This course supports the assessments for Earth Science: Content Knowledge. The course covers 2 competencies and represents 2 competency units. This course may take up to 4 weeks to complete.

Introduction

Overview

This course covers the advanced content knowledge that secondary earth science teachers are expected to know and understand. Topics include basic scientific principles of earth and space sciences, tectonics and internal earth processes, earth materials and surface processes, history of the earth and its life-forms, earth's atmosphere (meteorology) and hydrosphere (oceanography), and astronomy.

Getting Started

Welcome to Earth Science: Content Knowledge. In this course you will review Earth Science content and prepare for the Earth Science (5571) Praxis Subject Assessments tests. Individuals entering the teaching profession take the Praxis Subject Assessments tests as part of the teacher licensing and certification process required by many states. You will be using a VitalSource e-text along with videos, interactive tutorials, and quizzes. As part of this course, you will need to identify a testing center and schedule a date to take this exam.

Welcome Video

Watch the following video for an introduction to this course:

Note: To download this video, right-click the following link and choose "Save as...": download video.

Competencies
This course provides guidance to help you demonstrate the following 2 competencies:

- **Competency 2029.1.1: Synthesis of Earth and Space Sciences Concepts and Processes**
  The graduate synthesizes concepts and processes from across the earth and space sciences to generate a comprehensive understanding of the field.

- **Competency 2029.1.2: Verification of Earth and Space Sciences Content Knowledge and Skills**
  The graduate verifies that they possess the requisite earth and space sciences knowledge and skills by passing the earth and space sciences content knowledge test required to become a beginning teacher of secondary school earth and space science.
Teaching Dispositions Statement
Please review the Statement of Teaching Dispositions.

Course Instructor Assistance
As you prepare to demonstrate competency in this subject, remember that course instructors can help you reach your educational goals. As subject matter experts, instructors enjoy and take pride in helping students become reflective learners, problem solvers, and critical thinkers. Course instructors are able to share tips on approaches, tools, and skills that can help you apply the content you are studying. If your first try on your assessment does not go well, course instructors act as a support system to help you prepare for another attempt. Course instructors are excited to hear from you and to work with you.

Preparing for Success

The information in this section is provided to detail the resources available for you to use as you complete this course.

Learning Resources
The learning resources listed in this section are required to complete the activities in this course. For many resources, WGU has provided automatic access through the course. However, you may need to manually enroll in or acquire other resources independently. Read the full instructions provided to ensure that you have access to all of your resources in a timely manner.

Automatically Enrolled Learning Resources

You can access the learning resources listed in this section by clicking on the links provided throughout the course. You may be prompted to log in to the WGU student portal to access the resources.

VitalSource E-Texts
The following textbook is available to you as an e-text within this course. You will be directly linked to the specific readings required within the activities that follow.


Note: VitalSource texts are available to you as part of your program tuition and fees, but you may purchase a hard copy at your own expense through a retailer of your choice. If you choose to do so, please use the ISBN listed to ensure that you receive the correct edition.

ETS Practice Exam

The ETS Practice Exam is a full-length practice test that allows you to work through a set of test questions to simulate what you will experience on the actual day of the Praxis exam. After a completed attempt, you can view your score and review explanations for the correct answers. You will have unlimited attempts regardless of any notice to the contrary on the ETS website. This practice test includes one set of test questions. Retaking it will not provide different sets of questions or change the order in which they are delivered. If you have any questions, please
contact your course instructor.

**Geology LabPaq (or Science Methods LabPaq)**

Pull out your mineral and rock sample kit and become familiar with these samples. There may be only 17 samples per kit. If you have not already completed the labs to identify minerals and rocks, please do so now. Ask your course instructor for an answer key, if needed.

**Cohorts and Webinars**

Earth Science Praxis Cohort sessions are held most Tuesdays at 7:00 pm mountain time. Each webinar will address a specific topic and will be open to general questions and answers. View the current cohort and webinar schedule for Earth and Space Sciences.

**Practice Tests**

Practice tests and homework assignments are included as part of this course. The Praxis Assessment is a third-party exam offered through Educational Testing Services (ETS). In addition to what is provided with this course, ETS provides an optional, for a fee, interactive practice test, but it is not recommended that you purchase it for this course. The practice test consists of a single set of practice questions, so each time you take the practice test you answer the same questions in the same order. Retaking or repurchasing the same practice test more than once does not give you different practice questions or change the order of the questions.

**Study Companion**

ETS created a free Earth and Space Sciences Study Companion to help you prepare for the Praxis.

Read the following sections of this helpful document:

1. Learn About Your Test
2. Familiarize Yourself with Test Questions
3. Practice with Sample Test Questions
4. Determine Your Strategy for Success
5. Develop Your Study Plan
6. Review Smart Tips for Success
7. Understand Your Scores

The ETS Practice Exam is a full-length practice test that allows you to work through a set of test questions to simulate what you will experience on the actual day of the Praxis exam. After a completed attempt you can view your score and review explanations for the correct answers. You will have unlimited attempts regardless of any notice to the contrary on the ETS website. This practice test includes one set of test questions. Retaking it will not provide different sets of questions or change the order in which they are delivered. If you have any questions, please contact your course instructors.

**Recommended Activities**

Follow the guidance in sections 1 ("Learn About Your Test"), 4 ("Determine Your Strategy for Success"), and 5 ("Develop Your Study Plan") in the Earth and Space Sciences Study Companion. Be honest with yourself—identify areas in which you are comfortable (and continue to check your competence in these areas), areas that you understand but need more practice in, and areas in which you still need to learn the content.
Chapter 3 Pre-Assessment

Set aside the time that you need to ensure success on this exam. When you feel ready, use the pre-test in Chapter 3 as a pre-assessment to identify areas you need to work on.

Homework Assignments

These homework assignments provide additional activities for you to use to check your knowledge on specific topics.

- Week 1A
- Week 1B
- Week 2A
- Week 2B
- Week 3A
- Week 3B
- Week 4A
- Week 4B
- Week 4C

Topics and Pacing

The pacing guide suggests a weekly structure to pace your completion of learning activities. It is provided as a suggestion and does not represent a mandatory schedule. Follow the pacing guide carefully to complete the course in the suggested time frame.

Week 1

- Basic Principles of Science
  - Methodology and Philosophy
  - Scientific Tools
  - Scientific Ideas Change Over Time
- Geology (Earth's Composition)
  - Earth's Composition: Minerals, Rocks, and Rock Cycle
  - The Rock Cycle: Characteristics and Formation of Igneous, Sedimentary, and Metamorphic Rocks
- Geology (Surface Processes)
  - Earth's Surface Processes: Weathering
  - Earth's Surface Processes: Water, Wind, and Ice (Chemical and Physical Weathering)
- Weekly Homework

Week 2

- Geology (Internal Processes)
  - Earth’s Internal Processes
  - Earthquakes and Interior Structure
  - Volcanoes, Mountains, Folds, Faults, and Maps
  - Topographic and Geologic Maps
• Geology (History and Life)
  ○ Age-Dating and History of Life on Earth
• Weekly Homework

**Week 3**

• Oceanography
  ○ Ocean Features
• Meteorology
  ○ Atmosphere Composition and Structure
  ○ Clouds, Air Pressure, and Weather
• Weekly Homework

**Week 4**

• Space Sciences
  ○ Astronomy
  ○ Solar System
  ○ Beyond Our Solar System
• Review
• Final Steps
• Weekly Homework

**Preparing for the Praxis Assessment**

Understandably, many people are nervous on exam day. To help reduce any anxiety, you should learn more about the exam experience and the best preparation strategies.

**ETS Earth and Space Sciences Content Knowledge Exam**

Watch the following videos for a better understanding of the assessment. The first is an interactive demonstration of how the exam is administered, the tools available during the exam, and the general format of questions.

- “Computer-Delivered Testing Demonstration” (Flash) | View Transcript (1:29)
- “What to Expect on the Day of Your Computer-Delivered Test” (Flash) (7:00)

Watching these videos will help you prepare for the exam experience, allowing you to demonstrate your earth and space sciences content competency.

**Receiving WGU Credit for the Assessment**

WGU will pay for your first two attempts of the Praxis exam. You will be responsible for paying for third and subsequent attempts. If you need a fee waiver, please see “Fee Waivers” at the
In order to receive a pass on your degree plan, you must pass the exam based upon the WGU cut score (generally 153 or higher; check with your course instructor). Additionally, if the state in which you seek licensure requires the Praxis exam, you must pass the exam based on that state's cut score to be admitted into demonstration teaching, or allowed to graduate. Please note that it is possible to pass the exam based on either the WGU cut score or your state's cut score, and still need to take it again in order to satisfy the other cut score.

If your state requires you to take a state exam for teacher licensure, you are still required to take the Praxis as a WGU graduation requirement in addition to the state exam you must take for licensure.

What to Bring on Exam Day

- You will have access to a periodic table of elements during the exam and you are strongly encouraged to use it.
- No calculators will be allowed for this exam.
- For more information about what to bring, see the ETS "What to Bring" webpage.

Exam Registration

Start planning now!

For directions on how to receive access to outside vendor assessments, see the "How to Schedule a Praxis Exam" page.

Please discuss the information found at the following web page with your program mentor to ensure that you have plenty of time to review all relevant content before taking the exam.

- ETS website

Register for your preferred Praxis Subject Assessment dates at least 4 weeks in advance of the test. See exam dates here.

This online exam must be taken at an approved testing center, not from home. It is fine to take the Praxis Subject Assessment in a neighboring state. Please identify the nearest testing center using the Test Center Locator.

For disability accommodations, please see Accommodations for Test Takers with Disabilities of Health Related Needs. Note that you must make requests for accommodation as well as registration in writing through U.S. Mail (not online). It may take 6 to 12 weeks to make accommodations, and your range of available testing dates may be restricted.
If you need additional time because English is not your native language, please see Test Takers Needing Other Accommodations.

Additional information about registration is available at the ETS website: Exam Registration.

Degree Programs

- If you are in the BASCG12 or MASEG12 programs, WGU will pay for your first or second attempt at the Praxis exam. Earth Science: Content Knowledge must be in your current term for WGU to pay for your Praxis exam. **You must pay out of pocket for your third attempt.**
- If you are in the PBSC12 or MATSC12 programs, you must pay for the exam yourself. To determine if this is the correct exam for you, please see the Student Handbook article at: Student Handbook Database
- For directions on how to receive access to outside vendor assessments, see "How to Schedule a Praxis Exam".

To register for the Praxis exam with WGU payment

Please follow the instructions at:

- Praxis Registration Instructions—Science

**Basic Principles of Science**

In this section, you will review the processes involved in safe, effective, research-based instruction in science.

**Homework**

Access the homework document for this week:

- Week 1A

**Methodology and Philosophy**

Explore the processes involved in scientific inquiry, the disciplines within science, and scientific terms.

**Problem-Solving**

Review the following web page:

- Methods of scientific inquiry and how they are used in basic problem solving:
  - How Science Works: The Flowchart

**Scientific Inquiry**

View:
- “Science Principles” (4:01)
- “Scientific Reasoning” (8:17)
- “Consensus and Controversy in Earth Science” (4:46)
- “Dave’s Universe: Truth and Science” (5:22)
- “Scientific Law versus Scientific Theory” (4:25)
- “Fact vs. Theory vs. Hypothesis vs. Law...Explained!” (7:11)
- “Dave’s Universe: Your theory, My theory” (3:56)

Note that "law" = "principle" = "guiding idea." See here also

Read the following web pages:

- NSTA Position Papers on:
  - “Scientific Inquiry”
  - “Nature of Science”

Scientific Tools
In science, data is usually only as good as the measurement tools and the knowledge and skill level of the researcher(s).

Explore the following website

Review:

Use the following online library to review processes involved in scientific data collection and manipulation, and how to interpret and draw conclusions from data presented in tables, graphs, and charts:

- **Visionlearning Library**
  - View the topic "Process of Science" from the library menu on the right.

Math Skills

Review the following websites:

- Mathematics Practice Tests
- Scientific Notation
- Science Geek.net: Scientific Notation
- Metric Units and Conversions

The Atom, Atomic Structure, Ionic and Covalent Bonding and the Periodic Table of Elements

Review the following:

- Unit 1 Review Questions

Safety

Providing a safe learning environment is essential in the classroom.
Read the following webpage:

- "Laboratory Safety"

**Scientific Ideas Change Over Time**
This section covers some of the scientific contributions made by major historical figures.

**Keeping Track of the Major Players**

As you work through this course, make note of the major historical figures who have contributed to science.

Use the following web pages to become familiar with historical developments of science and the contributions of major historical figures.

- “Famous Astronomers”
- “Famous Biologists”
- “Famous Chemists”
- “Famous Physicists”
- “Famous Female Scientists”

**Geology (Earth's Composition)**

This section covers the principles of geology.

**Earth's Composition: Minerals, Rocks, and Rock Cycle**
Earth's crust and oceans are home to a wide variety of useful and essential minerals.

**Identification of Minerals**

Read the following in *Earth Science*:

- Chapter 2: "Matter and Minerals"

**Definition of a Mineral**

View the following videos:

- “Atoms Make Minerals”
- “Mineral Groups” (7:08)

Complete the following interactive tutorial:

- “Minerals”

**Properties of Minerals**

Read the following in Chapter 2: “Matter and Minerals” in *Earth Science*:

- p. 42 ("Properties of Minerals")
- p. 46 ("Mineral Groups")
- Figure 2.24 "Common Silicate Minerals"
- Pay attention to mineral formula (no need to memorize) and silicate structure since nonsilicates use these same structures (such as graphite and diamond).
  - Table 2.1 “Common NonSilicate Mineral Groups”

**Identification Tools**

Complete the following interactive tutorial:

- "Hardness Scales"

**Word Endings**

In some cases, the ending of a mineral’s name determines its chemical structure. Here are some word endings that you need to know:

- *-ate minerals* are cations bonded with oxygen
  - For example, sulfate = sulfur + oxygen
- *-ide minerals* are cations bonded to anything BUT oxygen
  - For example, sulfide = sulfur + something other than oxygen (like lead)
- *Oxide minerals* are oxygen bonded to anything other than more oxygen
  - For example, iron oxide = oxygen bonded to iron

**Practice:**

Using the following resource, identify mineral samples 5, 10, 15, and 20:

- Mineral Physical Properties and Identification

**Complete the following quiz:**

- Geology Matter and Minerals Quiz

**The Rock Cycle: Characteristics and Formation of Igneous, Sedimentary, and Metamorphic Rocks**

This section covers information you need to know about the rock cycle.

**Rock Identification and Classification**

Read the following in *Earth Science*:


**Watch the following video:**

- Rock Cycle

**Complete the following interactive tutorials:**
Formation and Characteristics of Intrusive and Extrusive Igneous Rocks

Read:

- pp. 61–70 ("Igneous Rocks: Formed by Fire")
- Figure 3.12 ("Bowen's Reaction Series")
  - This is one of the most important diagrams in geology. It will help you relate mineral composition to rock type, and magma source to tectonic environment.

Watch:

- “Igneous Rock Textures” (6:05)
- “Bowen's Reaction Series” (14:08)

Complete the following interactive tutorials:

- “Igneous Rocks”
- “Igneous Rock Textures”
  - Classification of Igneous Rocks, Based on their Mineral Composition and Texture

Read the following in Earth Science:

- Figure 3.7 "Igneous Rock Classification Chart" in Chapter 3: “Rocks: Materials of the Solid Earth”

Practice:

- Be able to identify at least six common igneous rocks.
- Be able to determine which minerals are contained within each rock type. Note grain size and rock textures:
  - Coarse-grained (phaneritic)
  - Fine-grained (aphanatic)
  - Porphyritic
  - Glassy
  - Vesicular
  - Pyroclastic

Formation and Characteristics of Clastic, Chemical, and Biological Sedimentary Rocks

Read the following in Earth Science:

- Figure 3.15 “Detrital Sedimentary Rocks”
View the following videos:

- “Sedimentary Environments” (8:37)
- “Clays” (4:00)

Complete the following interactive tutorial:

- “Sedimentary Rocks”

Practice:

- Memorize sedimentary rock names based on grain size and composition.
- Know the differences between clastic (detrital) and chemical sedimentary rocks.
- Note that chemical sedimentary rocks include:
  - Precipitates (from chemical reactions, often involving water)
  - Evaporates
  - Rocks of biological origin

Formation and Characteristics of Regional and Contact Metamorphic Rocks

Read the following in Earth Science:

- Figure 3.28 “Rotation of Platy and Elongated Mineral Grains to Produce a Foliated Texture”
- Figure 3.29 “Classification of Common Metamorphic Rocks”

View the following video:

- “Metamorphic Rocks” (25:25)

Complete the following interactive tutorials:

- “Foliation Processes”
- “Metamorphic Rocks”

Practice:

- Be able to identify five common metamorphic rocks.
- Memorize the sequence of foliation.
- Explain why foliation occurs as a result of regional metamorphism.
- Discuss non-foliated rocks. Know the relationship of calcite (mineral) to limestone (sedimentary rock) to marble (metamorphic rock).
Read the following in Chapter 3: “Rocks: Materials of the Solid Earth” from *Earth Science*:

- p. 87 ("Energy Resources: Fossil Fuels") and p. 88 ("Oil and Natural Gas")
- SmartFigure 3.35 "Common Oil Traps"

**Practice:**

- The fossil fuel sequence is worth memorizing. Note that all solid fossil fuels are sedimentary, except for anthracite coal (metamorphic).
- Which geologic structures trap oil and natural gas?
- What is hydraulic fracturing (fracking)?

**Complete the following quiz:**

- [Geology Rocks Materials of the Solid Earth Quiz](#)

**Geology (Surface Processes)**

Earth's surface is constantly changing. Rock disintegrates and decomposes, moves to lower elevations by gravity, and is carried away by water, wind, or ice.

**Homework**

Access the homework document for this week:

- [Week 1B](#)

**Earth's Surface Processes: Weathering**

Weathering, mass wasting, and erosion are called external processes because they occur at or near earth's surface, and are powered by energy from the Sun.

**Weathering, Soil, and Mass Wasting**

Read the following in *Earth Science*:

- Figure 4.10 "Acid Rain Accelerates the Chemical Weathering of Stone Monuments and Structures" in Chapter 4: "Weathering, Soil, and Mass Wasting"

**Watch:**

- "Weathering" (10:35)

**Complete the following interactive tutorials:**

- "Rock Types Influences Weathering"
- "Weathering and Soil"
Practice:

- Explain what happens with acid precipitation.

Complete the following quiz:

- Geology, Weathering, Soil, and Mass Wasting Quiz

Earth’s Surface Processes: Water, Wind, and Ice (Chemical and Physical Weathering)

Water is almost everywhere on earth—in the oceans, glaciers, rivers, lakes, air, soil, and living tissue.

The Water Cycle

Read the following in Earth Science:

- Chapter 5: "Running Water and Groundwater"

Complete the following interactive tutorials:

- The Hydrologic Cycle

Surface Water: Meandering and Braided Streams

Complete the following interactive tutorials:

- “Running Water”
- “Sediment Transport by Streams”
- “Formation of Cut Banks and Point Bars”

Groundwater: Aquifers and Artesian Wells

Complete the following interactive tutorials:

- “Groundwater”
- “Water Table Formation”
- “Artesian Systems”

Complete the following Quiz:

- Geology Running Water and Ground Water Quiz

Ice and Glaciers

Read the following in Earth Science:
Complete the following interactive tutorials:

- “Glaciers and Glaciation”
- “Glacial Processes”

View the following videos:

- “Pine Island Glacier in Antarctica” (3:18)

Wind and Deserts

Complete the following interactive tutorials:

- “Deserts and Winds”
- “Sediment Transport by Wind”
- “Cross-Bedding”

Complete the following quiz:

- Geology Glaciers Deserts and Wind Quiz

Geology (Internal Processes)

The idea that continents, particularly South America and Africa, fit together like pieces of a jigsaw puzzle came about during the 1600s, as better world maps became available.

Homework

Access the homework document for this week:

- Week 2A

Read the following in Earth Science:

- Chapter 7: “Plate Tectonics: A Scientific Theory Unfolds”

Plate Tectonics

Complete the following interactive tutorials:

- “Plate Tectonics”
- “Rigid Lithosphere Overlies the Weak Asthenosphere”
- “Continental Rifting”
Practice:

- Explain oceanic lithosphere vs. continental lithosphere.
- What is the difference between lithosphere and crust?
- What is and where is the Moho?

**Plate Boundaries**

**Read the following from *Earth Science***:

- Figure 7.12 “Divergent, Convergent, and Transform Plate Boundaries” in Chapter 7: “Plate Tectonics: A Scientific Revolution Unfolds”

**Complete the following interactive tutorials:**

- “Divergent Boundary Formation”
- “Sea Floor Spreading and Plate Boundaries”
- “Three Types of Convergent Plate Boundaries”
- “Transform Plate Boundaries”
- “Plate Boundary Features”
- “Motion at Plate Boundaries”

**Practice:**

- Note the types of plate boundaries (i.e., divergent, convergent, and transform).
- Become familiar with the names of tectonic plates.

**Geologic Hot Spots**

**Read the following in Earth Science:**

- Figure 7.28 “Hot Spots and Hot-Spot Tracks” in Chapter 7: “Plate Tectonics: A Scientific Revolution Unfolds”
- Figure 9.35 “Hot Spots and Mantle Plumes” in Chapter 9: “Volcanoes and Other Igneous Activity”

**Complete the following interactive tutorials:**

- “Convection and Tectonics”
- “Hot Spot Volcano Tracks”

**Practice:**

- Note geologic hot spots (sometimes called mantle plumes or intraplate volcanism).
- Know these three hot spots: Hawaii, Yellowstone, Iceland.

**Magnetic Stripes on the Ocean Floor**

Magnetic stripes in the ocean floor are definitive proof that seafloor spreading occurs and that
plate tectonics has a distinct mechanism. Earth's magnetic field is induced by rapid rotation of earth's outer and inner core; both move in the same direction but at different speeds, which creates a dynamo effect.

Read the following in *Earth Science*:

- Figure 7.32 “Ocean Floor as a Magnetic Recorder” in Chapter 7: “Plate Tectonics: A Scientific Revolution Unfolds”

Complete the following interactive tutorials:

- “Paleomagnetics—Magnetic Polarity and Polarity Timescales”
- “Time Scale of Magnetic Reversals”

Complete the following quiz:

- Geology Plate Tectonics Scientific Revolution Quiz

**Earthquakes and Interior Structure**

The slippage that occurs along faults can be explained by the plate tectonics theory, which states that large slabs of earth's lithosphere are continually grinding past one another.

**Earthquakes**

Read the following in *Earth Science*:

- Chapter 8: "Earthquakes and Earth's Interior"

Watch:

- Earthquakes
- Tsunami

**Seismology**

Complete the following interactive tutorials:

- “Body Waves (P and S Waves) versus Surface Waves”
- “Seismic Wave Motion”
- “Seismographs”
- “Earth's Interior”

Complete the following quiz:

- Geology Earthquakes and Earths Interior Quiz

**Volcanoes, Mountains, Folds, Faults, and Maps**

Because volcanoes extrude molten rock that formed at great depth, they provide our only
means of directly observing processes that occur many kilometers below earth's surface.

**Volcanoes**

Read the following in *Earth Science*:

- Chapter 9: "Volcanoes and Other Igneous Activity"

Complete the following interactive tutorials:

- “Volcanoes and Other Igneous Activity”
- “Igneous Features and Landforms”
- “Anatomy of a Volcano”
- “Volcano Types”
- “Tectonic Settings and Volcanic Activity”

Complete the following quiz:

- [Geology Volcanoes and Other Igneous Activity Quiz](#)

**Mountains, Folds, & Faults**

Read the following in *Earth Science*:

- Chapter 10: "Crustal Deformation and Mountain Building"

Complete the following interactive tutorials:

- “Maintain Building”
- “Common Types of Folds”
- “Faults”

**Accreted Terranes**

Accreted terranes are the only way a continent can grow significantly larger. Remember that continents are ancient crust cooled after the formation of Earth's Moon more than 4 billion years ago. In contrast, the ocean floor is made from relatively young rock (no more than 200 million years old) from plate tectonics processes, and oceanic crust is continuously made at divergent plate boundaries (seafloor spreading centers).

Read the following in *Earth Science*:

- [Figure 10.27 "Terranes That Have Been Added to Westerns North America During the Past 200 Million Years" in Chapter 10: “Crustal Deformation and Mountain Building”](#)

Complete the following interactive tutorials:

- “Terrane Formation”
- “Collision and Accretion of Small Crustal Fragments to a Continental Margin”
Isostasy
Isostasy occurs whenever overburden is removed. Overburden can be ice (like a glacier that retreated) or rock (such as mountains eroding; see the Appalachian Mountains).

Complete the following interactive tutorial:

- “Isostasy”

Complete the following quiz:

- Geology Crustal Deformation Mountain Build Quiz

Topographic and Geologic Maps
Topographic maps allow you to see a three-dimensional landscape on a two-dimensional surface. A geologic map shows the distribution and arrangement of rock types.

Topographic Maps

Read the following web page:

- “How to Read a Topographic Map”

View the following video:

- “Topo Maps” (14:33)

Geologic maps

Read the following web page:

- “Geologic Maps: What Are You Standing On?”

View the following video:

- “Geologic Maps” (5:56)

Explore the following web page:

- USGS “Geologic Maps”

Geology (History and Life)

The nature of our earth—its materials and processes—has been a focus of study for centuries.

Homework
Access the homework document for this week:

- Week 2B

Age-Dating and History of Life on Earth
Like the pages in a long and complicated history book, rocks record the geologic events and changing life-forms of the past.

**Fossils**

**Read the following in *Earth Science*:**

- p. 355 (“Fossils: Evidence of Past Life”) in **Chapter 11: “Geologic Time”**

**Complete the following interactive tutorial:**

- **“Fossil Assemblage”**

**Practice:**

- Know the five main principles of relative age-dating and three kinds of unconformities.

**Relative Age-Dating**

**Read the following in Chapter 11: “Geologic Time” of *Earth Science*:**

- p. 354 (“Applying Relative Dating Principles”)
- SmartFigure 11.13 "Applying Principles"
- **Figure 11.16 "Correlation"**

**Complete the following interactive tutorials:**

- “Relative Dating—Key Principles”
- “Relative Geologic Dating”
- “Angular Unconformities, Nonconformities, and Disconformities”
- “Applying Principles”

**Practice:**

- Determine the best rock layer to use to correlate locations.

**Radiometric (Absolute or Isotopic) Age-Dating**

**Read the following in *Earth Science*:**

- p. 360 (“Dating with Radioactivity”) in **Chapter 11: "Geologic Time”**
- **Figure 11.19 "Common Types of Radioactive Decay”**
- SmartFigure 11.21 "Radioactive Decay Curve" in **Chapter 11: "Geologic Time”**

**Complete the following interactive tutorials:**

- “Dating With Radioactivity”
- “Radioactive Decay”
- “Radioactive Decay Curve”
Practice:

- The ratio of parent to daughter atoms tells you how old the sample is.
  - Age of sample = # half-lifes x decay rate
- Why do # protons and # neutrons change as a result of alpha decay, beta decay, and electron capture?
- Memorize the radioactive decay curve.
- Know how to convert from the fraction (1/8) to ratio (1:7) to percent (12.5%) of the parent isotope.

Geologic Time Scale

Read the following in *Earth Science*:

- Chapter 12: "Earth's Evolution through Geologic Time"
  - Figure 12.3 "The Geologic Time Scale"

Explore the following web page:

- Click on every graphic at "Deep History of Life on Earth"

Complete the following interactive tutorial:

- "Geologic Time Scale"

View the following videos:

- “Like—An Autobiography (Biodiversity Rap)” (6:34)
- “Geologic Time Scale: Precambrian” (6:02)
- “Geologic Time Scale: Paleozoic” (8:24)
- “Geologic Time Scale: Mesozoic” (4:25)
- “Geologic Time Scale: Cenozoic” (4:00)

Practice:

- Know the Geologic Time Scale. You do not need to memorize all the names and dates, but be very familiar with key periods.

Complete the following quizzes:

- Geology Geologic Time Quiz
- Geology Earth's Evolution Geologic Time Quiz

Oceanography

Outgassing of gases and fluids through volcanic vents provided the raw materials to form earth's oceans (hydrosphere) and atmosphere. Geologic and biologic processes, including
human activities, continue to modify the planet's water and air.

**Homework**

Access the homework document for this week:

- **Week 3A**

**Ocean Features**

Oceans are a major part of our planet. In fact, Earth is frequently called the water planet or the blue planet.

**The Ocean Floor**

Read the following in Chapter 13: “The Ocean Floor” of *Earth Science*:

- **Figure 13.7 “Major Features of the Seafloor”**
- **Figure 13.11 "Turbidity Currents and Submarine Canyons"**
- **SmartFigure 13.12 "Active Continental Margins"**

Complete the following interactive tutorial:

- "Floor of the Ocean"

**Practice:**

- Pay attention to curved features (tectonic origin) versus straight-line features (hot spot origin).
- Curved ridges and trenches indicate plate boundaries.
- Locate the Mariana Trench and Aleutian Trench.
- "Active" means tectonic activity is occurring now.

**Research the following:**

1. Accretionary wedge
2. Forearc basin
3. Backarc basin

**Ocean Water**

Read the following in Chapter 14: “Ocean Water and Ocean Life” of *Earth Science*:

- **SmartFigure 14.2 "Variations in Surface Temperature and Salinity with Latitude"**
- **SmartFigure 14.12 "Benthos"**
- **Figure 14.13 "Marine Life Zones"**

Complete the following interactive tutorials:
“Variations in Surface Temperature and Salinity with Latitude”
“Benthos”

Practice:
Note the following conversions for the composition of seawater: 35 grams/liter = 35 parts per thousand = 35‰ = 3.5 parts per hundred = 3.5% salinity (mostly NaCl)
Understand the difference between thermocline and pycnocline and low latitudes versus high latitudes.

Surface Currents and Thermohaline Circulation

Read the following in Earth Science:

- **Chapter 15: "The Dynamic Ocean"**
  - pp. 454–457 ("The Ocean's Surface Circulation")
  - Figure 15.1 "The Gulf Stream"
  - Figure 15.2 "Major Surface-Ocean Currents"
  - 457–458 ("Upwelling and Deep-Ocean Circulation")
  - Figure 15.3 "The Chilling Effect of a Cold Current"
- **SmartFigure 12.16 "Connection Between Ocean Circulation and the Climate of Antarctica"** in Chapter 12: “Earth’s Evolution Through Geologic Time”
- **566–570 ("El Niño and La Niña and the Southern Oscillation") in Chapter 18: “Air Pressure and Wind”

Complete the following interactive tutorials:

- “Interactive Animation: Ocean Circulation”
- “Connection Between Ocean Circulation and Climate of Antarctica”
- “Coastal Upwelling”

Practice:

- Follow the Gulf Stream into the North Atlantic Drift. Why is this current important to people who live in northern Europe?
- Know the five major surface gyres. What drives surface currents? How does this link to deep thermohaline circulation?
- Tie coastal upwelling into El Niño and La Niña scenarios.

Coastal Processes and Tides

Read the following in Chapter 15: “The Dynamic Ocean” from Earth Science:

- pp. 485–460 ("The Shoreline: A Dynamic Interface")
- Figure 15.11 "Wave Basics"
- Figures 15.24 "Jetties"
- Figures 15.25 "Groins"
- SmartFigure 15.12 "Passage of a Wave"
Complete the following interactive tutorials:

- “Passage of a Wave”
- “Beach Drift and Longshore Currents”
- “Tidal Patterns”

Practice:

- Know the characteristics of ocean waves. How would a rubber ducky move when caught in a wave?
- Relate longshore current to wave refraction and coastal (shoreline) features. High energy waves erode sediment; low energy waves deposit sediment.
- Know the terms and end results of human efforts to modify shorelines. Where will sediment collect around a breakwater?
- Remember that the Sun contributes 40% of the gravitational pull that causes tides. Straight-line alignment = spring tide, ninety degree angle = neap tide. What are high and low tides?

Local Landscapes Enhance Tidal Ranges

Read the following web page:

- Tides in the Bay of Fundy

Read the following in Chapter 15: “The Dynamic Ocean” of Earth Science:

- Figure 15.34 "Spring and Neap Tides"
- SmartFigure 15.35 "Tidal Patterns"

Meteorology

Earth’s atmosphere is unique. No other planet in our solar system has an atmosphere with the exact mixture of gases or the heat and moisture conditions necessary to sustain life as we know it.

Homework

Access the homework document for this week:

- Week 3B

Atmosphere Composition and Structure

The gases that make up earth’s atmosphere and the controls to which they are subject are vital to our existence.

Introduction to the Atmosphere

Read the following in Chapter 16: “The Atmosphere: Composition, Structure, and Temperature” of Earth Science:
Read the following web page:

- "JetStream—An Online School for Weather"
  - The Atmosphere
    - Layers of the Atmosphere

Complete the following interactive tutorials:

- "Introduction to the Atmosphere"
- "Heating Earth's Surface and Atmosphere"
- "The Three Mechanisms of Heat Transfer"

Practice:

- Memorize the composition of earth's modern atmosphere.
- Know the percentages of: N2, O2, Ar. Note that H2O is 0.5% while CO2 reaches 0.4% fairly often now.
- Note that the exosphere is not shown in the diagram of the atmosphere's thermal structure in Figure 16.10.
- Note the locations of the ionosphere and ozone layer and ionosphere.
- Explain why there are differences between conduction, convection, and radiation.

The Greenhouse Effect

Read the following articles:
Note that Canada, Russia, and northern European countries are paying attention to mineral resources north of the Arctic Circle as earth’s albedo lowers from reduced sea ice cover.

- “We're Still Losing Ice at the Poles”
- "Russia to Boost Military Presence in Arctic as Canada Plots North Pole Claim"

Complete the following interactive tutorial:

- “Paths Taken by Solar Radiation”
- “Temperature Data and the Controls of Temperature”

Practice:

- For the greenhouse effect, albedo is crucially important.
- Know:
  - Absorb
  - Emit
  - Transmit
  - Scatter
Explain how clouds interact with sunlight from above and surface heat from below.
Explain how sea surface temperature indicates an El Niño event.
Explain seasonal change.
Explain climate change.

Complete the following quiz:

- Geology Atmosphere Comp Structure Temp Quiz

Clouds, Air Pressure, and Weather
The gases that make up earth’s atmosphere and the controls to which they are subject are vital to our existence.

Clouds

Read the following in Earth Science:

- Chapter 17: "Moisture, Clouds, and Precipitation"

Explore the following web page:

- Use the National Weather Service Online School for Weather
  - Complete: Rows 1–5 (through Synoptic Meteorology=weather maps) and Tropical Weather for El Niño

Complete the following interactive tutorials:

- “Changes of State Involve an Exchange of Heat”
- “Moisture and Cloud Formation”
- “Atmospheric Conditions That Result in Absolute Stability”
- “Classification of Clouds, Based on Height and Form”

Practice:

- What is latent heat?
- Which changes in the hydrologic cycle are exothermic and which are endothermic?
- Which chemical bonds hold water molecules together in ice?
- What bonds hold water molecules together in their liquid state?

Dew Point and Relative Humidity

Read the following in Earth Science:

- Figure 17.9 "Sling Psychrometer Used to Determine Both Relative Humidity and Dew Point" in Chapter 17: "Moisture, Clouds, and Precipitation"

Watch the following video:
Reading Relative Humidity and Dew Point Charts

Practice:

- How does a sling psychrometer measure dew point?
- How does a sling psychrometer measure relative humidity?

The Basis of Cloud Formation

Read the following in Chapter 17: “Moisture, Clouds, and Precipitation” of Earth Science:

- Table 17.3 "Forms of Precipitation"
- Figure 17.10 "Dry Versus Wet Adiabatic Rates of Cooling"
- Figure 17.11 "Orographic Lifting and Rain Shadow Deserts"

Practice:

- Consider the rain shadow effect and define the following:
  - Adiabatic
  - Condensation level
  - Environmental lapse rate
  - Which areas get rained on or stay dry?
  - The names of different types of precipitation.

Complete the following quiz:

- Geology Moisture Clouds Precipitation Quiz

Air Pressure and Wind

Read the following in Chapter 18: “Air Pressure and Wind” of Earth Science:

- Figure 18.12 "Cyclonic and Anticyclonic Winds in the Northern Hemisphere"
- Figure 18.24 "The Relationship Between El Niño, La Niña, and the Southern Oscillation"
- Figure 18.25 "Climatic Impacts of El Niño and La Niña"
- "Jet Stream and Rossby Waves"
- pp. 563–564 ("Local Winds")
- SmartFigure 18.19 "Sea and Land Breezes"

Read and explore the following web pages:

- “Local and Regional Wind Systems”
- NOAA “El Niño Portal”

View the following videos:

- “Coriolis Effect” (5:32)
- “Atmospheric Circulation” (14:37)
Complete the following interactive tutorials:

- “Air Pressure and Wind”
- “Isobars on a Weather Map”
- “Idealized Global Circulation Proposed for the Three-Cell Circulation Model of a Rotating Earth”

Practice:

- What drives the Coriolis Effect?
- Why is latitude relevant?
- How does surface friction complicate wind flow?
- High pressure air is high elevation, dry, rotates clockwise, and flows down and out. Low pressure air is low elevation, moist, rotates counterclockwise, and flows in and up. That is why storms like hurricanes and tornadoes are low pressure systems.
- What is the El Niño Southern Oscillation (ENSO)?
- How will the weather in the U.S. Midwest change during El Niño?
- How will the weather in the U.S. Midwest change during La Niña?

Weather Patterns and Severe Storms

Read the following in Earth Science:

- Chapter 19: "Weather Patterns and Severe Storms"

Complete the following interactive tutorials:

- “Basic Weather Patterns”
- “Idealized Structure of a Large, Mature Midlatitude Cyclone”

Practice:

- Know your weather fronts:
  - Warm
  - Cold
  - Stationary
  - Occluded
- Explain continental vs. maritime
- Explain tropical vs. polar

Air Masses and Fronts

Read the following in Chapter 19: “Weather Patterns and Severe Storms” of Earth Science:

Flow aloft concerns divergence and convergence high in the troposphere.
- Figure 19.3 "Air-Mass Source Regions for North America"
- Figure 19.10 "Stage in the Formation of an Occluded Front"
- Figure 19.14 "Flow Aloft Influences Surface Winds and Pressure"

Complete the following interactive tutorial:

- “Idealized Structure of a Large, Mature Midlatitude Cyclone"

Read and explore the following web pages:

- National Weather Service Online School
- Read the weather maps in your local area with the following interactive:
  - Today's Weather

Climate and Anthropogenic Climate Change

Read the following in Chapter 20: “World Climates and Global Climate Change” of Earth Science:

- Figure 20.5 "Climates of the World"
- pp. 609-612 (“World Climates”)  
- pp. 623–628 (“Human Impact on Global Climate")  
- Figure 20.20 "CO2 Concentrations Over the Past 400,000 Years"

Read and explore the following web pages:

- “World Climates"
- “Climate Feedbacks"

Practice:

- See summary on page 610 in Earth Science.
- There is no need to memorize the Koppen classification system.
- Can you see any latitude patterns?

Complete the following quiz:

- Geology Air Pressure and Wind Quiz

Space Sciences

The science of astronomy provides a rational way of knowing and understanding the origins of Earth, the solar system, and the universe.

Homework

Access the homework document for this week:
Week 4A

Astronomy

The science of astronomy provides a rational way of knowing and understanding the origins of Earth, the solar system, and the universe.

Planetary Motion

Read the following in Chapter 21: “Origin of Modern Astronomy” in Earth Science:

- Figure 21.5 "Retrograde Motion of Mars, as Seen Against the Background of Distant Stars"
- SmartFigure 21.6 "Ptolemy's Explanation of Retrograde Motion"

Complete the following interactive tutorial:

- “Ptolemy's Explanation of Retrograde Motion”

Practice:

Know your ancient European astronomers:

- Copernicus
- Brahe
- Kepler
- Galileo
- Newton

Ptolemy had the longest-running explanation of retrograde motion but Copernicus reasoned out the correct one.

Tycho Brahe

Read the following web page:

- “Tycho Brahe”

Please correct the misconception that it is hot in summer because Earth is closer to the Sun. Earth is actually moving swiftly at perihelion in early January while we are moving most slowly at aphelion around July 4th. Explain why the speeds change over the course of a year and what actually causes seasons.

What is an ellipse?

Read the following in Chapter 21: “Origins of Modern Astronomy” of Earth Science:

- Figure 21.10 "Drawing Ellipses with Various Eccentricities"
- Figure 21.11 "Kepler's Law of Equal Areas"

Complete the following interactive tutorial:
Practice:

- The eccentricity of an ellipse is dependent on the distance between the foci. 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 does.
- A comet far from the sun at aphelion moves slowly. Conversely, when the comet is close to the sun at perihelion, it moves quickly. It also has a tail, as the sun burns off some of the comet's ice.

Earth's Tilt Axis

Earth is tilted with respect to the Sun. Two main results of that tilt angle are seasons and precession.

Read the following in Earth Science:

- SmartFigure 16.12 "The Changing Sun Angle" in Chapter 16: “The Atmosphere: Composition, Structure, and Temperature”
- SmartFigure 6.27 "Orbital Variations" in Chapter 6: “Glaciers, Deserts, and Wind”

Complete the following interactive tutorial:

- “Characteristics of the Solstices and Equinoxes”
- “The Changing Sun Angle”
- “Precession of Earth's Axis”
- “Orbital Variations”

Earth?Moon?Sun Relationships

As the Moon orbits the Earth and the Earth orbits the Sun, the lineup of these three bodies cause phases of the moon as well as eclipses.

Read and explore the following web pages:

- “Top 4 Keys to Mastering Moon Phases”
- “What are Total Solar Eclipses?”
- “What is a Total Lunar Eclipse?”

Read the following in Chapter 21: “Origins of Modern Astronomy” in Earth Science:

- Figure 21.21 "Illustration of the Difference Between A Solar Day and a Sidereal Day"
- Figure 21.24 "The Difference Between a Sidereal Month (27 ½ days) and a Synodic Month (29 ½ days)"
- SmartFigure 21.27 "Lunar Eclipse"
Complete the following interactive tutorials:

- “Phases of the Moon”
- “Lunar Eclipse”

Practice:

- Synodic/solar means "with respect to the Sun"—what does an observer see from Earth?
- Sidereal means "with respect to the stars"—what does an observer beyond Earth see (what is really happening)?
- How do moon phases affect eclipses (solar vs. lunar) and tides (spring vs. neap)?
- Know:
  - Waxing vs. waning
  - Gibbous vs. crescent

Solar System

This section reviews information about the solar system.

Evolution of Earth and Moon

Read the following in Earth Science:

- Table 21.1 "Period of Revolution and Solar Distances of Planets" in Chapter 21: "Origins of Modern Astronomy"
- p. 12 ("Early Evolution of the Earth") in Chapter 1: "Introduction to Earth Science"

Complete the following interactive tutorial:

- “The Planets: An Overview”
- “Earth’s Moon”
- “Formation and Filling of Large Impact Basins”

Solar System Tour

Read the following in Earth Science:

- Chapter 22: "Touring Our Solar System"
  - Figure 22.2 ("Planetary Interiors")

Read the following web pages:

- Jovian Planets
  - "Magnetic Field of the Earth" and “The Dynamo Effect”

Dwarf Planets

- “Dawn at a Glance”
- “New Horizons”
Complete the following interactive tutorial:

- "A Brief Tour of the Planets"
- "Orbital Motion of Earth and Other Planets"

Practice:

- Memorize the correct order of the eight planets. Here is a mnemonic that will help: "My Very Educated Mother Just Served Us Nachos."
- Know the five zones:
  - Terrestrial planets
  - Asteroid belt
  - Jovian planets
  - Oort cloud
- Comets are icy and lumpy.
- Asteroids are rocky and lumpy.
- Dwarf planets are rocky and round, with moons, atmospheres, and density-differentiated interiors (like Earth).
- Large moons of Jovians planets are surprisingly terrestrial, too, with hydrospheres and atmospheres of their own.
- Look up "cryovolcano."
- Every planet has a solid core. Near the Sun, metal and rock dominate; beyond the frost line, rock and ice dominate.
- Jovian planets have liquid/slushy mantles that generate very strong magnetic fields. Compare that to how Earth makes its own magnetic field.
- Dwarf planets are found in both the Asteroid Belt and the Kuiper Belt. Eris is a dwarf planet that is more massive than Pluto and further away from the Sun.

Complete the following quiz:

- Geology Touring Solar System Quiz

Beyond Our Solar System
Since astronomers cannot study the universe by bringing it into the laboratory, and because the vast majority of celestial objects are too far away to visit, astronomers collect and study those things that come to Earth from space.

Spectroscopy

Read the following in Earth Science:

- Chapter 23: "Light, Astronomical Observations, and the Sun"
- Figure 23.2 "Electromagnetic Radiation"

Complete the following interactive tutorial:

- “Formation of the Three Types of Spectra"
• “The Doppler Effect”

Practice:

• Memorize the seven parts of the spectrum from longest to shortest wavelength: radio, microwave, infrared, visible, ultraviolet, x-ray, gamma. Note opacity/transparency of earth’s atmosphere to specific wavelengths.
• Know about absorption (dark-line) and emission (bright-line) spectra. Spectroscopy provides info about chemical composition of atmospheres/surfaces (but not interiors) and through Doppler effect, the speed, direction, and rotation rate of objects.

Stars and Stellar Evolution

Read the following in *Earth Science*:

• Chapter 23: “Light, Astronomical Observations, and the Sun"

Complete the following interactive tutorial:

• “Diagram of the Sun's Structure”

Practice:

• Thermonuclear fusion occurs in a star's core. Granules facilitate convection to bring the energy to the surface. Sunspots are relatively cool areas trapped by tangled magnetic field lines. The Sun's atmosphere is called the corona. Coronal mass ejections (CMEs) and solar flares create space weather and make auroras.
• Note that aurora is an atmospheric phenomenon. You need three things to make an aurora:
  ○ (1) **Space weather (solar wind, etc.)** to provide high-speed electrically-charged particles like solar protons
  ○ (2) **Magnetic field** (with corresponding electrical field)—auroras often follow a planet's magnetic field lines
  ○ (3) **Thick atmosphere** to have enough atoms to get hit by the fast particles—when an atom is hit, some of its electrons briefly absorb the extra energy and get excited, then drop down to their original energy states and emit the extra energy as light. That is when the Northern Lights (aurora borealis) glow

Spectroscopy and Stars

Complete the following interactive tutorials:

• “Hertzsprung-Russell Diagram”
• “Evolutionary Stages of Stars Having Various Masses”

Practice:

• Luminosity (brightness) is directly correlated with mass; as one goes up, so does the
other. Therefore, low-mass dwarf stars are at the bottom and high-mass giants/supergiants are at the top. Note that the temperature scale is backward, so hot blue-white stars are on the left and cool red stars are on the right.

- When a star that has enough mass uses up all the hydrogen in its core, it jumps off the main sequence, starts burning helium, and becomes a red giant. As the helium fuses to carbon, then to silicon and other elements to iron, the star contracts through variable stages. Some stellar remnants create nebulas, novas, or supernovas. Depending on initial mass, a star dies to become a white dwarf, a neutron star, or a black hole.

Complete the following quiz:

- Geology Light Astronomical Observation Sun Quiz

Galaxies and the Universe

Read the following in Earth Science:

- Chapter 24: "Beyond Our Solar System"
  - Figure 24.3 "Time Line for the Evolution of the Universe"

Read the following web page:

- "Cosmic Microwave Background"

Complete the following interactive tutorials:

- "Spiral Galaxies"
- "Raisin Bread Analogy for an Expanding Universe"
  - This discusses the raisin bread analogy nicely, then gets into the more important discussion of how the universe might die: Big Crunch or Big Rip (Big Chill)

View the following video:

- "Big Bang Cosmology: Looking Back to the Down of Time" (6:04)
  - Since the Big Bang, the rate of expansion of the universe has been fast (inflation), slowed until about 7 billion years ago, and then sped up again (getting faster today). Dark energy might explain this but no one understands what it is yet.

Complete the following quiz:

- Geology Beyond Our Solar System Quiz

Review

Spend this week reviewing the notes you have taken and the homework you have completed. Then complete the two-week eight practice test homework documents.
Homework

Access the homework documents for this week:

- Week 4B
- Week 4C

Final Steps

Congratulations on completing the activities in this course! This course has prepared you to complete the assessments associated with this course. If you have not already been directed to complete the assessments, schedule and complete your assessments now.

Exam Requirements

In order to receive a "Pass" on your degree plan, you must pass Earth and Space Sciences: Content Knowledge (5571) Praxis Subject Assessment based upon the WGU cut score. Additionally, if the state in which you seek licensure also requires the Praxis exam, you must pass the exam based on that state’s cut score before you will be admitted into demonstration teaching or allowed to graduate.

*Note: It is possible to pass the exam based on either the WGU cut score or your state’s cut score and still need to take it again in order to satisfy both cut scores.*

Please review the following article in the WGU Student Handbook:

- Article 2834 “WGU Cut Scores for Assessments That Require Praxis Examinations”

Payment

WGU will pay for your first two attempts at the Earth and Space Sciences: Content Knowledge (5571) Praxis Subject Assessment. You will be responsible for paying third and subsequent attempts. WGU will not pay for extended or emergency registration, so be sure to plan ahead when scheduling the exam. Please see the following web page for detailed information on test and service fees:

- "Test and Service Fees"

Scheduling

The Earth and Space Sciences: Content Knowledge (5571) Praxis Subject Assessment is only offered as a computer-delivered test. Please visit the following web page for a list of available sites and testing windows.

- "Praxis Test Centers and Dates"

These tests are offered only during certain time frames and not all test centers are open on all test dates, so plan accordingly. Once you have selected a testing center and date, use the following directions to schedule your exam:
• "How to Schedule a Praxis Exam"

Note: You must schedule your Praxis exam through WGU in order to have WGU pay for the exam.

Follow the ETS guidelines on what to bring on exam day by accessing the following web page:

• "What to Bring"

Submit Your Score

You will need to submit your scores to WGU after completing this exam. Once you have submitted your passing score, you will receive a "Pass" on your Degree Plan for the assessment.

After completing an outside vendor assessment, follow the directions for submitting a score report on the "Following Outside Vendor Assessments" page.