constantly moving in circular orbits, with the bigger object revolving around the smaller one	The light from the Sun shining on the Moon
	They are both repetitive, predictable cycles	The Moon is tidally locked to the Earth

EXTENSION QUESTIONS

1. Many exoplanets are tidally locked to their stars. Predict what might happen if the Earth was tidally locked to our Sun. Consider the climate, ocean currents and weather patterns. (This is a hypothetical scenario.)

Answers might include:

- Large temperature differences between the sun-ward side and the dark side.
- Cooling and subsequent freezing of the atmosphere on the dark side, creating a vacuum that would suck the atmosphere from the sun-ward side.
- Evaporating oceans.
- The end of life.

Teacher resources

Phases of the Moon

SUGGESTED ANSWERS cont'd

2. *How might your observations have been different if you had conducted this experiment in the northern hemisphere over the same dates?*

This is a tricky question. Essentially, the similarities are the phases. But the Moon will be the other way up in the northern hemisphere, and the amount of light on the face of the Moon will change in the opposite direction over time.

Read more: 'do we all see the same Moon phase?', EarthSky website, <https://earthsky.org/moon-phases/do-we-all-see-the-same-moon-phase/> (24 February 2021)

3. *Remembering that a day is defined as the time it takes an object to turn once on its axis, how long is a day on the Moon?*

About 27 days, the same length of time it takes for the Moon to complete an orbit of the Earth.

FURTHER RESOURCES

Read about the phases of the Moon:

'Moon in Motion', Earth's Moon NASA Science website, <https://moon.nasa.gov/moon-in-motion/moon-phases/>

Watch some videos about the Moon:

'Phases of the Moon', Australian Academy of Science, (9:46 mins), <https://www.science.org.au/curious/video/phases-moon> (6 February 2015)

'What causes the phases of the Moon?', Stile Education YouTube (2:23 mins), <https://www.youtube.com/watch?v=YLczDRcd054> (14 September 2018)

Read about why you can sometimes see the Moon during the day, *The Conversation* website, <https://theconversation.com/curious-kids-why-can-i-sometimes-see-the-moon-in-the-daytime-83969> (31 January 2018)

All websites accessed 8/3/2022