Observing the Moon

Does the Moon always look the same? Does its surface look different at different times? What will your students say when you ask them these questions?

Many students are aware that the Moon goes through phases, but except for the "man in the Moon" — which many admit they have a hard time seeing — they probably haven't thought about the surface of the Moon and how we view it from Earth. Some students may mention that the Moon changes colors. It actually doesn't — the Moon's color changes due to the effects of our own atmosphere, not anything intrinsic to the Moon.

National Science Education Standards

- Content Standard in K-4 Earth and Space Science (Changes in Earth and sky, Objects in the sky)
- Content Standard in 5-8 Earth and Space Sciences (Earth in the solar system)
- Content Standard in 5-8 Science as Inquiry (Abilities necessary to do scientific inquiry)

Materials

- Clear skies
- Notebook
- Soft drawing pencil
- Binoculars
- Chart on page 13

Preparation

First, figure out when you can see the Moon. Use the *StarDate* Sky Almanac or a calendar to find the Moon's phase on the day you will carry out this activity. The outdoor part of this activity requires good weather.

In choosing a day, keep these tips in mind:

- Although "new Moon" may seem to be the perfect phase for this activity, it really isn't. "New Moon" means "no Moon." During this phase, the Moon is in the sky all day, but it lies in the direction of the Sun and its night side is facing Earth. That means no lunar surface features will be visible.
- During full Moon, patterns of dark and light on its surface are easy to distinguish. That's when the "maria" — smooth, almost crater-free regions on the Moon — are easiest to see.
- During crescent or quarter phases, the craters and mountains cast distinct shadows and become more noticeable.

JOHN GIANFORTE

Lunar eclipse

Once you know the Moon's phase, the chart provided here will help you decide the best time of day (or night!) for lunar viewing.

Activity

Draw two 10-cm circles in your observing notebook. List the time, date, sky conditions, and location. Indicate the phase of the Moon within your circle. Now, sketch in the light and dark areas. A soft pencil works best. Some students like to smudge their lines to show light and dark. If you have binoculars, repeat the activity using them. Binoculars will allow you to see a lot more detail. At another phase (at least five days later), repeat the activity.

Phase	New	First Quarter	Full	Last Quarter
Rise	Sunrise	Noon	Sunset	Midnight
Highest in Sky	Noon	Sunset	Midnight	Sunrise
Set	Sunset	Midnight	Sunrise	Noon

Full Earth

The Moon is AWOL right now. It passes between Earth and the Sun early tomorrow, so it's hidden in the Sun's glare. And even if the Sun wasn't in the way, there wouldn't be much to see: It's night on the lunar hemisphere facing our way, so the entire disk is dark.

Well, almost dark. The Sun is shining on the far side of the Moon, so it's not lighting up the side that faces Earth. But the side that does face Earth *is* getting some sunshine — reflected off of Earth.

We can see this "earthshine" when there's a crescent Moon in the sky, because it makes the dark portion of the lunar disk look like a gray phantom.

Right now, the earthshine is at its most intense. That's because there's a full Earth in the lunar sky. Earth covers an area more than 13 times greater than the Moon does. And on average, each square mile of Earth's surface reflects more than three times as much sunlight back into space. So a full Earth is about 40 times brighter than a full Moon.

While a full Moon always looks the same, a full Earth is constantly changing. Anyone standing on the Moon would see the entire surface of Earth as our planet turns on its axis. So they'd see different continents and oceans, plus the unceasing motions of clouds in the atmosphere. And since the same side of the Moon always faces Earth, our planet would always appear in exactly the same spot in the sky — a bright blue and white ball spinning in the sunlight.

This is the transcript of a StarDate radio episode that aired May 7, 2005. Script by Damond Benningfield, ©2005.

Analysis

Compare the naked-eye and binocular drawings done on the same date with each other. What details are visible? Can you identify any features from the lunar map? Now compare the drawings from one date to the other.

Extension

For an in-class activity, make craters by dropping marbles or pebbles into a deep basin of flour sprinkled with dry chocolate milk mix. You should get nice craters with elevated edges, and some with a series of splashed out materials centered on the crater. In a darkened room, shine a flashlight onto the cratered surface and show how the angle of the flashlight determines the length of the shadows. Students can research the surface of the Moon in the library or on the Internet.

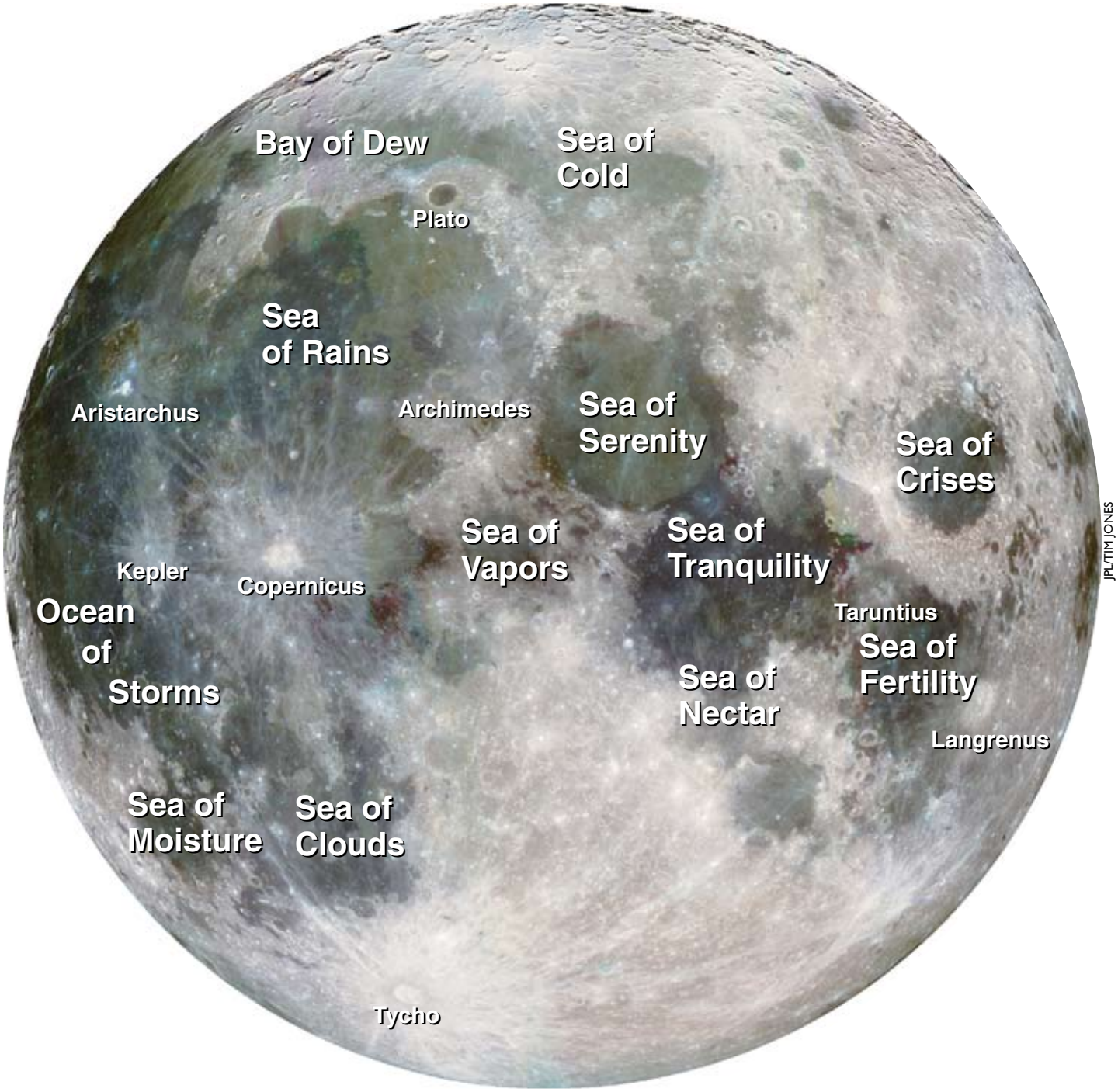
As a math extension, calculate the angle between the Sun and Moon for different phases.

For English, write a poem about the Moon.

Above: Impact craters and volcanic valleys on the lunar surface.
Right: An Apollo 15 astronaut salutes the flag.

JAXA/NHK (TOP); NASA

Learning the Lunar Landscape



JPL/TIM JONES

Observing the Moon

Subjects: Our Solar System, Observing the Sky

Grade Levels: K-8

Does the Moon always look the same? Does it's surface look different at different times? Students explore these questions by making drawings of the moon at different times.

Texas Essential Knowledge and Skills

Science

§112.11. grade K (b)-8(B) identify events that have repeating patterns, including seasons of the year and day and night.

§112.11. grade K (b)-8(C) observe, describe, and illustrate objects in the sky such as the clouds, Moon, and stars, including the Sun.

§112.12. grade 1 (b)-8(B) observe and record changes in the appearance of objects in the sky such as clouds, the Moon, and stars, including the Sun.

§112.12. grade 1 (b)-8(C) identify characteristics of the seasons of the year and day and night.

§112.13. grade 2 (b)-8(D) observe, describe, and record patterns of [caused by] objects in the sky, including [shadows and] the appearance of the Moon.

§112.14. grade 3 (b)-4(A) collect, record, and analyze information using tools, including microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, compasses, magnets, collecting nets, notebooks, sound recorders, and Sun, Earth, and Moon system models; timing devices, including clocks and stopwatches; and materials to support observation of habitats of organisms such as terrariums and aquariums.

§112.15. grade 4 (b)-8(C) collect and analyze data to identify sequences and predict patterns of change in shadows, tides, seasons, [in the reflection of sunlight,] and [in] the observable appearance of the Moon over time.

§112.16. grade 5 (b)-8(C) demonstrate that Earth rotates on its axis once approximately every 24 hours causing the day/night cycle and the apparent movement of the Sun across the sky.

§112.16. grade 5 (b)-8(D) identify and compare the physical characteristics of the Sun, Earth, and Moon.

§112.20. grade 8 (b)-7(B) demonstrate and predict the sequence of events in the lunar cycle.