Phases of the Moon

Monica Wilson
Saint Regis Elementary School
4th Grade Students - March 2010

Unit Overview

Students will learn that many people have carefully observed the Moon's appearance and motion in the sky and then utilized that knowledge in their daily lives. Through observation and modeling of the Moon over time, students will come to appreciate the explanatory and predictive power of accurate observation as they develop a deep conceptual understanding of the relationship between the phases of the Moon and the relative orientation of the Moon, Earth, and Sun in space.

Unit Objectives Aligned with Montana Benchmarks

Students will:

1. Recognize that observation is a key inquiry process for Montana American Indians. (Montana Science Content Standard 1, Benchmark 6, End of Grade 4)
2. Identify objects in the sky and their patterns of movement. (Montana Science Content Standard 4, Benchmark 6, End of Grade 4)
3. Use models that illustrate simple concepts and compare those models to the actual phenomenon. (Montana Science Content Standard 1, Benchmark 4, End of Grade 4)
4. Develop the abilities necessary to conduct scientific inquiry by asking questions about objects and events in our environment. (Montana Science Content Standard 1, Benchmark 1, End of Grade 4)
5. Use data to describe and communicate the results of scientific investigations. (Montana Science Content Standard 1, Benchmark 3, End of Grade 4)
6. Use digital tools and skills to construct new personal understanding. (Montana Technology Content Standard 3, Benchmark 5, End of Grade 4)

Essential Understandings

1. Students will learn that there is great diversity among the 12 tribal Nations of Montana in their languages, cultures, histories, and governments. Each Nation has a distinct and unique cultural heritage that contributes to modern Montana.

3. Students will discover that the ideologies of Native traditional beliefs and spirituality persist into modern day life as tribal cultures, traditions, and languages are still practiced by many American Indian people and are incorporated into how tribes govern and manage their affairs. Additionally, each tribe has its own oral histories, which are as valid as written histories. These histories pre-date the "discovery" of North America.

6. Students will realize that history is a story most often related through the subjective experience of the teller, with the inclusion of more and varied voices, histories are being rediscovered and revised. History told from an Indian perspective frequently conflicts with the stories mainstream historians tell.

Time/Scheduling
It will take one month to do the observations and the charting of the phases of the Moon. The other activities require about ten one-hour class periods.

Cultural Resources
- Assiniboine story: *Story About the Sun and the Moon* (available at http://apps.educationnorthwest.org/indianreading/6/story10.pdf)
- McCleary, T.P. (1997). *The stars we know: Crow Indian astronomy and lifeways.* Waveland Press.
- Cree story and Moon phase activity (available at http://www.wonderville.ca/asset/phases-of-the-moon)
- Stellarium: Free, open source Planetarium software that includes some American Indian constellation identifications (available at http://www.stellarium.org/)

Other Resources
- Going through a Phase, Probe 25 in Keeley, P., Eberle, F., & Farrin, L. (2005). *Uncovering Student Ideas in Science: 25 Formative Assessment Probes Vol. 1.*
- Moon phases photos may be found at: http://web.hallym.ac.kr/~physics/course/a2u/earthmoon/imgmoon.htm
- Moon orbit diagram may be found at: http://www.opencourse.info/astronomy/introduction/04.motion_moon/
- Moon phase simulator from the University of Nebraska may be found at: http://astro.unl.edu/naap/lps/animations/lps.html

Equipment and Supplies
Computers
3" Styrofoam balls
Skewers
Lamp without shade and 100 watt bulb
Pictures of Moon phases
Scissors
Glue
Poster boards or tag boards
Yardsticks
Extension cord
Pencils
Calendars
Protractors
Projector
Baseball
Golf ball
Rubber ball
Paper plates
Red construction paper
Masking tape

Lesson 1: Assiniboine and Sioux Tribes' Story

Monica Wilson
St. Regis Elementary School

Summary of Lesson

In this lesson students will listen to an Assiniboine and Sioux Tribes' story about the Moon.

Grade Level

4th grade

Approximate Time Required

45 minutes

Lesson Objectives and Montana Science Standards and Benchmarks Addressed

This lesson addresses the following unit objectives. Students will:

1. Recognize that observation is a key inquiry process for Montana American Indians. (Montana Science Content Standard 1, Benchmark 6, End of Grade 4)
2. Each tribe has its own oral histories, which are valid as written histories. These histories pre-date the "discovery" of North America. (Essential Understandings Regarding Montana Indians, Essential Understanding 3)

Resources and Materials

- Assiniboine and Sioux Tribes' story, *Story About The Sun And Moon* (available at http://apps.educationnorthwest.org/indianreading/6/story10.pdf)
- Ability to project *Story About The Sun And Moon.* If you cannot project the story, you can make copies for the students.

Teacher Preparation

- Review the story.
- Set up projector and/or make copies of story.

Background Information

For many years, Native American people have been observing the sky. They have told many stories about the Moon. Because the Moon has played a significant part in their cultures, some Native Americans have developed creation stories about the Moon.

Procedure

1. Ask students, "When you look up into the sky, what do you see?" If no student mentions the Moon, guide them to include this response.
2. Ask them, "Why do you think the Moon is important?"
3. Explain to students that Native American cultures have been observing the Moon for thousands of years.
4. Either project or hand out copies of the story.
5. Read *Story About the Sun and Moon.*

Formative Assessment
Tell the students that they have just listened to one of the many Native American stories about the Moon. Ask students to write a paragraph discussing what they found interesting about the story and why.

Lesson 2: Charting the Moon Phases

Monica Wilson
St. Regis Elementary School

Summary of Lesson

Students will observe and record the phases of the Moon for five weeks. They will be supplied with a five-week calendar and a chart that shows the Moon at different phases. Each night they observe, they will choose the photo that looks most like the Moon they saw that night and attach it to their calendar along with the time that they observed. Students will learn that the Moon's appearance changes throughout the month, that the phases begin to repeat after about a month, and that the moon can be seen at various times of the day.

Grade Level

4^{th} Grade

Approximate Time Required

This lesson will take about five weeks. Students will observe the Moon two to three times a week at any time during the day or night. Most of this lesson will be done outside of regular class time.

Lesson Objectives and Montana Science Standards and Benchmarks

This lesson addresses the following unit objectives. Students will:

1. Develop the abilities necessary to conduct scientific inquiry by asking questions about objects and events in our environment. (Montana Science Content Standard 1, Benchmark 1, End of Grade 4)
2. Use data to describe and communicate the results of scientific investigations. (Montana Science Content Standard 1, Benchmark 3, End of Grade 4)
3. Identify objects in the sky and their patterns of movement. (Montana Science Content Standard 4, Benchmark 6, End of Grade 4)

Resource and Materials

- Five-week calendar for each student. (attached to this lesson)
- Two 24-phase pictures of the moon. (attached to this lesson)
- Glue
- Pencils
- Scissors
- http://www.stellarium.org/

Teacher Preparation

Make copies of the calendar and fill in the month and dates that the students will be observing. Copy enough Moon phase charts so that each student has two. If there are clouds that prohibit viewing of the Moon, you can also view the phases through the Stellarium website. This website allows you to set the date and location, and track the phases for the entire month. Directions on how to use Stellarium are attached.

Background Information

The Moon's appearance changes throughout the month due to the changing relative positions of the Earth, Moon, and Sun. Half of the Moon is always bright, because it faces the Sun and reflects the sunlight which falls upon it, and half of the Moon is always in shadow, because the Moon itself blocks the sunlight from reaching it. The Moon rotates once every time it orbits, which means that the same side of the Moon always faces the Earth. When the Moon is between the Earth and the Sun, the side facing the Earth is wholly in shadow and we see none of the illuminated half. This is called a "New Moon." When the Moon is opposite the Sun in the sky, the side facing the Earth is wholly illuminated and we see a "Full Moon." When the Moon is in between these two extremes, the side facing the Earth is partly illuminated and partly in shadow. The different shapes created by how much of the illuminated portion we see from Earth are called lunar phases. Since the time of day the Moon can be seen depends on where it is in relation to the Sun, different lunar phases are seen at different times of the day.

Helpful web sites:

- See the University of Nebraska's Lunar Phase Simulator for an interactive illustration of these ideas: http://astro.unl.edu/naap/lps/animations/lps.html
- A Moon Phases Calendar for any month and year can be found at: http://www.moonconnection.com/moon_phases_calendar.phtml

Procedure

1. Ask students what shape they saw when they looked at the Moon. Have them draw the shape on the board. If they only draw a Full Moon, ask if anyone else has seen a different shape. Continue this until students come up with as many different shapes as possible.
2. Have them discuss the following with a partner:
    - Why are there are so many shapes?
    - How often do you see these shapes?

    When they are done discussing with their partner, have a class discussion.
3. Pass out the calendars and the Moon phase charts to each student.
4. Explain to students that they should try to observe the Moon two to three times a week for five weeks. They should have at least a day or two between each observation. They can observe the Moon during the day or at night. Once they start the observations, you might need to remind them to do their observations so that they don't forget.
5. Each time they observe the Moon, they will choose a photo from the Moon phase chart that most closely matches their observation. They should cut the photo out and attach it to the correct date on the calendar with the time they observed. If it is cloudy on the day they want to observe, they can observe the next day.
6. During the observations, they should be thinking about
    - Why does the Moon appear to change shape?
    - Were there certain times during the day or night that the Moon could not be seen?
    - Could the Moon always be seen at the same time throughout the five-week observing period? Ask the students to try to explain why.
7. When the five weeks are done, have the students bring in their calendars and discuss their observations.

Formative Assessment

Have students use the remaining 24-phase chart to predict what the phases will be for the rest of the month. On the back of the calendar, have them answer these questions:

1. What did you learn about the Moon while observing it for a month?
2. Why do you think the Moon appears to change shape?
3. Why could you see the Moon at different times of the day or night?

Rubric for Lesson 2 Formative Assessment Questions

3 pts.	Recognized that there was a pattern and answered the questions in a thoughtful way.
2 pts.	Looked often enough that they could see a pattern.
1 pt.	Made careful observations.

Month_____

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
time	time	time	time	time	time	time
time	time	time	time	time	time	time
time	time	time	time	time	time	time
time	time	time	time	time	time	time
time	time	time	time	time	time	time

Moon Phases

From: http://web.hallym.ac.kr/~physics/course/a2u/earthmoon/imgmoon.htm

Using Stellarium to Illustrate the Phases of the Moon

1. Open Stellarium and make sure your location is set to where you are. The location menu is the top left menu on the pop-out menu bar on the left side of the screen. Your location is probably already set correctly, but if not, you can look up your location or enter the latitude and longitude coordinates for your town (a quick Google search will help you find these on the web).

2. Use the arrow bars to move your viewpoint until you are facing south.

3. Open the time menu (the clock icon, second icon down on the left menu bar) and set your time to 9 or 10 in the evening (whatever time is appropriate for your observations).

4. Open the Sky and Viewing Options menu (third menu down on the left menu bar) and under the View menu at the top, choose the leftmost option, "Sky." Under the Stars and Planets menu at the right side, check the box that says "Scale Moon." This will tell the program to illustrate the lunar phases.

5. Use the ctrl page up/page down keys to zoom (on a Mac, use Apple up/down). Zoom out until you can see a wide field of view to the south. The horizon will start to look a little warped, but that's OK, you want to see a big swath of sky. Use the up and down arrow keys to place the horizon at the very bottom of the screen.

6. To move forward in time one solar day at a time, hit the = key. The – key will move you backwards in time one solar day at a time. Just keep hitting the key to move as far as you want in time as fast or slowly as you want. If, at any time, you want to zoom in on the Moon, you can use the mouse, or arrow keys to center the Moon and then zoom in on it. The Stellarium Moon looks fairly realistic.

To get a first idea of how the Moon changes appearance and location over time, its best to stay facing south, keep your time of observations constant, and step through time one day at a time. Once everyone is clear on what that looks like, then you can start changing the other variables one at a time (observation time, viewing direction, etc.). By continuously clicking the = key, you can make a nice movie of the Moon's motion and change of appearance over the course of a month. The kids should be able to explain why there are some days that you can't see the Moon at all at that particular viewing time (its not up yet, because of where it is in its orbit around the Earth). If you load the program on school computers, the kids could use the program in conjunction with their observations and models to check their predictions of what the Moon would look like on any future day.

7. The ? on the pop-out menu at the bottom left corner of the screen lists many shortcut keys you can use to control what you see on the screen and how you can move around in time and space. Here are a few useful ones:

L	increase time speed
J	decrease time speed
7	set time rate of flow to zero
=	move forward in time one solar day
-	move backward in time one solar day

You can also use the arrow keys at the right side of the pop-out bar at the bottom of the screen to move in time. The double right arrow will move you forward in time. Click it twice and the time flow rate will increase. Click it three times and it will increase even more. The double left arrow works the same way for moving backwards in time. The single forward arrow moves time forward at the normal rate.

8. There are several horizons you can choose from. If you want one that looks more like Montana, you can choose the Hurricane Ridge horizon- it has mountains and trees. You can find it in the Sky and Viewing Options Menu under Landscapes.

Lesson 3: Moon Phase Model

Monica Wilson
St. Regis School

Summary of Lesson

The students will model the phases of the Moon with a 3" Styrofoam ball, a light source, and a directional mat. By physically demonstrating the phases, students will gain an understanding of how the phases occur.

Grade Level

4th

Approximate Time Required

1-2 hours

Lesson Objective and Montana Science Standards and Benchmarks

This lesson addresses the following unit objectives. Students will:

4. Identify objects in the sky and their patterns of movement. (Montana Science Content Standard 4, Benchmark 6, End of Grade 4)
5. Use models that illustrate simple concepts and compare those models to the actual phenomenon. (Montana Science Content Standard 1, Benchmark 4, End of Grade 4)

Resources and Materials

- 3" Styrofoam balls, one for each pair of students
- Skewers, one for each pair of students
- Lamp without shade
- 100 watt bulb
- Poster boards or tag boards
- Black markers
- Yardsticks
- Protractors
- Scissors
- Glue
- Desk
- Extension cord
- Copies of Moon phases

Teacher Preparation

- In pairs, students need to make a directional mat before the lesson (see attached).
- Place the skewers in the Styrofoam balls.
- Make copies of the Moon Phase Pictures Form to hand out to students (see attached).
- Desks and chairs need to be pushed to the side of the room so that there is a large open space. Make the room as dark as possible. Place the directional mats around the room so that the 360º position points toward the light source.

- Place the lamp with the 100-watt bulb in the middle of the room on a desk. Make sure that the light from the lamp will not be blocked by anything near the center of the room.

Background Information

If you look at the Moon at different times of the month, its shape appears to change. Half of the Moon faces the Sun and sunlight is reflected from the surface of that half of the moon. The other half of the Moon faces away from the Sun and appears dark. When the half of the Moon that is facing the Sun is visible from Earth, the Moon appears as a full circle of light. This is known as a Full Moon. As the Moon orbits around the Earth, we see different amounts of the half of the Moon that is reflecting sunlight. The different shapes that we see from Earth have to do with the position of the Moon in its orbit around the Earth.

Procedure

1. Write this question on the board, "What causes the phases of the Moon?" Tell students that when they are doing this activity that they should be thinking of this question.
2. With the classroom lights off, student partners should form a circle around the light source.
3. One student from each pair should stand in the middle of the directional mat and face the light source (i.e., face the 360º degree mark on the directional mat).
4. Explain to students that they are the Earth and that they are going to hold the skewer with the Styrofoam ball, the Moon, at about arms length and eye-level in front of them.
5. Ask them to look at the Moon phase chart and locate which phase they see on their Styrofoam moon. They should see a new Moon.
6. Next, they switch places with their partner and ask what they see. Remind students to keep their Moon at eye-level and arm's length from themselves.
7. When both partners agree as to what phase they see, have them cut out the phase and glue it onto the 360˚ position.
8. Repeat steps 3-6 starting with 45˚ position, and then moving counterclockwise through the eight directional positions on the mat. When students reach 180˚, tell them that they might need to raise their Moon above eye-level so there won't be an eclipse.
9. After students have completed the activity, discuss as a class the question that is on the board, "What causes the phases of the Moon?"

Formative Assessment

Have students answer *Going Through a Phase,* probe 25, by Page Keeley, Francis Eberle, and Lynn Farrin, Uncovering Student Ideas in Science 25 Formative Assessment Probes Vol. 1, NSTA press, 2005

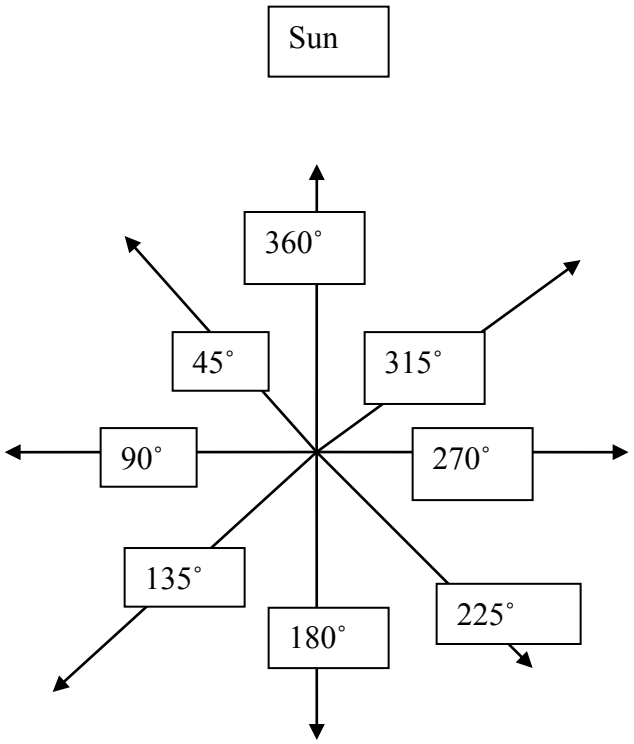
Instructions for Creating the Directional Mat

Materials and Supplies

- Poster board or tag board (one for every two students)
- Pencils and markers
- Protractors
- Yard stick

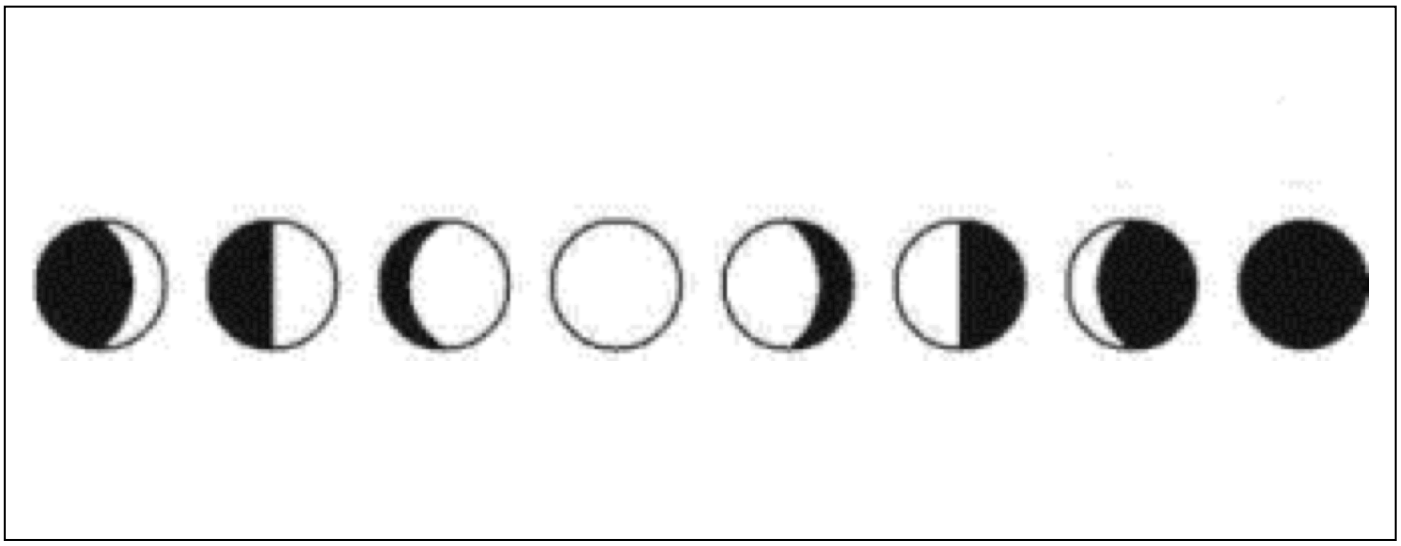
Procedure

1. Students begin by measuring the sides of the poster board or tag board to determine the center point of the board.
2. Once the center point is determined, students will draw a line down the center of the poster/tag board.
3. Next, students use protractors to measure and draw 45º, 90º, 180º, 225º, 315º, and 360º lines.
4. Finally, students label the 360º line as pointing toward the sun and label all other lines.



Credit: This activity was developed by Catherine Schuck, Rattlesnake Elementary, Missoula, MT, and adapted for use in a Big Sky Partnership Phases of the Moon astronomy unit coauthored by Catherine Schuck and Karen Peterson (Hellgate Elementary, Missoula). Used by permission.

Moon Phases



Modified from: http://www.astro.umd.edu/resources/introastro/images/waxing.gif

Lesson 4: Moon Plate

Monica Wilson
St. Regis Elementary School

Summary of the Lesson

Students will explore how lunar phases are created. They will use plates to demonstrate that at all times, half of the Moon is illuminated by the Sun. Using red construction paper to cover the half of the Moon that cannot be observed on Earth, students will explore the relationship between the Moon's position in its orbit and the proportion of the illuminated half of the Moon that can be seen from Earth. Students will also be shown a website that demonstrates this. By doing these activities, they will gain a deeper conceptual understanding of how the phases of the Moon occur.

Grade Level

4^{th}

Approximate Time Required

2 hours

Lesson Objectives and Montana Science Standards and Benchmarks Addressed

This lesson addresses the following unit objectives. Students will:

6. Identify objects in the sky and their patterns of movement. (Montana Science Content Standard 4, Benchmark 6, End of Grade 4)
7. Use models that illustrate simple concepts and compare those models to the actual phenomenon. (Montana Science Content Standard 1, Benchmark 4, End of Grade 4)

Resources and Materials

- 7″ paper plates, one for each pair of students
- Black markers
- Red construction paper
- 80 watt bulb and lamp without shade
- Baseball
- Golf ball
- Rubber ball, any size
- Masking tape
- Scissors
- Extension cord
- Styrofoam balls with skewers from previous lesson (one for each pair)
- Projector capable of showing an internet site

Teacher Preparation

- Before the lesson, each pair of students should design a Moon plate. (see attachment)
- You will need the directional mats from lesson 3, arranged as they were for that lesson.
- Copies of the formative assessment should be made. (see attachment)

- Become familiar with the Internet site:
  http://aspire.cosmic-ray.org/labs/moon/lunar_phase3.swf
  This site allows interactive modeling of the phases of the Moon.

Background Information

The physical shape of the Moon never changes. It is a sphere. What does change is what we can actually see of the Moon from Earth. We can only observe half of the Moon from Earth, because the other half is facing away from Earth. Half of the Moon is always illuminated by the Sun, but as the Moon orbits the Earth, sometimes we see more, and sometimes less, of that illuminated half. What phase the Moon is in is determined by the relative positions of the Sun, Moon, and Earth.

Procedure

1. Stand in front of the classroom with a rubber ball and ask the students,
   - Can you see all around the ball?
   - What side can you see?
   - Why can't you see the other side?
   - About how much of the ball can you see?
2. Move to another location in the classroom and repeat step one with a baseball, golf ball, and Styrofoam ball.
3. When done, ask the students, "What do these four objects have in common?" If no student mentions that they are all spheres, guide them to this answer.
4. Now ask, "When looking at these spheres, what could we see and what couldn't we see?" If no student mentions that they could only see half of the sphere, guide them to this answer.
5. Write on the board that when looking at a sphere, you can only observe half of it.
6. Direct students to move their desks and chairs from the center of the room.
7. At this point, put the lamp on the desk in the middle of the room.
8. Organize students into pairs around the lamp.
9. One of the partners should be standing in the middle of the directional mat, facing the Sun (i.e. looking towards 360˚) and holding the Moon at eye-level and arm's length.
10. The other partner needs to look at the Moon from all sides and answer the question, "How much of the Moon is in shadow?" and "Which half is in shadow, the side facing the Sun, or the side not facing the Sun?"
11. Repeat steps nine and ten for 45˚, 90˚, 135˚, 180˚, 225˚, 270˚, and 315˚. Remind students that at 180˚ they may need to raise their arm so that there is no eclipse.
12. When one partner is done, have the students switch places so that the partner that was answering the questions before is now holding the Moon while the other partner is answering the questions.
13. Ask students, "From all the positions on the mat, what percent of the Moon is always in shadow?"
14. Write on the board underneath the first observation, "Half of the Moon is in shadow and the other half is illuminated by the Sun for any position of the Moon in its orbit."
15. Now get out the Moon plate. Remind the students that they discovered that the Moon is half in shadow and half in light at any position in its orbit. Point to the plate and show

that this is a Moon and half is in shadow and half is in light. Label the shadow half with masking tape. Write shadow on the tape.

16. Read the first observation, we can see only half a sphere at any one time. The Moon is a sphere so we must only see half of it. The half we can't see is the red construction paper. Write, "can't see Moon" on the red construction paper.
17. Turn off the lamp and turn on the lights.
18. Demonstrate with a student. Have the student stand in the middle of the directional mat and tell them they will be the Earth. Make sure the other students are gathered around observing because they will do this activity with their partner.
19. The student needs to face the Sun at the 360˚ direction. Ask the students," What half of the Moon is illuminated by the Sun at this direction?" (See attached Moon Phase Diagram, picture A.)
20. Have a student place the Moon plate correctly so that the illuminated side of the plate is facing the Sun on the 360˚ line.
21. This procedure should be done for all the other positions starting at 45˚ and working counterclockwise. Students take turns being in the center of the mat.
22. Now start back at 360˚ with the Moon plate placed appropriately over that directional line. Ask the students, "What part of the Moon cannot be observed from Earth?" Have a student place the red construction paper on the half that cannot be observed from Earth. (See Moon Phase Diagram, picture A.)
23. Continue recording observations for the other angles starting with 45˚ and proceeding counterclockwise.
24. When students have completed the cycle, have them switch positions with their partner. You might have to guide them through the steps again.
25. The teacher should be observing, monitoring students, and giving assistance where needed to make sure that students are doing the activity correctly.
26. Go to http://aspire.cosmic-ray.org/labs/moon/lunar_phase3.swf. This site gives students a visual of the half of the Moon that is always lit by the Sun and the half that we can't see from Earth. Pause at different days in the Moon's orbit to show students both the part of the Moon that is lit up and the part that we can't see from Earth.

Formative Assessment

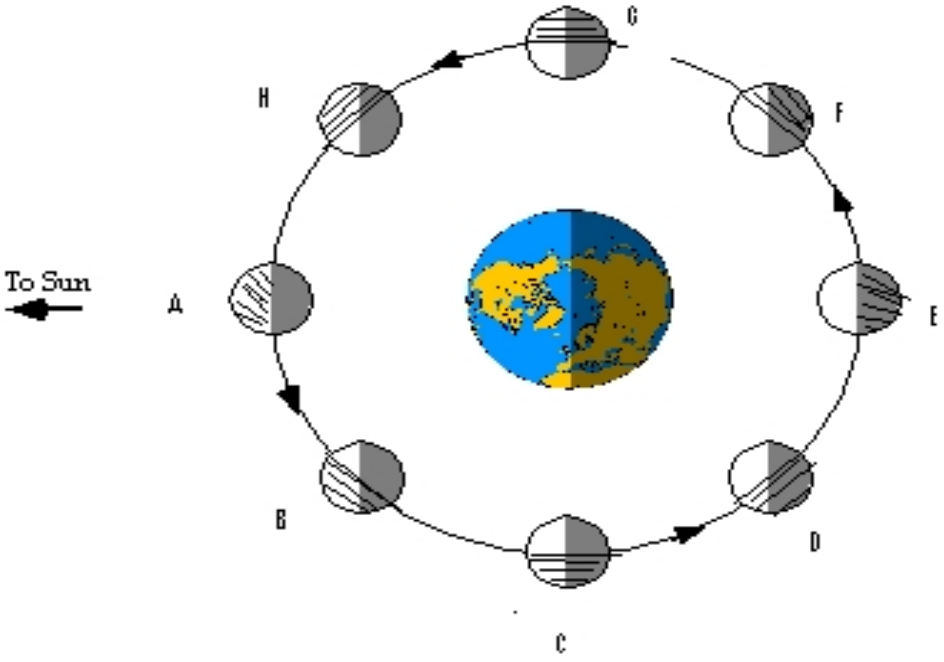
Pass out the picture of the Moon (see attachment). Have students explain why the Moon looks the way it does on the side facing Earth and what it must look like on the side facing away from the Earth. For example, we know that the Sun shines on half of the Moon and the other half is in shadow at any time in the Moon's orbit, but in this image we can only see about a "Quarter" Moon. Where is the other fourth that makes the half that is lit by the Sun? Repeat these questions for the part of the Moon that is in shadow. After you have explained the photo, pass out the formative assessment. Tell the students that they are going to have to explain what the entire Moon looks like- both the half of the Moon facing the Earth and the half of the Moon that is facing away from the Earth. Ask them how the Moon's appearance relates to where it is in its orbit. Ask them if they can use their model to explain what they saw when they observed the Moon over a period of several weeks.

Moon Plate Formative Assessment Rubric

Score	Criteria
3	Students understand that most of the lighted half of the Moon is on the side of the Moon facing away from the Earth. Only a little of the lighted half of the Moon is on the side of the Moon facing the Earth. In photo 2, student understands that all of the lighted half of the Moon is facing the Earth. The other side of the Moon is in shadow.
2	Student writes with some correct information about the light and shadow on the Moon image.
1	Student has little to no explanation of what they are observing.

Moon Plate Directions

1. Color half of the plate in black marker.
2. Cut a piece of red construction paper that would be the shape of half of the plate.



Black lines on the Moon indicate the half of the Moon that cannot be observed from Earth.

Shaded area of the Moon is what is not illuminated by the Sun.

Picture of the Moon

http://www.crazy-space.net/image/Moon%20Phase.jpg

Formative Assessment

Name_____

1. Use your pie plate Moon and red paper to figure out where in the Moon's orbit you would see a Moon that looks like this. Explain why this Moon looks the way it does.

2. Use your pie plate Moon and red paper to figure out where in the Moon's orbit you would see a Moon that looks like this. Explain why this Moon looks the way it does.

Lesson 5: Cree Story

Monica Wilson
St. Regis School

Summary of the Lesson

In this lesson, students will listen to a Cree story about the phases of the moon. They will work with a Moon phases computer simulation where they can interactively move the Moon to the phase that is being described. Students will then listen to an excerpt from *The Stars we Know* by Timothy P. McCleary about why the phases of the Moon are important to the Crow tribe.

Grade Level

4th

Approximate Time

1-2 hours

Lesson Objective and Montana Standards, and Benchmarks

This lesson addresses the following unit objectives. Students will:

Science

1. Identify objects in the sky and their patterns of movement. (Montana Science Content Standard 4, Benchmark 6, End of Grade 4)
2. Identify how observations of nature form an essential base of knowledge among the Montana American Indians. (Montana Science Content Standard 1, Benchmark 6, End of Grade 4)

Technology

1. Use digital tools and skills to construct new personal understanding. (Montana Technology Content Standard 3, Benchmark 5, End of Grade 4)

Resources and Materials

- You will need access to computers so that the students can do this activity. For class discussion, you will need a projector and speakers so that you can project the Internet site for the whole class to view.
- The Cree story and Moon phase activity can be found at: http://www.wonderville.ca/v1/activities/phases/phases.html
- *The Stars We Know: Crow Indian Astronomy and Lifeways*, Timothy P. McCleary
- Pencils
- Paper

Teacher Preparation

- Before the lesson, review the Cree Moon Story, http://www.wonderville.ca/v1/activities/phases/phases.html, and become familiar with the activity.
- Prepare the technology needed to project the Cree Moon Story website.
- Read chapter 9, pages 103 to 105 from *The Stars We Know: Crow Indian Astronomy and Lifeways*, by Timothy P. McCleary.

Background Information
This lesson will give students another way to demonstrate and understand the phases of the Moon. The web site gives visual and oral information on how long it takes the Moon to orbit around the Earth and the phases it goes through. Students will move the Moon in its orbit to match the Moon's orbital position with the correct image of the Moon as viewed from Earth at that time. The names of the phases are introduced as the students move through the lunar cycle. Students will clearly see the spatial relationship between the Sun, Earth, and Moon and how this relates to what they see from Earth. At the end of the activity, a Cree story is told on how the phases came to be.

Procedure
1. As a class, view the phases of the Moon activity at http://www.wonderville.ca/asset/phases-of-the-moon
2. After you have done the activity once, have students work in pairs at computers that have sound capabilities to do the activity.
3. When students have completed the activity on the website, read and discuss Chapter 9, pages 103 to 105 from *The Stars We Know: Crow Indian Astronomy and Lifeways.*

Formative Assessment
Have students write their own story explaining the phases of the Moon.

Moon Phase Story Rubric

Score	If the Student…
+	Gives detailed information about the phases of the Moon and a creative story.
√	Gives some details about the phases of the Moon and is lacking creativity in the story.
–	Writes very little

Rubric for Summative Assessment

Score	Criteria
3	The student's explanation of why the phases of the Moon occur demonstrates an accurate understanding of the basic scientific concept. Students understand that as the Moon orbits the Earth, they see more or less of the half of the Moon that is illuminated by the Sun. They understand that no matter where the Moon is in its orbit, half of the Moon is reflecting light from the Sun and half is in its own shadow, and so appears dark. Students understand that the phase- or relative amounts of bright and dark parts of the Moon they see is a function of the relative positions of the Earth, Moon, and Sun.
2	The student's explanation of why the phases of the Moon occur demonstrates some understanding of basic scientific concept.
1	The student's explanation of why the phases of the Moon occur demonstrates little to no understanding of the scientific concept.

Summative Assessment

Name_____

1. Explain to an adult why the phases of the Moon occur. Answer any of their questions and have them write down what you said.

2. What did you find difficult or not difficult to explain and why?