

# **Layers of Earth Unit Plan**

Grade 4

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## **Unit Overview**

The purpose of this unit is for students to gain conceptual understanding of Earth's internal structure. In addition, students will begin to develop their awareness of differing perspectives about people's relationship to the land. Students will engage in a variety of activities including research, creating models of Earth's layers, writing, and application of student knowledge by developing additional research questions for further inquiry and research.

## **Unit Objectives aligned with Montana Content Standards and Benchmark**

- 1) Students will name Earth's layers and describe their characteristics individually and relative to the other layers. (MT Science 4,8,1)
- 2) Students will use reference materials to research a layer of Earth. (MT Science 1,4,1)
- 3) Students will investigate and compare models of Earth's internal structure. (MT Science 1,4,4)
- 4) Students will write a paragraph detailing their understanding of Earth's layers. (MT Science 4,8,1)
- 5) Students will develop questions about Earth's layers for further research and inquiry. (MT Science 1,4,1)
- 6) Students will explore the cultural and geological history and the traditional place names in Glacier National Park. (MT Science 4,8,7)
- 7) Students will use their observational skills to draw accurate sketches of geologic formations. (MT Science 1, 4, 1)
- 8) Students will gain initial awareness of people's differing perspectives on their connections to the land.

## **Time and Scheduling**

Ten 30 to 60 minute lessons

Two lessons are outside and are best done when the ground is not frozen.

One all day field trip at the end of the unit, best done in late summer, early fall, or late spring.

## **Materials**

Visual representation of Earth's layers  
Student Science Notebooks  
Chart paper and plain white drawing paper  
Markers, colored pencils, crayons  
Student Record Sheets  
Student Note taking templates  
Reference books

Student note taking templates  
Chocolate covered cherries 1 per student)  
Peaches (1 per two students)  
Baggies (1 per student)  
Paper plates and towels (1 per student)  
Plastic knives  
100 meter measuring tape

Wooden stakes  
Hammer  
Meter stick  
Sand

Spray paint or bright ribbon  
Clipboards  
Backpack

## **Lesson One – Tribal Member Guest Speaker**

### **Summary of the Lesson**

Students visit with a tribal elder and discuss the importance of land and place to local tribal cultures.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

60 minutes

### **Lesson Objectives**

- 1) Students will visit with a tribal community member about the significance of land and place from a tribal perspective.
- 2) Students will discuss and practice local tribal protocol.
- 3) Students will reflect on what they learned by writing about it in their journals.

### **Montana Science Content Standard and Benchmarks**

*Standard 4:* Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and objects in space.

*Benchmark 7:* Identify scientific theories about the origin and evolution of the earth and solar system.

### **Resources/materials needed**

Tribal elder or other tribal community member guest

A gift of appreciation for the guest

List of traditional tribal place names for local sites

Map of aboriginal territory and contemporary homeland for the guest's tribe with place markers indicating traditional and contemporary place names

Student journals

### **Teacher Preparation**

- 1) Invite a tribal elder or other tribal community member to visit with your class about the importance of place and the connection to the land in their culture. Ask the speaker to share their oral history of local sites and their traditional names, particularly for sites that might be familiar to students. Tell them that you have a classroom map on which you will label local the sites and their traditional place names. Have a comfortable place ready for the guest speaker to present from along with some type of beverage. Have a gift ready to present to the speaker after the presentation as a way of saying thank you.
- 2) Have students create place markers with traditional tribal place names. Place them on the map and discuss them briefly with students before or during the guest's visit. If they are visible from your local area (e.g., mountain peaks), take students outside and point out them

out as you do this. If not, you may be able to find pictures of the sites that students can view. Google Earth could be used for this purpose.

- 3) Before the visit, talk with your students about the event, about local cultural protocol, and how to treat a guest politely and respectfully. Ask two students to greet the elder at the school door and direct them to the classroom. Ask two students to present the guest with a gift of appreciation after their visit. Demonstrate with students how to greet and thank elders.

### **Background Information**

The guest speaker's presentation is an introduction to the layer's of Earth unit and ties in directly to Earth's crust. This presentation will assist students in gaining awareness of the significance of the land to local tribes from a tribal member's perspective. This theme will continue into future units on Earth's structure, for example, as students explore formations visible on Earth's crust.

### **Procedure**

- 1) Send the two "greeter" students to meet the guest at the school door.
- 2) Assemble the rest of the students in a comfortable area and invite the guest to join them. Introduce the guest to the class and explain why she or he has been invited into class. As the guest talks about local sites, point them out and place markers for the sites on the map. Allow time for students' questions and follow up discussion.
- 3) Thank the guest and ask two students to present the guest with a gift.
- 4) Ask students to reflect on what they learned by writing about it in their journals.

## **Lesson Two- Before Paragraph - Assessment of Prior Knowledge**

### **Summary of the lesson**

Students write a paragraph detailing what they already know about the layers of Earth using a visual of Earth's structure as a guide.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

30 minutes

### **Lesson Objectives**

- 1) Students will write a paragraph detailing what they already know about the layers of the earth using a visual.
- 2) Students will share and discuss information from their paragraphs.

### **Montana Science Content Standard and Benchmarks**

*Standard 4:* Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and objects in space.

*Benchmark 1:* Students will model and explain internal structures of the Earth

### **Resources/materials needed**

Large visual representation of Earth's layers  
Science notebooks or notebook paper for student paragraphs  
Chart paper to record student questions  
Markers for writing on the chart paper  
Copies of the assessment checklist (1/student)

### **Teacher Preparation**

- 1) Prepare the lesson materials.
- 2) Update your understanding of Earth layers. Be prepared to answer questions such as: "How do scientists know this information?", "What types of tests have scientists done to make these discoveries?", "How can scientists be sure this is true if they have never been to the layers furthest away from the crust?"

### **Procedure**

- 1) Display visual representation of the layers of Earth so that all students can see it clearly. Lead a brief discussion with the students having them describe what they see.
- 2) Give students five or ten minutes to write a paragraph about what they know about the center of Earth, using the visual representation as a guide. This paragraph is called the "Before Paragraph."

- 3) Ask students to share their paragraph with a partner and discuss any similarities or differences that they encountered between each other's paragraphs.
- 4) After five to ten minutes of partner sharing and discussing, lead the class in a discussion of discrepancies that they noticed about each other's paragraphs. Use this discussion to prompt students to formulate questions about the internal structure of the earth. Use the chart paper to record student questions for further research. Keep the students' "Before Paragraphs" for use later in the unit.

### **Formative Assessment**

The "Before Paragraph" allows the teacher to take a look at each student's individual background knowledge of the layers of Earth and look for misconceptions that should be addressed through instruction. The attached checklist serves as tool to assist in assessing students' prior knowledge.

Checklist for Assessing Student Background Knowledge of the Layers of the Earth.

Directions: Use the chart to record the information present in each student's Before Paragraph

Student Name \_\_\_\_\_ Date \_\_\_\_\_

Layer Name	Size	Materials	Temperature
Core			
Inner Core			
Outer Core			
Mantle			
Lower Mantle			
Upper Mantle			
Asthenosphere			
Lithosphere			
Crust			

List any misconceptions written in the student paragraph below.

## **Lesson Three - The Earth Has Layers**

### **Summary of the lesson**

Students examine and critique two food models of Earth's structure and apply concepts and vocabulary relevant to Earth's layers to the models.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

40 minutes

### **Lesson Objectives**

- 1) Students will examine and critique models of Earth's layers.
- 2) Students will name the layers of Earth.
- 3) Students will describe the location of each layer in relationship to the other layers.
- 4) Students will describe the relative size of each layer in relationship to the other layers.

### **Montana Science Content Standards Addressed**

*Content Standard 4:* Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and objects in space.

*Benchmark:* Students will model and explain internal structures of the Earth.

### **Resources/materials needed**

Chocolate covered cherries (1/student)

Plastic knives for student use (to cut open the chocolate-covered cherry)

Peaches cut in half (half/student)

Baggies to put the peaches in

Paper towels or napkins

Paper plates

Student record sheet

Student layers of the earth worksheet

Student science notebook to new vocabulary

### **Teacher Preparation**

- 1) Prepare vocabulary and student friendly definitions for students to record in their science notebooks or log books.
- 2) Precut the peaches and put them in individual baggies for the students.
- 3) Copy student record sheets and layers of the earth worksheet (one of each for each student).



## **Procedure**

- 1) Ask students to wash their hands before the lesson.
- 2) Introduce new vocabulary to the students using the visual representation of Earth's layers from Lesson One as a guide. As you give information about each layer, students should record the name and a student friendly definition in their journals.
- 3) Introduce the idea of models and why and how we use them in teaching science. Give some examples of models familiar to students and that you may have in your classroom (e.g., a globe). Ask students how the model is similar and also different from what it represents. Guide them to the realization that models are approximations that have some inaccuracies, but that they help us understand scientific ideas.
- 4) Pass out the paper plates to the students and then the chocolate covered cherries. Tell the students that they are going to looking at the cherries as models of Earth's layers. Open the cherries (A plastic knife can be helpful here.). This can very messy so expect gooey hands.
- 5) Have students examine the contents of the cherry, the chocolate shell, the gooey filling, and the cherry center. Ask students to compare the candy model with the visual of Earth's layers. Ask prompting questions like "If the chocolate covered cherry was Earth, what part of the candy model would be the crust?" "the mantle?" "the core?". Prompt them also to compare the sizes of the layers they see in the visual and the candy model. Encourage them to use the vocabulary accurately in the context of their conversation. Have students draw a picture of the model in their journals and label the layers. Then let them eat the cherry.
- 6) Pass out half a peach to each student. One half of the peach will contain the pit since it is very difficult to cut in half, therefore each student with a peach pit should be working with a student without one. The pit represents the core of Earth. Again, have students examine the parts of the peach starting with the skin, the fruit part, and then the pit. Ask them to think about the peach as a model of Earth's structure as before. Have them draw the peach model in their journals and label the layers. Ask them to compare the two models of Earth's structure and discuss them with their neighbor.
- 7) As students are eating their peaches, ask them their impressions of the two food models – Were they good models? Why? What other food models might be useful? Invite students to bring in food models for sharing.
- 8) Do a quick cleanup by throwing away plates and washing hands if needed.
- 9) Ask students to color the layers of the earth worksheet and put it into their science notebooks.
- 10) Wrap up by asking students to orally summarize the comparison between either the peach and Earth or the chocolate covered cherry and Earth.

## **Formative Assessment**

Review each student's journal to assess their understanding of Earth's layers.

## **Lesson Four - Student Research of Earth's Layers**

### **Summary of the Lesson**

Students work in small groups to research an assigned layer of the Earth and write a short description of their assigned layer to share during the next lesson.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

1 – 2 thirty minute class periods

### **Lesson Objectives**

- 1) Students will name and describe the different layers of Earth.
- 2) Students will use reference materials to research one layer of the earth with a small group of students, specifically size, composition, and temperature.

### **Montana Science Content Standard and Benchmarks**

*Content Standard 1:* Students through the inquiry process demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.

*Benchmark 1:* Develop the abilities to safely conduct scientific inquiry, including asking questions about objects and events. . .

*Content Standard 4:* Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and objects in space.

*Benchmark 1:* Students will model and explain internal structures of the Earth

### **Resources/Materials Needed**

Reference books on Earth's structure  
Computer lab with internet access  
Note taking template (1/small group)  
Student journals

### **Teacher Preparation**

Familiarize yourself with various websites that will be useful to the students in conducting research. Some user friendly sites include:

[http://en.wikipedia.org/wiki/Crust\\_\(geology\)](http://en.wikipedia.org/wiki/Crust_(geology))

[http://volcano.und.edu/vwdocs/vwlessons/lessons/Earths\\_layers/Earths\\_layers4.html](http://volcano.und.edu/vwdocs/vwlessons/lessons/Earths_layers/Earths_layers4.html)

<http://earthquake.usgs.gov/research/structure/crust/index.php>

<http://pubs.usgs.gov/gip/dynamic/inside.html>

[http://en.wikipedia.org/wiki/Structure\\_of\\_the\\_Earth](http://en.wikipedia.org/wiki/Structure_of_the_Earth)  
[http://en.wikipedia.org/wiki/Inner\\_core](http://en.wikipedia.org/wiki/Inner_core)  
[http://en.wikipedia.org/wiki/Mantle\\_\(geology\)](http://en.wikipedia.org/wiki/Mantle_(geology))  
<http://www.thetech.org/exhibits/online/quakes/inside/mantle.html>  
<http://geology.com/nsta/earth-internal-structure.shtml>

### **Background Information/Prerequisite Skills**

Teacher should again be familiarized with the layers of Earth and their properties. Students should be familiarized with note taking, how to use reference materials, how to conduct Internet searches, and the metric system since most measurements and temperatures are recorded using this system.

### **Procedure**

- 1) Working in small groups, students will share their visual representations that they created in the last lesson. They should work together to discuss and review the relative size of the layers in relationship to each other. Encourage students to use the new vocabulary words as they work together. Guide groups as needed with questions to prompt them into thinking deeper about each layer of Earth.
- 2) After the group review session is complete, assign each group a layer of Earth. Be as basic as possible when assigning layers (don't give too much information by assigning groups the asthenosphere or lithosphere). Challenge them to dig deeper when they research to find these layers and information about them as well.
- 3) Go over the directions of the note taking template with the students. At this time each group should assign one member to be the secretary who is in charge of writing the groups notes onto the blank template.
- 4) Allow students time to work in their groups to research their layer using reference materials and/or the Internet.
- 5) Have students practice sharing their information within their small groups since they will be presenting during the next lesson.

### **Formative Assessment**

As students are conducting their research, teacher should be circulating and assisting in the research process as well as observing student participation and taking note of students' success in finding the required information. Teacher could utilize a checklist to aid in keeping track of student progress and to determine if a second day of research is required in order to prepare the students in sharing of their information (see attached checklist template).

## Note Taking Template

<b>Group Members' Names:</b>
<b>Earth Layer Name:</b>
<b>Size – How many kilometers thick is it?</b>
<b>Materials/Composition – What is it made of?</b>
<b>Temperature – What is the temperature in degrees Celsius?</b>
<b>Interesting facts – What are other interesting facts about this layer?</b>

### Formative Assessment Checklist for Lesson Four

Places student names in the appropriate group block.  
Use the following code to record student participation and research success.

+ = excellent work and/or effort  
√ = average level of work and/or effort  
- = minimal or low quality work

Assigned Layer and Group Number	Student Names	Participation	Level of Research Success
Group One – Core			
Group Two – Core			
Group Three – Mantle			
Group Four – Mantle			
Group Five – Crust			
Group Six – Crust			

Notes:

## **Lesson Five - Teacher Guided Journey through Earth Walk**

(Adapted from MyScienceBox Lesson Plan by Irene Salter)

### **Summary of the Lesson**

Students work together outside to construct a scale model of Earth's layers and peer teach about their research on each layer.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

60 minutes

### **Lesson Objectives**

1. Students will construct and examine a scale model of Earth's layers and will compare the layer sizes to familiar objects to gain a feel for the relative size and position of the layers.
2. Students will peer teach and gather additional information about the characteristics of each of Earth's layers.

### **Montana Science Content Standard and Benchmark**

*Content Standard 4:* Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and objects in space.

*Benchmark 1:* Students will model and explain internal structures of the Earth

### **Resources/materials needed**

100 meter measuring tape  
12 wooden stakes about 16" long (9 to be used for the activity and 3 extra)  
Spray paint or bright ribbon  
Hammer  
Clipboards (1/student)  
Copies of the Earth Journey Handout (1/student)  
Copy of the Earth Journey Teacher Cheat Sheet for yourself  
Meter stick  
Backpack  
Paperclip  
A spoonful of sand sealed in a plastic bag

### **Teacher Preparation**

- 1) Spray paint the wooden stakes a bright color or tie a ribbon around the top of each stake so that they are easy to see.
- 2) Label all nine wooden stakes with the layer of Earth they will demarcate:: center of the earth, inner core, outer core, lower mantle, upper mantle, asthenosphere, lithosphere, crust, and surface of the earth.

- 3) Pack all supplies in the backpack.
- 4) Find a suitable site to conduct the activity, like a soccer field or football field, that has plenty of space to lay out the layers and a soft surface that will allow you to pound a stake into the ground.
- 5) Read the Teacher Cheat Sheet and be familiarized with the approximate measurement for each layer.

### **Procedure**

- 1) Students should briefly gather in their small groups to review their research and practice what they are going to say when they describe their assigned layer during the class walk.
- 2) Pass out clipboards and the Earth Journey Handout to each student. Go over the directions for the Earth Journey Handout.
- 3) Go outside to the starting place of your walk and hammer the stake labeled “Center fo Earth” into the ground at your starting point for the walk.
- 4) Walking in a straight line away from the center of the earth stake, measure out 19 meters and then hammer in the stake labeled “Inner Core” into the ground (at the 19 meter mark).
- 5) Continue walking in a straight line and measure out 15 meters and then hammer in the stake labeled “Outer Core” (the outer core stake should be 34 meters from the starting point labeled center of the earth).
- 6) At this time students who are experts on the core should address the rest of the class and give information on the core’s two main layers including its size, temperature, and composition. Teacher needs to be sure information is accurate by using the Teacher Cheat Sheet as necessary.
- 7) After the core group has finished, continue walking in a straight line and measure 36 meters from the outer core. Hammer in the stake labeled “Lower Mantle” (this should be 70 meters from the center of the earth stake.)
- 8) Continue walking in a straight line and measure 26 meters from the lower mantle stake. At this point hammer in the stake labeled “Upper Mantle” (this takes you 96 meters from the starting point, center of the earth).
- 9) Continue walking in a straight line away from the upper mantle stake and measure 1.5 meters (this takes you 97.5 meters from the center of the earth stake). Hammer in the “Asthenosphere” stake.
- 10) Continue walking in a straight line away from the asthenosphere stake and measure 2 meters and hammer in the stake labeled “Lithosphere” (this should take you 99.5 meters from the center of the earth stake). Technically the asthenosphere is part of the upper mantle and the lithosphere is considered a part of the mantle and the crust. Make sure this information is shared with the class.
- 11) At this time students who are experts on the mantle should address the rest of the class and give information on the mantle’s two main layers including the asthenosphere and lithosphere. Information should be about the size, temperature, and composition. Teacher needs to be sure information is accurate by using the Teacher Cheat Sheet as necessary.
- 12) Continue walking in a straight line from the lithosphere stake and measure .5 meters and hammer in the crust stake and the “Surface of Earth” stake (this takes you a total of 100 meters).

- 13) Students who are experts on the crust layer should address the rest of the class and give information on the crust. Teacher needs to be sure information is accurate by using the Teacher Cheat Sheet as necessary.
- 14) Teacher then should share/demonstrate the following information:
  - A. deepest drill hole ever made is 15 km, represent with 1.5 meters stick
  - B. human being is about 1.7 meters, represent with a grain of sand
  - C. tallest building is about 440 meters, represent with a paperclip
  - D. tallest mountain is 8.8 km, represent with a meter stick
  - E. deepest mine is 3.8 km, represent with a backpack
- 15) Students should now fill in their Earth Journey Handout by marking the boundaries of each layer and adding in the appropriate labels.
- 16) Clean up, head back to class, answer any questions, and collect the student handout.

### **Formative Assessment**

Using the student Earth Journey Handout, determine whether students were able to mark and label the layers of Earth accurately according to the 100 meter replica that was created during the walk.



## **Lesson Six - Student Led Journey through Earth Walk**

### **Summary of the Lesson**

Students will work in small groups to take another walk through the layers of Earth. This walk will be very similar to the one that took place in the last lesson. However, this walk serves as a formative assessment tool in which the teacher will be looking for students' conceptual understanding of the relative size of Earth's layers, the temperatures of each layer, and the materials that make up each layer.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

60 minutes

### **Lesson Objectives**

- 1) Students will create a small scale replica of Earth's layers on an outdoor walk.
- 2) Students will orally compare the layers' size, temperature, and composition (materials, liquid, solid, etc).

### **Montana Science Content Standards**

*Content Standard 1:* Students through the inquiry process demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.

*Benchmark 4:* Use models that illustrate simple concepts and compare those models to the actual phenomenon.

### **Resources/materials needed**

11 stakes for each group, try to have only 4 or 5 groups  
spray paint or a bright colored ribbon  
hammer or mallet, one for each group  
formative assessment checklist  
100 meter measuring tape  
Teacher Cheat Sheet with measurements of each layer

### **Teacher Preparation**

- 1) Gather all materials. Each group should have their own set of stakes and a hammer. Stakes should be prepared as described in the last lesson.
- 2) Go out to the same field used in the first walk and put each group's first stake (center of Earth) and last stakes (crust and surface of Earth) into the ground for them, separating the stakes by 100 meters.

## **Procedure**

- 1) Divide students into small groups of four.
- 2) Explain the directions for the activity: Students will be conducting a student led walk through the layers of Earth. This time however, they will be working in small groups to mark off each layer in the 100 meter section **without a measuring tool**. (Teacher is looking to see if students understood the concept of each layer's relative size and location. See formative assessment below). Students will decide as a small group where each layer begins and ends and hammer the stakes in carefully at each point. If you would rather the students didn't hammer in the stakes then they could just lay the stakes down where they think they belong.
- 3) Head outside and assign each group an area in which to work. Allow students 10-15 minutes to mark off their layers.
- 4) As each group finishes teacher should meet with them and measure out the actual distances with the students to see how close they were with their replica. Students should also be prompted to discuss concepts in relation to the layers' size, temperature, and composition (materials, liquid, solid). If possible the discussion should be done outside, but for management purposes the discussion might need to take place indoors while students are working.
- 5) Clean up, head inside, and finish discussions if necessary.

## **Formative Assessment**

After students have marked out their layers of Earth meet with each group to determine whether students have conceptual understanding. It is best to conference with each group of students by having them walk you through each layer. As you walk, use questions to prompt student discussion to check for understanding. Use the checklist to determine whether or not students have gained conceptual understanding of the topic. Regurgitating facts is not as important as understanding the following concepts: the order in which the layers make up Earth (core, mantle, crust), the mantle is the largest layer, the crust is the smallest layer, the temperature of the layers get cooler as you move from the center out to the surface, and that some layers are solid while others are liquid or in a plastic state. Use this assessment to determine if reteaching is needed or if students are ready for the summative assessment.

## Assessment Checklist for Determining Conceptual Understanding

### *Student Led Journey through Earth Walk*

*Directions for using checklist:* Write in student names (use a separate checklist for each group). Indicate the level of participation with a plus for a maximum level of participation, checkmark for average participation, and a minus sign for minimum participation. For layer order, either put a plus for having the layers in the correct order or a minus sign if layers were out of order. For the remaining categories put a plus for demonstration of high levels of understanding of the concepts, a check for average levels of understanding of the concepts, and a minus for minimal levels of understanding of the concepts. Be sure to add in comments where needed.

Student Names	Participation (+, √, -)	Layer Order (+ or -)	Accuracy of Layer Size (+, √, -)	Discussion Of Size (+, √, -)	Discussion of Temperature (+, √, -)	Discussion of Composition (+, √, -)

Additional comments:

## **Lesson Seven - After Paragraph**

### **Summary of the Lesson**

This lesson is a follow-up of the first lesson of the unit. Students will be asked to revisit the paragraph they wrote at the beginning of the unit. Students will then use the same visual aid, notes, models, and science notebook to write a second paragraph detailing their conceptual understanding of the layers of Earth after the completion of the unit.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

30 minutes

### **Lesson Objectives**

- 1) Students will write a paragraph detailing their conceptual understanding of the layers of the Earth.

### **Montana Science Content Standard and Benchmarks**

*Content Standard 4:* Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and objects in space.

*Benchmark 1:* Students will model and explain internal structures of the Earth

### **Resources/Materials**

The same visual representation of Earth's layers that was used in the first lesson (poster, handout, text book page, etc.)

Students materials used throughout the unit (notes, science notebook, etc.)

Checklist for assessing student paragraphs

### **Teacher Preparation**

- 1) Have the visual ready for the lesson.
- 2) Make copies of the checklist for assessing student paragraphs, 1 per student.

### **Background Information**

Teacher should review the assessment checklist and determine what constitutes conceptual understanding for this unit.

### **Procedure**

- 1) Display the visual of Earth's layers; discuss what is seen in the picture either as a whole group or in small groups.
- 2) Handout the "before paragraphs" and have students read them silently at their seats.

- 3) Ask the question: “Do you know more now than you did when you started learning about Earth’s layers?”
- 4) Give directions for the writing assignment. Explain to students that they will be writing an “after paragraph” (starting either with the center of Earth and working out or starting at the surface and working into the center) describing all that they learned about Earth’s layers, including vocabulary and information regarding the relative size and temperature of each layer and what each layer is composed of.
- 5) Allow students to write for about 20 minutes. Evaluate at the end of twenty minutes if more time is needed.
- 6) Ask for student volunteers to share their paragraphs with the class.
- 7) Gather paragraphs and assess.

### **Summative Assessment**

This paragraph serves as a summative assessment tool. Use the checklist to record whether students have gained conceptual understanding of the topic. Regurgitating facts is not as important as understanding the following concepts: the order in which the layers make up the earth (core, mantle, crust), the mantle is the largest layer, the crust is the smallest layer, the temperature of the layers get cooler as you move from the center out to the surface, and that some layers are solid while others are liquid or in a plastic manner.

## Checklist for Assessing After Paragraphs

*Directions:* Use the following marks to determine whether conceptual understanding was demonstrated in the after paragraph: plus sign for maximum conceptual understanding, check mark for average conceptual understanding, or a minus sign for minimal conceptual understanding. Write in any misconceptions that are evident at the bottom of this page.

Earth Layer	Size	Materials (what the layer is made of)	Temperature
Core (including inner and outer core)			
Mantle (including lower and upper mantle)			
Asthenosphere			
Lithosphere			
Crust			

Misconceptions noted in student paragraph:

Additional Comments:

## **Lesson Eight – Glacier National Park Field Trip**

### **Summary of the Lesson**

This lesson is a follow-up of the first lesson of the unit. Students take a trip to Glacier National Park to visit significant geologic features of the park. While there, students hear stories about the cultural history of the area and the traditional place names given to the various features. Students make observational sketches and create their own place names for sites visited.

### **Grade Level**

4<sup>th</sup> grade

### **Approximate Time Required**

1 full school day

### **Lesson Objectives**

- 1) Students will observe various geological features of Glacier National Park.
- 2) Students will use observational skills to sketch pictures/diagrams of each geographical feature visited.
- 3) Students will create a place name for each geographical feature based on their observations.
- 4) Students will listen to traditional stories and learn the traditional place names for each site visited.

### **Montana Science Content Standard and Benchmarks**

*Content Standard 4:* Students, through the inquiry process, demonstrate knowledge of the composition, structures, processes and interactions of Earth's systems and objects in space.

*Benchmark 7:* Identify scientific theories about the origin and evolution of the earth and solar system.

### **Resources/Materials**

*Place Names of Glacier National Park*, by Jack Holterman

Student notebooks

Pencils

Camera

Tribal member guest and/or park naturalist

### **Background Information**

The area now known as Glacier National Park is a geological wonder that provides an excellent setting for viewing a wide variety of land formations. It has also long been an important part of aboriginal territory for aboriginal people. This fieldtrip will serve as a culturally competent introduction to formations of Earth's crust, the next topic in the curriculum. Many options could be considered when planning the trip. Read the section below for more information about potential resources that can make the trip a very rich experience.

## **Teacher Preparation**

- 1) Plan the field trip for early fall or late spring to Glacier National Park. Consider the conditions of roads as trails in choosing the specific sites you will visit.
- 2) The teacher should be familiar with the various geological features and cultural history of the sites that will be focused on during the trip. The teacher can find relevant background information by reviewing the information found on the park's web pages at [www.nps.gov/glac/historyculture/index.htm](http://www.nps.gov/glac/historyculture/index.htm), or by reading the Holterman book referenced in the Resources list above. Five suggested features that are accessible to students and would work well for this lesson include: Bear Creek, Bearhat Mountain (Hidden Lake area), Chief Mountain, Huckleberry Mountain, and Sacred Dancing Cascade (Lake McDonald Area). Tailor your visit to fit your time frame and the local conditions.

Note: There is a Glacier National Park virtual field trip that can be utilized if an actual trip to the park is not an option. The virtual field trip can be accessed at the URL listed above.

- 3) Invite a Blackfoot or Kootenai elder to accompany your class on the trip to talk about the local cultural significance and to teach students traditional tribal place names. The Kootenai and Blackfeet people have extensive experience providing educational outreach about their tribes' use of the area that includes the park. Contact culture committees in each community to find out who you could invite to work with your class.
- 4) Glacier National Park has excellent naturalists knowledgeable about the park's geology who may be able to accompany you on the trip. The park has developed geology curriculum about the area that could also be utilized on the trip. Visit the URL listed above to view the lessons and to find out how to arrange for a naturalist to work with you and your students if desired.

## **Procedure**

- 1) Upon arriving at Glacier National Park, visit each feature you have chosen for the trip and discuss the history of the area – both geological and cultural. Ask the tribal community member with you on the trip to share the Kootenai and/or Blackfoot name and the history of the name's significance. If you have opted to include activities from the park's geology curriculum, have students complete them as applicable.
- 2) At each stop, ask students to sketch and label the site in their science notebooks. Be sure to emphasize the importance of good observational skills and accurate labeling. Ask students to think of an original place name for each site, based on their observations, and have them write this in their notebook on the sketch of the site. Ask student volunteers to share the place name that they created and explain why they named it that.
- 3) Take pictures along the way as memorabilia and as a tool for debriefing about the trip.
- 4) Use the slides of the trip to discuss the park and its history. Use Google Earth and/or the virtual fieldtrip on the park's web pages to view the sites also. Use these images as a springboard for the next topic – the formation of Earth's crustal features.
- 5) Ask students to write a reflection about the trip in their journals.

## **Formative Assessment**

Assess students' sketches for proficiency in making and recording scientific observations.