

# **Phases of the Moon Astronomy Unit**

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Hellgate Elementary and Rattlesnake Elementary  
For 5<sup>th</sup> Grade Students - April 2009

## **Unit Overview**

In this unit, students will consider their own and other people's perspectives about Earth's moon. Students will explore the phases of the moon through inquiry lessons to develop a conceptual understanding of the cyclical changes in the Moon's appearance. Throughout the unit students will practice their communication skills by organizing their thoughts, listening respectfully, and communicating ideas.

## **Unit Objectives Aligned with Montana Benchmarks**

1. Students will recognize that people view and report historical events differently. (Montana Social Studies Content Standard 4, Benchmark 6, End of Grade 4 )
2. Students will identify how Montana American Indian tribes used their knowledge of the natural world in their lives. (Montana Science Content Standard 5, Benchmark 5, End of Grade 8)
3. Students will identify and describe the cyclical motion of the moon around Earth. (Montana Science Content Standard 4, Benchmark 6, End of Grade 8)
4. Students will use models that illustrate space science concepts and will compare those models to the actual phenomenon. (Montana Science Content Standard 1, Benchmark 4, End of Grade 4)
5. Students will identify themselves in various roles in the communication process and recognize the shared communication responsibilities of the speaker and listener. (Montana Speaking and Listening Content Standard 1, Benchmark 2)
6. Students will recognize that observation is a key inquiry process for Montana American Indians. (Montana Science Content Standard 1, Benchmark 1)
7. Students will create a work of art from their own ideas and images based on themes, symbols, events and personal experiences. (Montana Art Content Standard 1, Benchmark 1, Grade 8)
8. Students will communicate intended meaning based on their own ideas and concepts from other sources. (Montana Art Content Standard 3, Benchmark 2, Grade 8)
9. Students will recognize various reasons for creating works of art (Montana Art Content 5, Benchmark 3, Grade 4)
10. Students will explore their own culture as reflected through the Arts. (Montana Art Content 5, Benchmark 6, 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 Require**

About thirteen 60 minute class periods.

### **Materials**

#### *Cultural Resources*

- Blackfeet Skies video, <http://www.t2tweb.us/NativeAmerican>
- Cree Moon Stories interactive video, <http://www.wonderville.ca/v1/activities/phases/phases.html>
- Excerpts from *The Sun Came Down: The History of the World as My Blackfeet Elders Told It* by Percy Bullchild (attached)
- Excerpts from *The Stars We Know: Crow Indian Astronomy and Lifeways* by Timothy P. McCleary, Chapter 9: The Sun and the Moon (attached)
- *Place Names Curriculum*, <http://www.spatialsci.com/PlaceNames/index.php/fuseaction/resources.curriculum.htm>
- Stanford Solar Center, <http://solar-center.stanford.edu/AO/>
- Star Gazer Sky Simulation Software
- *More Than Just Flutes* or music from Montana Indian tribes

#### *Supplies for Demonstrations*

- Styrofoam balls
- Glow in the dark paint
- Black craft paint
- Golf tees
- Sticky tack
- Ping-pong balls
- Smiley incentive stickers
- Yellow highlighter markers
- Free standing lamp
- Month of Moon Sightings PowerPoint
- The Phases of the Moon PowerPoint

# **Lesson 1: The Significance of the Moon to Montana's Native Peoples**

Karen Peterson  
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## **Summary of the Lesson**

In this lesson, students will learn that many cultures value astronomy and use observation skills as part of their everyday life. Students will learn about some Montana tribal perspectives on the Moon, Sun and other stars through viewing a video, reading an excerpt from a book, and visiting with a tribal guest speaker. In particular, students will begin to gain an awareness of the significance of the Moon in Blackfeet culture.

## **Grade Level**

Fifth Grade, but modifiable for other grade levels

## **Approximate Time Required**

Three hours

## **Lesson Objectives and Montana Science Standards and Benchmarks addressed**

This lesson addresses the following unit objectives. Students will:

1. Identify and describe the cyclical motion of the moon around the Earth. (Montana Science Content Standard 4, Benchmark 6, End of Grade 8)
2. Recognize that observation is a key inquiry process for Montana American Indians. (Montana Science Content Standard 1, Benchmark 1)
3. Develop skills as both listeners and speakers in group conversations (Montana Speaking and Listening Content Standard 1, Benchmark 2)

## **Resources/Materials**

- Blackfeet Skies, Chapter 2: Astronomy, and Chapter 3: Stars.  
<http://www.t2tweb.us/NativeAmerican>
- Excerpts from *The Sun Came Down: The History of the World as My Blackfeet Elders Told It* by Percy Bullchild (attached to this lesson) – one copy per student
- Ability to project the Internet video for all to see and hear

## **Teacher Preparation**

- To prepare for the lesson, the teacher should watch and become familiar with the material on Leo Bird's "Blackfeet Skies" online video. The video is a wealth of information about Blackfeet cosmology. Also, be sure to have the technology prepared for projecting the video for the class to view together.
- Contact a member of a local tribal community and invite them to visit your classroom to talk about their tribe's perspectives on the Moon and stars. Obtain appropriate compensation for

- the guest and prepare your class by discussing with them the proper protocol for the visit.
- Three to four weeks before this lesson occurs, have students begin making nightly observations and drawings of the phases of the Moon.
  - Also before teaching this lesson, make sure students know the names and locations of the seven American Indian reservations and twelve American Indian tribes in Montana.
  - Make copies of the Bullchild chapter, one per student.

### **Background Information**

The Earth's Moon has long been observed by people around the globe. The Moon is a significant part of the cultural cosmology for many different groups of people. Some of this knowledge may not be appropriate for sharing in the classroom. Be sure to check with tribal elders before teaching their people's cosmological perspectives.

The Blackfeet people of northwestern Montana have a well developed cosmology that includes stories about the Moon. Many excellent resources detailing Blackfeet cosmology are available for teachers including Leo Bird's video and Percy Bullchild's book of Blackfeet stories, parts of which are included in this lesson.

### **Procedure**

1. Pose the question, "Where does the Moon's light come from?" and ask students to respond to this question in their science journal.
2. As a class, watch Leo Bird's online presentation, then have students read the excerpt from the Bullchild book.
3. Tell students that they will work in small groups to write a summary of the online video and the Bullchild story about the Moon that they will share with the class.
4. Ask student volunteers to share their group's findings with the class. Guide a discussion to help students identify Blackfeet understandings of nature and science evident in the online presentation and reading. Have students develop and record questions about cosmology that can be saved to ask a tribal visitor.
5. Ask the tribal member guest to share their knowledge, as appropriate, of their tribe's perspectives on the Moon and stars. After the guest has finished their talk, allow students to ask their questions, recorded earlier, about the cosmos.

### **Formative Assessment**

Assess students' increased awareness of Blackfeet understandings about science and nature by having them write two paragraphs about what they have learned.

### **Summative Assessment**

As a summative assessment, ask student to first identify the Blackfeet tribe and its location in Montana. Then ask them to list five statements relating to the Blackfeet perspective of the Moon. Look for a preliminary awareness of Blackfeet cosmology.

## **Lesson 2: Why Does the Moon Appear to Change?**

Karen Peterson and Catherine Schuck  
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### **Summary of the Lesson**

In this lesson, students explore their personal ideas of why the moon looks different over the course of a month by completing an assessment probe and an online simulation of the Moon's phases. In addition, the lesson focuses on respectful communication as the students defend and discuss their rationales for why we see different phases of the moon over the course of a month.

### **Grade Level**

Fifth Grade, but modifiable for other grade levels

### **Approximate Time Required**

Ninety minutes

### **Lesson Objectives and Montana Science Standards and Benchmarks Addressed**

This lesson addresses the following unit objectives. Students will:

1. Identify and describe the cyclical motion of the moon around the Earth. (Montana Science Content Standard 4, Benchmark 6, End of Grade 8)
2. Develop skills as both listener and speaker in group conversations. (Montana Speaking and Listening Content Standard 1, Benchmark 2)
3. Use evidence to formulate hypotheses. (Montana Science Content Standard 1, Benchmark 1)

### **Resources/Materials**

- Cree Moon Story and Online Activity  
<http://www.wonderville.ca/v1/activities/phases/phases.html>
- Ability to project the Internet site for the whole class to view
- Month of Moon Sightings PowerPoint
- Copies of formative assessment "Going Through a Phase." (Page 25 in Uncovering Students Ideas in Science) - one copy for each student
- Science journals
- Respectful Communication Student Assessment Observation Sheets - one per group

### **Teacher Preparation**

- Before the lesson, review the Cree Moon Story web site and become familiar with the activity.
- Prepare the technology needed to project the Powerpoint presentation and the Cree Moon Story website.
- Make copies of the Moon phases probe, one per student.

## **Background Information**

The moon phase concept is a difficult one for fifth graders. It is important for student to realize that the physical shape of the moon never changes, it is always a sphere with millions of craters and other landforms on it. What changes is what we can actually see of the Moon from Earth on any given day. Exactly half of the moon is always illuminated by the Sun. However, the shape of the Moon that we see from Earth at any given time is determined by the relative positions of the Earth, Sun and Moon at that time. The Cree website helps illustrate the Moon phases and what causes them to change. The full Moon, for example, occurs when the Sun, Earth and Moon are in a straight line in this order, enabling the Sun's light to completely illuminate the side of the Moon facing Earth. The new Moon occurs when the Moon is between Earth and the Sun, so that the side of the Moon facing away from Earth is illuminated and the side facing Earth is dark, leaving the Moon invisible to the unaided eye of an Earth bound observer.

The "Going Through a Phase" probe is designed to identify common misconceptions about Moon phases, providing information about students' understanding that the teacher can use to design instruction that challenges these students' misconceptions.

## **Procedure**

1. Pose the question "Why Does the Moon appear to change shape?" for students to respond to in their science journals.
2. Show the Month of Moon Sightings PowerPoint and explain that someone took photos of the moon at night and this is what they looked like.
3. Give each student a copy of "Going through a Phase". Have students read through it and write an explanation for why they agree with a particular student's thinking.
4. Tally students' responses, noting individual variations. Discuss students' rationales with the whole group.
5. Have students work with the Cree interactive website activity which provides simulations of the phases of the moon.
6. In small groups, ask students to again form a hypothesis about why the Moon appears to change shape. Students should write their groups' hypothesis in their journal, then illustrate and label the Moon phases to support their ideas. Do not provide the final correct response. Students will develop deeper understanding throughout the unit.

## **Formative Assessment**

*Assessment Probe* - Students' responses to "Going through a Phase" and the ensuing discussion will help the teacher identify students' ideas.

## **Summative Assessment**

*Student Journals* - The groups' journal illustrations, labels for the phases, and their hypotheses about what causes the phases will provide further insights into student thinking.

*Communication Observation Tool* – Observe student groups as they discuss their hypotheses for the phases of the Moon. Use the Respectful Communication Student Assessment Observation

Sheet, attached to this lesson, to assess students' proficiency at filling the roles of listener and speaker in the conversations in their groups.

# **Lesson 3: Self Shadow Activity**

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## **Summary of the Lesson**

Students will explore the difference between a self shadow and a shadow cast by an object onto another surface, an important distinction to grasp in order to understand Moon phases. Students will use models that cast shadows and self-shadows, allowing them to compare them to develop understanding of the properties of these two types of shadows.

## **Grade Level**

Fifth grade, but modifiable for other grades

## **Approximate Time Required**

Sixty minutes

## **Lesson Objectives and Montana Science Standards and Benchmarks Addressed**

This lesson addresses the following unit objectives. Students will:

1. Draw and explain the distinction between self shadows and cast shadows and relate them to the formation of Moon phases (Montana Science Content Standard 4, Benchmark 6, End of Grade 8)
2. Develop skills as both speaker and listener in group conversations. (Montana Speaking and Listening Content Standard 1, Benchmark 2)
3. Use evidence to develop a hypothesis about formation of Moon phases. (Montana Science Content Standard 1, Benchmark 1)

## **Resources/Materials Needed**

- Light sources: the sun, overhead lights, lamps
- Rubric for Shadows assessment
- Student science journals

## **Teacher Preparation**

Refer to the self-shadow article entitled “The Moon's Phases and the Self Shadow” in the September 2008 issue of *Science and Children*.

## **Background Information**

This activity is designed to help students gain understanding of shadows and the difference between cast shadows and self shadows, an important concept required to truly understand the reason for the Moon’s apparent phases.



### **Procedure**

1. Probe students' ideas with the questions, "How are shadows made? Where do you see shadows?" Ask students to respond in their science journals.
2. Facilitate a class discussion of these ideas, solicit students' ideas and probing for further ideas.
3. Lead students to explore the properties of cast shadows and self shadows. Provide appropriate lighting or go outside if it is sunny so that students can make these different types of shadows. As students make shadows, help them to understand the difference between self and cast shadows. The Science and Children article provides further information on these ideas and how to support students' explorations of them.
4. Have students draw three examples of each type of shadow in their journals. They should list the properties of each type of shadow (cast and self).
5. Discuss findings with the whole group in the classroom. Relate the ideas of self and cast shadows to the formation of the phases of the Moon.

### **Formative Assessment**

Use the Shadow Rubric to evaluate students' drawings and descriptions of self and cast shadows. Student journal entries can also be used to provide insights into students' ideas about shadows.

## **Lesson 4: Modeling and Observing the Phases of the Moon**

Karen Peterson and Catherine Schuck  
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### **Summary of the Lesson**

In this lesson, students will use models that illustrate the Moon phases to develop their understanding of the mechanisms (the changing relative positions of the Sun, Earth and Moon) that create the phases.

### **Grade Level**

Fifth grade but modifiable for other grade levels

### **Approximate Time Required**

Fifty to sixty minutes

### **Lesson Objectives and Montana Science Standards and Benchmarks Addressed**

This lesson addresses the following unit objectives. Students will:

1. Describe the cyclical motion of the Sun, Earth and Moon in creating the phases of the Moon. (Montana Science Content Standard 4, Benchmark 6, End of Grade 8)
2. 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)
3. Use evidence to develop hypotheses. (Montana Science Content Standard 1, Benchmark 1)

### **Resources/Materials Needed**

- 8 - 15cm. diameter styrofoam balls, half painted with day glow paint and half painted black
- 8 golf tees to hold the balls up for viewing
- 8 small balls of clay for holding up the golf tees
- Light source, free standing lamp (80 watts) without shade
- Directional mats (see directions for making)
- Moon phase data sheets (one per student)
- Yellow highlighters and pencils (one of each per student)

### **Teacher Preparation**

- Paint the Styrofoam balls half black and half day glow. Place the balls glow side up under direct sunlight or a light source several hours before the lesson.
- The activity requires a large space. The center of the room will represent the Earth. The light source will represent the Sun and should be placed at one end of the room. Place eight chairs in a circle around the center of the room in 45 degree increments for placement of the Styrofoam balls. Set up the balls on the chairs, oriented to represent the phases of the moon (i.e., their glow sides should face the side of the room where the light source is coming from). The students will sit in the center of the room (i.e., they will have the perspective of

the Earth). Refer to the Science and Children self-shadow article entitled “The Moon’s Phases and the Self Shadow” for further details about setting up this lesson.

### **Background Information**

This demonstration helps students see the lit and dark side of the Moon from different perspectives. It is important for the teacher to communicate with the students about what exactly they should be seeing. For instance, in the case of the new Moon, the students should see a black circle (this is the self-shadow of the moon). In the case of the waxing crescent, the lighted crescent should be on the right side of the Moon sphere. The concept of self-shadow, when applied to the Moon, can be used to help students overcome the naïve conception that the phases of the Moon are caused by the Earth casting a shadow on the Moon.

### **Procedure**

1. Have students sit in the center of room, taking the perspective of the Earth. The styrofoam glow balls are arranged around the Earth in 45 degree increments, representing moon phases. The light source, representing the Sun, is placed on one side of the room, shining on all the half painted glow sides of the Styrofoam balls.
2. Instruct students to observe the glow balls from different vantage points. For each glow ball, ask what the students see, and then explain just exactly what the eye should see in terms of self-shadow and light.
3. Have students record their observations on their data sheet. For each moon on their data sheet, the lighted part should be illustrated with a highlighter and the self-shadow should be illustrated with pencil shading.
4. In the previous lesson, students wrote hypotheses about the formation of the Moon phases and labeled the different phases in their journals. At this time, lead students in a discussion about their new findings, and how these findings compare with their previous ideas. Allow time for students to revise their hypotheses and drawings.
5. Finally, ask students to reconsider and make changes to their original “Going through a Phase” assessment as needed, based on their new understanding of the phases of the Moon.

### **Formative Assessment**

Examine students’ Moon data sheets to assess students’ understanding of the correct shading for the different positions of the moon. Are the lighted and dark areas on the correct side of the moon for each position? Are the lighted areas the right shape? Are the phases correctly labeled?

The “Going through a Phase” revisions will reflect students’ developing understanding of the phases of the moon. The Student Assessment Observation Sheets may also be used to provide data on individual students’ understandings and communications.

## **Lesson 5: Ball on a Stick Activity**

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### **Summary of the Lesson**

Students will work with a partner to model phases of the Moon using a ping-pong ball on stick model to simulate the Moon's orbit around Earth. They will be able to accurately describe the cyclical motion of the Moon around Earth. Students will read about how the Crow people use the Moon to provide vital information.

### **Grade Level**

Fifth grade, but modifiable for other grades

### **Approximate Time Required**

Ninety minutes to two hours

### **Lesson Objectives and Montana Science Standards and Benchmarks Addressed**

This lesson addresses the following unit objectives. Students will:

1. Students will identify how Montana American Indian tribes used their knowledge of the natural world in their lives. (Montana Science Content Standard 5, Benchmark 5, End of Grade 8)
2. Describe the cyclical motion of the moon around the Earth and how the motion results in the phases of the Moon. (Montana Science Content Standard 4, Benchmark 6, End of Grade 8)
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 skills as speakers and listeners in group discussions. (Montana Speaking and Listening Content Standard 1, Benchmark 2)
5. Use observation to collect evidence and formulate hypotheses about the Moon's phases. (Montana Science Content Standard 1, Benchmark 1)

### **Resources/Materials Needed**

- A dark room with one lamp without shade in the center of the room
- Thirteen ping pong balls skewered to the top of a stick for students to hold
- Thirteen smiley incentive stickers
- Data sheet (one copy per student)
- Thirteen chairs
- Lap boards/clip boards
- Highlighters and pencils
- Directional placemats for underneath the chairs.

- Excerpts from *The Stars We Know: Crow Indian Astronomy and Lifeways* (attached ) - one copy per student
- Classroom Performance System (CPS) equipment and software will be needed if the teacher plans to use a CPS assessment at the end of this lesson.
- Student Assessment Observation Sheets

### **Teacher Preparation**

- Before the lesson, have students make the directional placemats. Directions are included in the unit materials at the end of the unit).
- Poke holes in the ping pong balls and skewer them on the top of the sticks. Placing a tiny smiley sticker to each ping-pong ball will help students understand why we always see the same side of the Moon facing Earth (i.e., because the amount of time the moon takes to rotate on its axis is the same amount of time it takes to revolve around the Earth).
- A large room is helpful for enacting this lesson. The room must be big enough to accommodate thirteen chairs arranged in a circle around the light source. The students need enough room for a pair of students to work on and around one chair. A few feet of space are needed around each chair. The students will be moving the chair to face different directions.
- Set up the light source in the center of the room and arrange the thirteen chairs in a circle around the light source. The chairs should all face the light source. A directional placemat should be placed underneath each chair, and correctly oriented.
- CPS equipment should be ready for the final assessment.
- Make copies of the data sheet, one per student.

### **Background Information**

This activity will show how the Moon's orbit creates the cyclical Moon phases. Every 29.5 days, the moon orbits the Earth. As the Moon revolves around Earth, people on Earth see different amounts of the Sun's reflected light shining from the Moon. The amount and shape of the reflected light that people see coming from the Moon corresponds to what are called phases of the Moon.

### **Procedure**

1. Students will work in pairs. Each pair should have a ping-pong ball (the moon), a chair, and a directional mat. Each student should have a data sheet.
2. To begin, one student should be the Earth bound observer and the second student will hold the ping pong ball moon. The Earth bound student sits in the chair facing the light source. The moon student kneels in front of the chair (not blocking the light) and holds the ping pong ball over his/her head. This is the 0 degree position.
3. The Earth student observes and records on the data sheet the appearance of the ping pong moon. At each position, the student should use the pencil to fill in the corresponding data sheet moon circle. The dark appearing areas should be represented with pencil shading. The light appearing areas should be represented with highlighting.
4. After the Earth bound student completes his/her observations and recording at the 0 degree position, the pair should move the chair 45 degrees counterclockwise and complete another

observation. The moon student should always be positioned in front of the Earth student for the observations.

5. The students continue turning and observing/recording until they have completed all eight positions representing 360 degrees.
6. Partners switch roles and go through steps three through five again.
7. After both the partners have gone through all positions and made their observations and recordings, the students should compare their illustrations. If the illustrations do not match, the students should discuss and justify why they think their illustrations are accurate representations from the model. Circulate throughout the room, checking that the students are coming to agreement about accurate representations of the phases, and supporting the students as needed.
8. Next, have students work in pairs to answer the questions on the back of the data sheet.
9. After the students discuss their observations and answer the questions, bring the class together and facilitate a discussion of students ideas about the patterns and reasons for the moon phases.
10. Next, reveal the names of each phase of the moon. The students should label the phases of the moon on their data sheets.
11. The class will read the Crow story excerpt *The Stars We Know: Crow Indian Astronomy and Lifeways*, by Timothy P. McCleary, Chapter 9: The Sun and the Moon. Ask students to think about how the Crow people pay attention to the moon's phases.
12. Discuss with students the idea that the Moon phases have helped people for many generations. For example, the Crow people use the Moon phases to predict the weather.

### **Formative Assessment**

Circulate throughout the room and use the Communication Assessment Observation Sheets to evaluate how well the students are communicating with their partners their understanding of the Moon's phases.

### **Summative Assessment**

After this activity, the teacher can provide students with blank data sheets and ask students to draw the phases of the Moon, label the names of the phases, and answer the questions on the back of the data sheet. The teacher may examine students' understandings of the phases, the order in which the phases appear, the names of the phases, and the reason why we see the phases of the moon as we do from the Earth.

The teacher may also choose to use a Classroom Performance System; Moon Unit Final assessment as a final summative evaluation of the students' understandings. A sample set of questions is provided with the unit materials.

## **Lesson 6: Moon Art**

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### **Summary of the Lesson**

In this lesson, students will develop an understanding of the importance of sense of place to the Salish people and also to themselves. Students will identify the specific phase of the Moon that occurred on their date of birth and will create a piece of art that represents the special place and moon when they were born.

### **Grade Level**

Fifth grade, but modifiable for other grades

### **Approximate Time Required**

Three – 90 minute sessions

### **Lesson Objectives and Montana Science Standards and Benchmarks Addressed**

This lesson addresses the following unit objectives. Students will:

1. Correctly illustrate the phase of the Moon for their birth date (Montana Science Content Standard 4, Benchmark 6, End of Grade 8)
2. Create a work of art from their own ideas and images based on themes, symbols, events and personal experiences. (Montana Art Content Standard 1, Benchmark 1, Grade 8)
3. Communicate intended meaning based on their own ideas and concepts from other sources. (Montana Art Content Standard 3, Benchmark 2, Grade 8)
4. Explore their own culture as reflected through the arts. (Montana Art Content 5, Benchmark 6, Grade 4)

### **Resources/Materials Needed**

- *Place Names Curriculum* available at <http://www.spatialsci.com/PlaceNames/index.php/fuseaction/resources.curriculum.htm>
- Star Gazer Sky Simulation Software to identify the moon's position and phase from 10 – 12 years ago.
- *More Than Just Flutes* or traditional music from Montana Indian tribes Tribal Music to play as students create their birth moon places artwork
- Art supplies

### **Teacher Preparation**

- Compile a list of students' birthdates and, using Stargazer software, print a black and white copy of each student's birth moon.
- Familiarize yourself with the *Place Names Curriculum*.
- Reserve the computer lab for students' use, as needed.

- Obtain traditional music from Montana Indian tribes to play as students are working on creating their art.

### **Background Information**

The Moon has cultural significance for groups of people all over the world, including the Crow people of eastern Montana. The lesson uses information from Tim Cleary's book, *The Stars We Know* as a source of information about the significance of the Moon to the Crow people. Before teaching the lesson, teachers should visit with Crow tribal elders or other appointed representatives to determine appropriate and accurate information about this topic that can be taught in the classroom. A visit by a Crow elder to guest teaches is also recommended.

The *Place Names Curriculum* was developed through a collaborative process involving students and faculty from the University of Montana and Salish and Pend d' Oreille people. The overall goal of the curriculum is to convey the strong sense of place Indigenous people feel for their traditional homelands in western Montana. The curriculum includes a wide variety of resources including interviews with elders, lesson plans, Google Earth maps and exercises, to help students gain awareness of the history and significance of the area to the Salish and Pend d' Oreille people.

### **Procedure**

1. Engage students in completing *Place Names Building Worldviews* Lessons One and Two to help them develop understanding of the importance of the sense of place to the Salish and Pend d Oreille people and an understanding of the sense of place in their own lives.
2. Provide students with the Moon phases print outs for their birth dates and ask students to create (using their own ideas, experiences and images) a visual representation of their birth Moon phase within the landscape of the place they were born. Encourage students to talk with their parents about the time and place where they were born. On the back of their drawing, students should write their name, their birth date, the phase of the Moon for their birth date and a description of their own sense of place for the scene they have created.

### **Summative Assessment**

Assess students' understanding of Moon phases by looking at the illustration of their birth date. Students should be able to accurately represent the moon phase of their birth date in their illustration or painting.



## Respectful Communication Skills Student Assessment Observation Sheet

<p><b>Student 1 <i>Communication Skills</i></b>  <b><i>Respectfully Listen &amp; Communicate Clear Organized Thoughts</i></b></p> <p>1 –Low  2 - Medium  3 – High</p>          <p>Notes:</p>	<p><b>Student 2 <i>Communication Skills</i></b>  <b><i>Respectfully Listen &amp; Communicate Clear Organized Thoughts</i></b></p> <p>1 –Low  2 - Medium  3 – High</p>          <p>Notes:</p>
<p><b>Student 3 <i>Communication Skills</i></b>  <b><i>Respectfully Listen &amp; Communicate Clear Organized Thoughts</i></b></p> <p>1 –Low  2 - Medium  3 – High</p>          <p>Notes:</p>	<p><b>Student 4 <i>Communication Skills</i></b>  <b><i>Respectfully Listen &amp; Communicate Clear Organized Thoughts</i></b></p> <p>1 –Low  2 - Medium  3 – High</p>          <p>Notes:</p>

## Conceptual Understanding Assessment Observation Sheet

<p>Student 1 <i><b>Conceptual Understanding</b></i> <i><b>Writing responses</b></i></p> <p>Question 1 - Describe the pattern in your drawing. 1 –Low 2 - Medium 3 – High Notes:</p> <p>Question 2 - Why does the moon appear to change shape? 1 –Low 2 - Medium 3 – High Notes:</p>	<p>Student 2 <i><b>Conceptual Understanding</b></i> <i><b>Writing responses</b></i></p> <p>Question 1 - Describe the pattern in your drawing. 1 –Low 2 - Medium 3 – High Notes:</p> <p>Question 2 - Why does the moon appear to change shape? 1 –Low 2 - Medium 3 – High Notes:</p>
<p>Student 3 <i><b>Conceptual Understanding</b></i> <i><b>Writing responses</b></i></p> <p>Question 1 - Describe the pattern in your drawing. 1 –Low 2 - Medium 3 – High Notes:</p> <p>Question 2 - Why does the moon appear to change shape? 1 –Low 2 - Medium 3 – High Notes:</p>	<p>Student 4 <i><b>Conceptual Understanding</b></i> <i><b>Writing responses</b></i></p> <p>Question 1 - Describe the pattern in your drawing. 1 –Low 2 - Medium 3 – High Notes:</p> <p>Question 2 - Why does the moon appear to change shape? 1 –Low 2 - Medium 3 – High Notes:</p>

### Organized Thoughts Assessment Observation Sheet

Student 1 <i><b>Organized Thoughts Data Sheet Correctly Filled Out</b></i>	Student 2 <i><b>Organized Thoughts Data Sheet Correctly Filled Out</b></i>
<p>1 – No information recorded at all  2 - Occasional recording, but not correct  3 – Sometimes recorded information  4 - Recorded information often and accurately  5 – Always recorded information and always accurately</p> <p>Notes:</p>	<p>1 – No information recorded at all  2 - Occasional recording, but not correct  3 – Sometimes recorded information  4 - Recorded information often and accurately  5 – Always recorded information and always accurately</p> <p>Notes:</p>
Student 3 <i><b>Organized Thoughts Data Sheet Correctly Filled Out</b></i>	Student 4 <i><b>Organized Thoughts Data Sheet Correctly Filled Out</b></i>
<p>1 – No information recorded at all  2 - Occasional recording, but not correct  3 – Sometimes recorded information  4 - Recorded information often and accurately  5 – Always recorded information and always accurately</p> <p>Notes:</p>	<p>1 – No information recorded at all  2 - Occasional recording, but not correct  3 – Sometimes recorded information  4 - Recorded information often and accurately  5 – Always recorded information and always accurately</p> <p>Notes:</p>

### Shadow Rubric for Lesson 3

	<b>High</b>	<b>Medium</b>	<b>Low</b>
Cast Shadows	The student describes and demonstrates that a cast shadow requires a light source, an object blocking the light, and a surface onto which the shadow is cast.	The student describes and demonstrates at least two of the requirements (light source, object blocking light, surface onto which shadow is cast).	Student describes one of the three requirements for a cast shadow.
Self Shadows	The student describes and demonstrates that a self shadow requires a light source and an object blocking the light. Student describes that the shadow is found on the side of the object away from the light source.	The student describes and demonstrates that self shadow is found on the object itself. May not include light source, or may show self shadow on the wrong side of the object.	Student does not differentiate between a cast shadow and a self shadow.

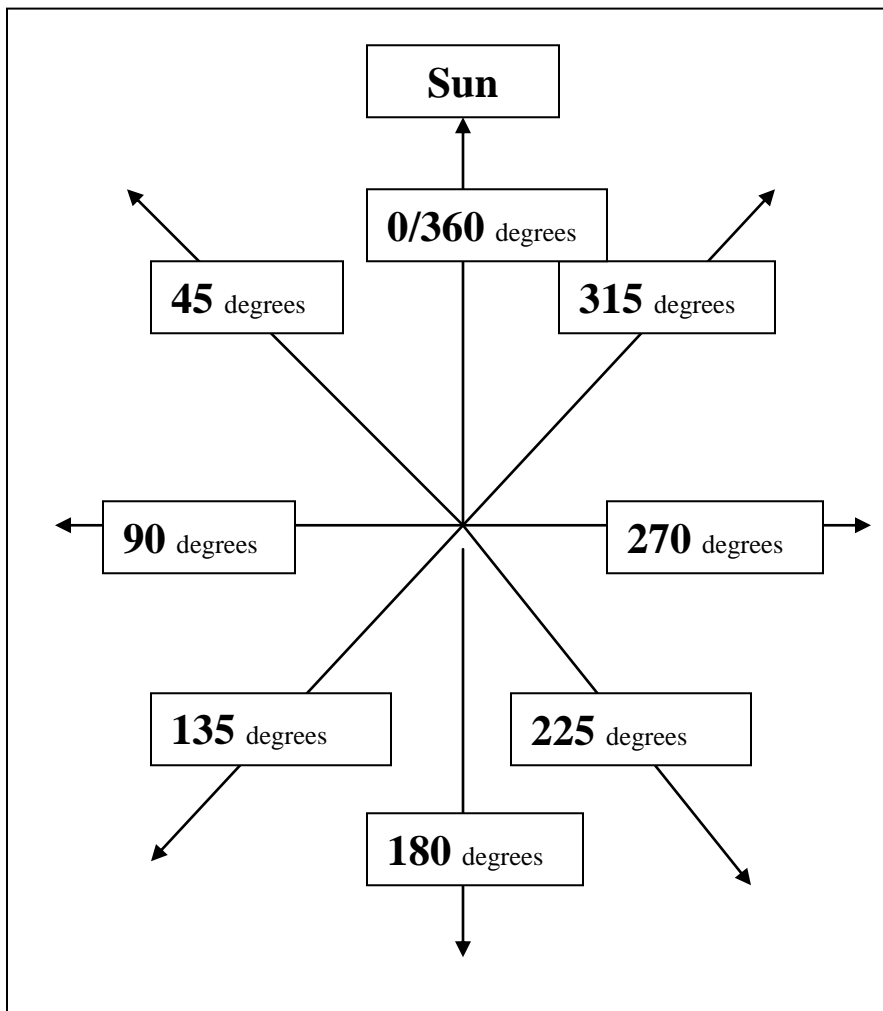
# Instructions for Creating the Directional Placemats

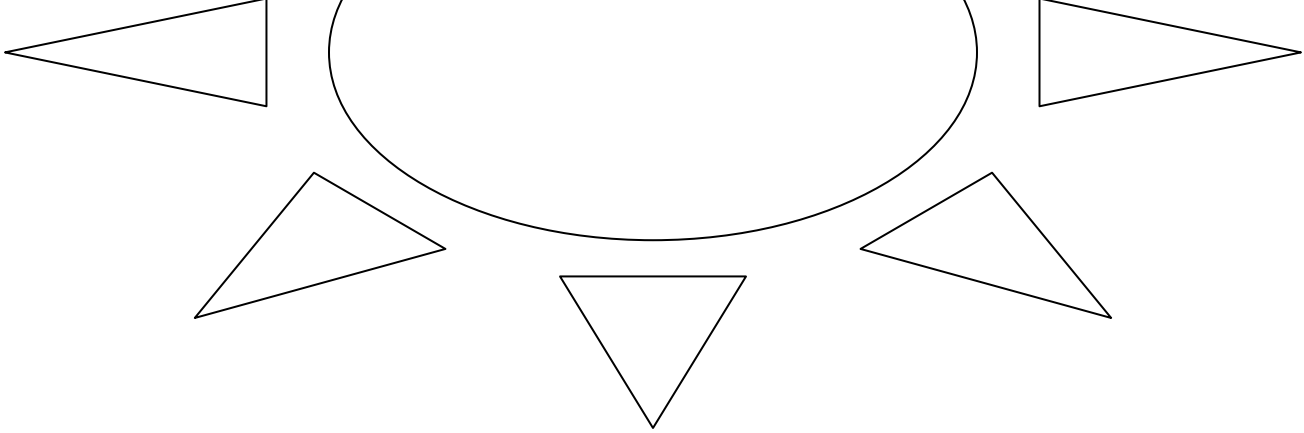
## Materials and Supplies

- Poster board (one for every two students)
- Pencils and markers
- Protractors
- Meter sticks.

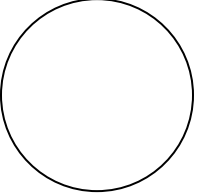
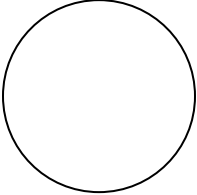
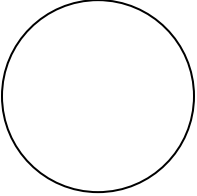
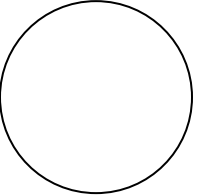
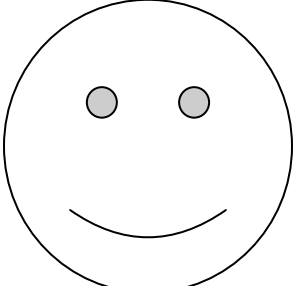
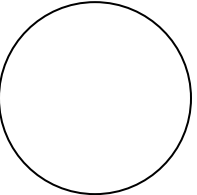
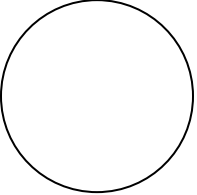
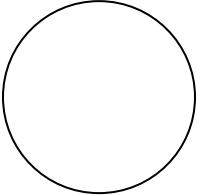
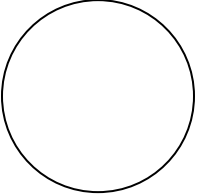
## Procedure

1. Students begin by measuring the sides of the poster board to determine the center point of the poster board.
2. Once the center point is determined, students will draw a line down the center of the poster board.
3. Next, students use protractors to measure and draw 45, 90, 180, 225, 270, 315 and 350 degrees lines.
4. Finally, students label the 3/360 line as pointing toward the sun.





## Moon Phases Observation Sheet

<b>2</b> 	<b>1</b> 	<b>8</b> 
<b>3</b> 	 Earth	<b>7</b> 
<b>4</b> 	<b>5</b> 	<b>6</b> 

## Side Two of Moon Phases Observation Sheet

1. Describe the pattern of Moon phases you observe.

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2. Why does the moon appear to change shape?

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## Moon Phase Final CPS Test

1. When you see a first quarter moon from Earth, someone who could fly all around the Moon would notice that
  - a. One quarter of the Moon's surface is illuminated
  - b. Half of the Moon's surface is illuminated
  - c. Three quarters of the Moon's surface is illuminated
  - d. The entire surface of the Moon is illuminated
2. What phase will the moon be in three days after Full Moon?
  - a. waxing crescent
  - b. waning gibbous
  - c. waxing gibbous
  - d. new moon
3. During which phase will you NOT be able to see the moon even if it is up in the sky and the sky is clear?
  - a. first quarter
  - b. full moon
  - c. waxing crescent
  - d. new moon
4. About how many days after a new Moon would you see a first quarter Moon?
  - a. 3- 4 days
  - b. 5 – 6 days
  - c. 7- 8 days
  - d. 8 – 9 days
5. True or False A self shadow is a shadow that is projected on an object and NOT on itself.
6. True or False the phases of the Moon are seen because the surface of the Moon changes.
7. True or False The moon makes its own light.
8. True or False. One side of the moon always faces Earth.
9. What moon phase is shown in this photo?
  - a. new moon
  - b. waning gibbous
  - c. **waxing gibbous**
  - d. third quarter





### Answers to Final Moon Quiz

1. b
2. b
3. d
4. b
5. False - A self shadow is a shadow that is projected on it's own surface.
6. False - The phases of the Moon are seen not because the surface changes, but rather the portion of the light that is illuminated due to earth rotation and tilt.
7. False - The moon does not light itself. The light seen is the reflected light of the sun.
8. False - One side of the moon always faces earth, however some of that surface is covered with a self shadow.
9. b