Focus on Inquiry
The student will investigate the different layers of Earth’s interior and get an idea of the differences and composition of each layer.

Lesson Content Overview
Students will look at models depicting each layer of the Earth’s interior and decide which layer is being represented and figure out basic descriptions of each layer.

<table>
<thead>
<tr>
<th>Duration</th>
<th>Setting</th>
<th>Grouping</th>
<th>PTI Inquiry Subskills</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 minutes</td>
<td>Classroom</td>
<td>Whole classroom and groups of 3-4 students.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesson Components</th>
<th>Estimated Time</th>
<th>Inquiry Subskills Used</th>
<th>Technology Used</th>
<th>Level of Student Engagement</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage</td>
<td>10 Minutes</td>
<td>1.1, 1.3,2.3, 3.1,3.3,3.6 ,3.7</td>
<td>None</td>
<td>2</td>
<td>Students will cut open a fun size Milky Way candy bar and make observations about the inside, and answer questions that relate the Milky Way to the Earth's Interior Layers.</td>
</tr>
<tr>
<td>Explore</td>
<td>25 Minutes</td>
<td></td>
<td>None</td>
<td>3</td>
<td>Students will look at 4 different baggies, each filled with different substances. These substances will lead the students to describing and figuring out which layer is which.</td>
</tr>
<tr>
<td>Explain</td>
<td>15 Minutes</td>
<td></td>
<td>None</td>
<td>2</td>
<td>Students will use a resource to answer and fill out a chart that explains more characteristics of each layer.</td>
</tr>
<tr>
<td>Expand</td>
<td>20 Minutes</td>
<td></td>
<td>None</td>
<td>2</td>
<td>Students will use all of their knowledge to figure out a diagram of Earth's Interior Layers.</td>
</tr>
<tr>
<td>Evaluate</td>
<td>10 Minutes</td>
<td>7.4</td>
<td>None</td>
<td>1</td>
<td>Exit slip will check for student understanding</td>
</tr>
</tbody>
</table>

Level of Student Engagement

1. Low  Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2. Moderate Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3. High Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

Next Generation Science Standards – Inquiry
NGSS Practice 2:Developing and Using Models
NGSS Practice 3: Planning and Carrying Out Investigations
NGSS Practice 4: Analyzing and Interpreting Data
NGSS Practice 6: Constructing explanations
NGSS Practice 7: Engaging in arguments from evidence
NGSS Practice 8: Obtaining, Evaluating and Communicating Information

Next Generation Science Standards – Earth Science

ESS2.A: Earth’s Materials and Systems: The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth’s history and will determine its future
**Florida Science Standards - Inquiry**

SC.7.N.1.1- Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions

**Florida Science Standards – Earth Science**

SC.7.E.6.1- Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid cores

---

**Materials and Advance Preparation**

**Materials List**

Class set:
- Layers Cards
- Containers
- Play doh
- Marble
- Water
- Dirt
- Ziploc Bags
- Funsize Milky Way candy bars
- Plastic knives

Student materials:
- Lab
- Container with the following
  - Layer Cards
  - 1 Ziploc bag labeled A with water (about ¼ full) OUTER CORE
  - 1 Ziploc bag labeled B with Play doh (about the size of a small bouncy ball) MANTLE
  - 1 Ziploc bag labeled C with dirt (about ½ full) CRUST
  - 1 Ziploc bag labeled D with a marble INNER CORE
- Colored pencils and markers
- Textbook or computer for resource to look up characteristics of each layer

**Blackline Masters**

1. Earth’s Layers Lab
2. Earth’s layers Diagram
3. Earth’s Layers Cards
4. Earth’s Layers Assessment

**Advance Preparation**

1. Print out a copy of the lab for each student
2. Print out earth’s layers cards and cut them out. Put 1 of each card in a set. There should be 4 cards per set. (Crust, Mantle, Outer Core, Inner Core). Each container gets 1 set.
3. Set up the containers. You need one container with all of the following per group.
   - Layer Cards
   - 1 Ziploc bag labeled A with water (about ¼ full) OUTER CORE
   - 1 Ziploc bag labeled B with Play doh (about the size of a small bouncy ball) MANTLE
   - 1 Ziploc bag labeled C with dirt (about ½ full) CRUST
Layers of the Earth

1. The student will be able to identify the layers of the Earth and explain specific characteristics of each layer.
2. The student will be able to label the Earth’s interior correctly.

Prior Knowledge Needed by the Students
- Students need to know how to make observations of models
- Students need to know how to create a bar graph
- Students should know that the Earth has an interior.

Background Information
The Earth’s interior is set up in layers, with each layer different from the previous. The Earth’s Interior beginning from the surface starts with the crust. The crust is the thinnest layer and is made up of dirt, soil, and mostly solid rock. The crust extends up to 70 kilometers below the surface and temperatures go up to 400 degrees Celsius (close to the mantle). The next layer, the Mantle is the thickest layer at about 2900 kilometers thick. Temperatures range from 2800-3200 degrees Celsius. In the upper part of the mantle rocks are melted forming magma. The mantle is considered to be a semi-solid layer. The next layer is the Outer core which is about 2250 kilometers thick and made up of liquid iron and nickel. Temperatures range between 4,000-5,000 degrees Celsius. The innermost layer is called the inner core and it’s 1280 kilometers thick with temperatures at about 6,000 degrees Celsius. The inner core is made up of solid nickel and iron because the pressure of the layers above it compress it into a solid.

Lesson Procedure

Engage
Include guiding questions you might ask to help students. If you use a video (include the URL in your lesson plan instructions) or a book (the author, title, and publication date), and include questions that you would ask before, during or after the video/book reading selection.

1. Teacher will pass out the Milky Way candy bar and plastic knives. Give 1 fun size Milky way per 2 students. **Teacher says, please cut the Milky Way in half as neatly as possible. Once done cutting the Milky Way, answer the observation questions in your lab. Once all questions have been answered you may eat the candy (optional).**

2. Teacher will go over the engage questions and have the students share. **Teacher asks, students to share their observations and answers on the following questions: What did you notice about each of the layers? Students responses may include each layer is a different thickness, different consistencies, different colors, different materials.**

**Teacher asks, how do you think this relates to the Earth? Student’s responses may include, that the Earth’s interior is in layers, the Earth is made up of different materials.**

**Teacher asks, what kinds of benefits and limitations were there to the Milky Way model of the Earth’s layers? Student’s responses may include, that the model only had 3 layers and the Earth has more, the model is too small, Earth is not made of chocolate.**

Explore
This should be a student-centered, hands-on activity that teaches your students about science. No lectures or direct teaching allowed. Please be as hands-on as possible. Also, please provide enough detail so that Dr. Blanchard could teach your lesson based on what you have included in these steps.

1. Teacher will pass out buckets containing materials for the lab and explains how the data table will be filled out. **Teacher says, here are your materials needed to complete the Earth’s layers data table. In each bucket you have 4 Ziploc bags containing different materials and your goal is to make observations about each bag and figure out what layer they are**
representing. Each bag is labeled with a letter and that letter will represent that bag in the data table. Once you have made your observations you will use the 4 layer cards to figure out the name of each bag and put it in the chart. Once you have completed the table answer the question What did you notice about the composition of each layer? How were they different?

2. Teacher will explain how the bar graph should be completed. **Teacher says, use the temperature at the bottom of each card and create a bar graph in increasing order, and color each bar using the key provided. Make sure you put labels for the x and y axis, and a title. Once graph is complete answer the following questions. What did you notice about the temperatures on the graph? How did they change? Hypothesize why you think the temperatures changed. Explain the relationship between the layers composition and temperature.**

**Explain**

Include guiding questions you might ask students during the EXPLORE activity. You should have at least 10-15 questions to guide student discussion and learning.

1. Students will complete the characteristic chart about each layer and answer conclusion questions. When answering the chart, use whatever resource your school has available. Textbook, Computer, etc…

2. Questions that can be asked.

   - **Teacher says, which layer is the thickest?** Possible student answers are the mantle (correct), or any of the other layers if they got the thicknesses incorrect in the chart.
   - **Teacher says, which layer is the hottest?** Possible student answers are the inner core (correct), or any of the other layers if they got the temperatures incorrect in the chart.
   - **Teacher says, Between the mantle and the crust there are 2 sub layers called the lithosphere and asthenosphere, explain what they are** Possible student answers are that the lithosphere is the uppermost part of the mantle and the asthenosphere is directly below the lithosphere (correct). May flip the asthenosphere location with lithosphere location.
   - **Teacher says, hypothesize why you think the outer core is a liquid and the inner core is a solid?** Possible student answers may vary because it’s a hypothesis, but they may say because of pressure of the layers above it, the material makes it a solid
   - **Teacher says, which layer is the thinnest?** Possible student answers Possible student answers are the crust (correct), or any of the other layers if they got the thicknesses incorrect in the chart.
   - **Teacher says, What is the composition of the inner and outer cores?** Possible student answers iron and nickel (correct) or another composition if they got the chart incorrect.
   - **Teacher says, Which layer do you think all of the heat comes from?** Possible student answers inner core (correct), or any other layer if they got the temperatures wrong in the chart.
   - **Teacher says, What would be a good model to use for the mantle?** Possible student answers play doh, honey oatmeal. Anything that is considered a semi solid.
   - **Teacher says, Why would it be impossible to travel to the center of the Earth?** Possible student answers temperature is too hot, pressure is to intense, Take too long because the layers are too thick, no technology available.
   - **Teacher says, What did you learn that was new about the Earth’s interior?** Possible student answers will vary because it’s a reflection.

**Expand**

Include a similar student centered activity that will allow students to practice or connect what they have just learned in Explore. This is not an opportunity to introduce a new topic, but to provide enrichment on the topic of this lesson.

1. Students will complete a diagram of the Earth’s layers and label them in correct order from the surface to the inner core, and color each layer using the key. **Answers in order are the following:**
   1. Crust=Green
   2. Mantle=Yellow
3. Outer Core-Orange
4. Inner Core- Red
5. Lithosphere=Gray
6. Asthenosphere=Blue

Evaluate

FORMAL EVALUATION

a. Attach a FORMAL EVALUATION (1-3 questions) on a separate sheet of paper that you have developed to use as your evaluation tool.
b. For each question, identify in parentheses at the end of the criteria the GLE (GLE#___) and/or Learning Objective (LO#___) you are assessing for your lesson. If you use an Inquiry GLE, please note it as INQ GLE #___.

INFORMAL or OPTIONAL EVALUATIONS

1. What are the layers of the Earth starting from the surface inward?
2. What happens to the temperature when you go from the inner core to the crust?

WRAP UP.

Bring the lesson to a conclusion by having the students share with each other what they have learned from the activity and the teacher can address any misconceptions.

Supplementary Resources

Interactive look at Earth’s Layers-7th grade

Interactive look at Earth’s Layers-7th grade

CITATION OF SOURCES.

Where did you get the idea/materials for this lesson? (Put the author/date/book name or the Name of the website and the complete URL). I/We used the following resources to build our lesson:


Yes, I cited all materials and resources used in this lesson.

Kristin Bartee
Lesson author signature
Layers of the Earth

**Standard:** SC.7.E.6.1 - Describe the layers of the solid Earth, including the lithosphere, the hot convecting mantle, and the dense metallic liquid and solid cores

**Learning Target:** Students will identify and describe the layers of the Earth.

**Do Now:** Take your Milky Way candy bar and cut it in half, keep one half and give the other to your partner. Observe the candy bar and answer the following questions:

1. Label and draw what you see on the inside of the Milky Way candy bar.

2. What do you notice about each of the layers?

3. How do you think this relates to the Earth?

4. What kinds of benefits and limitations were there to the Milky Way model of the Earth’s layers?

**Once questions are answered you may eat it!**

**Earth’s Layers:**
1. Take the bags of different materials and observe them. Do not open the bags!
2. Make some observations in the table below. 3 for each bag.

<table>
<thead>
<tr>
<th>Qualitative Observations</th>
<th>Bag A</th>
<th>Bag B</th>
<th>Bag C</th>
<th>Bag D</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 for each bag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid, Liquid, Semi-Solid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of Earth’s Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After you have observed the bags use the cards to figure out which bag is representing each layer and put it on the table.
1. What did you notice about the composition of each layer? How were they different?

__________________________________________________________________________
__________________________________________________________________________

Graph:

Using the index card, create a bar graph of the highest temperature of each layer. Have the temperatures in increasing order. Color each bar according to the key and label the axis’s.

1. What did you notice about the temperatures on the graph? How did they change?

__________________________________________________________________________

2. Hypothesize why you think the temperatures changed

__________________________________________________________________________

3. Explain the relationship between the layers composition and temperature

__________________________
Characteristics of Layers:
Using the Sciencesaurus (pg. 177) and textbook (pgs. 258-261) fill in the chart below about each layer.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Crust</th>
<th>Mantle</th>
<th>Outer Core</th>
<th>Inner Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition (what it’s made of)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid or Liquid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Which layer is the thickest? ____________________________
2. Which layer is the hottest? ____________________________
3. Between the mantle and the crust there are 2 sub layers called the lithosphere and asthenosphere, explain what they are____________________
   _________________________________________________________________________
   _________________________________________________________________________
   _________________________________________________________________________

4. Hypothesize why you think the Outer Core is a liquid and the Inner Core is a solid ________________________________________________
   _________________________________________________________________________
   _________________________________________________________________________
   _________________________________________________________________________
Layers of the Earth Diagram:
1. Label each layer in the correct order from the surface inward using the word bank provided.
2. Color each layer using the color code:
   - Crust - Green
   - Mantle - Yellow
   - Outer Core - Orange
   - Inner Core - Red
   - Lithosphere - Gray
   - Asthenosphere - Blue

** Use the Sciencesaurus, textbook, and information from the lab**

Word Bank:
Crust, Inner Core, Mantle, Outer Core, Lithosphere, and Asthenosphere
**Outer Core**
- Liquid
- 5,000°C

**Inner Core**
- Solid
- 6,000°C

**Crust**
- Rocky, Very thin
- 400°C

**Mantle**
- Semisolid, moves Slowly
- 3,200°C
Layer’s of the Earth Exit Slip

1. Which statement below best describes how temperature reacts in the Earth’s interior as you travel deeper into the Earth? SC.7.E.6.1
   a. The temperature constantly decreases
   b. The temperature constantly increases
   c. The temperature constantly decreases then increases
   d. The temperature constantly increases then decreases

2. In the diagram what is letter C representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core

3. In the diagram what is letter A representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core

4. In the diagram what is letter D representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core

5. In the diagram what is letter B representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core
Layers of the Earth Exit Slip

1. Which statement below best describes how temperature reacts in the Earth’s interior as you travel deeper into the Earth? SC.7.E.6.1
   a. The temperature constantly decreases
   b. The temperature constantly increases
   c. The temperature constantly decreases then increases
   d. The temperature constantly increases then decreases

![Diagram of layers of the Earth]

2. In the diagram what is letter C representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core

3. In the diagram what is letter A representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core

4. In the diagram what is letter D representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core

5. In the diagram what is letter B representing? SC.7.E.6.1
   a. Inner Core
   b. Crust
   c. Mantle
   d. Outer Core