NASA Spotlite
Interactive Lesson

Composition of Earth's Atmosphere
Grades 5-8

Teacher Packet

NASA Spotlite Interactive Lesson Guide

This NASA eClips™ Spotlite Interactive Lesson supports existing curriculum and should be used as one of many strategies to build students' understandings of science content. The goal of this 5E lesson is to correct the science misconception. Through watching a student-produced video (Engage), completing activities (Explore), learning new vocabulary collectively using a Frayer Model (Explain), and applying new information (Extend/Elaborate), students will develop an understanding of the science content and how to correct the science misconception.

This PDF document should be downloaded to use the interactive features. The hyperlinks included in this document open PDFs or webpages and may perform differently based on the device being used. Links may have to be cut and pasted into a web browser to open.

Try using Adobe Acrobat Reader and Flash Player for optimal performance of all interactive features included in this guide.

An accompanying student packet is located on the NASA eClips™ Website.

What are NASA Spotlites?

NASA Spotlites are 90-120 second student-produced video segments that address common science misconceptions as determined by reputable assessment sources such as the National Assessment of Educational Progress (NAEP), National Science Foundation (NSF) Factual Knowledge Questions, and the Misconceptions-Oriented Standards-based Assessment Resources for Teachers (MOSART). NASA Spotlites are designed to increase scientific literacy in a standards-based classroom. By producing Spotlite videos, students gain production experience, as well as deepen their understanding of science content. Approved NASA Spotlites can be found at the NASA eClips™ website. https:// nasaeclips.arc.nasa.gov/

Animated 5E Instructional Model

NASA eClips™ Guides use the 5E constructivist model developed by Biological Sciences Curriculum Study. Constructivism is an educational philosophy that promotes student-centered learning where, students build their own understanding of new ideas. The 5E instructional model consists of five stages for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate.

Lesson Information

Science Misconception

Student Misconception: Oxygen is the most abundant gas in Earth's atmosphere.

Standards

Next Generation Science Standards

Disciplinary Core Idea:
5-ESS2.A: Earth Materials and Systems
Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. Crosscutting Concepts:
A system can be described in terms of its components and their interactions.

Objective

As a result of watching the Spotlite video, learning the vocabulary collaboratively, and discussing the composition of Earth's atmosphere, students explain that Earth's atmosphere is mostly made up of nitrogen.

Time Frame

Between two and three 45-minute class periods:
Day 1 - Engage and Explore
Day 2 - Explain and Elaborate/Extend
Day 3 – Evaluate

Safety

Review digital citizenship before students use online resources.

This icon identifies the suggested directions and information to read to students.

Materials

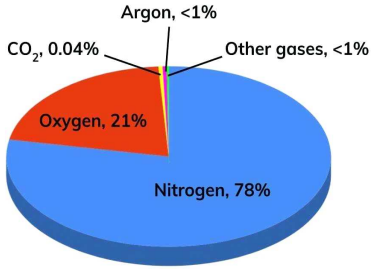
Assessment
Per student: copy of pretest and posttest
Frayer Model Activity

- Per small group: copy of a digital Frayer Model (alternatively, this can be printed)
- Per classroom: chart paper for posting final vocabulary definitions

Background Information

- The layer of gases that surrounds Earth is called the atmosphere.
- The atmosphere is made up of a mixture of chemical elements and compounds that we collectively call air.
- The most abundant elements in air are the gases nitrogen, oxygen and argon.
- The most abundant compounds in air are the gases carbon dioxide (CO2), and water vapor (H2O).
- The atmosphere contains tiny solid particles like dust and pollen.

Target Vocabulary:
matter, element, compound, water vapor, carbon dioxide, atmosphere, oxygen, nitrogen, argon



Remind students to save responses. Suggested steps: Under "file" choose "save as." Type your name in front of the document name. Choose "save."

Engage

Pre-Assessment

Probe for students' prior knowledge using the pre-assessments.

1. Pretest items are located on page 12. Student packets contain a pretest.
2. Essential question
3. Discussion questions (this page)

Essential Question
What are the primary gases making up Earth's atmosphere?

Today's Lesson

In today's lesson you will learn about the composition of Earth's atmosphere. Using interactive Frayer Models, you will learn key vocabulary that will help you form a clearer understanding of the elements, compounds, and other materials that make up our atmosphere.

What do you already know about the gases in Earth's atmosphere?

True or False: Oxygen is the most abundant gas in Earth's atmosphere.

Select the best answer.
True
False

Spotlite Video

Next, you will watch a short video about Earth's atmosphere. As you watch the video, pay close attention to any new vocabulary.
(Example vocabulary: matter, element, compound, water vapor, carbon dioxide, atmosphere, oxygen, nitrogen, argon)

Video Link- NASA Spotlite: Atmosphere Dragon
NASA eClips Website - https://nasaeclips.arc.nasa.gov/spotlite/earths-atmosphere/earths-atmosphere
NASA eClips YouTube - https://youtu.be/e-wYfLpRl3U

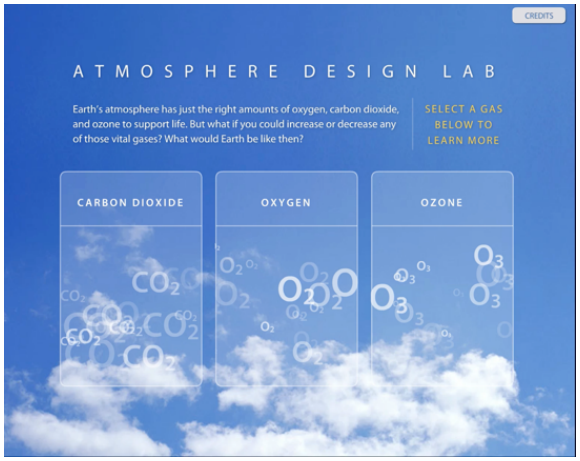
Use these questions to lead the class in a discussion.

1. What did you learn about Earth's atmosphere from the video?
2. What is the most abundant gas in Earth's atmosphere?
3. Name some abundant compounds in Earth's atmosphere.
4. What solid particles are found in Earth's atmosphere?
5. What can be found in Earth's atmosphere that is not naturally occurring?

Explore

Explore Activity

Use this interactive to explore carbon dioxide, oxygen and ozone in Earth's atmosphere.



Resource credit - http://forces.si.edu/atmosphere/interactive/atmosphere.html

What did you learn about increasing or decreasing the amount of the following found in Earth's atmosphere?

1. carbon dioxide
2. oxygen
3. ozone

This chart show the gases in Earth's atmosphere.

Gases	Amount in Earth's Atmosphere
Oxygen (O2)	21.0%
Argon (Ar)	0.9%
Nitrogen (N2)	78.0%
Carbon dioxide (CO2)	0.035%

Graph the data on the table. What does it show about the gases in the atmosphere?

Graphs can be made on paper, using standard spreadsheet programs, or at an online website like Create-a-Graph: https://nces.ed.gov/nceskids/createagraph/ .

Explore

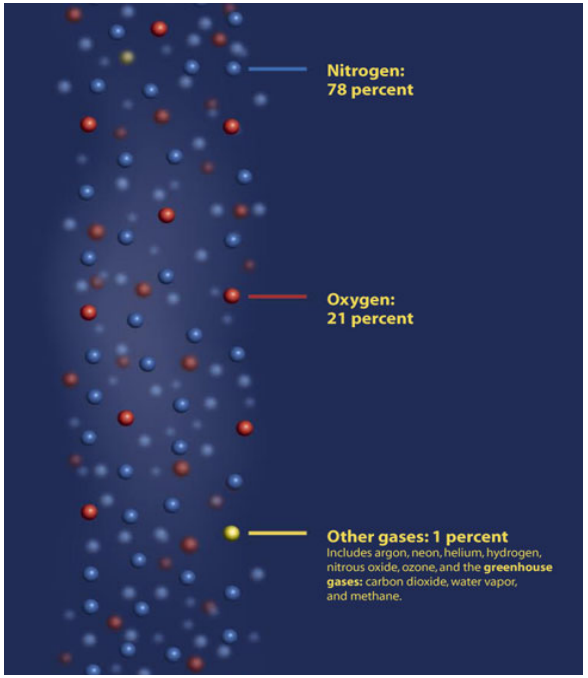
Think-Pair-Share

Do you find it surprising that oxygen is not the most abundant gas in Earth's atmosphere? Why or why not?

What other gases/materials do you think make up the remaining 1% of the atmosphere?

Let's compare your answers.

Earth's atmosphere consists largely of a mixture of nitrogen (78%) and oxygen (21%) gases. The remaining 1% of the atmosphere contains gases that are relatively inactive (they do not interact with other elements). These inactive gases include argon, neon, helium, hydrogen, and xenon. Other gases that make up the remaining 1% of Earth's atmosphere include water vapor, carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbons.



Incognita, T. (n.d.). Atmosphere Design Lab. Smithsonian National Museum of Natural History. Retrieved from http://forces.si.edu/Atmosphere/04_00_00.html.

Explain

Vocabulary Development

It's almost impossible to learn science concepts without also learning vocabulary words. Those vocabulary words help people discuss science concepts, so they're important. However, knowing vocabulary words is not the same as understanding science concepts. This section is designed to help your students do more than memorize definitions as they connect the vocabulary to the science concepts that they have explored.

As a class, use the Frayer Model to help students develop a conceptual understanding of key vocabulary.

1. Place the word "**matter**" in the center of the graphic organizer. (See page 11 for a fillable Frayer Model.) Facilitate a discussion with students exploring why this word is key vocabulary to this study.
2. Ask students to brainstorm characteristics of "**matter**" and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their textbook and notes.
4. Next, ask students to add examples and non-examples in the Frayer Model. Emphasize the higher-level thinking skill of comparing and contrasting.

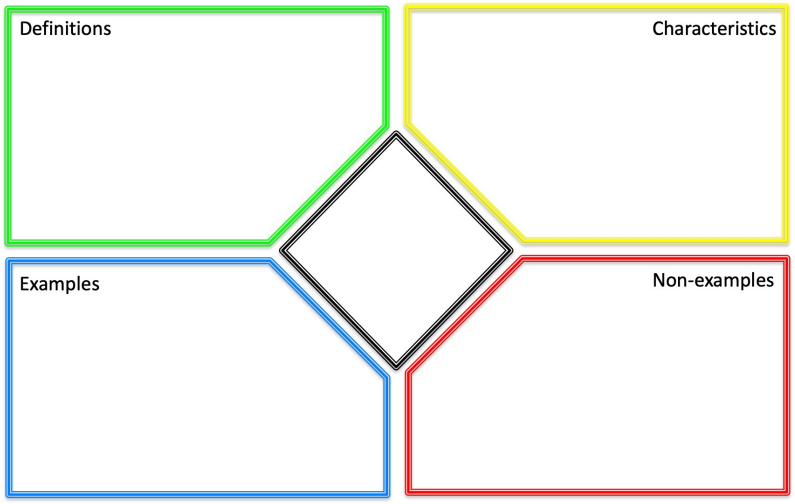
How are the examples alike/different than the non-examples?

5. Using the information provided, ask students to develop their own definition of the word "**matter**" that is clear and concise. An example is in the Answer Key section of this document (page 14).
6. After completing the example together, have students select or assign a new vocabulary word to each group of students to work on collaboratively.

Now complete a new Frayer Model with a partner. Select one word from the key vocabulary list and fill in the graphic organizer. We will share some as a class.

Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.

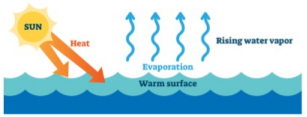


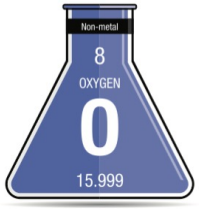
7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word. Refer to definitions in the Answer Key (page 8).
8. Compile and post final definitions so all students have access for later reference.

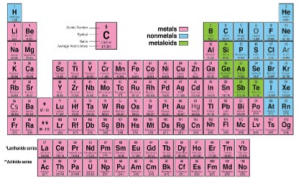
You will review key vocabulary. Pay attention to how your definitions compare to standard definitions.

Explain

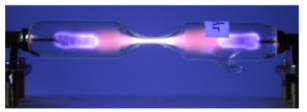
Word	Definition
ATMOSPHERE  Image credit: NASA	The atmosphere is the envelope of gases surrounding Earth. Earth's atmosphere consists of 78% nitrogen, 21% oxygen, 0.9% argon, as well as small amounts of carbon dioxide and water vapor. It also contains traces of dust particles, pollen, and other solid particles.

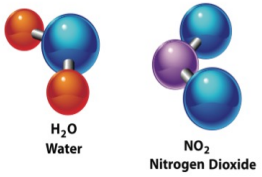
Word	Definition
WATER VAPOR  Image credit: By VectorMine, Shutterstock.com	Water vapor is the water present in the atmosphere in a gaseous form.

Word	Definition
OXYGEN  Image credit: By Alejo Miranda, Shutterstock.com	Oxygen is a gas that makes up 21% of Earth's atmosphere. Oxygen is used by cells of most organisms to release energy from food.

Word	Definition
ELEMENTS  Image credit: By Mister X, Shutterstock.com	An element is a substance that cannot be separated or broken down into simpler substances by chemical means. Key elements in Earth's atmosphere include nitrogen (78%), oxygen (21%), and argon (0.9%).

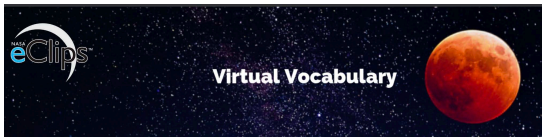
Word	Definition
CARBON DIOXIDE  CO_2 Carbon Dioxide Image credit: By OSweetNature, Shutterstock.com	Carbon dioxide is a colorless, odorless, non-poisonous gas that makes up about 0.03% of Earth's atmosphere.

Word	Definition
ARGON  Image credit: By Kim Christensen, Shutterstock.com	Argon is a colorless, odorless gas that is totally inert (does not react with other substances). Argon is the third most abundant atmospheric gas, making up 0.94% of the Earth's atmosphere.

Word	Definition
COMPOUNDS  H_2O Water NO_2 Nitrogen Dioxide Image credit: By OSweetNature, Shutterstock.com	A compound is a substance that is formed by the chemical combination of two or more elements. Compounds in Earth's atmosphere include carbon dioxide and water (in the form of water vapor).

Word	Definition
NITROGEN  Image credit: By Alejo Miranda, Shutterstock.com	Nitrogen is the seventh element of the periodic table. Almost eighty percent of Earth's atmosphere is made of nitrogen gas. Nitrogen gas is replenished in the atmosphere through the nitrogen cycle.

Visit the NASA eClips™ Virtual Vocabulary for more definitions.



Elaborate/Extend

It is important for the students to explain what's going on by applying what they have learned. It is not unusual for students to have a bit of difficulty with elaborate activities. Student are not used to doing "novel" activities and being asked to apply what they know.

NASA Connection

Compare Earth's Atmosphere to the Atmospheres of Mars and Earth's Moon.

In the near future, NASA has plans to return to the Moon and continue studying Mars. Draw three pie graphs that illustrate the composition of the atmospheres for Earth, Mars and Earth's moon.

Object	Mass (kilograms)	Carbon Dioxide	Nitrogen	Oxygen	Argon	Methane	Sodium	Hydrogen	Helium	Other
Sun	$3.0x10^{30}$							71%	26%	3%
Mercury	1000			42%			22%	22%	6%	8%
Venus	$4.8x10^{20}$	96%	4%							
Earth	$1.4x10^{21}$		78%	21%	1%					<1%
Moon	100,000				70%		1%		29%	
Mars	$2.5x10^{16}$	95%	2.7%		1.6%					0.7%
Jupiter	$1.9x10^{27}$							89.8%	10.2%	
Saturn	$5.4x10^{26}$							96.3%	3.2%	0.5%
Titan	$9.1x10^{18}$		97%			2%				1%
Uranus	$8.6x10^{25}$					2.3%		82.5%	15.2%	
Neptune	$1.0x10^{26}$					1.0%		80%	19%	
Pluto	$1.3x10^{14}$	8%	90%			2%				

Image and activity source - https://spacemath.gsfc.nasa.gov/astrob/10Page7.pdf

1. How does Earth's atmosphere compare with that of the Moon?Mars?

2. Which planet has the greatest percentage of oxygen in its atmosphere? the greatest percentage of nitrogen?

Does Air Contain Water Vapor?

To further explore the composition of Earth's atmosphere, have students complete this investigation to determine if air contains water vapor.

Think About This!

Have you ever observed water droplets on the outside of a glass when you were drinking a cold drink on a very warm day? Where did these droplets come from? Did the liquid seep through the glass to the outside? How do you know? Could you test a prediction about this phenomenon?

Image and Activity Source - Meteorology Activities for Grades 5-9
https://science.nasa.gov/does-air-contain-water-vapor

Evaluate

Post-Assessment

Check students' understanding with these activities.

Identify Misconception

What is a common misconception about the composition of Earth's atmosphere and how can you correct it?

Discussion Questions

1. What are the elements in Earth's atmosphere?
2. What percent of Earth's atmosphere is nitrogen gas, N2? What percentage is Oxygen, O2?
3. Name some of the tiny solid particles that are found in Earth's atmosphere?

Carefully rewatch the NASA Spotlite video about the composition of Earth's atmosphere to assess your understanding of what make up the atmosphere.

Video Link- NASA Spotlite: Atmosphere Dragon
NASA eClips Website - https://nasaeclips.arc.nasa.gov/spotlite/earths-atmosphere/earths-atmosphere
NASA eClips YouTube - https://youtu.be/e-wYfLpRl3U

Vocabulary Review

Fill-in-the-blanks using vocabulary about the components of Earth's atmosphere.

The layers of gases surrounding Earth is called the 1) ____ (atmosphere). Earth's atmosphere is a mixture of elements and compounds called air.

oxygen

A substance formed by the chemical combination of two or more elements are 2) ____ (compounds). Carbon dioxide and water vapor are the most abundant compounds in the atmosphere.

oxygen

Substances that cannot be separated or broken down into simpler substances by chemical means are 3) ____ (elements).

oxygen

In Earth's atmosphere, the most abundant element is 4) ____ (nitrogen).

oxygen

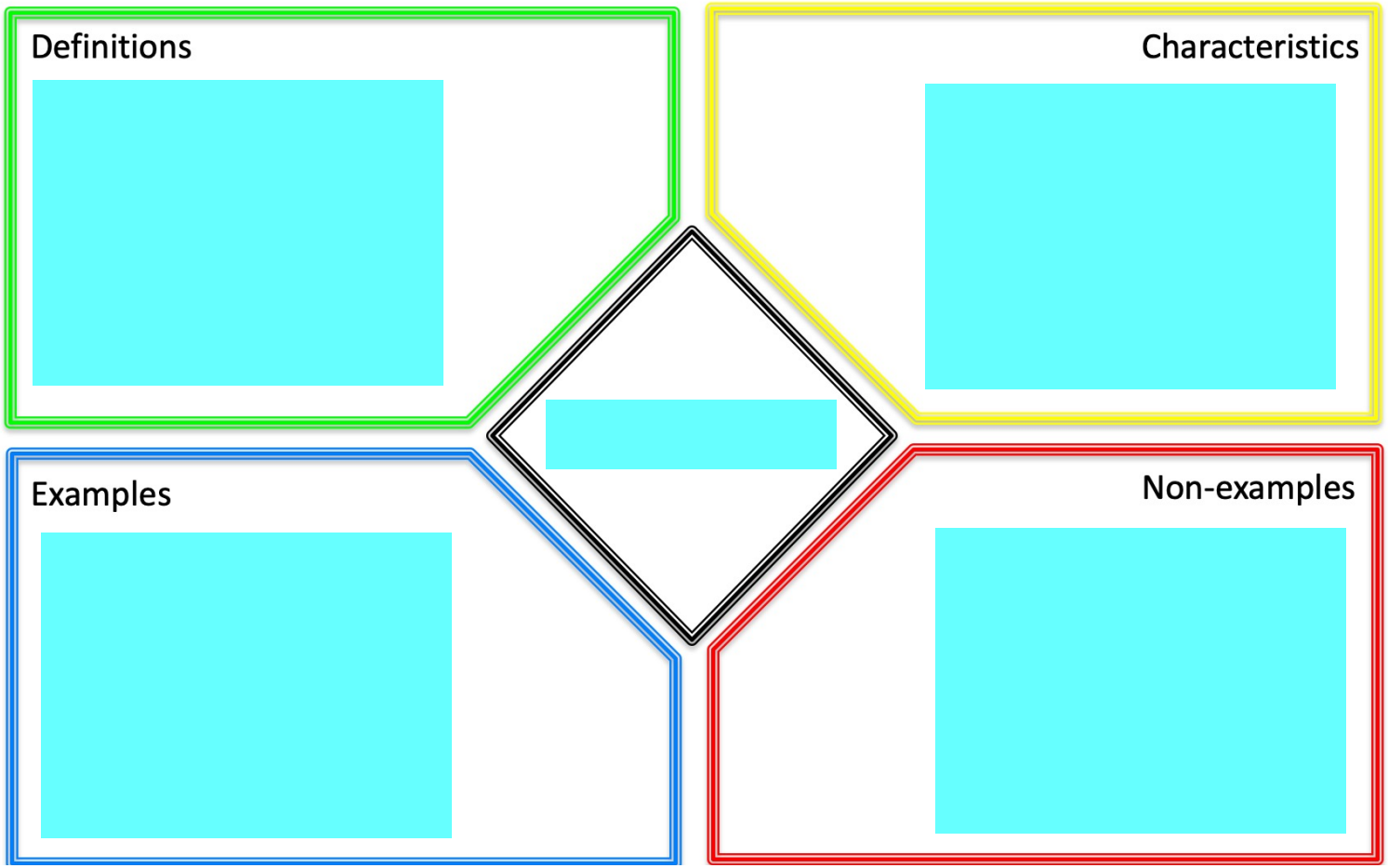
The element 5) ____ (oxygen) only makes up 21% of the air.

oxygen

Resources

Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.



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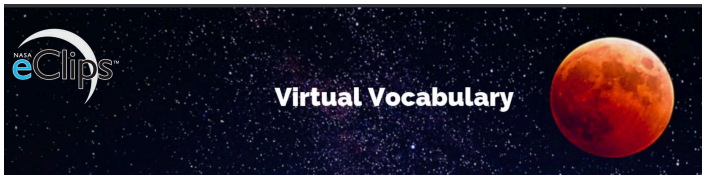

Resources

Composition of Earth's Atmosphere
Pretest / Posttest
NASA Spotlite Interactive Lesson

Read each question and select the best choice.

1. The layer of gases that surrounds Earth is called the:

Select the best answer.
A. lithosphere
B. atmosphere
C. biosphere
D. hydrosphere

2. The most abundant gas in Earth's atmosphere is:

Select the best answer.
A. oxygen
B. nitrogen
C. helium
D. hydrogen

3. Which of the following is not a naturally occurring part of Earth's atmosphere?

Select the best answer.
A. gases such as oxygen
B. gases such as carbon dioxide
C. dust and other tiny solid particles
D. sulfur oxides from factories

4. Nitrogen gets returned to the atmosphere through

Select the best answer.
A. the nitrogen cycle
B. precipitation
C. the water cycle
D. animal waste

5. Which statement about Earth's atmosphere is incorrect?

Select the best answer.
A. It contains the gases nitrogen and argon.
B. It contains the gases carbon dioxide and nitrogen.
C. It consists mostly of oxygen.
D. It contains tiny solid particles like dust and pollen.

Answer Key

Composition of Earth's Atmosphere
Pretest / Posttest
NASA Spotlite Interactive Lesson

Read each question and select the best choice.

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B. **atmosphere *****
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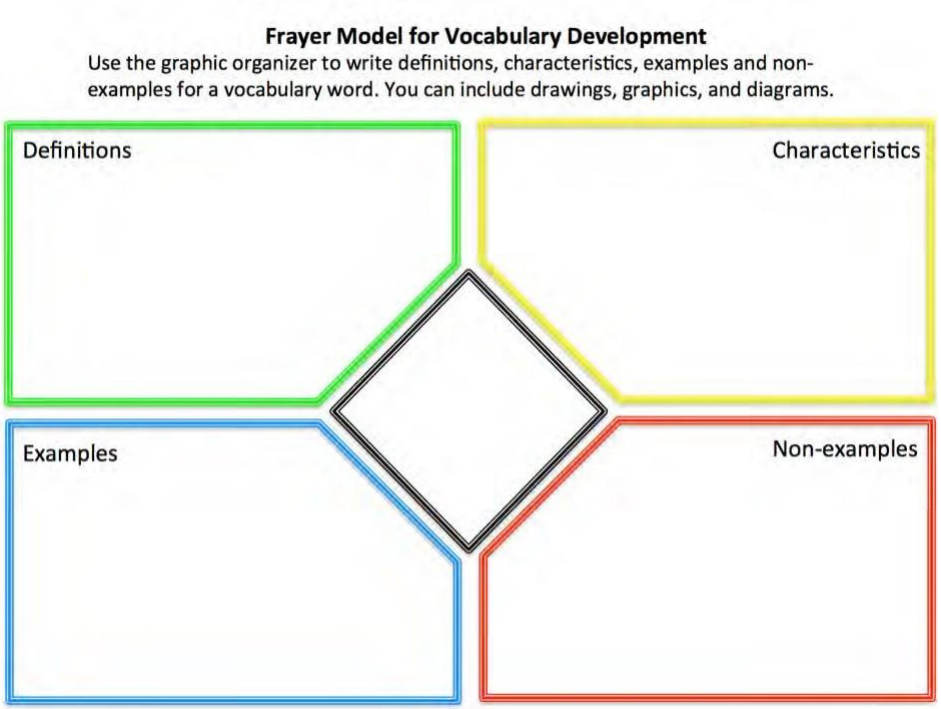
D. Earth's atmosphere contains tiny solid particles like dust and pollen.

Answer Key



Vocabulary Word
matter

Characteristics
- Matter can be in several different states, including solids, liquids or gases.
- Is made up of atoms and molecules.

Example
ocean
frog
airplan
grass
smoke

Non-examples

-sound
-light

Definition
Matter is often defined as anything that has mass and takes up space (has volume); the substance of which all physical objects are composed.

Product Information

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