SCOPE

On the skies

Phase this lunar narrative into your lesson plan.

Lighting the night

The following story from Native American Pahute lore suggests that the cyclical pattern of the Moon's phase changes can serve as a timepiece to mark the unit of time we call a month.[1]

The long, cold night

There was a time when the Earth was almost always dark. It was dark so much and so unpleasant for the creatures of the Earth that the people complained a lot to Shinob, the younger of two Pahute gods. "Why do you complain so much?" Shinob asked of his people.

"It is dark all of the time." The people replied. "Only the night bird can see." "We are hungry and cold," they continued. "We go to sleep in darkness and we wake up to darkness. Without light we cannot see to hunt! You must do something."

"You know that man who carries the Sun?" asked Shinob. "Well, he is the only one who does that job, and he cannot work all the time, so he sometimes stops to rest." "Besides," Shinob explained to the people, "Sun Man says he wants to quit, and if he were to quit, it would be dark all of the time."

"Why does he wish to quit?," asked the people. "He has a good job."

"He works all of the time and has no time to find a wife and have a family," replied Shinob. "And he is lonely," Shinob added.

Shinob asked the people if a young maiden were available to meet Sun Man. The people selected a young maiden and sent her off with Shinob, who would prepare her to meet Sun Man. Shinob changed her skin to a beautiful golden color, then took her to Sun Man to become his wife.

Sharing more light

Now that he had a life companion, Sun Man was very happy, and so he worked long, regular hours, often rising early. However, he wished his beautiful wife to be round like the Sun he carries with him. "She shines like the Sun," Sun Man said to Shinob, "so would you change her into a round shiny orb to make her even more like the Sun?" Shinob did this for the Sun Man as he knew it would make Sun Man happy, so Sun Man would continue to be consistent in his work carrying the Sun.

As time wore on, Sun Man's wife became homesick for her people. She asked Sun Man if she could go down to visit her hometown. Sun Man said it would be okay, but that she should hurry back as he would miss her.

Before leaving, she rubbed herself until her golden skin shined more than it ever had before. She went down toward Earth. Then, when traveling through the mountains, she came upon a lake. Because she had often been told of her beauty but had never seen herself after she had been turned into a golden ball, she decided to stop and admire her reflection. Ah, she was beautiful!

Seeing her reflection made her so excited and happy, she began to bounce up and down like a giant ball. Bouncing excitedly to her village, she started to swoop down close, toward the heads of her townspeople. Her approach frightened everyone because the people were unaware that the shining golden ball was really one of their brethren. Consequently, the townspeople panicked and ran away in fear, causing many of them to be hurt.

Compensating her people

The townsfolk called out to Shinob to stop the menacing bouncing ball from attacking them. They shouted for him to kill the ball before any more people were hurt, or even killed. Shinob hesitated to do this because he knew that killing Sun Man's wife would make Sun Man very angry and probably cause him to quit his job. Shinob defended her, saying, "the golden ball is only playing."

The townsfolk retorted that if Sun Man's wife were only playing when she caused them so much trouble, then perhaps a similar mishap would occur with Sun Man. Shinob agreed with their point, for without Sun Man, life on Earth as we know it would be very different. Shinob punished Sun Man's wife by commanding her to share her light with her townsfolk, compensating them for the darkness she had brought into their lives.

"She will be like the night bird," Shinob proclaimed. "She will travel only at night while Sun Man will continue to travel during the day as he always has. Her shiny skin will glow as she slowly moves through the sky, giving you some light during the night," he concluded.

The townspeople were not convinced that Shinob's punishment was a good idea and protested, "But she will be up there in the sky and can swoop down on us again."

"Do not worry," said Shinob, "she will be round like a ball for only a short time, such a short time that she won't have a chance to swoop down. Once she has fattened to the shape of a ball, she will immediately start to grow thinner—also, she will have a flat side so that she cannot bounce. Her slimming process will continue until she nearly wastes away. Then she will begin to fatten again, until she becomes round like a ball.

"She will be called Mat-oits (the Moon), and her size changes will be so regular you can keep time with them," Shinob continued. "Start counting when she is thin, and the time it takes for her to become fat and then thin again will be one measure. Call this measure one *moon*—every moon will be the same length. Call 12 moons one *snow*, and give each moon a name to specify

the seasonal changes."

And so it has been: Mat-oits has been this way ever since Shinob proclaimed her punishment. She is still married to Sun Man, who continues to carry the Sun across the sky. Sun Man travels day, whereas his wife travels at night. Occasionally they *do* meet in the sky and turn the sunlight the other way so they can be together in privacy for a while.

A Moon unit

Students can follow the lunar cycle of phase changes quite easily by conducting the following lunar observation activity.

Have students turn a sheet of plain or graph paper sideways and draw a line lengthwise across the page to represent the southern horizon. Have them mark the left end as east, the right end as west, and the midpoint of the line south. Students can add houses, buildings, trees, or other familiar objects that appear along the horizon at home.

Determine when the next new moon phase will occur and start this activity on one of the two evenings following the new moon. Night after night, at the same time, students should note note the Moon's directional position using a compass, its height above the horizon, and its current phase shape. Then on the same sheet of paper, students should sketch the Moon in its appropriate position above the drawn-in horizon. Students should continue observing the Moon in this way for two weeks. Have students mark the approximate date and time of each Moon sketch, or if there is not enough room, have them number the sketches sequentially.

To help students understand what causes the phase changes, you may want to use a light bulb, a globe, and a small styrofoam or tennis ball to represent the Sun, the Earth, and the Moon, respectively, in order to demonstrate how the Sun's light reflects off the Moon and bounces back to Earth. Turn out all lights in the classroom, turn on the "Sun," and move the "Moon" around the "Earth." Emphasize that this model in no way represents how the Earth, Sun, and Moon move in relationship to one another. The model is only to help students begin to understand why the Moon has phases based on the position of the Moon with respect to the Earth and Sun.

By the end of two weeks, at approximately the next full moon, students should have a sense of how the Moon moves with respect to the Earth and Sun. Each successive evening, the Moon has moved further away from the Sun's position in the sky at sunset. As the Moon's sky position changes, so does its phase. The moon phases increase, or wax, by filling in from west to east until the full moon. After reaching full moon, the Moon phases decrease, or wane, until the new moon. Students should also observe that the Moon sets later and later every evening.

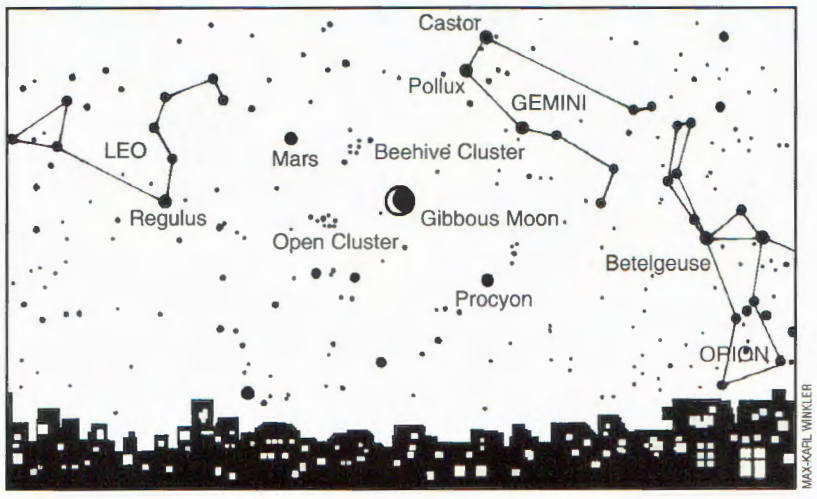
Approximately one week after the full moon phase, the third quarter moon, also called the last quarter, will sit over the southern horizon at sunrise. For a change of perspective, on a few mornings, have students observe and graph the Moon's changing position with respect to the Sun after sunrise: The Moon gradually moves toward the Sun as it progresses to the new moon phase.

Bright spring, dark skies

On Tuesday, March 21, the Sun passes over the equator, marking the March Equinox, the first day of spring in the northern hemisphere. During early spring, the Sun lies within the boundaries of the constellation Pisces the Fishes. This constellation and the surrounding star patterns are not visible because they appear only in the day sky. However, the constellations opposite the Sun's position are visible after sunset.

Look to find the sky's centerpiece—Leo the Lion, a constellation shaped like a sickle or reversed question mark. This constellation rises high over the southern horizon during March and features few truly bright stars. However, you should be able to see Leo, even if you live in the city.

West, or to the right, of Leo is a relatively empty-looking space where the faint stars of Cancer the Crab lie.



LOOKING EAST AT 9 P.M. ON MARCH 12, 1995.

Slightly farther to the west you will find the twin stars, Pollux and Castor, of the constellation Gemini. If you follow a line from Castor through Pollux toward Leo, about halfway to Leo you will find a faint, fuzzy-looking patch of light known as the Praesepe, or the Beehive Cluster. Appearing among the brighter of Cancer's dim stars, Praesepe is an open cluster of about 50 stars. Praesepe is fairly easy to see in dark skies and is visible through binoculars in any sky. Another, somewhat larger but fainter open cluster has 200 stars. You will need binoculars to see this cluster, which is located below the Beehive Cluster.

The Red Planet shines brightly between the stars of Cancer and Leo. The accompanying star chart shows an area of sky centered on Cancer. The waxing gibbous moon passes through this region of the sky toward the middle of March, passing closest to the Beehive Cluster and Mars on March 12.

Reference

1. Palmer, W.R. (1978). Why the Moon Changes. In *Why the North Star Stands Still, and Other Indian Legends*. Springdale, UT: Zion Natural History Association, Zion National Park.

Bob Riddle *is the planetarium director of the Kansas City School District at Southwest Magnet Math & Science High School.*

Moon phases

March
New Moon - March 1
First Quarter - March 9
Full Moon - March 17
Third Quarter - March 23
New Moon - March 31

April
First Quarter - April 8
Full Moon - April 15
Third Quarter - April 21
New Moon - April 29

Evening planets

Saturn: Sets shortly after sunset, not visible during March.
Mars: Rises at sunset and is visible all night.