SECTION 2.5 INTRODUCTION

2.5 Review and Revise Your Explanation

t 1 $\frac{1}{2}$ class periods*

Shape and Temperature

Overview

Students revise their original hypotheses about how and why the shape of a planet affects surface temperature. They also have explored the degree to which temperature varies. The revised hypotheses are the basis for initial surface temperature predictions on *Planet X*.

Targeted Concepts, Skills, and Nature of Science	Performance Expectations
Scientists use new information and ideas to revise their learning process.	Students should learn that to investigate as scientists, they must take new information into consideration and revise their explanations.
The shape of a planet directly affects its surface temperatures.	Students should create a visualization of *Planet X* in *My World* which shows a decreasing amount of solar energy, and temperature, as distance from the Equator increases.

Materials

1 per student	computers with *My World* software
1 per student	completed data table from *Section 2.4*

Homework Options

Reflection

- **Science Content:** Which latitudes on Earth's surface experience the highest range of temperatures? Which latitudes experience the lowest range of temperatures? *(Latitudes nearest the Equator experience the lowest range of temperatures. Latitudes farthest from the Equator and nearest the poles experience the lowest temperatures.)*

*A class period is considered to be one 40 to 50 minute class.

- **Science Process:** Why is it helpful to find averages when acquiring data instead of just taking one sample? *(Students should understand that an average is more representative, while one sample may be very different from what is regularly experienced.)*

Preparation for Back to the Big Challenge

- **Science Process:** Start thinking about your predictions concerning the surface temperatures on *Planet X. (Students' answers will vary.)*

NOTES

SECTION 2.5 IMPLEMENTATION

t $1\frac{1}{2}$ class periods*

2.5 Review and Revise Your Explanation

Shape and Temperature

You have studied shape and its effects on temperature. Recall what you have learned about direct and indirect light. Think about what you have learned about how much incoming solar energy changes at higher latitudes compared to the Equator.

Look at your original prediction on shape and its effects on temperature. Think about what you have learned so far. You are ready to revise your explanation.

Review and Revise Your Explanation

You have studied how the shape of Earth affects the incoming solar energy that strikes an area. Think about the connections you have begun to make between incoming solar energy and temperature. You are ready to revise your explanation about shape as a factor in predicting surface temperature.

Earlier, your class wrote an explanation of how shape affects the surface temperature. Using what you learned from this last investigation, review the explanation. Use the following *Stop and Think* questions as a guide.

Stop and Think

Answer the questions below before you revise your explanation. These questions will help you analyze the class explanation. If the explanation is not as good as it could be, the questions will help you create a better one. Answer these questions on your own.

1. Use evidence from your investigations to describe your current explanation about how the shape of a planet influences temperature.
2. How has this explanation changed since your earlier prediction? What have you learned that made you change it?
3. How has your understanding of why shape influences temperature changed since you started?
4. Write an explanation that combines the answers to *how*, *why*, and *how much* shape influences surface temperatures. Make sure to use evidence from your investigations to explain your answer.
5. Use a *Create Your Explanation* page to rewrite the explanation.

2.5 Review and Revise Your Explanation

Shape and Temperature

Review and Revise Your Explanation

10 min.

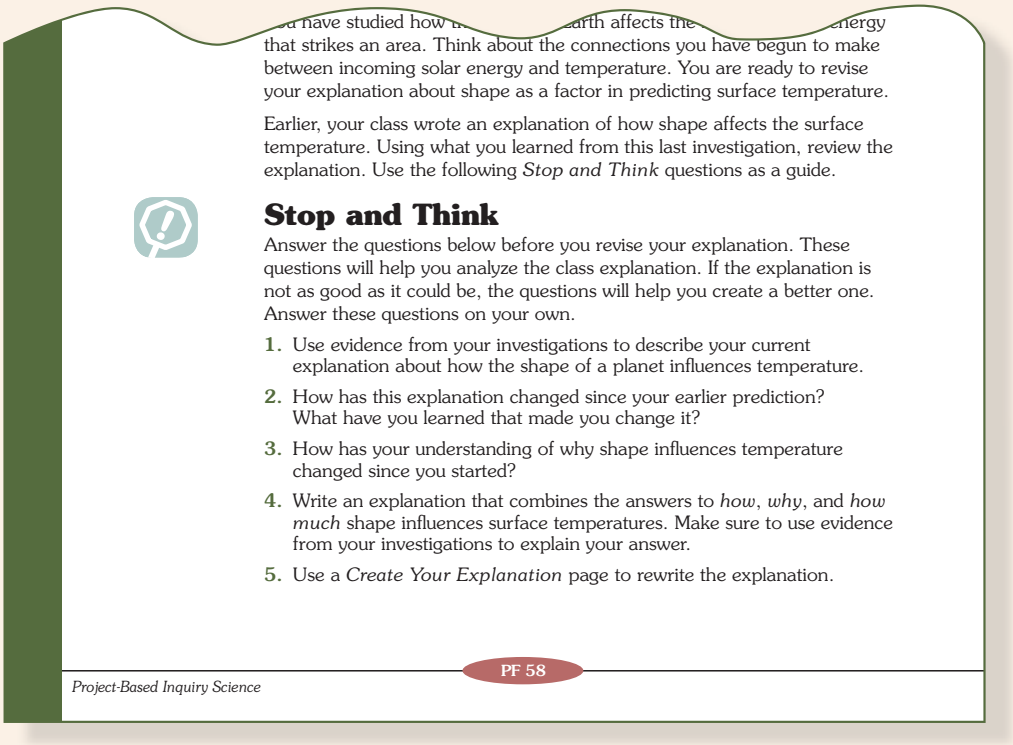
Get students to revise their original hypotheses using the information they have learned in this Learning Set.

Engage

Have students locate their original hypotheses on shape from *Section 2.1*. Lead a brief discussion about how the students first thought shape affected temperature and why it had that effect. Ask a few students to share their old ideas and explain some of their new ideas. Make sure that students include evidence for why their ideas changed.

Stop and Think

10 min.



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Project-Based Inquiry Science

Get Going

Lead the students through the *Stop and Think* questions as a class. Students can use these questions to stimulate their thought processes. At the end of the *Stop and Think* segment, students will use a *Create Your Explanation* page to write an explanation.

Assess

Students will be aware that they are considering temperatures, but they may not be aware of how or where these temperatures are measured. During the procedure, question the students as to where the data comes from. Ask questions to probe their knowledge. Here are some examples:

- "How are these temperatures obtained?"
- "Where are these temperatures measured?"
- "Are these temperatures taken from inside houses? Under water? Under bushes?"

Make sure that students understand that these temperatures are taken outside from the air a few feet above the ground. In other words, temperatures are gathered from the places where humans are living. Have students recall the Investigation in *Learning Set 1*, where they took temperature data from their environment.

2.5 *Review and Revise Your Explanation*

Conference

Share your explanation with your group. After you consider everyone's explanations, your group will create a group explanation. Then you will meet with your class to discuss the answers to the questions and the group explanations. Your class will select or create a new class explanation that best explains the relationship between shape and temperature.

Update the *Project Board*

Now that you have done this investigation, you know more about how a planet's shape affects surface temperature. You are now ready to fill in the *Project Board* more completely.

Which regions of a newly discovered planet have appropriate surface temperatures for a human colony?				
What do we think we know?	What do we need to investigate?	What are we learning?	What is our evidence?	What does it mean for the challenge or question?

Once again you are going to focus on the *What are we learning?* and *What is our evidence?* columns. You will still have questions in the *What do we need to investigate?* column. As you record what you are learning in the *What are we learning?* column, you will be answering some of those questions. Describe what you have learned from your investigations. Provide evidence for what you have learned.

You will fill in the *Project Board* as a class. Make sure to record the same information on your own *Project Board* page.

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PLANETARY FORECASTER

Conference

15 min.

☐ Assess

Students should now have evidence to indicate how the shape of the Earth affects temperature:

- There is more incoming solar energy at the Equator, so it is warmer closer to the Equator.
- As you move farther away from the Equator, either north or south, it will get colder because there is less incoming solar energy.

☐ Assess

Students should now clearly understand why the shape of the Earth affects temperature:

- Incoming solar energy is distributed differently over Earth's surface because Earth is curved.
- Incoming solar energy is most direct at the Equator.
- As you move away from the Equator, the incoming solar energy becomes less direct. It is spread out over a greater area and is less intense, causing temperatures to decrease.

Students should now be able to tie together how Earth's shape affects temperature. Here is a sample explanation:

"As you move away from the Equator, and solar energy becomes less direct, incoming solar energy gradually decreases. The amount of incoming solar energy decreases the most from 40-60 degrees north or south, so the temperature also changes the most across that latitude range."

NOTES

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You will fill in the *Project Board* as a class. Make sure to record the same information on your own *Project Board* page.

Update the Project Board

20 min.

Guide the class in recording the explanations in the Project Board, *focusing on the last column, which will contain students' explanations and recommendations.*

△ Guide

Students should have already written their final hypotheses about how shape affects temperature. Well-written hypotheses will include both the "how" and the "why" for the effects of shape. They will also include evidence to support the hypothesis. You may want to ask a few students to share their hypotheses with the class.

Get Going

Make sure that students take time updating the *Project Board*. If necessary, review the previous sections of *Learning Set 2* to refresh their memories. Make sure that students fill out their own *Project Board* pages.

Assessment Options

Targeted Concepts, Skills, and Nature of Science	How do I know if students got it?
Scientists use new information and ideas to revise their learning process.	**ASK:** How did your explanation about how Earth's shape affect surface temperatures change according to what you learned? **LISTEN:** Students should provide evidence and information from investigations and explain how they incorporated this data into revising their explanations.
Students should use their knowledge about planet shape to make predictions about temperatures on *Planet X*.	**ASK:** What predictions did you make about the relationship between planet shape and temperature for *Planet X*? **LISTEN:** Students' answers will vary but they should mention factors such as solar energy and distance from the Equator.

Teacher Reflection Questions

- How did the revised explanations compare to the initial explanations created by the students at the beginning of the lesson? Did the differences in the explanations reflect the learning process experienced by the students?
- How effective is the *Project Board* in allowing students to think about the *Big Challenge?* Which parts of the *Project Board* do students generally need more help or guidance in filling out?