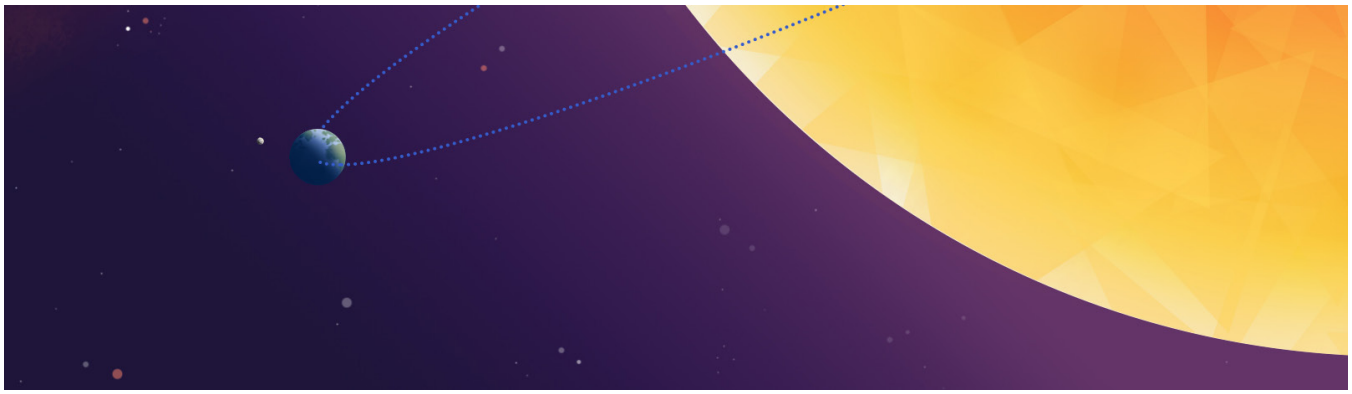
AmplifyScience



Patterns of Earth and Sky:

Analyzing Stars on Ancient Artifacts

Investigation Notebook

© 2018 by The Regents of the University of California. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage or retrieval system, without permission in writing from the publisher.

Teachers purchasing this Investigation Notebook as part of a kit may reproduce the book herein in sufficient quantities for classroom use only and not for resale.

These materials are based upon work partially supported by the National Science Foundation under grant numbers DRL-1119584, DRL-1417939, ESI-0242733, ESI-0628272, ESI-0822119. The Federal Government has certain rights in this material. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

These materials are based upon work partially supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A130610 to The Regents of the University of California. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

Developed by the Learning Design Group at the University of California, Berkeley's Lawrence Hall of Science.

Amplify Science Elementary is based on the *Seeds of Science/Roots of Reading*® approach, which is a collaboration between a science team led by Jacqueline Barber and a literacy team led by P. David Pearson.

www.scienceandliteracy.org

Amplify.
55 Washington Street, Suite 800
Brooklyn, NY 11201
1-800-823-1969
www.amplify.com

Patterns of Earth and Sky: Analyzing Stars on Ancient Artifacts
ISBN: 978-1-945192-84-5
AMP.NA18

Table of Contents

Safety Guidelines for Science Investigations 1

What Is a Scientific Explanation? 2

Chapter 1

Observing the Mystery Artifact 3

Daily Written Reflection 4

Exploring Stars in a Simulation 5

Think-Write-Pair-Share: Where Are the Stars in Space? 6

Daily Written Reflection 7

Getting Ready to Read: *How Big Is Big? How Far Is Far?* 8

Reading Reflection: *How Big Is Big? How Far Is Far?* 9

Daily Written Reflection 10

Investigating Distances to Stars 11

Daily Written Reflection 12

Investigating Stars in Daytime and Nighttime 13

Daily Written Reflection 14

Think-Write-Pair-Share: What Would You Say? 15

Word Relationships 16

Daily Written Reflection 17

Scientific Explanation: Stars in the Daytime 18–19

Chapter 1: Check Your Understanding 20

Chapter 2

Daily Written Reflection 21

Think-Write-Pair-Share: Patterns in the Mount Nose Model 22

Daily Pattern Investigation 24–25

Daily Written Reflection 26

Think-Write-Pair-Share: Using Data in an Investigation 27

Table of Contents (continued)

Daily Written Reflection 28
Word Relationships 29
Daily Written Reflection 30
Getting Ready to Read: *Which Way Is Up?* 31
Reading Reflection: *Which Way Is Up?* 32
Visualizing What Happens 33
Revisiting Predictions 34
Daily Written Reflection 35
Daily Written Reflection 36
Scientific Explanation: Why the Sun Is Up Sometimes 38–39
Thinking About Standing on Earth 40
Chapter 2: Check Your Understanding 41

Chapter 3

Daily Written Reflection 42
Student X's Investigation Plan 43
Investigating Stars on Different Nights 44–45
Daily Written Reflection 46
Daily Written Reflection 47
Yearly Pattern Investigation 48–50
Think-Write-Pair-Share: Cause of the Yearly Pattern of Stars 51
Daily Written Reflection 52
Getting Ready to Read: *Dog Days of Summer* 53
Reading Reflection: *Dog Days of Summer* 54
Daily Written Reflection 55
Modeling Constellations over Time 56
Thinking About the Artifact 57

Table of Contents (continued)

Daily Written Reflection 58
Identifying the Constellation on the Missing Piece 59
Chapter 3: Check Your Understanding 60

Chapter 4

Daily Written Reflection 61
Getting Ready to Read: *Star Scientist* 62
Reading Reflection: *Star Scientist* 63
After Reading: Thinking About an Investigation 64
Think-Write-Pair-Share: Plan and Complete an Investigation 65
Choosing a Question to Investigate 66
Daily Written Reflection 67
Investigation Plan 68–69
Daily Written Reflection 70
Investigation Plan 72–73
Investigation Plan 74–75
Did You Answer Your Investigation Question 76
Chapter 4: Check Your Understanding 77

Glossary 79–80

Safety Guidelines for Science Investigations

1. **Follow instructions.** Listen carefully to your teacher's instructions. Ask questions if you don't know what to do.
2. **Don't taste things.** No tasting anything or putting it near your mouth unless your teacher says it is safe to do so.
3. **Smell substances like a chemist.** When you smell a substance, don't put your nose near it. Instead, gently move the air from above the substance to your nose. This is how chemists smell substances.
4. **Protect your eyes.** Wear safety goggles if something wet could splash into your eyes, if powder or dust might get in your eyes, or if something sharp could fly into your eyes.
5. **Protect your hands.** Wear gloves if you are working with materials or chemicals that could irritate your skin.
6. **Keep your hands away from your face.** Do not touch your face, mouth, ears, eyes, or nose while working with chemicals, plants, or animals.
7. **Tell your teacher if you have allergies.** This will keep you safe and comfortable during science class.
8. **Be calm and careful.** Move carefully and slowly around the classroom. Save your outdoor behavior for recess.
9. **Report all spills, accidents, and injuries to your teacher.** Tell your teacher if something spills, if there is an accident, or if someone gets injured.
10. **Avoid anything that could cause a burn.** Allow your teacher to work with hot water or hot equipment.
11. **Wash your hands after class.** Make sure to wash your hands thoroughly with soap and water after handling plants, animals, or science materials.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

What Is a Scientific Explanation?

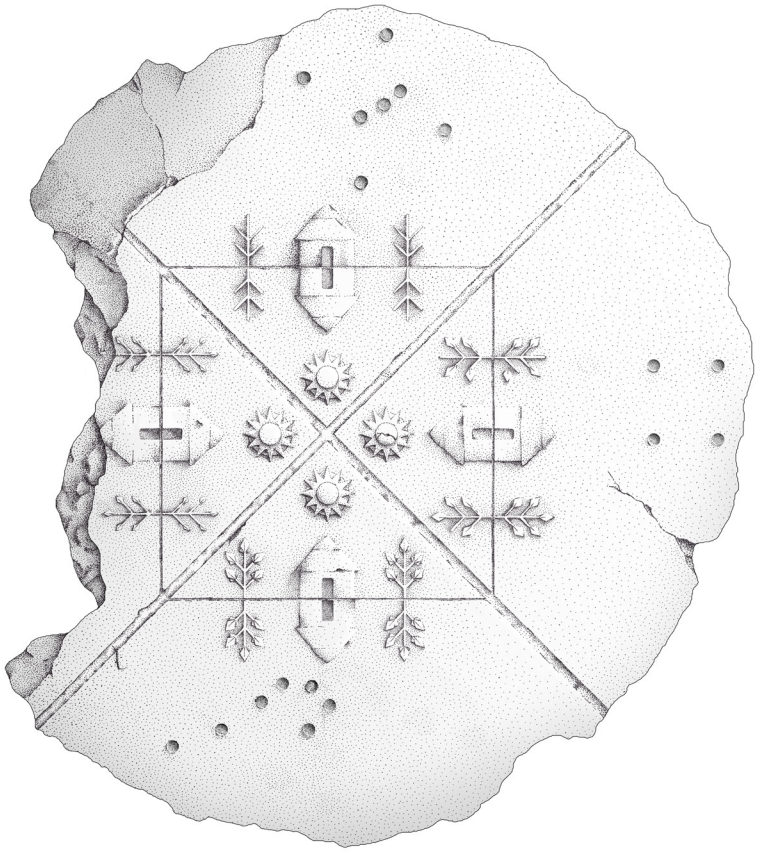
1. It answers a question about how or why something happens.
2. It describes things that are not easy to observe.
3. It is based on ideas you learned from investigations and text.
4. It uses scientific language.
5. It is written for an audience.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Observing the Mystery Artifact

Observe each section of the artifact, and then record your observations.



1. What did you observe about this artifact?

_____

_____

_____

2. What similarities or differences did you notice in the artifact sections?

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

If you were making a model of Earth, what would you use to make the model? Describe your model and how it would be like Earth.

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Exploring Stars in a Simulation

Explore the Sim with your partner, and then record your ideas.

A. List some things you discovered about how the Sim works.

_____

_____

_____

_____

_____

_____

B. List some questions you have about how the Sim works.

_____

_____

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Think-Write-Pair-Share: Where Are the Stars in Space?

1. Think about the question, *Where are the stars in space?*
2. Record your ideas.
3. Share your ideas with your partner.

_____

_____

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

1. Is Earth big or small? Explain your thinking.

_____

_____

_____

2. How big is the sun, compared to Earth?

_____

_____

3. How big are you, compared to Earth?

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Getting Ready to Read: *How Big Is Big? How Far Is Far?*

1. Before reading *How Big Is Big? How Far Is Far?*, read the sentences below.
2. If you agree with the sentence, write an "A" on the line before the sentence.
3. If you disagree with the sentence, write a "D" on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_____ Earth is a big planet compared to other planets.

_____ When we see stars in the sky, they look small because they are small.

_____ The sun is smaller than Earth.

_____ The sun is the only star in our solar system.

_____ The stars we see are all the same distance away from Earth.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Reading Reflection: *How Big Is Big? How Far Is Far?*

Record ideas from the book that support each statement.

1. Earth is a big planet.

_____

_____

_____

2. Earth is a small planet.

_____

_____

_____

3. Earth is far from the sun.

_____

_____

_____

4. Earth is close to the sun.

_____

_____

_____

5. How is it possible for something to seem both big *and* small or both far *and* close?

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

The sun is 150 million kilometers from Earth. If you wanted to explain to a friend how far that is, what would you say?

_____

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigating Distances to Stars

1. Record the distance from Earth to the stars. Begin with the sun and then the four stars that form the Great Square of Pegasus.
2. With your partner, use Sky View to choose four additional stars. Record their names in the left-hand column and their distances from Earth in the right-hand column.

Name of star	Distance from Earth to star (light-years)
sun	
Alpheratz	
Beta Pegasi	
Algenib	
Markab	

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

From Earth, why does the sun look so much larger than other stars? Is the sun actually larger than the stars outside our solar system? Explain your ideas below. Include a drawing that shows your ideas, if necessary.

_____

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigating Stars in Daytime and Nighttime

1. Open the Sim and press PLAY. Observe the stars in Sky View, both in daytime and nighttime.
2. Use your observations to answer the questions below.

Compare daytime and nighttime. What did you observe? How are the stars in Sky View different at those times?

_____

_____

_____

_____

What ideas do you have about why we can't always see the stars that are all around us?

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Think of a model that you used while investigating the stars. Name the model and explain what it helped you understand about the stars.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Think-Write-Pair-Share: What Would You Say?

1. Think about what each person is saying, then decide what you would say in response.
2. Record your ideas.
3. Share your ideas with your partner.

Someone says, "Stars are like the sun, except stars are very tiny."
What would you say?

_____

_____

_____

_____

Someone says, "The sun seems brighter because it is bigger than other stars." What would you say?

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Word Relationships

1. Work with your group to create sentences that use at least two word cards in each sentence.
2. Create at least one sentence that helps explain why we can't always see the stars, even though they are all around us.
3. Record a few of the sentences that you created.
4. With your group, choose one sentence to share with the class.

solar system daytime nighttime star sun Earth bright

1. _____

_____

_____

_____

2. _____

_____

_____

_____

3. _____

_____

_____

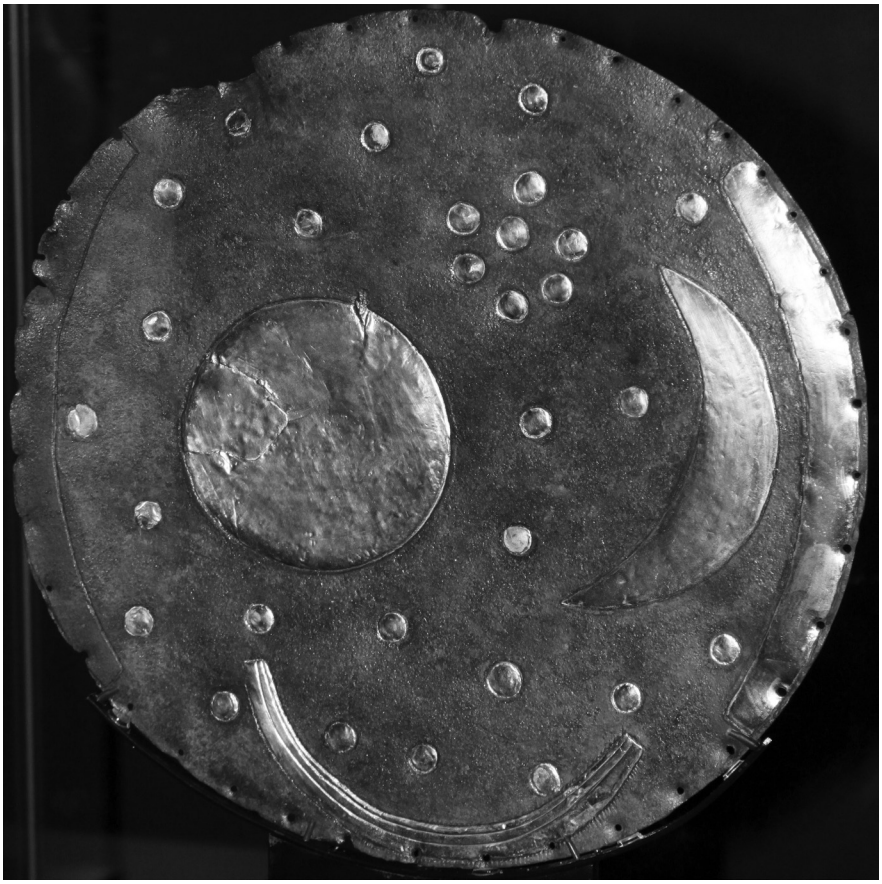
_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Scientists don't all agree on what the Nebra Sky Disc shows. What do you think it shows? If you like, you may add arrows and labels to help explain.



© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Scientific Explanation: Stars in the Daytime

1. Write a scientific explanation that answers the question, Why don't we see a lot of stars in the daytime?
2. Make a drawing if it helps you explain your ideas.

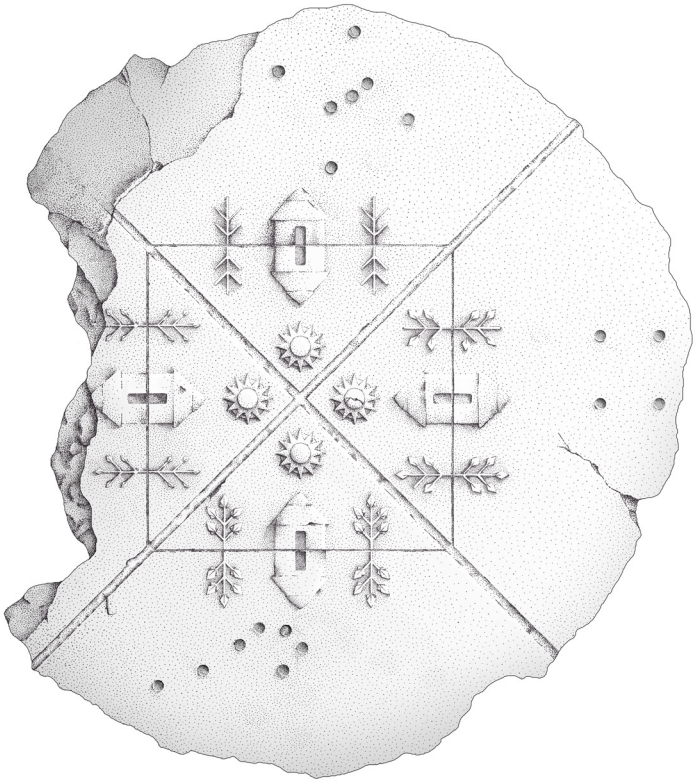
© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Scientific Explanation: Stars in the Daytime (continued)

Think about the explanation you just wrote. What new ideas do you have about what the artifact shows?

_____



_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Chapter 1: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out why we see different stars at different times?

I understand why the sun looks bigger and brighter than all other stars in the sky. ____ Yes ____ Not yet

I understand why we don't see other stars during the daytime when the sun is up. ____ Yes ____ Not yet

I understand which direction is up for people at different places on Earth. ____ Yes ____ Not yet

I understand why it changes from daytime to nighttime every day. ____ Yes ____ Not yet

I understand why we see different stars on different nights. ____ Yes ____ Not yet

I understand that science explanations describe the way natural events happen. ____ Yes ____ Not yet

I think I understand or don't yet understand these ideas because

_____

_____

What about the artifact are you still wondering?

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Think about three different patterns that you have observed in your daily life. List them below.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Think-Write-Pair-Share: Patterns in the Mount Nose Model

1. Think about this question:

   As you participated in the Mount Nose Model, what pattern, or patterns, did you observe?
2. Record your ideas.
3. Share your ideas with your partner.

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

You can use this page to record notes or create drawings.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Pattern Investigation

Constellation:

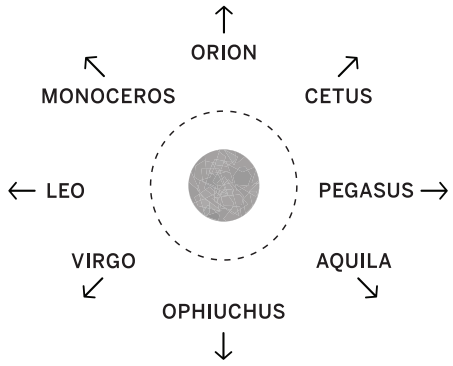
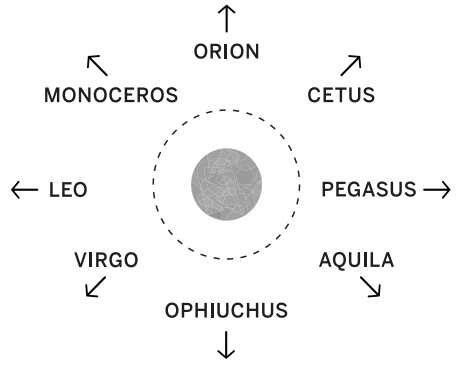
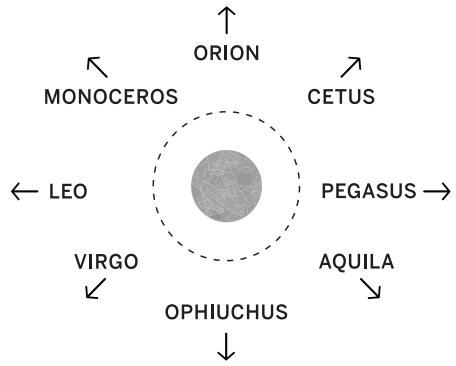
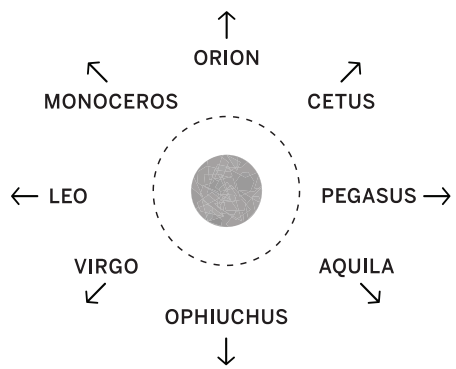
_____

Starting date:

_____

Investigation Question: What causes the daily pattern of when we see the sun and other stars?

1. Record the constellation name and starting date.
2. Highlight your constellation by pressing its name in System View.
3. For each time, decide if the constellation is visible.
4. Draw *Earth* and *the observer on Earth* in each System View sketch.

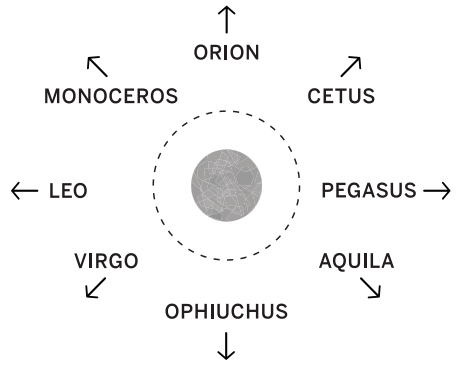
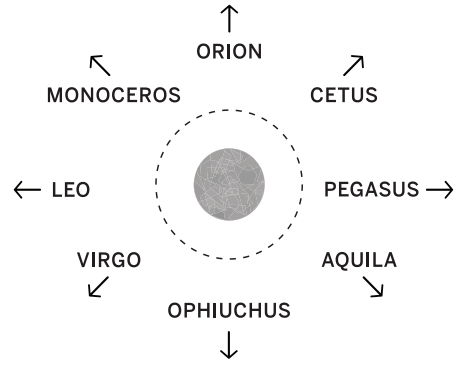
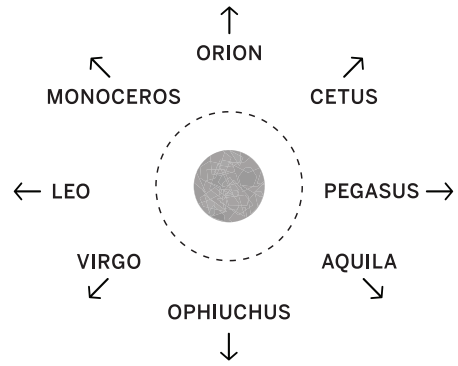
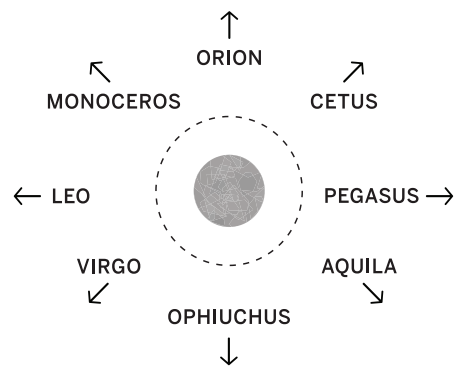
	System View
Starting day, **midnight** Is it visible? ☐ yes ☐ no	
Starting day, **6 a.m.** Is it visible? ☐ yes ☐ no	
Starting day, **noon** Is it visible? ☐ yes ☐ no	
Starting day, **6 p.m.** Is it visible? ☐ yes ☐ no	

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Pattern Investigation (continued)

System View

Next day, **midnight** Is it visible? ☐ yes ☐ no	
Next day, **6 a.m.** Is it visible? ☐ yes ☐ no	
Next day, **noon** Is it visible? ☐ yes ☐ no	
Next day, **6 p.m.** Is it visible? ☐ yes ☐ no	

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

What are some things that scientists need to think about carefully as they plan their investigations?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Think-Write-Pair-Share: Using Data in an Investigation

1. Think about the Investigation Question: *What causes the daily pattern of when we see the sun and other stars?*
    - Use your data table from the Sim to look for things that repeat each day.
    - Why does this pattern happen?
2. Record your ideas.
3. Share your ideas with your partner.

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Why is it important for scientists to carefully plan their investigations? Be specific.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Word Relationships

1. Work with your group to create sentences that use at least two word cards in each sentence.
2. Create at least one sentence that helps explain what causes the daily pattern of when we see the sun and other stars.
3. Record a few of the sentences that you created.
4. With your group, choose one sentence to share with the class.

daytime nighttime sun Earth spin stars day

1. _____

_____

_____

_____

2. _____

_____

_____

_____

3. _____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Think of a time when visualizing helped you understand how something moves. What did you visualize? How was it helpful?

_____

_____

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Getting Ready to Read: *Which Way Is Up?*

1. Before reading *Which Way Is Up?*, read the sentences below.
2. If you agree with the sentence, write an "A" on the line before the sentence.
3. If you disagree with the sentence, write a "D" on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_____ Gravity is a force that pulls all objects on Earth.

_____ Earth stays still and the sun moves across the sky every day.

_____ Down is always toward Earth.

_____ Up is always toward the sun.

_____ If an object weighs more on Earth, that means the pull of gravity is stronger for that object.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Reading Reflection: *Which Way Is Up?*

Why does Earth's spin make it seem like the sun is moving? What is really happening?

_____

_____

_____

_____

_____

_____

_____

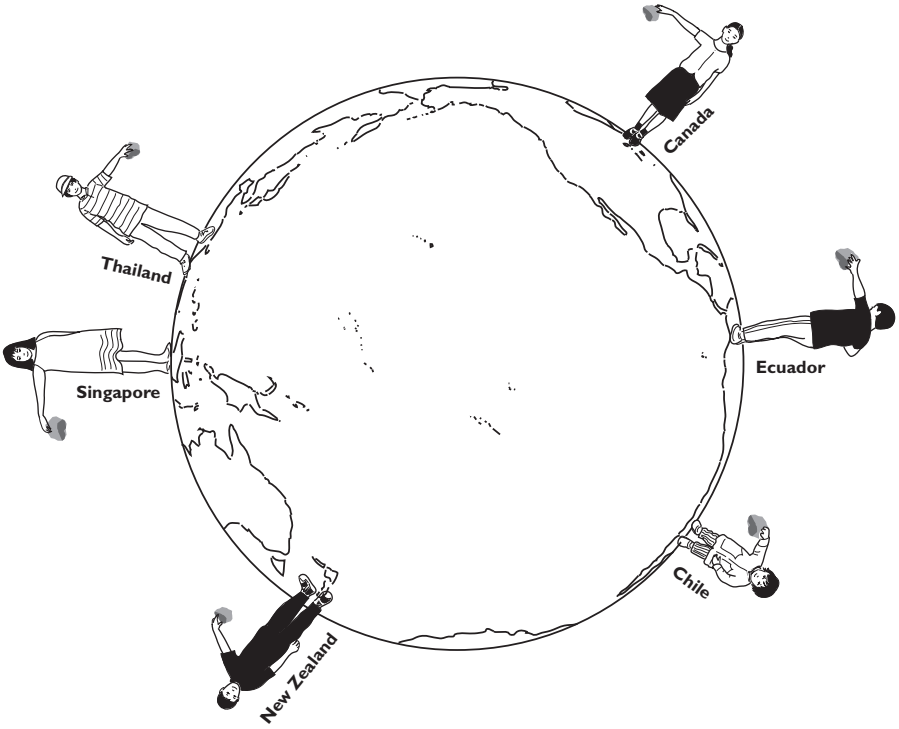
Draw a picture to show how what someone sees up in the sky changes as Earth spins. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Visualizing What Happens

Each person is holding a rock. Draw lines to show what you think will happen when the rocks are dropped. Then, answer the question below.



What do you predict will happen to the rocks after the people drop them? Why?

_____

_____

_____

_____

_____

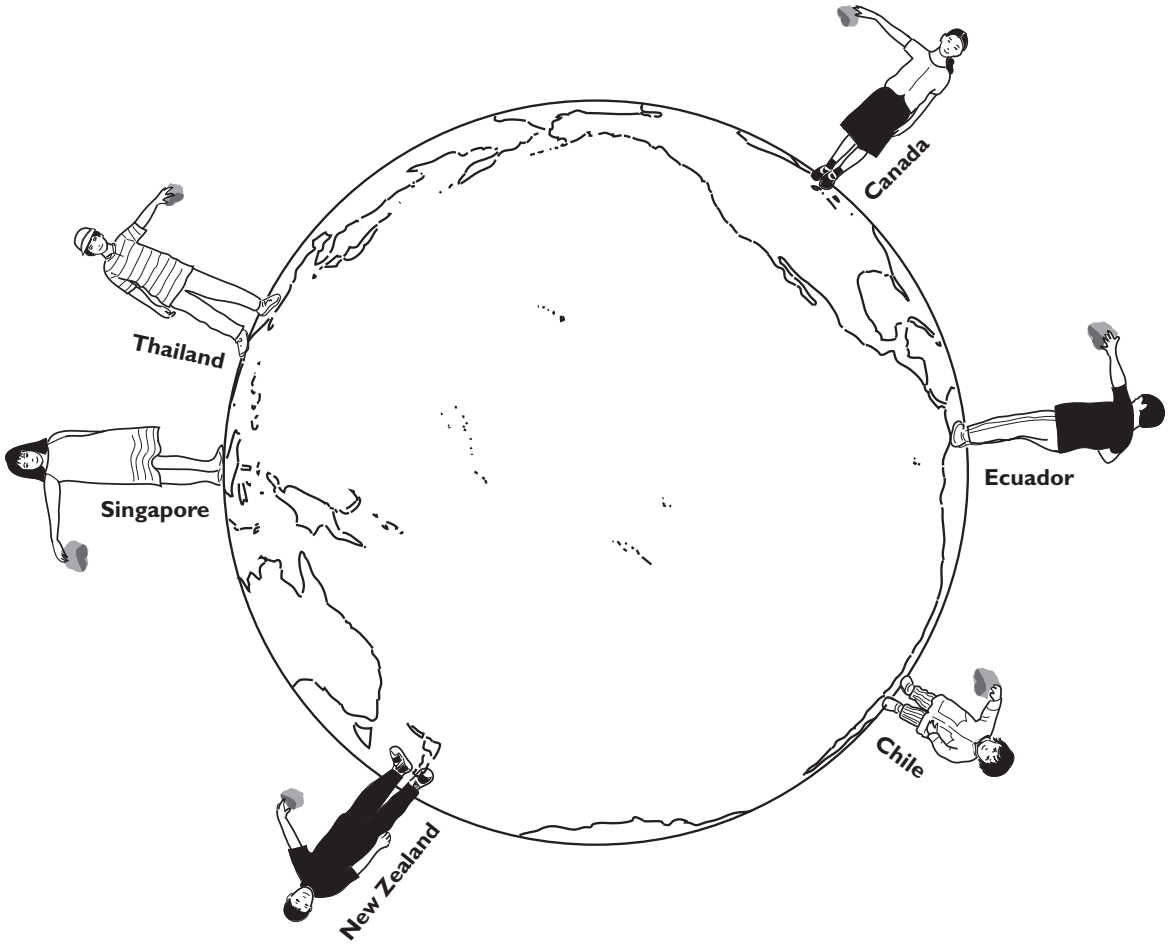
_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Revisiting Predictions

After watching *The Way Things Fall*, record on the diagram what happened when people from all these places on Earth dropped their rocks.



© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

If Earth spins, why don't we fall off? Explain what keeps us from falling off Earth.

_____

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

You have been investigating the question, *Why is the sun up sometimes, but not other times?* Which classroom science activities have helped you answer this question?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

You can use this page to record notes or create drawings.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Scientific Explanation: Why the Sun Is Up Sometimes, but Not Other Times

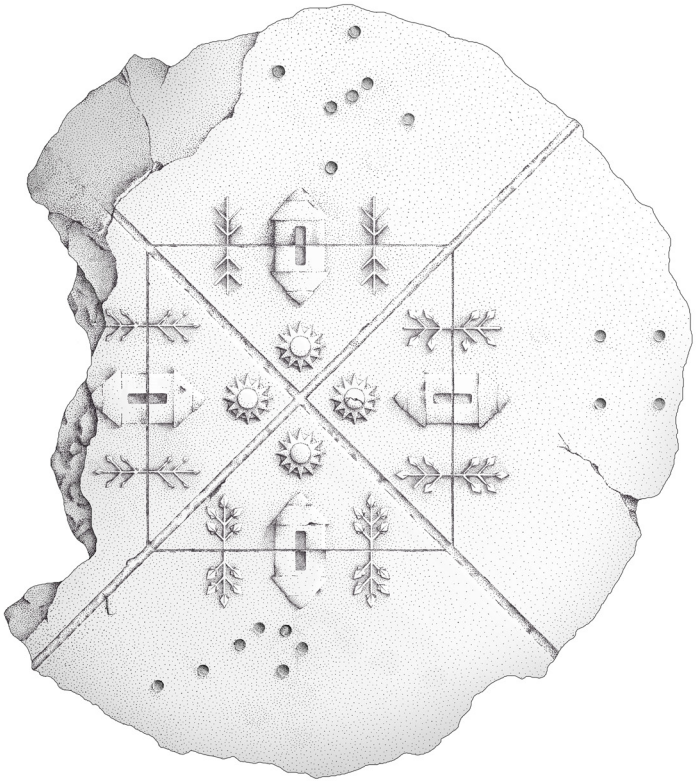
1. Write a scientific explanation that answers the question, Why is the sun up sometimes, but not other times?
2. Make a drawing if it helps you explain your ideas.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Scientific Explanation: Why the Sun Is Up Sometimes, but Not Other Times (continued)

Think about the explanation you just wrote. What new ideas do you have about what the artifact shows?



_____

_____

_____

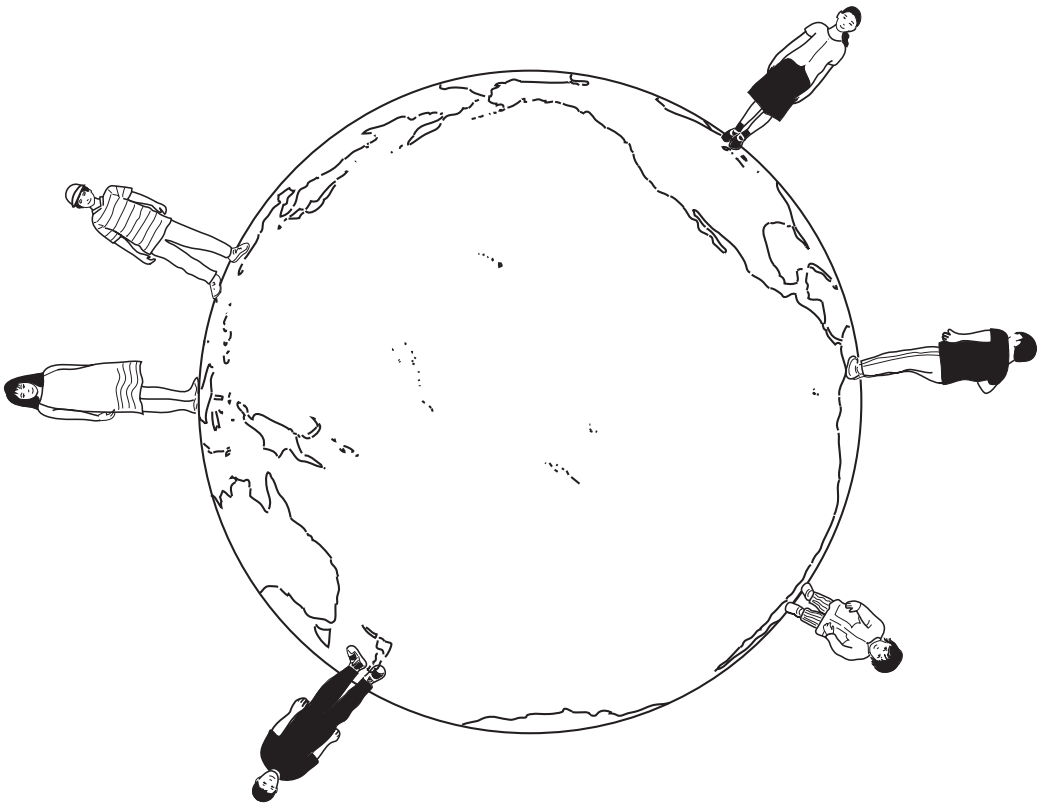
_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Thinking About Standing on Earth

These people are standing on different parts of Earth. Draw an arrow next to each person so it shows which way is UP for that person. Then, answer the question below.



Would any of these people fall off Earth? Why or why not?

_____

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Chapter 2: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out why we see different stars at different times?

I understand why the sun looks bigger and brighter than all other stars in the sky. ____ Yes ____ Not yet

I understand why we don't see other stars during the daytime when the sun is up. ____ Yes ____ Not yet

I understand which direction is up for people at different places on Earth. ____ Yes ____ Not yet

I understand why it changes from daytime to nighttime every day. ____ Yes ____ Not yet

I understand why we see different stars on different nights. ____ Yes ____ Not yet

I understand that science explanations describe the way natural events happen. ____ Yes ____ Not yet

I think I understand or don't yet understand these ideas because

_____

_____

What about the artifact are you still wondering?

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Why is it important for scientists to write scientific explanations?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Student X's Investigation Plan

Review Student X's investigation plan and data table, and then answer the questions.

Investigation Plan: My goal is to investigate this question, Do we see different stars at different times of year? I am choosing a bunch of different times, and I will look to see what constellations I can see anywhere in the sky.

Data Table

Date and Time		All Constellations Visible in the Sky
January 22, 2005	midnight	
May 28, 2006	8:00 am	
March 13, 2007	4:00 am	
October 26, 2008	2:00 am	
June 7, 2009	midnight	

1. Is this an example of a systematic (careful and orderly) investigation? Why or why not?

_____

_____

_____

2. Could you improve this investigation? How?

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigating Stars on Different Nights

Set up the data table: Choose a starting date and record the year, month, and day in the first three columns of the first row.
Record the year, month, and day (the day will always be the same as the first day) for five more sky observations, every six months.

Investigate in the Sim: Change the month and year to the starting date and set time to MIDNIGHT. List three constellations that you observe in Sky View when facing south. Look for the constellations that you've already listed.

Question: *Do we see different stars at different times of year?*

Midnight on			**Three Visible Constellations** (facing south)
			1:
			2:
_____ (year)	_____ (month)	_____ (day)	3:

six months after first observation

			1:
			2:
_____ (year)	_____ (month)	_____ (day)	3:

six months after second observation

			1:
			2:
_____ (year)	_____ (month)	_____ (day)	3:

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigating Stars on Different Nights (continued)

six months after third observation

_____ (year)	_____ (month)	_____ (day)	1:
			2:
			3:

six months after fourth observation

_____ (year)	_____ (month)	_____ (day)	1:
			2:
			3:

six months after fifth observation

_____ (year)	_____ (month)	_____ (day)	1:
			2:
			3:

1. Do we see different stars at different times of year? _____

   _____

2. Did you ever see the same stars in the nighttime sky? If you noticed a pattern, describe it. _____

   _____

   _____

   _____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Why is it important for scientists to collect data in a systematic way?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Write about a time that you observed the stars. What did you see? What time of year was it?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: ______________________________ Date: ______________

Yearly Pattern Investigation

Constellation:

____

Year:

____

Investigation Question: What causes the yearly pattern of stars that we see?

1. Record the constellation name.
2. Record the observation year.
3. Highlight your constellation by pressing its name in System View.
4. Decide if the constellation is visible on each date.
5. Draw Earth and the observer on *Earth* in each System View sketch.

System View

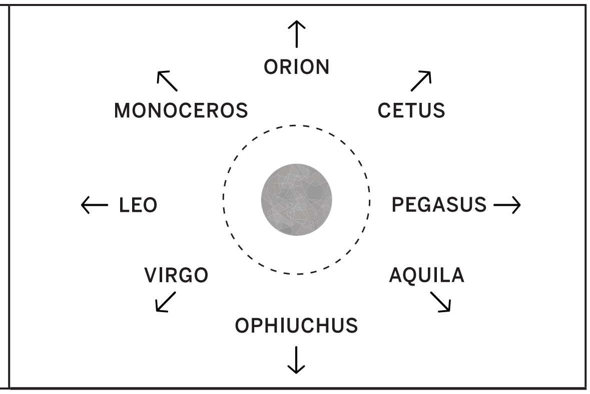
______________ (date)

time: **midnight**

Is it visible?

☐ yes

☐ no



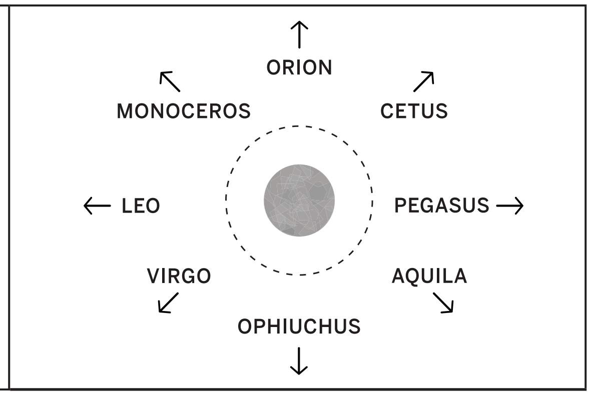
______________ (date)

time: **midnight**

Is it visible?

☐ yes

☐ no



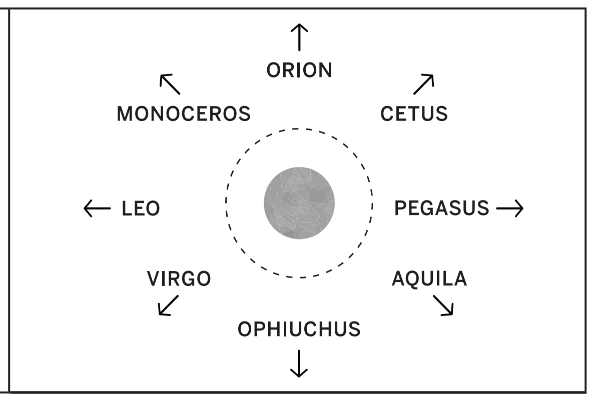
______________ (date)

time: **midnight**

Is it visible?

☐ yes

☐ no



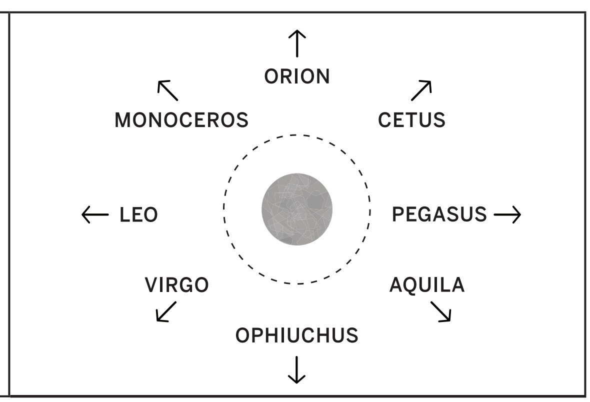
______________ (date)

time: **midnight**

Is it visible?

☐ yes

☐ no



© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: ______________________________ Date: ______________

Yearly Pattern Investigation (continued)

System View

____

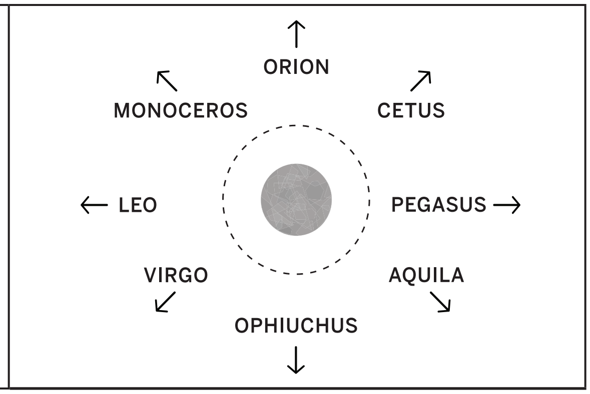
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



____

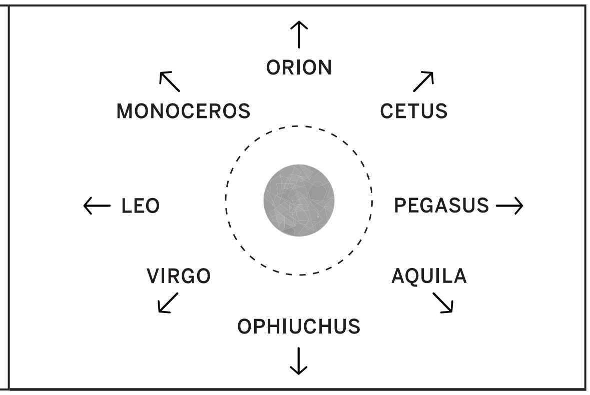
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



____

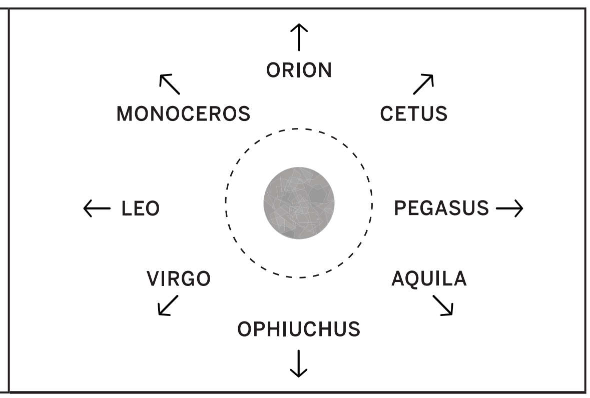
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



____

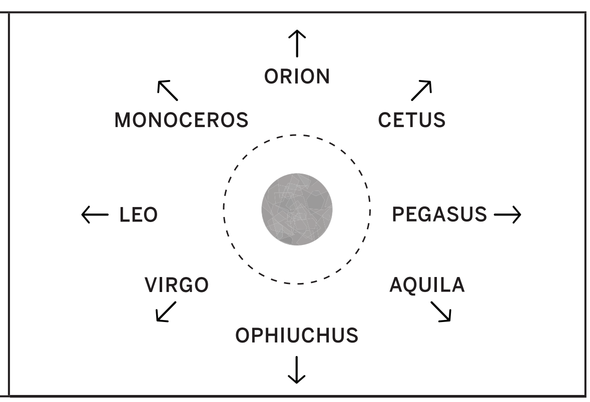
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: ______________________ Date: ______________

Yearly Pattern Investigation (continued)

System View

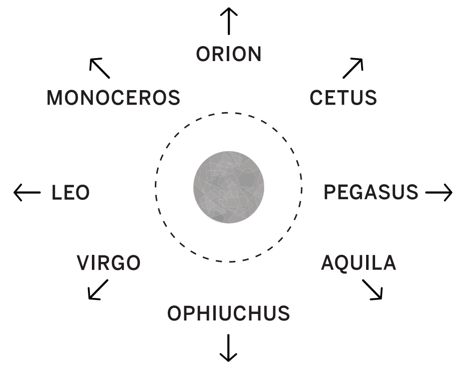
____
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



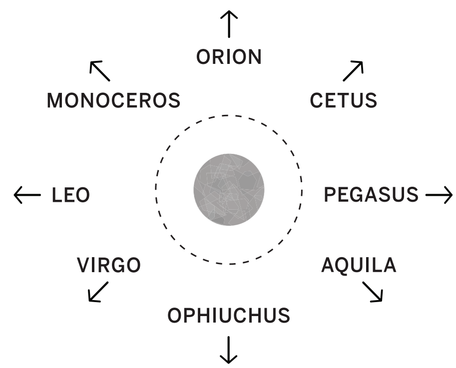
____
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



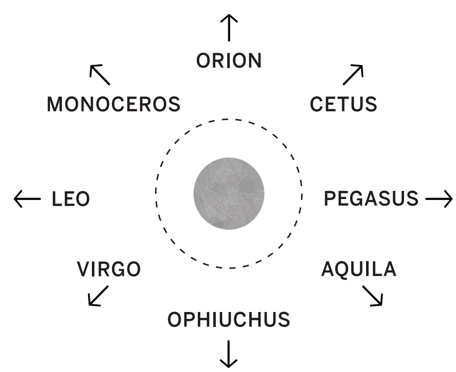
____
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



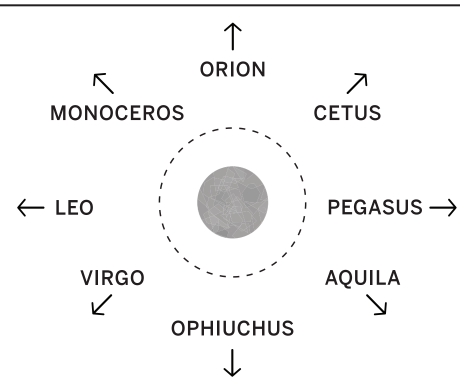
____
(date)

time: **midnight**

Is it visible?

☐ yes

☐ no



© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Think-Write-Pair-Share: Cause of the Yearly Pattern of Stars

1. Think about this question:

   What causes the yearly pattern of stars that we see?
2. Record your ideas.
3. Share your ideas with your partner.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

List two examples of things that spin:

1. _____

2. _____

List two examples of things that orbit:

1. _____

2. _____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Getting Ready to Read: *Dog Days of Summer*

1. Before reading *Dog Days of Summer*, read the sentences below.
2. If you agree with the sentence, write an "A" on the line before the sentence.
3. If you disagree with the sentence, write a "D" on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_____ The stars and constellations can cause hot weather.

_____ Long ago, people used the stars to tell what time of year it was.

_____ Sometimes we can see certain stars and sometimes we can't because the stars move slowly across the sky.

_____ Bigger stars are always brighter when seen from Earth.

_____ People long ago, like the ancient Greeks and Romans, observed the sky just as astronomers do today.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Reading Reflection: *Dog Days of Summer*

1. Why is winter the best time of year to observe the Dog Star?

_____

_____

_____

2. The Dog Star is not visible in the sky in July. Why is this?

_____

_____

_____

3. What are some ways that ancient people used stars to help them in their daily life?

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Describe one way that people long ago used their observations of yearly star and constellation patterns to help them or to plan an activity.

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Modeling Constellations over Time

You just created a model that used the information in this table.

Constellation	Month When Constellation Is Visible in the Night Sky
Gemini	February
Scorpius	May
Aquarius	August
Taurus	November

Explain why we see these constellations at different times of year.

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Thinking About the Artifact

1. Identify and label the constellation shown in each part of the artifact.
2. Below the constellation's name, write the name of the month when an observer on Earth's head points directly at the constellation.

A _____

_____

B _____

_____

C _____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

What do scientists include in their scientific explanations? Why?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Identifying the Constellation on the Missing Piece

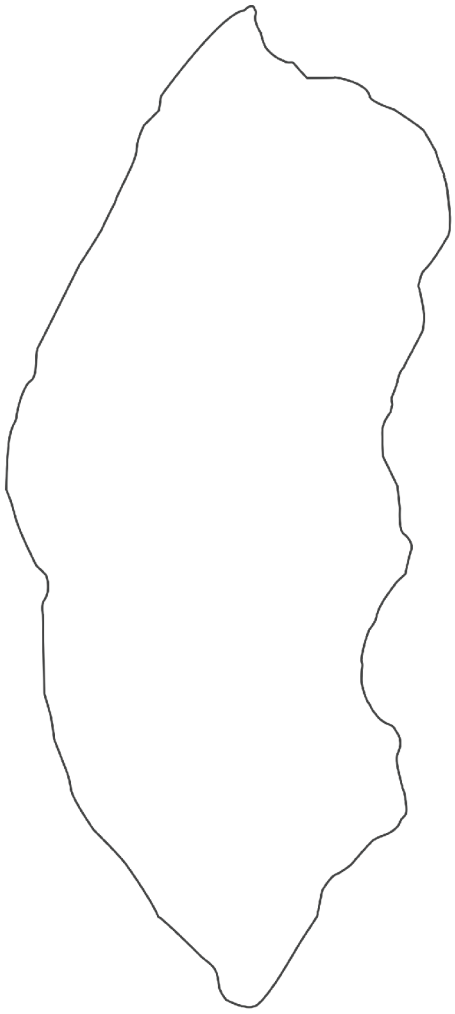
List the constellations you see at midnight when you face south during the month of March. Record those constellations that are visible in the sky for many days during the month.

_____ _____

_____ _____

_____ _____

_____ _____



1. Which constellation do you recommend? The Museum of Archaeology is reconstructing the missing piece to show visitors what the artifact might have looked like before it was broken.

   _____

2. Draw the constellation that you selected on the outline of the missing piece.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Chapter 3: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out why we see different stars at different times?

I understand why the sun looks bigger and brighter than all other stars in the sky. ____ Yes ____ Not yet

I understand why we don't see other stars during the daytime when the sun is up. ____ Yes ____ Not yet

I understand which direction is up for people at different places on Earth. ____ Yes ____ Not yet

I understand why it changes from daytime to nighttime every day. ____ Yes ____ Not yet

I understand why we see different stars on different nights. ____ Yes ____ Not yet

I understand that science assumes consistent patterns in natural systems. ____ Yes ____ Not yet

I think I understand or don't yet understand these ideas because

_____

_____

What about the artifact are you still wondering?

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

In what ways have you been like an astronomer?

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Getting Ready to Read: *Star Scientist*

1. Before reading *Star Scientist*, read the sentences below.
2. If you agree with the sentence, write an "A" on the line before the sentence.
3. If you disagree with the sentence, write a "D" on the line before the sentence.
4. After you read the book, see if your ideas have changed. Be ready to explain your thinking.

_____ Scientists do not change their ideas during an investigation.

_____ Stars are easy to investigate.

_____ Stars other than the sun also have planets orbiting around them.

_____ Scientists can use the same data to answer different questions.

_____ Planets are big and bright compared to stars.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Reading Reflection: *Star Scientist*

1. Gibor Basri and other scientists wanted to find out whether stars other than the sun have planets orbiting around them. What made this a difficult question to investigate?

_____

_____

_____

_____

2. What did Basri and other scientists do in order to plan and complete their investigation?

_____

_____

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

After Reading: Thinking About an Investigation

Use *Star Scientist* to answer the following questions.

1. What question did Gibor Basri and other scientists help answer? (*page 5*)

_____

_____

2. Which data did the scientists choose to collect and why? (*page 6*)

_____

_____

_____

3. Why was it important to collect data for several years? (*page 8*)

_____

_____

_____

4. The scientists made a graph with the data they collected. How did making a graph help them understand their data? (*page 11*)

_____

_____

_____

5. What did the scientists find out? (*page 12*)

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Think-Write-Pair-Share: Plan and Complete an Investigation

For each question:

1. Think about the question.
2. Record your ideas.
3. Share your ideas with your partner.

What new ideas do you have about planning an investigation?

_____

_____

_____

What new ideas do you have about completing an investigation?

_____

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Choosing a Question to Investigate

Which question will you and your partner investigate? Complete the circle next to your choice.

◯ 1. Choose one constellation or star. During which months is it visible in the night sky?

◯ 2. Choose one constellation or star. How does the direction I would look to see it at midnight change throughout a year?

◯ 3. Choose one constellation or star. How does the time that it appears to rise (or set) change from one day to the next?

◯ 4. Choose one constellation or star. How does the total amount of time it is visible in the night sky change from month to month throughout the year?

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Think about *Star Scientist* and the investigation done by Dr. Basri and other scientists. Now, think about the investigation that you are beginning. How might they be similar? How might they be different? Explain your thoughts.

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigation Plan

1. Record your investigation question. Include the name of the constellation or star as part of the question.
2. Write what you will observe and record, what you will change, and what you will keep the same in your investigation.
3. Complete the headings for each column in the data table.

What is your investigation question?

_____

_____

_____

What will you observe and record?

_____

_____

_____

What will you change every time you make an observation?

_____

_____

_____

What will you keep the same every time you make an observation?

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigation Plan (continued)

Data Table

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Daily Written Reflection

Investigations can be hard to do. Did you and your partner face any problems as you were planning your investigation? Describe the problems and what you did to solve them.

_____

_____

_____

_____

_____

_____

Make a drawing if it helps you explain your thinking. Label your drawing.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

You can use this page to record notes or create drawings.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigation Plan

1. Record your investigation question. Include the name of the constellation or star you are investigating as part of the question.
2. Write what you will observe and record, what you will change, and what you will keep the same in your investigation.
3. Complete the headings for each column in the data table.

What is your investigation question?

_____

_____

_____

What will you observe and record?

_____

_____

_____

What will you change every time you make an observation?

_____

_____

_____

What will you keep the same every time you make an observation?

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigation Plan (continued)

Data Table

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigation Plan

1. Record your investigation question. Include the name of the constellation or star you are investigating as part of the question.
2. Write what you will observe and record, what you will change, and what you will keep the same in your investigation.
3. Complete the headings for each column in the data table.

What is your investigation question?

_____

_____

_____

What will you observe and record?

_____

_____

_____

What will you change every time you make an observation?

_____

_____

_____

What will you keep the same every time you make an observation?

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Investigation Plan (continued)

Data Table

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Did You Answer Your Investigation Question?

Investigation question:

_____

_____

Answer to the question (or, if you were not able to answer your question, describe any patterns you found so far):

_____

_____

_____

_____

_____

Evidence (observations and data) that supports your thinking:

_____

_____

_____

_____

_____

If you had more time to investigate, how would you change your plan?

_____

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

Chapter 4: Check Your Understanding

This is a chance for you to reflect on your learning so far. This is not a test. Be open and truthful when you respond.

Scientists investigate in order to figure out how things work. Am I getting closer to figuring out why we see different stars at different times?

I understand why the sun looks bigger and brighter than all other stars in the sky. ____ Yes ____ Not yet

I understand why we don't see other stars during the daytime when the sun is up. ____ Yes ____ Not yet

I understand which direction is up for people at different places on Earth. ____ Yes ____ Not yet

I understand why it changes from daytime to nighttime every day. ____ Yes ____ Not yet

I understand why we see different stars on different nights. ____ Yes ____ Not yet

I understand that science assumes consistent patterns in natural systems. ____ Yes ____ Not yet

I think I understand or don't yet understand these ideas because

_____

_____

What about Earth and sky are you still wondering?

_____

_____

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Name: _____ Date: _____

You can use this page to record notes or create drawings.

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Glossary

astronomer: a scientist who studies stars, planets, and other objects in the universe
astrónomo/a: un/a científico/a que estudia las estrellas, los planetas y otros objetos del universo

constellation: an arrangement of stars as seen from Earth
constelación: una disposición de estrellas según se ven desde la Tierra

data: observations or measurements recorded in an investigation
datos: observaciones o mediciones registradas en una investigación

day: a period of time that is 24 hours long and includes daytime and nighttime
día: un periodo de tiempo que dura 24 horas e incluye las horas diurnas y nocturnas

explanation: a description of how something works or why something happens
explicación: una descripción de cómo algo funciona o por qué algo pasa

evidence: information that supports an answer to a question
evidencia: información que respalda una respuesta a una pregunta

investigation: an attempt to find out about something
investigación: un intento de aprender sobre algo

gravity: the pull between Earth and other objects, which acts even without touching
gravedad: el jalón entre la Tierra y otros objetos, lo cual actúa aun sin tocar

model: something scientists make to answer questions about the real world
modelo: algo que los científicos crean para responder preguntas sobre el mundo real

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Glossary (continued)

orbit: to move in a regular path around something
orbitar: moverse en una trayectoria regular alrededor de algo

pattern: something we observe to be similar over and over again
patrón: algo que observamos que sea similar una y otra vez

solar system: the sun, the planets that orbit the sun, and other objects that orbit the sun
sistema solar: el sol, los planetas que orbitan el sol y otros objetos que orbitan el sol

star: a huge object in space that gives off heat and light
estrella: un objeto enorme en el espacio que emite calor y luz

sun: the only star in our solar system
sol: la única estrella de nuestro sistema solar

visualize: to make a picture in your mind using information from different sources
visualizar: hacer una imagen en tu mente con información de diferentes fuentes

year: the length of time it takes for Earth to orbit the sun once
año: la cantidad de tiempo que le toma a la Tierra orbitar el sol una vez

© 2018 The Regents of the University of California. All rights reserved. Permission granted to photocopy for classroom use.

Lawrence Hall of Science:
Program Directors: Jacqueline Barber and P. David Pearson
Curriculum Director, Grades K–1: Alison K. Billman
Curriculum Director, Grades 2–5: Jennifer Tilson
Curriculum Director, Grades 6–8: Suzanna Loper
Assessment and Analytics Director: Eric Greenwald
Learning Progressions and Coherence Lead: Lauren Mayumi Brodsky
Operations and Project Director: Cameron Kate Yahr
Student Apps Director: Ari Krakowski
Student Content Director: Ashley Chase

Leadership Team: Jonathan Curley, Ania Driscoll-Lind, Andrew Falk, Megan Goss, Ryan Montgomery, Padraig Nash, Kathryn Chong Quigley, Carissa Romano, Elizabeth Shafer, Traci K. Shields, Jane Strohm

***Patterns of Earth and Sky: Analyzing Stars on Ancients Artifacts* Unit Team:**

Leah B. Anderson
Stacy Au-yang
Candice Bradley
Jonathan Braidman
Lee M. Bishop
Meghan Comstock
Barbara Clinton
John Erickson
Jennifer B. Garfield
Alya Hameed
Deirdre MacMillan
Helen O. Min
Julia D. Neal
Catherine Park
Michelle M. Selvans

Amplify:

Irene Chan
Samuel Crane
Shira Kronzon
Charvi Magdaong
Thomas Maher
Rick Martin
Matt Reed
Eve Silberman
Steven Zavari

Credits:
Photograph: Page 17: Anagoria via CC BY 3.0

Your Investigation Notebook

Scientists use notebooks to keep track of their investigations. They record things they learn from other scientists. Sometimes they draw or make diagrams. They record ideas and information they want to remember.

Your Investigation Notebook is a place for you to keep track of:

- investigations you do in class.
- what you learn from reading science books.
- your questions, predictions, and observations.
- your explanations and the evidence you find to support those explanations.
- your ideas!

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Amplify. Published and Distributed by Amplify.
www.amplify.com

AMP.NA18

ISBN 978-1-945192-84-5