Your competence will be assessed as you complete the BRC2 objective assessment. This course of study may take up to 12 weeks to complete.

Introduction

This course of study is aligned to the BRC2 objective assessment. The same study materials are utilized in the BRT2 performance assessment. If you have previously completed the BRT2 assessment, then you should have already completed the required study activities found in this course of study. You may wish to review the assignments here, but you are not required to repeat these activities. If you have not yet completed the BRT2 assessment, then please proceed through this course of study in full.

Overview
Earth and Space Science involves the study of astronomy, geology, meteorology, and oceanography. As a science teacher, you will want to convey the excitement of careers related to earth science to your students and help them connect the concepts to their own lives.

While working through this course of study, connect your new knowledge with your current base. Sometimes new knowledge contradicts your current understanding. You will need to pay close attention during these times so that you can properly reframe your understanding. Your goal is to become the best teacher you can be.

Outcomes and Evaluation
There are 4 competencies covered by this course of study; they are listed in the "Competencies for Earth and Space Science" page.

Teaching Dispositions Statement
Please review the Statement of Teaching Dispositions.

Pre-Assessment
You will complete the following pre-assessment:

- PBRC

Objective Assessment
You will complete the following objective assessment:

- BRC2

For specific information about this assessment, click the link under the “Assessment Type” column of your Degree Plan.

Preparing for Success

The information in this section is provided to help you become ready to complete this course of study. As you proceed, you will need to be organized in your studies, competent in the indicated

areas, and ready to pass the final assessments.

Your Learning Resources

Enroll in or order the learning resources for this course as early as possible so as to give them time to arrive and give you enough time to become familiar with them.

Enroll in Learning Resources

You will need to enroll in or subscribe to several learning resources as a part of this course of study.

Please access your Degree Plan and verify that you have access to the following learning resources. If you do not currently have access, please enroll or renew your enrollment at this time.

Note: For instructions on how to enroll or subscribe through your Degree Plan, please see the "Acquiring Your in Learning Resources" document.

Earth Science (CourseCompass)

CourseCompass is an online learning environment that includes geoscience animations, practice quizzes, and the following e-text:

- Tarbuck, E., Lutgens, F., & Tasa, D. (2009). *Earth science* (12th ed.). NJ: Prentice Hall. ISBN-13: 978-0136020073.

GEODe DVD

This resource includes the GEODe DVD, which is mailed to your home address. Your mentor will need to approve this learning resource. This resource is interactive and includes excellent animations, videos, illustrations, photographs, and narration for a clear and thorough review and tutorial of important geoscience facts and concepts.

LabPaq

The "Science Methods" LabPaq from Hands-On Labs is a physical shipment. This lab kit (LabPaq) is covered by your program lab fee and is required to complete the performance assessment. You may have already enrolled for this resource through a different course. This kit includes a lab manual along with the science equipment, specimens, supplies, and chemicals necessary to complete college laboratory experiments at home. The experiments reinforce science content and teach laboratory techniques.

AMNH Online Seminars (Optional)

The online seminars offered by the American Museum of Natural History (AMNH) uses multimedia and discussions to connect teachers and future teachers from around the world to cutting-edge research, classroom resources, and each other. Participating in the AMNH online seminars develops your understanding of the content, models an appropriate teaching technique, and exposes you to an array of resources that can be used in your classroom or to help with lesson planning. While this is an optional learning resource, you are strongly encouraged to take advantage of this opportunity. These seminars, which are typically around

$450, are covered as part of your WGU tuition.

There are three seminars related to these assessments:

- "Earth Inside and Out"
- "The Ocean System"
- "The Solar System"

Each six-week seminar requires about 8 hours per week of your time. Participating in these seminars does not appear on your WGU transcript. The time required to complete these courses is in addition to the time needed to make progress passing assessments. These seminars have definite start and stop times, so, review the AMNH Calendar to determine when the course is offered, and consult your mentor to coordinate this seminar into your schedule. Discuss the AMNH-WGU FAQ with your mentor to better understand how to successfully use the AMNH course as a WGU learning resource.

Once your mentor approves your enrollment, you will be sent a confirmation e-mail. Please check your e-mail regularly for a registration e-mail directly from AMNH. This message will contain the information you will need to access this online seminar.

Additional Preparation

There are many different learning tools available to you within your course of study in addition to the learning resources discussed above. Some or all of them may be very useful to you as your progress through this course of study. Take the time to familiarize yourself with them and determine how best to fit them into your learning process.

The following activities and information will help you as you work through this course of study.

Message Boards, Learning Communities, Study Notes, FAQs

Message boards, learning communities, study notes, and FAQs are available in every course of study.

Use the "Additional Learning Tools" document to review these tools.

Best Practices Tool: It is suggested that you create a paper or digital notebook for your study notes as you go through this document. Use organizers or dividers to separate your work. You may want to include a glossary, study notes, topics to revisit, and helpful websites.

Course Mentor Assistance

Course mentors are available to help you. Their job is to aid understanding in areas where you need to improve and to guide you to learning resources. Request their help as needed when preparing for assessments.

Course mentors cannot provide reviews of entire assessments. If you fail assessment attempts, review the provided feedback first, then ask the course mentor specific questions about what you can do to meet the competency standard. Request course mentor assistance as necessary

in preparing for second attempts at objective assessments or performance task revisions. Mentors cannot guarantee you pass as they do not evaluate assessments; however, they can provide the assistance and advice necessary to help you succeed.

Composition of Earth

After completing this section's activities, you will be able to

- describe the layered structure of Earth,
- use latitude and longitude to find a point on Earth,
- identify minerals and rocks,
- describe the rock cycle, and
- describe Earth's geological resources.

Makeup of the Earth

When people dig into the earth to build structures, they are only scratching the surface of the earth's crust. In this topic you will learn about what is underneath the crust people walk on.

Earth's Internal Structure

In your notebook, draw a cross section of the earth. Label and color code each layer. Add information about the earth's size, general composition, and layered structure.

Answer the following questions:

- If you were to dig a hole through the center of the earth to the other side, how long would your tunnel be?
- How many layers would you need to dig through?
- What materials would you dig through?

Using the CourseCompass website, reference the following page in *Earth Science* text to help you complete this task:

- page 16

Geology: An Overview

Watch the following 30 minute recording, in which the Course Mentor presents an overview of the Geology content. During the video, take notes and write down any follow up questions. If your questions are not addressed as you continue working through the Course of Study, contact the Course Mentor for additional assistance.

Earth's Grid System

Using the CourseCompass website, read the following appendix in the Earth Science text:

- appendix B

This section describes the earth's grid system. You should be able to locate a point on earth using this system.

The following figure in appendix B of the *Earth Science* text will help you show you how this is done:

- figure B.2

In your notebook, make note of where zero latitude and zero longitude are located.

- How are positions recorded using these references?

Minerals

Identifying minerals can be challenging. With the knowledge gained in this topic, you will be able to identify the rocks you pick up outside.

What Is a Mineral?

Using the CourseCompass website, read the beginning of the following chapter in the *Earth Science* text:

- chapter 2 ("Minerals: Building Blocks of Rocks")

After reading this section, write down a definition of mineral in your notebook.

Review the next sections in this chapter on elements and bonds.

Properties of Minerals

Using the CourseCompass website, review the following sections in chapter 2 ("Minerals: Building Blocks of Rocks") in the *Earth Science* text:

- "Properties of Minerals"
- "Mineral Groups"

Using the CourseCompass website, review the following figures in the Earth Science text:

- figure 2.13, which shows the hardness scale
- figure 2.15, which shows common cleavage directions
- figure 2.21, which shows common silicate minerals (note that there are two different feldspars mentioned in figure 2.21)

Read through the Mineral Physical Properties and Identification website.

Memorize the Mineral Identification chart and, without using any notes, practice identifying samples using the links to specific minerals at the bottom of the website.

At the completion of this activity, you should be able to identify hand samples of common rock-forming and ore minerals by their properties (e.g., color, luster, streak, density, cleavage).

Mineral Activity

The Science Methods LabPaq contains 18 minerals and a list of 18 mineral names. Using what you have learned in the previous activity, match the 18 minerals with their appropriate names.

Use the following websites as necessary to help you better understand how to use these tests to identify minerals

- Streak Test
- **Hardness Test**

Once you have identified the minerals, list two common uses of each mineral and send your results to the course mentor for feedback.

Mineral Groups

Over 90% of the earth's crust is composed of silicate minerals. Temperature and pressure determine the type of specific minerals created.

While reading in chapter 2 ("Minerals: Building Blocks of Rocks") of the *Earth Science* text, take notes on the conditions (temperature and pressure) in which the specific minerals were formed.

Check for Understanding of Chapter 2

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 2 ("Minerals: Building Blocks of Rocks")

The Rock Cycle

Varying degrees of temperature, pressure, and weathering are needed to change the form of rocks. What processes created the marble used as tile in a building or the granite used for a countertop in a kitchen?

Earth as a System

Using the CourseCompass website, review the beginning of the following chapter in the *Earth Science* text:

- chapter 3 ("Rocks: Materials of the Solid Earth")

Focus specifically on the following section:

- "Earth as a System: The Rock Cycle"

In your notebook, explain the general details of the processes involved when one type of rock (i.e., igneous, metamorphic, or sedimentary) is transformed into any other.

Igneous Rocks

Using the CourseCompass website, read the following section in chapter 3 ("Rocks: Materials of the Solid Earth") of the *Earth Science* text:

- "Igneous Rocks: Formed by Fire"

As you read this section, write down in your notebook how these rocks can be identified by their texture and composition. For example, granite has a course-grained texture. How is this related to its appearance, and where it was made?

You should be able to identify six common igneous rocks found in the following figure in the *Earth Science* text:

- figure 3.11

Sedimentary Rocks

Using the CourseCompass website, read the following section in chapter 3 ("Rocks: Materials of the Solid Earth") of the *Earth Science* text:

- "Sedimentary Rocks: Compacted and Cemented"

Mechanical weathering creates the detrital group of sedimentary rocks, while chemical weathering creates the chemical group of sedimentary rocks (chapter 4 of Earth Science discusses weathering in more detail).

As you read this section, write down in your notebook how these rocks can be identified by their texture and composition. The size of the sediment particles helps with sedimentary rock classification. For example, sandstone is made from sand sediment.

Metamorphic Rocks

Using the CourseCompass website, read the following section in chapter 3 ("Rocks: Materials of the Solid Earth") of Earth Science text:

- "Metamorphic Rocks: New Rock from Old"

Write down in your notebook how these rocks can be identified by texture and composition. For example, slate is made from very fine grains, whereas marble is made from larger grains. When looking at marble, you can typically see the grains, whereas in slate you cannot distinguish individual grains.

You should be able to identify five common metamorphic rocks shown in the following figure of the *Earth Science* text:

- figure 3.31

Experiment 12: Crystal Growing and the Rock Cycle

Complete the following experiment in the Science Methods LabPaq:

- experiment 12 ("Crystal Growing and the Rock Cycle")

After completing the lab, send your lab report to the course mentor to receive feedback.

Check for Understanding of Chapter 3

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 3 ("Rocks: Materials of the Solid Earth")

Geological Resources

Humans use many geological resources for building materials as well as for energy sources.

How Geological Resources Are Formed

In your notebook, explain the general processes by which important geological resources are formed. The making of petroleum is usually associated with marine sediment.

The final conversion to hydrocarbons requires high temperature and pressure.

Coals are either sedimentary or metamorphic rock, which likely began in swampy conditions on land.

The following pages in the *Earth Science* text, found on the CourseCompass describe these processes:

- pages 66-67
- page 76 (describes the formations of various mineral resources)

Environmental Impact of Resource Extraction

The environment is impacted as a result of extracting, processing, and using petroleum, coal, and ores. During the previous topic, you studied how these resources are formed.

Use the following pages found on the Pollution Issues web site to take notes on the impact of the following substances:

- Petroleum
- Coal

Movement on Earth

Although Earth has a rocky base, there is much movement on its surface. Air, water, and the earth itself are constantly moving. Due to the water cycle, water is continuously moving, which causes wear and tear on the Earth's surface.

Gravity causes boulders and mud to move downhill. Convection currents keep the Earth's inner materials moving, which in turn moves the Earth's plates. What observations can you make that verify these movements on the Earth? After completing this section's activities, you will be able to

- describe the effects of weathering;

- describe examples of mass wasting;
- describe the effects of streams on Earth's surface;
- explain the theory of plate tectonics;
- describe the consequential effects of plate tectonics, such as volcanoes and earthquakes;
- describe the production, measurement, and effects of earthquakes;
- distinguish between types of volcanoes; and
- describe the production and effects of volcanoes.

Effects of Wind, Water, and Ice on the Landscape

Weathering is part of the rock cycle. Erosion occurs because of the effects of wind, water, or ice.

Weathering and Erosion

For this activity you will access the e-text through CourseCompass.

Read the section on glacial erosion that starts on the following page of *Earth Science* text:

- page 159

Read the section on wind erosion that starts on the following page of the *Earth Science* text:

- page 177

Mass Wasting

Mass wasting, or movement, is due to the effects of gravity. Rocks naturally want to roll downhill. Moving water can transport sediment, creating large deposits downstream. Earth is wasting away, or, more appropriately, Earth is moving due to gravity.

The Work of Gravity

Using the CourseCompass website, Read the following pages on mass wasting in chapter 4 ("Weathering, Soil, and Mass Wasting") of the *Earth Science* text:

- pages 107-110

In your notebook, describe the types and mechanics of mass wasting, including the bold-faced terms used. Drawings may help with your learning.

In the CourseCompass *Earth Science* resource, there are Geoscience Animations related to chapter 4 that show the processes of mass movements.

The GEODe DVD has a "Sculpturing Earth's Surface" section that also demonstrates these concepts

Human Activity

In your notes on mass wasting, write your thoughts on the following question:

- How might the destruction caused by mass wasting be prevented?

Check for Understanding of Chapter 4

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 4 ("Weathering, Soil, and Mass Wasting")

Streams

Review the water cycle and the benefits of running water. In this topic, you will learn what humans can do to slow down the erosion caused by streams.

The Work of Running Water

For this activity you will access the e-text through CourseCompass.

Begin reading the following chapter of the *Earth Science* text:

- chapter 5 ("Running Water and Groundwater")

Notice the movement of water through the hydrologic cycle in the following figure in the Earth Science text:

- figure 5.3

To help you better understand the process by which streams erode and deposit sediments, read the following section in the *Earth Science* text:

- "Shaping Stream Valleys"

The stages of stream development can be seen in the following figure of the *Earth Science* text:

- figure 5.17

In your notebook, describe the stages of stream development.

Stream Channels

Using the CourseCompass website, read the following section in chapter 5 ("Running Water and Groundwater") of the *Earth Science* text:

- "Stream Channels"

In your notebook, write down the processes by which streams change their course.

Floods and Flood Control

Using the CourseCompass website, read the following section in chapter 5 ("Running Water and Groundwater") of the *Earth Science* text:

- "Floods and Flood Control"

In your notebook, write down the motivations for and consequences of human attempts to alter stream processes.

Check for Understanding of Chapter 5

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 5 ("Running Water and Groundwater")

Plate Tectonics

In the early 1900s, there were no planes to circumnavigate the Earth, no satellite imagery, and no submersibles to view ocean ridges. Despite lacking these technological advances, Alfred Wegener was able to propose the idea of continental drift.

Supporting Evidence of Continental Drift

Using the CourseCompass website, read the following section in chapter 7 ("Plate Tectonics: A Scientific Theory Unfolds") of the *Earth Science* text:

- "Continental Drift"

In your notebook, write down the evidence Wegener used to support his ideas.

Plate Boundaries

Using the CourseCompass website, read about the types of plate boundaries (i.e., divergent, convergent, and transform) in the following chapter of the *Earth Science* text:

- chapter 7 ("Plate Tectonics: A Scientific Theory Unfolds")

As you read, write down what is occurring at each type. Answer the following questions:

- When do volcanoes occur at divergent boundaries?
- When do volcanoes occur at convergent boundaries?
- How are earthquakes related to plate boundaries?

Make a chart in your notebook to help you organize this information. As you read about each type of boundary, add to your chart.

In your notes, answer the following question:

- Which type of boundary created the Hawaiian Islands?

Modern Evidence of Plate Tectonics

Using the CourseCompass website, read the following sections in chapter 7 ("Plate Tectonics: A Scientific Theory Unfolds") of the *Earth Science* text:

- "Testing the Plate Tectonics Model"
- "Measuring Plate Motion"

As you read, write down in your notebook the modern evidence that can now be measured because of technological advances.

Experiment 14: Plate Tectonics

Complete the following experiment in the Science Methods LabPaq:

- experiment 14 ("Plate Tectonics")

After completing the lab, send your lab report to the course mentor to receive feedback.

Changes in the Lithosphere

Based on what you have learned about plate tectonics, explain in your notebook the formation and ongoing evolution of the ocean basins and continental land masses in terms of plate tectonics.

Using the CourseCompass website, examine the following figure in the Earth Science text to better understand the stages of change Pangaea went through:

- figure 7.12

To better appreciate how current ocean basins developed, read box 7.1 on the following page of the *Earth Science* text:

- page 190

Review Animations for Plate Tectonics

Using the CourseCompass website, review all of the geoscience animations for the following chapter in *Earth Science*:

- chapter 7 ("Plate Tectonics: A Scientific Theory Unfolds")

Check for Understanding of Chapter 7

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 7 ("Plate Tectonics: A Scientific Theory Unfolds")

Earthquakes

As the theory of plate tectonics describes, Earth's crust is moving. Occasionally, the movement is quick enough for you to feel.

The Production of Earthquakes

Using the CourseCompass website, read the first three sections (through p. 226) in the following

chapter of the *Earth Science* text:

- chapter 8 ("Earthquakes and Earth's Interior")

Earthquakes create P- and S-waves. You can remember these waves by their types. P-waves push and pull (note that both words begin with p). Also, P-waves are considered the primary waves (another p word to associate with P-waves), since they move faster than S-waves, arriving ahead of the S-waves. S-waves actually create an s curve in the surface of land.

The differences between P-waves and S-waves are clearly illustrated in the following figure in the *Earth Science* text:

- figure 8.9

In your notebook, explain why earthquakes occur along faults and describe the waves that earthquakes generate.

Measuring the Size of Waves

Using the CourseCompass website, read the following pages in chapter 8 ("Earthquakes and Earth's Interior") of the *Earth Science* text:

- pages 227-231

In your notebook, describe the three scales used to measure earthquakes (i.e., modified Mercalli, Richter, and moment magnitude) and how these scales are used and calculated.

The different levels of the Mercalli intensity scale are clearly described in the following table in the *Earth Science* text:

- table 8.1

Isoseismal lines can be drawn on a map to connect areas with similar earthquake experiences.

Destruction From Earthquakes

Using the CourseCompass website, read the following section in chapter 8 ("Earthquakes and Earth's Interior") in the *Earth Science* text:

- "Descruction from Earthquakes" (p. 231)

In your notebook, describe the hazardous effects of an earthquake. If the ground is saturated with water, what can occur during an earthquake?

Review Animations of Earthquakes

Using the CourseCompass website, review the geoscience animations in the following chapter of *Earth Science*:

- chapter 8 ("Earthquakes and Earth's Interior")

Check for Understanding of Chapter 8

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 8 ("Earthquakes and Earth's Interior")

Volcanoes

The mantle is one layer of Earth's structure. This material, which is partly molten, occasionally makes its way to Earth's surface.

Types

Using the CourseCompass website, begin reading the following chapter (through p. 260) in the *Earth Science* text:

- chapter 9 ("Volcanoes and Other Igneous Activity")

In your notebook, explain why some volcanoes have explosive eruptions, while others are quiet. Create a table comparing the conditions for an explosive volcano versus a quiet volcano.

The Hazards of Volcanoes

Using the CourseCompass website, begin reading on page 260 in the *Earth Science* text through the end of the following section:

- "Living in the Shadow of a Composite Cone"

In your notebook, describe the hazards associated with volcanoes.
Read the following section (starting on p. 277) of the *Earth Science* text:

- "Living With Volcanoes"

Review Animations of Volcanoes

Using the CourseCompass website, review all of the geoscience animations for the following chapter of *Earth Science*:

- chapter 9 ("Volcanoes and Other Igneous Activity")

Check for Understanding of Chapter 9

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 9 ("Volcanoes and Other Igneous Activity")

Earth's History

Scientists collect data from around the world to better understand what has happened in Earth's

history. After completing this section's activities, you will be able to

- describe common geological landforms,
- understand how scientists determine the age of rocks they find,
- appreciate Earth's unique qualities, and
- provide a timeline of events in Earth's past.

Geological Landforms

National parks are often known for certain geological features. The Grand Canyon shows the effects of the Colorado River carving into the earth's surface. What are landforms in your state that you can share in your classroom as a teacher?

Identifying Forms on Earth

For this activity you will access the e-text through CourseCompass.

Chapter 9 ("Volcanoes and Other Igneous Activity") in *Earth Science* described forms caused by volcanoes. Review the following figures to see examples of different types of volcanoes:

- figure 9.12
- figure 9.13
- figure 9.15
- figure 9.17

Draw pictures of these in your notebook and describe their differences.

Using the following page in the *Earth Science* text, describe in your notes a how a caldera is formed:

- page 262

Using the following figure in the *Earth Science* text, describe how caverns and karst landscapes are formed:

- figure 5.39 (p. 146)

Glaciers also carve out landforms. The following figure in the *Earth Science* text shows the moraines that are formed by glaciers:

- figure 6.15 (p. 165)

Read the section on moraines in chapter 6 ("Glaciers, Deserts, and Wind") of *Earth Science* and describe these land features in your notebook.

Using the following figure in the *Earth Science* text that shows the meandering path of streams that transport sediment, describe in your notebook the alluvial channels created by streams:

- figure 5.12 (in chapter 5)

Wind creates some interesting landforms as well, such as sand dunes. The following figure in the *Earth Science* text shows the sand dunes at White Sands National Monument in New Mexico:

- figure 6.36 (p. 180)

Chapter 10 ("Mountain Building") of *Earth Science* has pictures of landforms around the world created by different natural methods. Examine the following figure showing a fault scarp:

- figure 10.8 (p. 289)

Draw examples of various faults in your notebook.

An example of landforms caused by meteors can be seen in the following figure of the *Earth Science* text:

- figure 22.30 (p. 648)

This example shows the impact structure created by a meteor that impacted Arizona within the last 50,000 years. The moon has many impact craters on its surface.

Fossils

There are many types of fossils. Footprints left in mud and preserved over many years are considered fossil evidence. In this topic, you will learn about types of fossils.

Fossils in the Making

Using the CourseCompass website, read the section on fossils in chapter 11 ("Geologic History") of *Earth Science* that starts on the following page:

- page 318

In your notes, explain how fossils are formed.

The following figure in the *Earth Science* text shows various types of fossils:

- figure 11.13

The best preservation of fossils has been found in the Burgess Shale, which was first found in the Canadian Rockies. Organisms preserved in the Burgess Shale were buried in fine mud that maintained the details of the soft and hard parts of the organisms.

Fossils found in this area have provided great insight into the diversity of organisms that existed during the Cambrian period. Determining the age of fossils helps scientists determine their geological time frame. The age of fossils can be determined by measuring the amount of

radioactive isotopes left in a fossil sample.

Diversity of Life

Using the CourseCompass website, read about how fossils are used to better understand past events in the following section of the *Earth Science* text,:

- "Fossils and Correlation" (p. 322)

In your notebook, explain how fossils provide evidence of the diversity and complexity of life over time. For example, the fossils in the Burgess Shale provide evidence that complex life-forms existed during the Cambrian period that do not exist today and did not exist before the Cambrian period.

"Diversity" refers to the idea that different life-forms have existed over time, versus the idea that life-forms have remained the same over time.

Dating

Knowing the order of events helps to put a timeline in place. Scientists use the chemical properties of rocks to help them determine a rock's age.

Introduction of Chapter 11

Using the CourseCompass website, read the first two sections of the following chapter in the *Earth Science* text to help you better understand how studying rocks helps people understand the past:

- chapter 11 ("Geologic History")

Relative Dating

Using the CourseCompass website, read the section on relative dating in the following chapter of the *Earth Science* text:

- chapter 11 ("Geologic History")

In your notebook, describe the methods used for relative dating.

Absolute Dating

For this activity you will access the e-text through CourseCompass.

Read the following section of the Earth Science text:

- "Dating With Radioactivity" (p. 323)

The following figure in chapter 11 ("Geologic History") of the *Earth Science* text helps to show how half-lives can be used for dating:

- figure 11.17

The GEODe DVD has a section on "Dating with Radioactivity" to help with your understanding. Practice dating a sample, knowing the percentage of isotope left.

The following table in chapter 11 ("Geologic History") shows the radioactive isotopes that can be used to date ancient rocks:

- table 11.1

For dating of more recent items, carbon-14 is used, since it has a shorter half-life.

Go through the review questions at the end of the following chapter in the *Earth Science* text to solve simple half-life problems involving radiogenic isotopes and their daughter products:

- chapter 11 ("Geologic History")

Experiment 13: Radioactive Decay

Complete the following experiment in the Science Methods LabPaq:

- experiment 13 ("Radioactive Decay")

After completing the lab, send your lab report to the course mentor to receive feedback.

Review Animations for Radioactive Decay

Using the CourseCompass website, review all of the geoscience animations for the following chapter of *Earth Science*:

- chapter 11 ("Geologic History")

Geologic Timeline

Based on the evidence collected, a geologic timeline for earth has been put together. In this timescale, a hundred or even a thousand years is a relatively short time span.

Geologic Timescale

Identify the principal divisions of geologic time.

Using the CourseCompass website, read the following section in chapter 11 ("Geologic History") of the *Earth Science* text:

- "The Geologic Time Scale" (p. 326)

Earth's History

For this activity you will access the e-text through CourseCompass.

In your notes, identify the approximate time period for important events in Earth's physical and biological history. The following figures in the *Earth Science* text will help you with this:

- figure 12.4 (p. 339)
- figure 12.23 (p. 353)

Read the following chapter in *Earth Science*, which describes each era in further detail:

- chapter 12 ("Earth's Evolution Through Geologic Time")

Study the order that the organisms become more complex over time in the column "Development of Plants and Animals." This is shown in the following figure of the *Earth Science* text:

- figure 12.4

Check for Understanding of Chapter 11

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 11 ("Geologic History")

The Importance of Earth's Placement

One thing you should appreciate is Earth's placement in the solar system, which is not too close to the sun (where all water would vaporize), or too far from the sun (where all water would freeze). Earth also has enough gravity to hold an atmosphere.

Conditions on Earth

Using the CourseCompass website, read the following section in the *Earth Science* text:

- "Earth's Spheres" (p. 12)

These spheres are continuously interacting, which creates a system. This complex system is unique to planet Earth. Read about the system those spheres create in the following section of the *Earth Science* text:

- "Earth as a System" (p. 22)

Earth's Unique Characteristics

Using the CourseCompass website, begin reading the following chapter in the *Earth Science* text:

- chapter 12 ("Earth's Evolution Through Geologic Time")

As you read, write down the important factors that allow life to exist here.

- Why is Earth considered the right size?
- Why is Earth's place in the solar system important?
- Why is timing important?

Compare Earth's surface temperatures to its neighboring planets Mars and Venus. How much hotter does Venus get than Earth? How much colder does Mars get than Earth?

On the message board, share how Earth's placement in the solar system helps to create the conditions that enable organisms to survive.

Origin of the Atmosphere and Oceans

Using the CourseCompass website, to help you appreciate the beginnings of the atmosphere and oceans, continue reading the following chapter in the Earth Science text:

- chapter 12 ("Earth"s Evolution Through Geologic Time")

In your notebook, describe the stages in the early formation and evolution of the atmosphere.

Check for Understanding of Chapter 12

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 12 ("Earth's Evolution Through Geologic Time")

The Bottom of the Ocean

From the earth's surface, only the ocean's top layer, exposed to the sun, can be seen. Using instruments such as sonar, scientists can detect the structures that are at the bottom of the ocean. Sea level is always the starting point for elevation measurements, whether measuring the height of a mountain or the depth of an abyss. After completing this section's activities, you will be able to

- describe the ocean's basins,
- describe how scientists gather information about the ocean, and
- analyze ocean sediment.

The Ocean Floor

The ocean floor has a varied terrain, just as land's surface does. Boundaries between continental plates are seen as ridges where new crust can be forming.

Bathymetric Chart

A map showing the contours of the ocean floor is a called a bathymetric chart.

Using the CourseCompass website, begin reading the following chapter of the Earth Science text to learn how these charts are made:

- chapter 13 ("The Ocean Floor")

As you read, write down descriptions of the tools scientists use to collect oceanic data.

Contour lines are often drawn on bathymetric charts to show areas at the same depth. These

chapters show several examples of different charts depicting the ocean floor. Take the time to interpret these bathymetric charts. Keep in mind that sea level is the starting point for all measurements.

Ocean Basins

For this activity you will access the e-text through CourseCompass.

To better understand continental margins and ocean basins, continue reading the following chapter of the *Earth Science* text:

- chapter 13 ("The Ocean Floor")

The following figure in the *Earth Science* text shows that deep ocean basins take up considerable space between two continental margins:

- figure 13.8 (p. 373)

As you can see, the center of the basin has an oceanic ridge, which is where new seabed is formed. In your notebook, write a physical description of earth's oceanic ridges.

There are four main ocean basins: the Pacific, Atlantic, Indian, and Arctic. Become familiar with the terms describing the features found on the ocean basins.

Ocean Sediment

Sediment includes particles of debris that accumulate in the oceans. This debris can include particles that wash from land and the shells of once-living organisms.

Types of Sediment

Using the CourseCompass website, read the following section in chapter 13 ("The Ocean Floor") of the *Earth Science* text:

- "Seafloor Sediments" (starting on p. 381)

While reading about sediments, write down the different types by comparing their source, properties, and distribution.

Check for Understanding of Chapter 13

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 13 ("The Ocean Floor")

Properties of Oceans

The chemical properties of ocean water contribute to its movement and its ability to sustain living organisms. After completing this section's activities, you will be able to

- describe the physical properties of seawater,
- describe the various water masses that are distinguishable within oceans, and
- describe the organisms living in oceans.

Properties of Seawater

The composition of seawater can change, which then can change seawater's behavior. For example, when icebergs are created, the excess salts are left dissolved in the ocean. Consequently, the seawater left after an iceberg freezes is denser and therefore sinks. Where do dissolved substances come from that are found in seawater?

Composition of Seawater

Using the CourseCompass website, begin reading the following chapter of the *Earth Science* text:

- chapter 14 ("Ocean Water and Ocean Life")

In your notebook, describe the chemical composition of seawater (i.e., the dissolved substances).

Temperature and Density Variations

The temperature of water affects its density. The more particles in a given amount of water, the denser the water is. In cold water, the water molecules are closer together, and, consequently, cold water is denser than hot water. The temperature and density of water impacts its movement.

Processes Affecting Seawater Salinity

Using the CourseCompass website, continue reading the following chapter in the *Earth Science* text from the beginning through page 398:

- chapter 14 ("Ocean Water and Ocean Life")

In your notebook, explain how temperature and salinity affect the density of seawater.

Ocean water masses organize themselves by density. Add to your notes how and where water masses of varying density are produced.

The following figure in the *Earth Science* text describes processes that affect seawater's density:

- figure 14.2

How does the formation of sea ice increase seawater salinity?

Ocean Temperature Variation

The following figure in chapter 14 ("Ocean Water and Ocean Life") of the *Earth Science* text, found on the CourseCompass website shows the variation in ocean water temperature at different latitudes:

- figure 14.4

Below the surface layer of the ocean is the thermocline layer, where the temperature changes dramatically. Notice that near the Earth's poles, there is not much of a thermocline, since the surface water is cold as well.

In your notebook, describe the thermal layering of the ocean.

Ocean Life

There are many organisms that live in oceans. Most organisms are adapted to a particular subset of the ocean.

Oceanic Lifestyles

Using the CourseCompass website, read the following section in chapter 14 of the *Earth Science* text:

- "The Diversity of Ocean Life" (pp. 398-402)

In this section, you will learn that organisms are classified by where they live. If you know the prefixes and suffixes for terms, you will be able to decipher the terminology used to name organisms. You will also compare and contrast the three oceanic lifestyles by using examples of each (e.g., pelagic [planktonic], swimming [nektonic], and attached [benthic]).

The following figure in the *Earth Science* text shows some pelagic organisms.

- figure 14.9

Write down some examples of pelagic organisms in your notebook.

Various oceanographic factors influence where marine organisms live. In your notebook, describe the characteristics of marine life zones.

Ocean Productivity

Organisms live where they can find the nutrients they need to survive.

Using the CourseCompass website, continue reading in the following chapter of the Earth Science text:

- chapter 14 ("Ocean Water and Ocean Life")

Explain how the concentrations of the elements of life within the oceans affect the amount of living material the oceans can support.

Read the following section starting on page 402 in the *Earth Science* text and take notes on what limits the productivity of oceans:

- "Oceanic Productivity"

Check for Understanding of Chapter 14

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 14 ("Ocean Water and Ocean Life")

The Movement of Oceans

Waves are just one example of the movement of oceans. Currents move water great distances on the surface as well as deep in the ocean. After completing this section's activities, you will be able to

- describe the global circulation of water and
- describe how beaches change due to the ocean's impact.

Surface Currents

Surface currents are driven by wind.

Patterns

Using the CourseCompass website, begin reading the following chapter in the Earth Science text to help you understand surface circulation (e.g., the Coriolis Effect and Ekman transport):

- chapter 15 ("The Dynamic Ocean")

Ocean currents affect the climate. As the diagrams in this chapter illustrate, a general pattern in the Northern Hemisphere is for the currents to move clockwise. This pattern occurs because of the Coriolis effect and Ekman transport.

Using the CourseCompass website, study the following figure in the Earth Science text to learn how currents affect climates in different hemispheres and on different coasts:

- figure 15.3

You can see that in the North Atlantic, the Gulf Stream brings the warmer water from the south along the eastern United States to northern Europe, which provides more temperateclimates to these areas. Without this current, these areas would have colder temperatures, which are more common for the areas located at these latitudes. In contrast, along the California coast, currents bring colder arctic water south, which means water temperatures are much colder along this coast than along the East Coast.

You can see that in the Southern Hemisphere, the currents between the continents move counter clockwise. Note that the Southern Hemisphere has less land to block moving currents. The Antarctic current is able to move freely around the globe.

Upwelling

Using the CourseCompass website, read about the process of upwelling starting on the following page in the Earth Science text:

- page 417

In your notebook, explain the process and importance of coastal upwelling. What causes upwelling?

Deep Ocean Circulation

The cause for deep ocean circulation is primarily due to the vertical movement of water that is created as dense water moves downward.

Circulation

Using the CourseCompass website, read the following section in the *Earth Science* text:

- "Deep-Ocean Circulation" (starting on p. 418)

In your notebook, describe the formation and importance of deep water masses and the deep ocean circulation that depends on them. What are the names of these water masses? In which direction do they flow?

Ocean Waves

Ocean waves are a form of energy moving through the water.

Cause of Ocean Waves

Using the CourseCompass website, read the section on waves in the following chapter in the *Earth Science* text:

- chapter 15 ("The Dynamic Ocean") (starting on p. 421)

In your notebook, write down

- the three factors that determine a wave's size,
- an explanation for the cause and behavior of ocean waves, and
- where large waves are likely to be found.

Impact of Ocean Waves

Waves change the coastal topography over time.

Using the CourseCompass website, continue reading the following chapter in the Earth Science text:

- chapter 15 ("The Dynamic Ocean")

In your notebook, explain the impact of ocean waves on coastal topography.

Beaches

Sand is easily moved and will move in a fairly predictable manner.

Longshore Transport

Using the CourseCompass website, review the following section in chapter 15 ("The Dynamic Ocean") of the *Earth Science* text:

- "Sand Movement on the Beach" (p. 424)

In your notebook, describe the process of the longshore transport of sand.

The movement of sand creates various coastal conditions. Read the following section in chapter 15 ("The Dynamic Ocean") of the *Earth Science* text:

- "Shoreline Features"

In your notebook, describe the process of the creation and destruction of sandbars.

Tides

Gravitational forces create changing tides.

Tidal Patterns

Using the CourseCompass website, read the following section in chapter 15 ("The Dynamic Ocean") of the *Earth Science* text:

- "Tides" (p. 437)

In your notebook, describe how the sun and the moon influence tides.

Check for Understanding of Chapter 15

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 15 ("The Dynamic Ocean")

Heating Earth

Earth's atmosphere allows life to exist on this planet. After completing this section's activities, you will be able to

- describe Earth's atmosphere,
- explain the differential heating of the earth's surface,
- explain why there are seasons, and
- explain the greenhouse effect.

Atmosphere

Humans breathe to bring oxygen into their lungs, but air is made of more than just oxygen.

Composition of the Atmosphere

Using the CourseCompass website, begin reading the following chapter in the Earth Science

text:

- chapter 16 ("The Atmosphere: Composition, Structure, and Temperature")

In your notebook, state the chemical composition of earth's atmosphere.

Temperature Gradient

Using the CourseCompass website, continue reading chapter 16 ("The Atmosphere: Composition, Structure, and Temperature") to the following page in the Earth Science text:

- page 455

In your notebook, describe the structure of the atmosphere in terms of the temperature gradient. In this case, the term gradient is referring to the change in temperature as the elevation changes.

Using the CourseCompass website, examine the following figure in the *Earth Science* text:

- figure16.8

As you can see, the temperature trends vary within the various atmospheric layers. Create an acronym so that you can remember the layers of the atmosphere, which start with the letters T, S, M, and T. At the surface of the Earth, temperatures decline as elevation increases.

Ozone

Based on what you have read in chapter 16 ("The Atmosphere: Composition, Structure, and Temperature") of the *Earth Science* text, describe the ozone layer in the stratosphere. How does the ozone shield the Earth from ultraviolet (UV) rays?

GEODe Interactive: Slides 1327-1374

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner of the screen, navigate to and review the following slides:

- slides 1327-1374

Meteorology: An Overview

Watch the following 24 minute recording in which the Course Mentor presents an overview of the Meteorology content. During the video, take notes and write down any follow up questions. If your questions are not addressed as you continue working through the Course of Study, contact the Course Mentor for additional assistance.

Earth-Sun Relationships

In this topic, you will learn about why the hemispheres have seasons at opposite times.

Reasons for the Seasons

Using the CourseCompass website, read the following section of the *Earth Science* text, to help you understand the reason for day lengths and seasons:

- "Earth-Sun Relationships" (starting on p. 455)

In your study notebook, answer the following questions:

- How is the earth positioned during the equinoxes and solstices?
- How does the earth's tilt affect climate?
- Why do the two hemispheres have opposite seasons?
- Why do equatorial regions receive greater amounts of solar radiation per square kilometer than polar regions?

GEODe Interactive: Slides 1459-1618

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner of the screen, navigate to and review the following slides:

- slides 1459-1618

Temperature, Heat, and Climate

Proper use of terminology is important. In this topic, you will learn to distinguish between the terms *temperature, heat,* and *climate.*

Weather and Climate

For this activity you will access the e-text through CourseCompass.

Weather changes daily, and even with today's technology, it is often difficult to predict. The first few pages in the following chapter of the *Earth Science* text distinguish between *weather* and *climate*:

- chapter 16 ("The Atmosphere: Composition, Structure, and Temperature")

Write definitions for weather and climate in your notebook.

Heat and Temperature

A thermometer is used to measure temperature. When two objects meet, heat will flow from the object with the higher temperature to the object with the lower temperature. Heat can be transferred between objects by radiation, conduction, and convection. For example, the sun's radiation increases the temperature on Earth.

Conduction occurs when two materials are touching. Most wind is generated by convection, which is the movement of the air due to the differences in density.

Air is warmed near Earth's surface, causing its molecules to move and the air to become less

dense. The rising of warmer air allows cooler air to take its place.

Using the CourseCompass website, read about temperature, heat, and conduction in chapter 16 ("The Atmosphere: Composition, Structure, and Temperature") of the *Earth Science* text starting on the following page:

- page 460

In your notebook, write a formal definition for *heat* and *temperature*.

GEODe Interactive: Slides 1301-1416

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner of the screen, navigate to and review the following slides:

- slides 1301-1416

You can skip over the section on the composition of the atmosphere, since you have already reviewed this section in a previous activity.

Greenhouse Effect

Planet Earth acts somewhat similarly to a greenhouse.

Incoming Solar Radiation

What happens to all the incoming solar radiation on earth? Some of it is reflected back into space. The albedo, or reflective power, of earth is about 30%. What does this mean?

Some of the sun's energy reaches the surface of the earth. Of the light that reaches the earth's surface and that is the correct wave length for photosynthesis, only about 0.4% is actually converted to carbohydrates by plants.

Using the CourseCompass website, read the following section of the *Earth Science* text to help you understand what happens to incoming solar radiation:

- "The Fate of Incoming Solar Radiation" (starting on p. 462)

The Greenhouse Effect

Using the CourseCompass website, read the following section in chapter 16 (“The Atmosphere: Composition, Structure, and Temperature”) of Earth Science to help you better understand the greenhouse effect:

- "Heating the Atmosphere: The Green house Effect" (p. 464)

How is this effect related to a car's interior warming up in a parking lot?

Draw a picture describing the greenhouse effect process in your notebook.
The greenhouse effect and global warming are separate concepts. life on this planet would not exist without the greenhouse effect to provide a warm environment. Global warming refers to the excessive heating of the earth.
GEODe Interactive: Slides 1327-1374

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner, navigate to and review the following slides:

- slides 1327-1374

Differential Heating

When provided with the same amount of sunlight, land and water change temperatures differently.
Temperature Variations

Using the CourseCompass website, finish reading the following chapter of the *Earth Science* text to analyze the temperature gradients within the continental United States:

- chapter 16 ("The Atmosphere: Composition, Structure, and Temperature")

The following figure in this chapter uses isotherms to show distribution:

- figure 16.25

  Although the entire earth is warmed by the greenhouse effect, there are great temperature variations on the earth. Part of this is due to land and water heating up at different rates.

Notice in figure 16.25 that the Midwest cities, such as Fargo, are colder than the more coastal cities, such as Boston. Water has a higher specific heat than land does, which means that water is slower to warm up and slower to cool down than land is. The land near Fargo will cool down faster than water, leading to cooler temperatures in Fargo than in Boston.

In your notebook, write down reasons for the differential heating of land and water. Also, write down the weather implications caused by the differential heating of land and oceans.
Measuring Temperature

There are three scales for measuring temperature. Celsius (C) marks zero as the freezing temperature of water and 100 as the boiling point of water. Kelvin (K) marks zero as much colder than the freezing point of water-the temperature at which molecules stop their movement, or the absence of all thermal energy. In the Fahrenheit (F) scale, water freezes at 32 degrees and boils at 212 degrees.

To convert from Fahrenheit to Celsius, you need to subtract 32 from the temperature and then multiply by 5/9ths. Each degree Fahrenheit is 5/9ths of a degree Celsius. In your notebook, practice converting between Fahrenheit and Celsius.

Check for Understanding of Chapter 16

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 16 ("The Atmosphere: Composition, Structure, and Temperature")

Clouds

When air has reached its saturation level, meaning it cannot hold any more water, clouds, fog, or dew can develop. After completing this section's activities, you will be able to

- define relative humidity,
- describe the effects of air moving upward, and
- describe the weather associated with different types of clouds.

Collecting Weather Data

In this topic, you will learn about what causes people to comment that it is a "hot, sticky day" or that there is a "dry heat."

Humidity

Using the CourseCompass website, begin reading the following chapter in the *Earth Science* text to learn more about water and humidity, which refers to the amount of water in the air:

- chapter 17 ("Moisture, Clouds, and Precipitation")

Warmer air can hold more water than colder air can. *Relative humidity* is a measure of air's actual water content compared to what it can potentially hold at that particular temperature and pressure. If the relative humidity is 30%, then the air is holding 30% of the water vapor that it could potentially hold at that particular temperature and pressure.

You feel the effects of high humidity in the summer because your body sweats to release body heat, but your sweat does not evaporate since the air is already saturated. After reading about humidity in chapter 17, write a definition for relative humidity in your notebook as well as how humidity is measured.

Instruments Used to Collect Weather Data

To collect weather data, scientists use a variety of tools: a barometer for measuring air pressure, a hygrometer for measuring relative humidity, a weather vane for determining wind direction, etc.

Using the CourseCompass website, read the follow section of the Earth Science text to help you better understand how a psychrometer with wet and dry bulbs is used:

- "Measuring Humidity" (pp. 483-485)

As you study meteorology, keep a list in your notebook of the instruments used to collect weather data (e.g., barometer, hygrometer, weather vane, etc.).

Adiabatic Cooling and Lapse Rate

In this topic, you will learn why air cools as it rises.

The Basis of Cloud Formation

As air rises, it expands and cools. This temperature change, which is due to the air's expansion, is considered an adiabatic temperature change.

Using the CourseCompass website, to learn about adiabatic temperature change, read the following section in the *Earth Science* text:

- "The Basis of Cloud Formation: Adiabatic Cooling" (p. 485)

In your notebook, write the adiabatic rate for wet and dry air. There are different reasons air might rise, causing adiabatic cooling. Lapse rate refers to the rate at which temperature decreases as elevation increases.

Inversions

During inversions, there is an exaggeration of thermal layering.

Temperature Inversions

Using the CourseCompass website, read the following box of the *Earth Science* text to learn about temperature inversions:

- box 17.1 (p. 492)

In your notebook, answer the following questions:

- How do inversions originate?
- What are the effects of an inversion?
- Why might an inversion affect air quality?

Clouds

When air reaches its dew point, clouds can form.

Formation

Using the CourseCompass website, to help you better understand what is needed for clouds and fog to form, begin reading the following section in the *Earth Science* text:

- "Condensation and Cloud Formation" (p. 493)

In addition to the air being saturated with water, water vapor needs a surface to condense on. In your notebook, write down what can serve as surfaces for condensation.

Types of Clouds

There are three main could forms that blanket the sky: high thin cirrus clouds, puffy cumulus clouds, and stratus clouds.

Using the CourseCompass website, continue reading the following chapter in the *Earth Science* text:

- chapter 17 ("Moisture, Clouds, and Precipitation")

The following table in this chapter describes the 10 basic cloud types that you should know:

- table 17.2

Weather Associated With Clouds

In your notebook, for each of the 10 cloud types (listed in table 17.2) in *Earth Science*, draw a picture of the cloud.

Using the CourseCompass website, reference the following figure in Earth Science text to help you complete this task:

- figure 17.20

For each of your cloud pictures, write down the weather associated with it.

GEODe Interactive: Slides 1729-1948

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner of the screen, navigate to and review the following slides:

- slides 1729-1948

Check for Understanding of Chapter 17

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 17 ("Moisture, Clouds, and Precipitation")

Moving Air

Air moves from high pressure to low pressure. After completing this section's activities, you will be able to

- explain air pressure and how it is used to predict upcoming weather,
- describe the global patterns of moving air, and
- describe local weather patterns.

Air Pressure

Although air is not visible, its weight still exerts pressure on Earth. Air will move from areas of high pressure to areas of low pressure. This movement of air is felt as wind.

Understanding Air Pressure

Using the CourseCompass website, begin reading the following chapter in the *Earth Science* text:

- chapter 18 ("Air Pressure and Wind")

In your notebook, define *air pressure*. Also, answer the following questions:

- What is the average air pressure at sea level?
- Does that seem like a lot of pressure per square inch?
- How is air pressure measured?

Highs and Lows

Using the CourseCompass website, continue reading the following chapter in *Earth Science* through the "Highs and Lows" section:

- chapter 18 ("Air Pressure and Wind")

The Coriolis Effect determines the wind patterns associated with high and low pressure.

Examine the pictures shown on the following page of the *Earth Science* text:

- page 521

High pressure in the United States moves winds clockwise, away from the high's center. In your notebook, describe the mechanics and weather effects of centers of high and low air pressure.

Predicting Weather

For this activity you will access the e-text through CourseCompass.

Now you can piece together the information from chapter 18 ("Air Pressure and Wind") to explain how changes in air pressure help people predict upcoming weather.

Examine the following figure in the *Earth Science* text:

- figure 18.3 (p. 515)

The dial shows that fair weather is associated with high pressure and air moving down. In contrast, rising air (low pressure) often results in cloud formation and precipitation. Think about the process of precipitation. Water changes from a previous gaseous state to liquid precipitation. The liquid state requires less energy than the gaseous state. Consequently, heat is given off when water goes from a gaseous to a liquid state. This is one reason that lowering pressure can have warmer weather.

GEODe Interactive: Slides 1949-2026

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner of the screen, navigate to and review the following slides:

- slides 1949-2026

Global Wind Circulation

The general circulation of air is complex. Forces caused by air pressure, the Coriolis Effect, and solar radiation all need to be taken into account.

Jet Stream

The polar cells are related to jet streams. The colder arctic air at the poles travels toward the equator and then rises at around 60 degrees latitude before reaching the midlatitude cell. Because of the Coriolis Effect, this air movement is angled, which causes the jet stream.

Using the CourseCompass website, re-read the following section within chapter 18 ("Air Pressure and Wind") of the Earth Science text to better understand jet streams, which are situated over the polar front:

- "Friction with Earth's Surface" (p. 518)

In your notebook, draw a simple picture of Earth. Draw an arrow to indicate the jet stream. Label the air north of the jet stream as cold arctic air. When watching weather forecasts, take note of jet stream movement.

In the Northern Hemisphere, the jet stream blows west to east. This wind circulation of the jet stream separates the colder polar air from the warmer air just southward. On typical weather maps of North America, the jet stream is shown. As the cooler polar air moves south, so does the jet stream.

Hadley Cells

For this activity you will access the e-text through CourseCompass.

Continue reading the following chapter in the *Earth Science* text:

- chapter 18 ("Air Pressure and Wind")
- section "General Circulation of the Atmosphere"
- section "The Westerlies"

In your notebook, describe global wind circulation, which includes the Hadley cells.

In the following figure in the *Earth Science* text, notice that the Hadley cells near the equator cause trade winds:

- figure 18.16

The Coriolis Effect causes the wind to angle along the Earth's surface.

To help you remember these cell patterns, review the following figure in the *Earth Science* text:

- figure 18.16

The higher blue arrows all point away from the equator. The air moves down only at the subtropical 30 degree latitudes.

Practice drawing the Hadley cells while not looking in the book, and then check your accuracy.

El Ni?o

Using the CourseCompass website, read the section on El Niño in the following chapter of the *Earth Science* text:

- chapter 18 ("Air Pressure and Wind")
- "El Niño and La Niña" (p. 530)

Examine the following figure:

- figure 18.23

The strong trade winds cause an equatorial current which flows from east to west in the Pacific Ocean under normal conditions. For reasons that are still unclear, this current can change directions, giving rise to the El Niño weather pattern. In your notebook, describe the cause of El Niño and its effects on regional conditions.

Local Winds

Global wind patterns show general trends. At the local level, wind direction can change for a variety of reasons.

Monsoon

Using the CourseCompass website, review the following page in the Earth Science text as an introduction to monsoons:

- page 524

In your notebook, describe the causes and effects of Indian monsoons.

Land and Sea Breezes

Using the CourseCompass website, read the section on land and sea breezes that starts on the following page of the *Earth Science* text:

- page 526

In your notebook, describe the causes and effects of the breezes described in this section.

Review your notes from chapter 16 ("The Atmosphere: Composition, Structure, and Temperature") of *Earth Science* on the differential heating of land and water. How does the differential heating of land and water affect land and sea breezes?

Draw pictures of land and sea breezes in your notebook. If you were living at the beach, when would you feel an on-shore breeze blowing from the ocean to your house?

Mountain and Valley Breezes

Mountains and valleys alter wind patterns.

Using the CourseCompass website, read the section on mountain and valley breezes that starts on the following page of the *Earth Science* text:

- page 528

In your notebook, describe the causes and effects of mountain and valley breezes. Relate these concepts to those on page 487 in figure 17.11 describing the processes that lift air.

Chinook and Santa Ana Winds

Using the CourseCompass website, read the section on Chinook and Santa Ana winds that starts on the following page of the *Earth Science* text:

- page 528

In your notebook, describe the causes and effects of Chinook and Santa Ana winds.

Check for Understanding of Chapter 18

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 18 ("Air Pressure and Wind")

Fronts

Fronts are boundaries between air masses.

Moving Air Masses

Using the CourseCompass website, begin reading the following chapter in the *Earth Science* text to learn about moving air masses and fronts:

- chapter 19 ("Weather Patterns and Severe Storms")

Cold fronts move cold air, whereas warm fronts move warm air. In your notebook, compare and contrast cold and warm fronts in terms of the motion of air masses and describe the weather these fronts bring.

Warm Front

Draw a picture of a warm front in your notebook with the associated cloud formations. Notice the gentle wedge of air masses as the warm air gradually passes over the cold air. At a warm front, the cirrostratus clouds give a warning that precipitation is coming. Nimbostratus clouds eventually form, which bring steady rain.

Watch the Geo Animation "Cold Front and Warm Fronts" available at the CourseCompass website in chapter 19

Cold Fronts

Draw a picture of a cold front in your notebook with the associated cloud formations. Notice the steeper grade between the air masses as the cold air pushes the warm air up. At a cold front, cumulonimbus clouds form, bringing heavy downpours, thunderstorms, and vigorous wind gusts.

Watch the geoscience animation "Cold Front and Warm Fronts" available at the CourseCompass website in chapter 19

GEODe Interactive: Slides 2027-2117

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner of the screen, navigate to and review the following slides:

- slides 2027-2117

Weather Map

Watching the news on the television usually includes a view of a weather map.

Interpreting a Weather Map

During your readings so far, there have been many examples of weather maps. Be sure you can interpret a weather map.

For this activity you will access the e-text through CourseCompass.

Review the following pages in the *Earth Science* text to see some examples of weather maps:

- pages 548-551

Warm fronts are shown with red semicircles, and cold fronts are shown with blue triangles. The air mass is moving in the direction the shapes are pointed. Make note of this as you look at the maps.

Examine the following figure in the *Earth Science* text to see how a developing front has alternating shapes. Notice how the air masses are moving in relation to the lines of the map:

- figure 19.10

You can visit The Weather Channel website to see the national weather map and practice interpreting a weather map.

The leading edge of a cold front has the most severe weather. Examine the following figure in the *Earth Science* text and note which city would have the most severe weather:

- figure 19.11

Notice that city D has the most severe weather since it is located at the leading edge of the cold front. Cold fronts move faster than warm fronts. Afternoon summer thunderstorms can develop fairly quickly as a cold front moves through the area.
GEODe Interactive: Slides 1418-1458

Insert and play the GEODe DVD on your computer.

Using the narration active box in the bottom right corner of the screen, navigate to and review the following slides:

- slides 1418-1458

Electrical Storms

Thunderstorms can generate lightning.
Thunderstorms

Using the CourseCompass website, continue reading the following chapter in the *Earth Science* text to help you better understand thunderstorms that generate lightning and thunder:

- chapter 19 ("Weather Patterns and Severe Storms")

Warm humid air needs to rise, which could occur near cold fronts as described in the previous section. In your notebook, answer the following question:

- What other conditions might cause warm humid air to rise?

Tornadoes and Hurricanes

Tornadoes and hurricanes are weather systems that can have devastating effects.
Hurricanes

Using the CourseCompass website, read the following section of the Earth Science text:

- "Hurricanes" (p. 560)

By definition, a hurricane has winds of 74 mph or more. For a hurricane to form, the ocean temperature must be at least 80 degrees F. In your notes, write down the requirements for a *hurricane, tropical depression,* and *tropical storm*. Describe how hurricanes

and other large cyclonic weather systems form, move, and dissipate.

Check for Understanding of Chapter 19

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 19 ("Weather Patterns and Severe Storms")

Human Impact on Global Climate

Climates on Earth were changing long before humans were prevalent on Earth. Human activity, however, can influence climate change.

Anthropogenic Climate Change

Using the CourseCompass website, read about human impact on global climate, starting on the following page of the *Earth Science* text:

- page 584

The Solar System

As technology improves, so does the information that people can gather on the solar system. For example, Galileo was able to observe Jupiter's moons by using a telescope. Earth's solar system includes four dense inner terrestrial planets orbiting the sun, and four large outer Jovian planets that are less dense. Other objects rotate around the sun, as well. After completing this section's activities, you will be able to

- describe Earth's solar system and
- explain how the sun, moon, and earth are positioned during eclipses

The Heliocentric Model

In Greek, helios means sun and kentron means center. The heliocentric model has the sun in the center of Earth’s solar system.

Ancient Astronomy

Using the CourseCompass website, begin reading the following chapter in the *Earth Science* text to help you appreciate the many ideas that different cultures had to explain their observations of the sky:

- chapter 21 ("Origin of Modern Astronomy")

As with all topics in science, current understanding is based on discoveries made over time. The change in thinking from an earth-centered model to a sun-centered model took thousands of years. The sun-centered model, with planets moving in circular orbits, did not explain the celestial observations. A more precise model was needed.

The Elliptical Orbit of Planets

Kepler helped with the current understanding of the elliptical path that planets take around the sun. Today, his discoveries are referenced as three laws.

Using the CourseCompass website, continue reading in the following chapter of the *Earth Science* text to learn about the current understanding of Earth's solar system:

- chapter 21 ("Origin of Modern Astronomy")

Make flash cards listing Kepler's laws. To help with your learning, find a willing participant and explain Kepler's findings to them. Use your flash cards to reinforce your knowledge of Kepler's laws.

Astronomical Units

When measuring distances between planets and stars, measuring in meters or kilometers is cumbersome. Therefore, larger units are used. The average distance from the earth to the sun is called one astronomical unit, or AU. When measuring length within the solar system, AUs are used.

Using the CourseCompass website, examine the following table in the *Earth Science* text to see the distance of the planets from the sun:

- table 21.1 (p. 608)

You should know the order of the planets in the solar system. You should also know the units used to measure distances within the solar system (i.e., astronomical units) and when measuring distances beyond the solar system (i.e., light years).

The Heliocentric Solar System

In your notebook, write down Galileo's observations and how they influenced the establishment of the heliocentric model. Newton built upon this model by describing the forces involved in this model.

Using the CourseCompass website, notice a picture of the heliocentric solar system on the following page of the *Earth Science* text in chapter 22 ("Touring Our Solar System"):

- page 626

Look at how the sun is in the center surrounded by orbiting planets. This arrangement has been deduced after hundreds of years of scientific observations and is now commonly taught in school.

Draw a diagram of the heliocentric model. The four dense rocky planets orbit closer to the sun, and the four large planets are much farther from the sun.

Observing the Night Sky

Understanding the solar system began by observing the night sky.

Celestial Sphere

For this activity you will access the e-text through CourseCompass.

- "Positions in the Sky" (page 611)

Examine the following box in this section of text:

- box 21.2

Examine the following appendix in the *Earth Science* text:

- appendix B (page 704)

Here you will find more information on latitude and longitude. Using a grid system allows viewers to observe and discuss objects in the sky. Share what you enjoy about studying the night sky on the message board.

Retrograde Motion

Using the CourseCompass website, examine the following figure in the Earth Science text, which shows why Mars might appear to be traveling backwards in the sky at times:

- figure 21.6

Earth passes Mars on the inside of Mars's orbit, creating this illusion.

Identifying Objects

Stars appear to be fixed objects in space and can be used as reference points in the sky. For example, the Big Dipper has maintained the same configuration over time. As the Earth rotates, a person has a different viewing angle of the sky.

Planets can be identified since they move in relation to fixed stars' locations. You can see man-made satellites moving relatively quickly across the night sky because they are much closer than neighboring planets.

A *planisphere* is a portable star chart, or map, that can help you locate constellations in the sky. To use it, you match its two attached disks to your date and time, allowing you to see which stars should be visible. Planispheres are designed for specific latitude zones, so you need to be sure that you are using one appropriate for your latitude.

There a few online planispheres that you can use to view the night sky from various positions. OpenLearn's Virtual Planisphere provides a virtal planisphere with interactive controls allowing you to view the night sky at any time of the year. Ernie Wright's online Planisphere Applet provides a traditional planisphere that is programmable to your own location.

The Motions of Earth

Earth can act like a spinning top.

Earth's Orbital Parameters

Using the CourseCompass website, read the following section in chapter 21 ("Touring Our Solar System") of the *Earth Science* text:

- "The Motions of Earth" (p. 615)

Study the following figure from the *Earth Science* text:

- figure 21.24

This figure depicts the ecliptic plane, which is the plane created as the earth revolves around the sun. This figure also depicts the plane of the equator, which cuts through earth's equator. This is also referred to as the celestial equator or celestial plane

In your notebook, write down a description of earth's precession. Recall the importance of earth's tilt in creating the seasons and howthe motions of earth affect global climates.

Elliptical Movement

Earth moves around the sun in a slightly elliptical pattern. Kepler investigated the idea that planets have an elliptical path, versus a circular path.

For this activity you will access the e-text through CourseCompass.

To review this shape, refer to the following figure in the *Earth Science* text, which depicts two different ellipses:

- figure 21.11 (p. 206)

The eccentricity of an ellipse is dependent on the distance between the foci. Answer the following question in your notes:

- If the distance between the foci were zero, what shape would the ellipse have?

Earth's path around the sun is almost a circle, but not quite. Asteroids and comets have more eccentric paths around the sun than the Earth.

Look at the following figure in the *Earth Science* text to review Kepler's law of equal areas:

- figure 21.12

A comet far from the sun at aphelion moves slowly. Conversely, when the comet is close to the sun at perihelion, it moves quickly and also has a tail as the sun burns off some of the comet's ice.

Changes in Earth's Movement

There are three types of variations in earth's orbit that have been recorded.

Using the CourseCompass website, read the following section in chapter 6 ("Glaciers, Deserts, and Wind") of the Earth Science text:

- "Variations in Earth's Orbit" (p. 170)

Figure 6.24 in this section describes the following changes:

- Earth's orbit around the sun (changes on a 100,000-year cycle)
- Earth's axis of rotation (changes on a 41,000-year cycle)
- Earth's precession (changes on a 26,000-year cycle)

These cyclical events are thought to explain major climatic changes that have occurred over thousands of years.

Motions of the Earth-Moon System

As the moon orbits the Earth and the Earth orbits the sun, the lineup of these three bodies can cause some interesting effects.

Phases of the Moon

Using the CourseCompass website, read the following section in chapter 21 ("Origin of Modern Astronomy") of the *Earth Science* text:

- "Phases of the Moon" (p. 618)

Where is the moon in relation to the earth and sun during a full moon? Where is it during a new moon? The sun is always lighting up half of the moon and the earth. It is the perspective from earth that produces the phases of the moon.

Eclipses

Using the CourseCompass website, read the following section in chapter 21 ("Origin of Modern Astronomy") of the *Earth Science* text:

- "Eclipses of the Sun and Moon" (p. 619)

Where is the moon in relation to the earth and sun during a lunar eclipse? Where is it during a solar eclipse? In your notebook, draw a diagram of each eclipse and label the umbra and penumbra.

Using common household materials such as a flashlight and balls, create a demonstration to depict lunar and solar eclipses. Be sure you can demonstrate how each occurs and the results of each.

Check for Understanding of Chapter 21

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 21 ("Origin of Modern Astronomy")

Planets and Moons

There are eight planets, and some of these planets have moons. After completing this section's activities, you will be able to

- describe the formation of the solar system and
- describe the components of the solar system.

Formation of the Solar System

The solar system formed from rotating interstellar dust and gas.

Early Evolution of Earth

Using the CourseCompass website, take a moment to review the following section in chapter 1 ("Introduction to Earth Science") of the *Earth Science* text:

- "Early Evolution of Earth" (p. 11)

In your notebook, write down the importance of gravity in the formation of stars and planets from interstellar dust and in determining whether a body will be a star or a planet.

During the evolution of the solar system, rotating matter condensed and clumped together to form larger and larger pieces. This accretion (sticking together) continued as matter revolved around what would become the sun.

Objects close to the sun were hotter than those far from the sun and therefore became more dense as gases burned off, leaving behind only metallic and rocky substances.

In your notebook, describe the scientific explanation for the formation of the solar system.

Understanding Gravity

The effects of gravity are dependent on the distance between the objects involved and the mass of each object. The closer the objects and the higher their masses, the greater the gravitational effects will be between the objects.

Using the CourseCompass website, review the following section from chapter 21 ("Origin of Modern Astronomy") in Earth Science text:

- "Sir Isaac Newton"

Be sure to understand Newton's law of universal gravitation. Newton described objects in motion in general, whereas Kepler's laws were specific to the path of planets in motion.

Draw a picture of an object orbiting another object. Draw another picture with the object now orbiting a little farther away. In which of these two models is the gravitational force between the objects greater?

The majority of mass is in the center of the solar system: the sun. The gravitational force of the sun keeps materials rotating around this center. Earth's moon is attracted to Earth due to the force of gravity. There is also a force propelling the moon forward that was created during the solar system's early beginnings. Gravity determines the orbit of a body in motion around another body.

Creating the Giant Planets

For this activity you will access the e-text through CourseCompass.

Read the following section at the beginning of chapter 22 ("Touring Our Solar System") in the *Earth Science* text:

- "The Planets: An Overview"

Read the box on the following page that describes why the Jovian planets are much larger than the four interior planets in the solar system:

- page 629

Why are the four inner planets so much smaller than the outer planets? Because of their distance from the sun, the outer planets are colder. During the formation of the solar system, the accretion of ice and cold gases added to the mass of the outer planets.

This increase in mass then increased the gravitational pull of the forming planet, thereby attracting even more mass. The increase in gravitational pull allowed the forming planet to hold gases even closer, causing the gaseous molecules to come closer together. Jupiter, for example, has hydrogen in its atmosphere and liquid hydrogen at its surface.

In your notebook, draw a picture of a planet with air molecules in its atmosphere. Then draw a second picture depicting how those same air molecules would behave if that same planet had a higher gravity. In this second picture, the air molecules should be drawn closer together. You should understand the effects of gravity on a planet's atmosphere.

Holding an Atmosphere

Gravity is important in determining whether a planet will be able to hold an atmosphere. A planet's atmosphere depends on its mass and its temperature.The moon has one-sixth the gravity of Earth and consequently does not hold an atmosphere as Earth does. Conversely, Jupiter's huge gravitational forces create enormous pressures and cause hydrogen to be a liquid at its surface.

Earth has enough gravity to hold an atmosphere and yet allow gasses to persist, allowing for the existence of life.

Using the CourseCompass website, read the following section in the Earth Science text to further your understanding:

- "The Atmosphere of the Planets" (p. 628)

The outer planets are colder and much more massive than earth, which explains the existence of an atmosphere on these outer planets. Review this section in the text to further your understanding.

GEODe Interactive: The Planets

Insert and play the GEODe DVD on your computer.

Hover your mouse over "Earth's Place in the Universe" and click on "The Planets: An Overview," or navigate to the following slide:

- slide 2118

Review each slide in this section.

Earth's Moon

With a simple telescope, or even binoculars, you can see surface features of the moon. What caused these features?

Describing the Moon

Using the CourseCompass website, read the following section in chapter 22 ("Touring Our Solar System") of the *Earth Science* text:

- "Earth's Moon" (p. 629)

In your notebook, write the description of the moon in terms of its relative size, mass, volume, density, general surface features, and general history.

GEODe Interactive: Earth's Moon

Insert and play the GEODe DVD on your computer.

Hover your mouse over "Earth's Place in the Universe" and click on "Earth's Moon," or navigate to the following slide:

- slide 2147

Review each slide in this section.

Planets

The greatest density of the solar system is at its center with the sun and the four rocky planets.

Earth in Perspective

Using the CourseCompass website, read the following section in the *Earth Science* text:

- "The Planets: A Brief Tour" (p. 632)

Review the "Earth in Perspective" PDF, which shows the relative sizes of the planets with each other.

The following in the *Earth Science* text show differences between the planets along with their order from the sun:

- figure 22.2
- table 22.1

For each planet, describe its type (rocky or gaseous), relative size, relative distance from the sun, general surface features, gravity, and special features (e.g., rings of Saturn, moons of Jupiter, etc.) in your notebook.

Also answer the following questions in your notebook:

- Which planets are the dense, rocky planets?
- How far away is the farthest planet from the sun?

GEODe Interactive: A Brief Tour of the Planets

Insert and play the GEODe DVD on your computer.

Hover your mouse over "Earth's Place in the Universe" and click on "A Brief Tour of the Planets," or navigate to the following slide:

- slide 2175, using the narration

Review each slide in this section.

Composition and Motion of Galaxies, Asteroids, Comets, and Meteors

In this topic, you will learn about the composition of galaxies, as well as the asteroids, comets, and meteors that move within them.

Objects in Space

Using the CourseCompass website, to better understand the terms asteroids and comets, read the following pages in chapter 22 ("Touring Our Solar System") of the *Earth Science* text:

- pages 643-649

Answer the following questions in your notebook:

- What are asteroids and comets made of?
- What path do they take?
- What is found in the Kuiper Belt?
- What is found in the Oort Cloud?

Compare Asteroids, Comets, and Meteoroids

In your notes, compare asteroids, comets, and meteoroids. Make a three-circle Venn diagram to show similarities and differences between these things. Describe to a friend asteroids, comets, and meteoroids.

Galaxies

A galaxy is a massive system of stars. Use the following pages in chapter 24 ("Beyond Our Solar System") of the *Earth Science* text to understand the composition and movement of galaxies:

- pages 692-695

In what galaxy is earth located?

Check for Understanding of Chapter 22

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 22 ("Touring Our Solar System")

Beyond Earth's Solar System

The sun is just one star in the Milky Way galaxy. Young stars behave differently than old stars. When a star's fuel begins to be exhausted, heavier elements can be created. After completing this section's activities, you will be able to

- describe properties of light,
- describe how stars use fuel, and
- explain how black holes are formed.

Properties of Light and the Sun

By analyzing the light given off by stars, scientists can determine a star's properties.

Spectroscopy

Scientists use spectroscopy to understand the composition of stars. Each gas atom has electrons at different energy levels. If an electron moves from a high energy level to a lower energy level, light waves are given off.

When light is projected onto an atom, light waves are absorbed if the light’s energy matches with the atom’s difference in electron energy levels.

Using the CourseCompass website, read the following pages in chapter 23 ("Light, Astronomical Observations, and the Sun") of the *Earth Science* text, which describe the concept of using spectroscopy to study astronomical bodies:

- pages 654-656

As you read, write down in your notebook all the information on stars that can be gathered by

studying the wavelength of light and spectroscopy.

Doppler Effect and Spectroscopy

Scientists use the Doppler effect of light rays to determine the radial velocity of stars in relation to the Earth. Light travels in waves. Different wavelengths determine the different colors of light. If a star is moving away from the Earth, the waves will be stretched and the appearance of the color of the star will be modified accordingly. If a star is moving toward the Earth, the light waves will be compressed and the appearance of the color of the star will be modified accordingly. Therefore, scientists can use the colors of stars to determine the stars' movements in relation to the Earth.

Using the CourseCompass website, read the following pages in chapter 23 ("Light, Astronomical Observations, and the Sun") of the *Earth Science* text to learn about how scientists use the Doppler effect of light rays to determine the radial velocity of stars in relation to the earth:

- pages 656-658

As you read, add to your list of information on stars that can be gathered by studying the wavelength of light and spectroscopy. Why is the Doppler effect not used to measure transverse velocity?

The Sun

Using the CourseCompass website, read the following section in chapter 23 ("Light, Astronomical Observations, and the Sun") of the *Earth Science*:

- "The Sun" (pp. 665–672)

Make a labeled drawing describing the sun's structure and its surface, including sunspots (whose number cycles every 11 years). Include six layers of the sun in your drawing (i.e., inner core, radiative zone, convection zone, photosphere, chromosphere, and corona).

In your notebook, describe the sun's process for moving energy. It is important to understand how scientists make observations of the sun. Sunspots can be seen by projecting the sun's image through telescopes. Impressive details of the sun's surface (such as spicules and filaments) can be seen only by using photographic filters.

Check for Understanding of Chapter 23

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 23 ("Light, Astronomical Observations, and the Sun")

Stars

Stars evolve differently, depending on their size.

Observing Stars

Using the CourseCompass website, begin reading the following chapter in the *Earth Science* text to better understand how scientists collect data on stars:

- chapter 24 ("Beyond Our Solar System")

Hertzsprung-Russell Diagrams

In 1912, Hertzsprung and Russell plotted attributes of stars and noted patterns. Hertzsprung and Russell's organization of collected data is referred to as the H-R diagram.

Using the CourseCompass website, read the following pages in chapter 24 (“Beyond Our Solar System") of the *Earth Science* text so that you are able to interpret information on the H-R diagram:

- pages 681-683

Notice that the numbers on the axis do not necessarily go in the traditional direction. When interpreting an H-R diagram, you need to pay attention to the numbers on the axis.

Stellar Evolution

For this activity you will access the e-text through CourseCompass.

Read the following pages in chapter 24 ("Beyond Our Solar System") of the *Earth Science* text to help you understand stellar evolution:

- pages 684-692

Examine the following figure in the *Earth Science* text:

- figure 24.12

Notice in this figure that medium- and high-mass stars go through a red-giant phase, which starts after the all usable hydrogen fuel is consumed. During this phase, heavier elements, such as carbon, are created. Be sure you understand the red-giant phase. All the elements on the periodic table up to iron are made during the red-giant phase.

Read the following section in chapter 24 ("Beyond Our Solar System") of the *Earth Science* text to learn about what happens after all the fuel is used up and the star collapses:

- "Burnout and Death"

Black Holes

Only high-mass stars can eventually form black holes. During a supernova, the star’s core condenses.

Using the CourseCompass website, read the section on black holes, starting on the following page in the *Earth Science* text:

- page 692

What is emitted that helps scientists detect black holes?
Check for Understanding of Chapter 24

Using the CourseCompass website, take the quiz on the following chapter of the *Earth Science* text:

- chapter 24 ("Beyond Our Solar System")

Final Steps

Congratulations on completing the Earth and Space Science Course of Study! As you now appreciate, earth science covers a broad range of topics. Your studies included the physical properties of earth, weather patterns in earth's atmosphere, the ocean environment where organisms live, and space beyond planet earth.

As a science teacher, you should comprehend how these topics are interrelated so that you can share the connections with your students. During your earth science studies, you performed hands-on labs to apply your new knowledge. Share this experience with your students.

What strategies helped you learn the material? Write these strategies down and share them with your students as you teach. You now need to demonstrate your competency in earth science by passing the performance assessment.

Assessment Information

The activities in this course of study have prepared you to complete the BRC2 objective assessment. The following activities will guide you through the assessment process.
Accessing Pre-Assessments

Complete the following pre-assessment:

- PBRC

Follow these directions for accessing your pre-assessments.

The results will provide a percentage for each of the topics in this course of study. You should review your notes for topics with low scores. The textbooks have quizzes to check your understanding.

Another way to check your understanding is to start with blank paper and write down your understanding of the topic. Pretend you are teaching this topic to a student. You can also post your understanding in the message board for review. Once you have confidence with your new knowledge, take the pre-assessment again.
Accessing Objective Assessments

Complete the following objective assessment:

- BRC2

For directions on how to receive access to objective assessments, see the "Accessing Objective Assessments" page.

Feedback

WGU values your input! If you have comments, concerns, or suggestions for improvement of this course, please submit your feedback using the following form:

- Course Feedback

ADA Requirements
Please review the University ADA Policy.