Lesson 4.12: Life Science – Nitrogen & Water Cycles

Weekly Focus: Reading Comprehension
Weekly Skill: Finding Evidence from Passage

Lesson Summary: This week students will read two different passages on the nitrogen cycle. The first passage includes information about the water cycle while the second passage focuses on the nitrogen cycle. Students can also review the material from the reading passages by watching a short video clip, if time permits.

Materials Needed:

- Comprehension Reading **Unit 4.12 Handout 1**
- Comprehension Reading **Unit 4.12 Handout 2** (Spectrum Science, Grade 6, pages 54-55)
- Video **Unit 4.12 – The Nitrogen Cycle** (2:46 min)
- Extra Work/Homework **Unit 4.12 Handout 3**

Objectives: Students will be able to…

- Read comprehension passages with vocabulary related to the nitrogen and water cycles
- Practice citing evidence from reading passages to answer comprehension questions

College and Career Readiness Standards: RI, RST, WHST

ACES Skills Addressed: EC, LS, ALS, CT, SM, N

Notes: Please review and be familiar with classroom routine notes for: reading for fluency strategies (**Routine 2**), summarizing techniques (**Routine 4**), self-management skills (**Routine 1**). The notes for the different activities will help with making a smooth transition to each activity.

GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be two short answer questions (suggested 10 minutes each) where students may have to design an experiment or identify errors in a conducted experiment, summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.

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Activities:

Warm-Up: KWL Chart	Time: 10 - 15 minutes

- As students enter the class, have the following written on the board or overhead **"The *nitrogen cycle* describes how nitrogen moves between plants, animals, bacteria, the atmosphere (the air), and soil in the ground."** Have students create a **"KWL"** chart on a piece of notebook paper (below). This helps to activate students' prior knowledge by asking them what they already **K**now (column 1); students (collaborating as a classroom unit or within small groups) set goals specifying what they **W**ant to learn (column 2); and after reading students discuss what they have **L**earned (column 3).
- Students apply higher-order thinking strategies which help them construct meaning from what they read and help them monitor their progress toward their goals.

KWL Chart:

K - What (else) do I KNOW?	W - What do I WANT to know?	L - What did I LEARN?

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Activity 1: Comprehension Reading (Unit 4.12 Handout 1)	Time: 40 - 45 minutes

1) Hand out **Unit 4.12 Handout 1** to students.
2) Explain to students they will read about the nitrogen cycle. This information is important foundational knowledge for questions that may be on the 2014 GED Science module.
3) Discuss with students that when reading for comprehension, there are many strategies to use: read the title to predict what the reading is about; look at the subheadings to get a better idea of what each section is about; if there are images, look at them to gain understanding; while reading remember to ask "What is this all about?"
4) Have students read the passages independently while answering the questions at the end.
5) Circulate class while they are reading to make sure they understand the information presented and see if there are any questions.
6) Review answers as a whole class. Ask students to point to the evidence from the reading passage that helped them determine the answer(s).
7) If there is time, students can summarize the reading or write the main idea.
8) Students can fill in the **"L"** portion of the KWL chart.

Break: 10 minutes

Activity 2: Comprehension Reading (Unit 4.12 Handout 2)	Time: 40 - 45 minutes

1) Hand out **Unit 4.12 Handout 2** to students.
2) Explain to students they will continue learning about the nitrogen cycle by reading another passage. This information is important foundational knowledge for questions that may be on the 2014 GED Science module.

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3) Discuss with students that when reading for comprehension, there are many strategies to use: read the title to predict what the reading is about; look at the words in bold and their definitions on the left side of page; if there are images, look at them to get a better understanding; while reading remember to ask "What is this all about?"
4) Have students read the passages independently while answering the questions on each page.
5) Circulate class while they are reading to make sure they understand the information presented and see if there are any questions.
6) Review answers as a whole class. Ask students to point to the evidence from the reading passage that helped them determine the answer.
7) If there is time, students can create their own Venn diagram (from previous units) and look for what is similar and what is different from each of the reading passages with regards to the nitrogen cycle. This is an opportunity for students to practice what may be expected of them on the 2014 GED test.

Wrap-Up: Summarize	**Time: 5 minutes**
Have students turn to a partner (or write in their journals) about what they have learned today about nitrogen and water cycles. Ask them to tell a partner one thing they learned today in one or two sentences. *Note: Use Routine 4 Handout*	

Extra Work/Homework: Unit 4.12 handout 3	**Time: 30 - 45 minutes outside of class**
Students can continue to read about photosynthesis (unit 4.11) and its connection with Earth and Space science with a ReadWorks.org passage. This activity does a great job of bringing various science themes together in one reading passage. It is highly recommended for students to do outside of class.	

Differentiated Instruction/ELL Accommodation Suggestions	**Activity**
If some students finish early, they can turn their paper over and summarize the reading passage.	**Activity 1 and Activity 2**
Teachers should be aware that ELLs could have some difficult time with some of the vocabulary encountered in the handouts for Activity 1 & 2. Encourage them to look for context clues in the reading that will help them with interpreting the main idea of each reading passage.	**Activity 1 & 2**

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Online Resources:

If students have Internet connection, they can try an online interactive activity with the nitrogen cycle. It is from PBS Learning Media (click on "launch" to make it interactive).

http://www.pbslearningmedia.org/resource/lsps07.sci.life.eco.nitrogen/the-nitrogen-cycle/

This is a link a slideshow presentation on the nitrogen cycle. There are plenty of images that may help with comprehension.

http://www.picse.net/CD2011/nitrogen-cycle/index.html

This is an interactive "game" about the nitrogen cycle.

http://www.classzone.com/books/ml_science_share/vis_sim/em05_pg20_nitrogen/em05_pg20_nitrogen.swf

Suggested Teacher Readings:

- GED Testing Service – GED Science Item Sample (to get an idea of what the test *may* be like)

http://www.gedtestingservice.com/itemsamplerscience/

- Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:

http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf

- Minnesota is getting ready for the 2014 GED test – the following is a website with updated information on the professional development in Minnesota regarding the 2014 GED.

http://abe.mpls.k12.mn.us/ged_2014_2

- Essential Education's 2014 GED Test Curriculum Blueprint (PDF)

http://www.passged.com/media/pdf/educators/curriculum-blueprint.pdf

Unit 4.12 handout 1 (4 pages total)

How Do Nitrogen and Water Cycle?

Most of Earth's water is in the oceans. Most of the nitrogen is a gas in the air. Living things use both water and nitrogen, which cycle between Earth's surface and atmosphere.

Nitrogen in the Environment

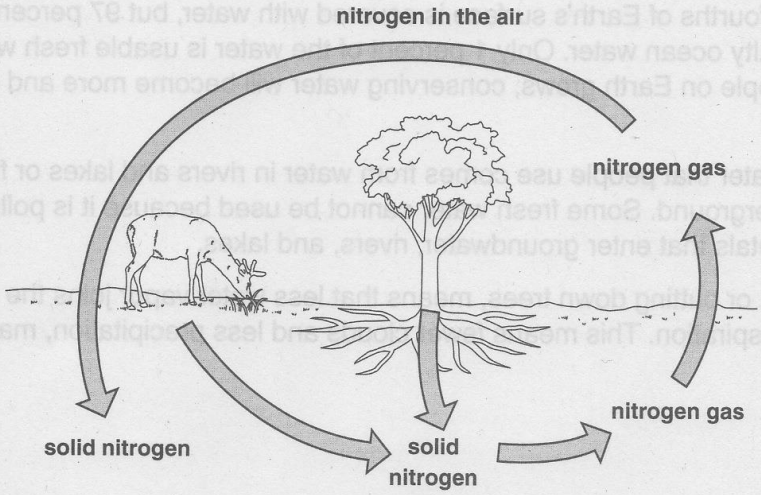
Much of Earth's atmosphere is made of nitrogen gas. But most plants and animals need nitrogen in the form of nitrogen compounds in order to use it. During nitrogen fixation, nitrogen gas is changed into useful nitrogen compounds.

Lightning helps with nitrogen fixation. The energy from lightning joins nitrogen and oxygen in the air. The new compounds mix with rainwater.

Most nitrogen fixation is done by special bacteria that live in soil, water, and on the roots of some plants. The roots feed the bacteria, and the bacteria give the plants fixed nitrogen.

Organisms called decomposers keep plants and animals from using all the nitrogen. Decomposers such as bacteria and fungi break down, or decompose, animal wastes and dead plants and animals. This puts nitrogen compounds back into the soil, so plants can use them. Other bacteria change nitrogen in the soil into the nitrogen gas in the air.

Sometimes people do things that leave too much or too little nitrogen in the soil. This upsets the nitrogen cycle. When farmers cut down plants that are used for food, the nitrogen in the plants goes away and does not come back. Water can also wash nitrogen out of the soil. Farmers put chemicals called fertilizers on the soil to add nitrogen back in. They also plant peanuts or beans because nitrogen-fixing bacteria live on their roots.



Nitrogen Cycle

Water in the Environment

The bodies of all living things are made mostly of water. Living things need water so their life processes can work. Like oxygen and carbon dioxide, water cycles through the environment.

Most of Earth's water is found in oceans. Ocean water is salty. Fresh water is found in lakes, rivers, and other bodies of water. Some of the water on land is under the ground in the soil or in spaces between solid rocks. Frozen water makes up snow, ice, and large pieces of snow and ice called glaciers. Water in the atmosphere is water vapor and tiny drops of water or ice in clouds.

The Water Cycle

Water is always moving from Earth's surface to Earth's atmosphere and back to the surface in a process called the water cycle. Energy from the Sun heats up water in the oceans and on land. During evaporation, water uses this energy to change from a liquid to a gas called water vapor. Water evaporates from a plant's leaves during a process called transpiration.

Animals are also part of the water cycle. They give off water as urine, sweat, and as water vapor when they breathe. Any liquid water animals give off evaporates.

Water vapor in the atmosphere can condense, or turn into a liquid. Tiny drops of water form clouds. When the drops of water get heavy, they fall to Earth as rain, sleet, hail, or snow. Water that falls to Earth from a cloud is called precipitation.

Water Conservation

Almost three-fourths of Earth's surface is covered with water, but 97 percent of Earth's water is salty ocean water. Only 1 percent of the water is usable fresh water. As the number of people on Earth grows, conserving water will become more and more important.

Most of the water that people use comes from water in rivers and lakes or from water that is stored underground. Some fresh water cannot be used because it is polluted by chemicals and metals that enter groundwater, rivers, and lakes.

Deforestation, or cutting down trees, means that less water vapor joins the water cycle through transpiration. This means fewer clouds and less precipitation, making these places drier.

Name _____ Date _____

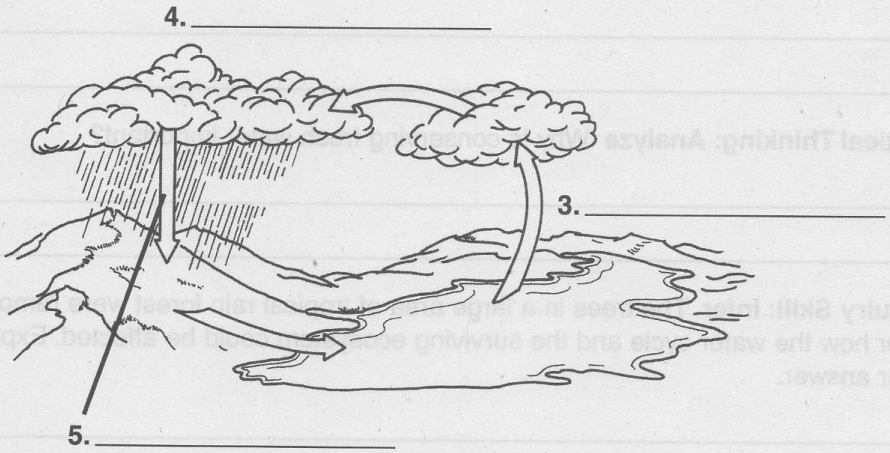
How Do Nitrogen and Water Cycle?

Fill in the blanks.

1. The process of changing nitrogen gas into usable nitrogen is called _____.

2. As a result of _____, nitrogen compounds return to the soil.

Label the steps of the water cycle in the diagram below.



6. Of the 3 percent of Earth's water that is not salt water, less than _____ is usable fresh water.

7. Available fresh water is limited by _____, particularly by metals and chemicals.

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Name _____ Date _____

8. Main Idea Why is the cycling of nitrogen and water so important for life?

_____

_____

9. Vocabulary Explain the difference between evaporation and transpiration.

_____

_____

10. Reading Skill: Main Idea and Details What process makes nitrogen usable by plants and animals? What are two ways this process takes place?

_____

_____

11. Critical Thinking: Analyze Why is conserving fresh water important?

_____

_____

12. Inquiry Skill: Infer The trees in a large area of tropical rain forest were removed. Infer how the water cycle and the surviving ecosystem could be affected. Explain your answer.

_____

_____

_____

13. Test Prep Nitrogen gas in the air can be used by

A most plants.
B certain animals.
C certain bacteria.
D all organisms.

Lesson 4.12: Life Science – Nitrogen & Water Cycles

Unit 4.12 handout 1

TEACHER ANSWER KEY

1. nitrogen fixation

2. decomposition.

3. evaporation

4. condensation

5. precipitation.

6. 1 percent

7. pollution

8. *Answer will vary. Suggested answer*: Both substances are necessary for life, so they need to be recycled.

9. *Answer will vary. Suggested answer:* Evaporation changes water from a liquid to a gas; transpiration is the evaporation of water from a plant's leaves.

10. *Answer will vary. Suggested answer:* The process is nitrogen fixation and it is made from lightning or the action of bacteria

11. *Answer will vary. Suggested answer*: It is scarce in some places and an increasing number of people on Earth means more water will be used, making it more scarce.

12. *Answer will vary. Suggested answer:* Transpiration from leaves no longer adds water vapor to the air. This means less water will condense and fall as precipitation. These areas may be drier.

13. C

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4.12 Handout 2 (3 pages total--read pages 54-55 from Spectrum Science before completing word match)

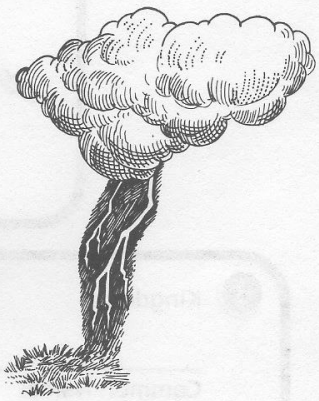
Name _____ Date _____

The Nitrogen Cycle

Another important cycle is the nitrogen cycle. Nitrogen is necessary for life. It is found in all proteins that cells use for growth. The amount of nitrogen stays the same as it is cycled through living and nonliving things. Match each term in the word box to its description.

lightning	leaching	ammonia	legumes	amino acids
bacteria	atmosphere	decomposition	nitrification	animals

1. _____ Nitrogen is a building block of these, a component of protein in all living things.
2. _____ 80% of this consists of nitrogen, making it the largest reservoir of this element on Earth.
3. _____ Only certain bacteria, volcanic action, and this can break down nitrogen in the air and convert it into a form that enters food webs.
4. _____ Nitrogen is fixed into the soil for plants to use through the activities of this.
5. _____ Plants use nitrogen in the soil as they grow. Directly or indirectly, plants are the only nitrogen source for these.
6. _____ During this process bacteria and fungi break down wastes and remains of organisms into ammonia.
7. _____ This process occurs when water in the soil moves out of an area, taking the dissolved nitrogen and other nutrients with it.
8. _____ This plant crop is able to fix nitrogen from the atmosphere into the soil.
9. _____ During this process bacteria convert nitrogen in the soil and release it back into the atmosphere.
10. _____ When plants and animals die, their nitrogen compounds are broken down into this.



4.12 Handout 2

TEACHER ANSWER KEY

1. true

2. false

3. true

4. false

5. false

6. true

7. The role of nitrogen fixing bacteria is to convert the nitrogen in the air and soil into a usable form

8. The two sources of free nitrogen in the soil are animal waste and decaying plant and animal matter

9. Too many nitrates in a body of water can be a problem because bacteria don't have a chance to convert the nitrates back into nitrogen gas, which can make the water dangerous for people and animals.

10. Nitrates make their way into lakes and stream through rainwater and water used to irrigate crops

11. The sources of nitrogen for carnivores is by preying on herbivores

Unifying Concepts and Processes:

Answer may vary. Possible answer: **The oxygen cycle; both happen continuously, and both are necessary for life on Earth**

Page 3:

1. amino acids

2. atmosphere

3. lightning

4. bacteria

5. animals

6. decomposition

7. leaching

8. legumes

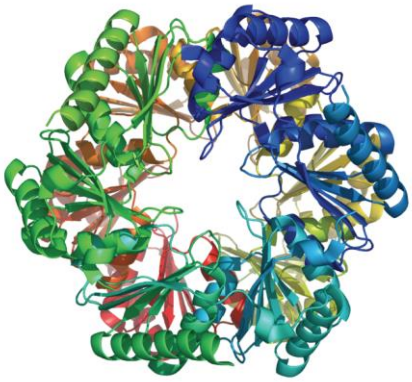
9. nitrification

10. ammonia

4.12 Handout 3 (5 pages total)

From ReadWorks.org –

Processes



There's a deep and complex relationship between living creatures, inorganic materials such as rock and minerals, and the climate conditions we experience, such as rain and wind. These relationships are not always easy to see. Sometimes, the relationship operates on a level that is microscopically small, such as the way plants transform sunlight into nutrients. Other times, the relationship can be observed only across a hugely long span of time – hundreds, thousands, or even millions of years. But the connection is there, and we're in a unique and privileged position to see and appreciate it.

If you could overcome these two limitations of everyday seeing – if you could see things that were very small and subtle, and if you could see things that occurred over a very long stretch of time, - what would you see?

It's a matter of debate, but there's certainly a good case to be made that photosynthesis may be the most exciting earth process we know of. We know that plants are capable of converting water, carbon dioxide, and sunlight into the oxygen. They are able to achieve this remarkable feat with a relatively small number of separate parts, and have done so, very reliably, for ages. Anyone who's ever had a household plant, watered it, set it near light, watched it grow, and felt the air in her home to be cleaner has experienced this magic firsthand. But if you could see this process on a

microscopically small scale, this abstract magic would be revealed as an extraordinary set of mechanisms.

What if you could see photosynthesis working over the span of billions of years? This is the other remarkable thing: This mechanism, which operates on the smallest scale imaginable, has consequences that are literally global in scope, and span ages. If you could watch the earth evolve, you could see how, over two-and-a-half billion years ago, before the emergence of plants that could release oxygen, there simply wasn't much of it at all in the atmosphere. Not much oxygen in the atmosphere meant there were nowhere near the number and variety of creatures we've come to know today.

Over the course of hundreds of millions of years, you'd slowly begin seeing the emergence of tiny organisms capable of producing oxygen. However, you'd also notice that most of that oxygen was captured by minerals and other organic matter, never growing to very high levels in the atmosphere. Sooner or later, though, these organic and inorganic matter would reach their saturation point—the moment when they simply could not absorb any more oxygen. That's when the oxygen created by organisms would become free oxygen. Free oxygen for everyone.

Then, as an observer across the ages, you'd begin seeing the atmosphere change, from one dominated by methane and other elements, to one plentiful with oxygen. As we know, this is what set the stage for a huge diversity of mineral and organic life to emerge, including, many billions of years later, human beings. All of us, along with the foods we consume and the ground we walk on, are the direct descendants of a process that began billions of years ago, and that continues today, all across the planet, on a microscopically small level. What could be more exciting than that?

Of course, if photosynthesis is the most exciting earth process we enjoy, then its energy from the opposite direction—heat from the Earth's core—that's the most mysterious. That's because it originates, at least in part, from events that occurred at the very formation of the planet.

Can you imagine such a thing as "pre-earth" space? It's a pretty heavy concept. But imagine the part of the universe where the earth would soon be, but wasn't yet. There, when the hot gases and particles were pulled together by gravity to create the early earth, immense heat was generated, and the resulting planetary core continues to cool to this day, radiating heat outward.

The movement of more and less dense parts of the earth's core produces heat. Most of all, there are massive amounts of radioactive material deep in the earth's core, decaying slowly and releasing heat as they do.

While energy from the sun sets in motion extraordinary interactions between the atmosphere, organisms and minerals, energy from the earth's core profoundly affects the shape of the ground we walk on—literally. Again, imagine having the power to see very small and very slow. Processes that result from earth's energy operate at these levels. We're all familiar with the most visible results: earthquakes and volcanoes, which can be mighty indeed. But energy from the earth's core is also responsible for the shift of tectonic plates, that is, the very placement of one continent relative to another, and, as a result, the emergence of mountains, chasms, oceans, and myriad more aspects of the environment.

This is what it really means to contemplate the origins of the planet and the universe. It's not simply a matter of the far-away cosmos and their relationship to us. It's the question of how it came to be that events occurring unimaginably long ago, and taking place at a rate so slow it's impossible to see, have come to shape the ground we walk on. The decay of radioactive material deep in the earth's core is responsible for not only the Rocky Mountains, but the formation of cities and societies that have lived there for generations, such as Rocky Mountain National Park, which serves as a beacon to the natural wonders of America and Canada. It's responsible for mountains that serve as barriers, bringing to life divisions in culture unique to each side, while also posing a challenge to be crossed and burrowed into, spurring on scientific innovation in the process.

So many aspects of what it means to be human, from the way cities are constructed, to the way nations are organized, are influenced by our natural environment, by the vast and complex set of processes that have shaped the earth since its inception, and will continue to do so long into the future.

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Answer the following questions from information in the reading passage.

1. Photosynthesis is an example of what?
- **A.** one of philosophy's big ideas
- **B.** one of Earth's key processes
- **C.** one of humankind's best inventions
- **D.** one of science's most well-known innovations

2. In this passage, the author provides a list of what?
- **A.** ways that the earth has been shaped by ancient natural processes
- **B.** ways that the earth has been shaped by scientific innovation
- **C.** ways that our lives have been shaped by philosopher's theories
- **D.** ways that our lives have been shaped by cultural events

3. Photosynthesis is an important process that supports many kinds of life. What evidence from the text supports this conclusion?
- **A.** Photosynthesis may be the most exciting earth process we know of.
- **B.** Photosynthesis produces oxygen, which allowed diverse mineral and organic life to emerge.
- **C.** Photosynthesis operates on the smallest scale imaginable.
- **D.** Photosynthesis is a process by which plants convert water, carbon dioxide, and sunlight into oxygen.

4. What do processes on Earth have an impact on?
- **A.** living things only
- **B.** living things and the non-living environment
- **C.** the non-living environment only
- **D.** climate conditions only

5. What is this passage mainly about?
- **A.** the history of the planets and moons within our solar system
- **B.** how the development of the earth has been impacted by its natural processes
- **C.** the early organisms that helped to populate the earth with oxygen
- **D.** the consequences that arise from the earth's tectonic plate shifts

6. The author describes processes that involve changes happening on a small scale, and over billions of years. How does the author help the reader to understand those processes?
- **A.** The author includes graphs, charts, and a timeline.
- **B.** The author includes detailed illustrations to show these processes.
- **C.** The author describes what one would see as an "observer across the ages."
- **D.** The author describes instructions for conducting one's own experiments.

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7. Choose the answer that best completes the sentence below.

Energy from the sun sets in motion extraordinary interactions between the atmosphere, organisms and minerals. _____, energy from the earth's core profoundly affects the shape of the ground we walk on.

A Consequently
B Meanwhile
C In conclusion
D For example

8. Human beings need oxygen to breathe. Why is photosynthesis essential to the survival of human beings?

_____

_____

_____

_____

9. Explain how the earth's core has impacted human life. Use evidence from the text to support your answer.

_____

_____

_____

_____

10. Could humans survive on Earth over two-and-a-half billion years ago, before the emergence of plants? Why or why not? Use evidence from the text to support your answer.

_____

_____

_____

_____

Unit 4.12 Handout 3

TEACHER ANSWER KEY

1. B

2. A

3. B

4. B

5. B

6. C

7. B

8. *Answers may vary. Suggested answer:* Photosynthesis produces oxygen, which humans need to breathe in order to survive.

9. *Answers may vary. Suggested answer:* Students should explain that the earth's core affects the shape of the ground we walk on. Advanced answers may explain that this has implications on where people settle and how they form communities and societies. Students may also note that the decay of radioactive material deep in the earth's core is responsible for not only the Rocky Mountains, but the formation of cities and societies that have lived there for generations, such as Rocky Mountain National Park. It's responsible for mountains that serve as barriers, bringing to life divisions in culture unique to each side, while also posing a challenge to be crossed and burrowed into, spurring on scientific innovation in the process

10. *Answers may vary.* Suggested answer: No. Students should note that humans need oxygen to breathe, that photosynthesis creates oxygen, and that our atmosphere did not become full of oxygen until after plants evolved.