
Weather Changes



Lesson 2: Earth's Atmosphere

Essential Question: Is it possible to distinguish between the different layers of the atmosphere without seeing them?



TEKS Objectives:

Science

- **Identify** and **describe** the importance of earth materials including rocks, soil, water and gases of the atmosphere in the local area and **classify** them as renewable, nonrenewable, or inexhaustible resources. (3.11A)
- **Represent** the natural world using models and **identify** their limitations. (5.3C)

Math

- **Graph** a given set of data using an appropriate graphical representation such as a picture or line graph. (5.13C)
- **Use** fractions to **describe** the results of an experiment. (5.12A)
- **Select** and **use** appropriate units and formulas to measure length, perimeter, area, and volume. (5.10C) *extension*



Student Outcomes

- Students will create models and diagrams of the layers of the atmosphere and identify important characteristics of each layer.
- Students will create circle graphs of the composition of Earth's atmosphere.



Suggested Time:

2 hours, 45 minutes

Engage – 15 minutes

Explore – 30 minutes

Explain – 30 minutes

Elaborate – 60 minutes

Evaluate – 30 minutes



Background Information:

(From Zoom School: Earth's Atmosphere

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Atmosphere.shtml>)

“The Earth's atmosphere is a thin layer of gases that surrounds the Earth. It composed of 78% nitrogen, 21% oxygen, 0.9% argon, 0.03% carbon dioxide, and trace amounts of other gases. This thin gaseous layer insulates the Earth from extreme temperatures; it keeps heat inside the atmosphere and it also blocks the Earth from much of the Sun's incoming ultraviolet radiation.

The Earth's atmosphere is about 300 miles (480 km) thick, but most of the atmosphere (about 80%) is within 10 miles (16 km) of the surface of the Earth. There is no exact place where the atmosphere ends; it just gets thinner and thinner, until it merges with outer space.”

View the rest of this article at Zoom School

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Atmosphere.shtml>



Vocabulary:

atmosphere – the layer of air that surrounds the planet

oxygen – a gas found in the air

stratosphere – the layer of the atmosphere that contains the ozone and is above the troposphere

thermosphere – the outermost layer of the atmosphere where temperatures increase with altitude

gas – a state of matter that has no definite shape and does not take up a definite amount of space.

carbon dioxide – a gas found in the air that animals exhale.

troposphere – the layer of atmosphere closest to the Earth

nitrogen – a gas found in the air

mesosphere – the layer of the atmosphere between the stratosphere and the thermosphere; characterized by temperatures that decrease with increasing altitude.

reusable resource - Natural resources that are renewed by natural cycles and can be used more than once; inexhaustible resources



Materials:

Engage:

Air Sayings

Explore

Construction paper pieces: red, green, yellow (place in baggies for each group)

Colored marshmallows may be substituted

Paper plates

Earth's Atmosphere Record Sheet

Elaborate

Computers/ library reference books

Lesson 2: Earth's Atmosphere

Kathleen Crowe

Evaluation

Earth's Atmosphere: Layers of the Atmosphere Assessment

Extension

28 cm strips for each student or group
scissors
ruler
toothpicks
gumdrops (red, green, yellow)



Suggested Literature:

Harcourt Science p. C64

Sciencesaurus pp. 198 – 199; molecules: pp. 250-255



Teacher Preparation

Read about the greenhouse effect and the Earth's atmosphere.



Technology:

- Microsoft Excel
- Websites

BrainPop: Periodic Table, Earth's Atmosphere

IPPEX: Interactive Matter: Atoms

<http://ippex.pppl.gov/interactive/matter/atoms.html>

Composition of Air

http://www.ldeo.columbia.edu/edu/dees/ees/climate/slides/gas_comp.gif

Enchanted Learning: Earth's Atmosphere

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Atmosphere.shtml>

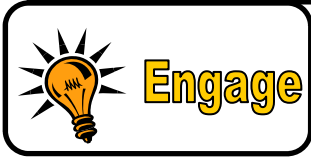
Windows to the Universe: Earth's Atmosphere (English and Spanish)

<http://www.windows.ucar.edu/tour/link=/earth/Atmosphere/overview.html>

Windows to the Universe: Layers of the Atmosphere

http://www.windows.ucar.edu/tour/link=/earth/images/atmosphere_mural_jpg_image.html

Wikipedia: Atmospheric Layers



1. Ask and discuss:

- **What are some systems on our earth?**
- **Is there a system that surrounds our earth?**
- **What do we call the air around us that we breathe?** atmosphere
- **What is the atmosphere made of?** Answers will vary. Students may say oxygen, carbon dioxide, gases
- **Is it a system or part of a system? Explain.**

2. Ask students to draw or write what they think the atmosphere is made of in their Journals. Students should include the gases they think are found in the atmosphere. Students may share their ideas with the class. Show pictures of the earth's atmosphere. Show examples of clean and polluted air.

Option: Language Arts:

1. Make a transparency of *Air Sayings*. Uncover one saying at a time on the overhead. Ask students to explain what the sayings mean.
2. **Ask and discuss: Why is air included in so many sayings?**
3. Generate additional sayings.

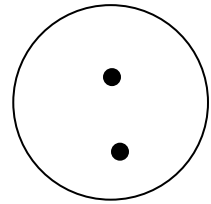


1. Explain that students will be making models of the layers of the atmosphere.
2. Pass out the *Earth's Atmosphere Record Sheet* to each student. Students may also use their Journals.
3. Pass out four paper plates to each student or small group. Label each plate *as troposphere, stratosphere, mesosphere, and thermosphere.*
4. Pass out the multicolored construction paper pieces (red, green, and yellow). Students will use the following table to glue the pieces on each plate or layer. Leave equal space between each

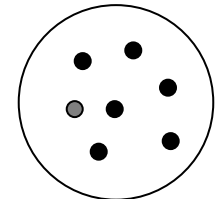
piece of construction paper for each plate. Point out that nitrogen, oxygen, and other gases are found in our atmosphere. The paper pieces will represent these gases.

Layer	Nitrogen (red)	Oxygen (green)	Other gases (yellow)	Total Number of Molecules
Mesosphere	6	1	0	
stratosphere	11	3	1	
Thermosphere	2	0	0	
troposphere	19	5	1	

5. Once students have prepared their plates with the paper strips, students will write the fraction that represents the amount of each gas inside the layers of their models of the atmosphere. Students may record their fractions in their Journals or Record Sheet.

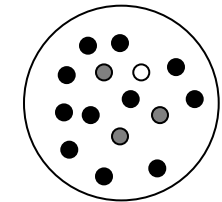


6. Students will organize the plates from top to bottom based on where they think each layer is located in the atmosphere.

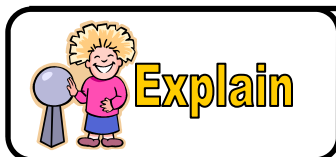
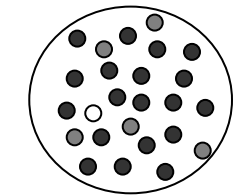


7. Ask and discuss:

- Explain why you placed the plates in the order you chose.
- Explain how the gases are important to the atmosphere.
- Is there a gas you expected to see that is missing from the table? Explain.
- What do you know about the gases represented?
- What do you want to know about the gases in the atmosphere?



8. Record any questions students may have on the board or chart paper. Target the questions as they are addressed throughout the lesson.



1. Show students a diagram of the atmosphere using a web site such as:

Enchanted Learning: Earth's Atmosphere

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Atmosphere.shtml>

Windows to the Universe: Layers of the Atmosphere

<http://www.windows.ucar.edu/tour/link=/earth/Atmosphere/layers.html>

Wikipedia: Atmospheric Layers

http://en.wikipedia.org/wiki/Earth's_atmosphere

2. Locate the main layers of the atmosphere: troposphere, stratosphere, mesosphere, and thermosphere. Students will compare the order of their plates with the diagram displayed on the Presentation Station. Students may make adjustments if necessary.
3. **Ask and discuss:**
 - **Describe what you notice about the molecules on each plate.**
 - **How are the numbers of molecules connected to the location of the layers?**
4. Students will create their own diagram of the atmosphere in their Journals, adding machine tape, or on construction paper.
 - a. Students should use web, Sciencesaurus, and/or library resources to identify the names of each layer and a characteristic of each layer.
 - b. Students should also include the temperature range at each layer.
5. View *BrainPop: Earth's Atmosphere*. Students may add information to their diagrams.
6. Students should share what they learned about each layer with the class.



1. Draw a circle on the board. Explain that the class will be creating a pie (circle) graph of the composition of Earth's air. Remind the class that the circle represents 100% of the Earth's air.
2. Students will make a T-chart in their Journals. One side should be titled "What I think." The other side should be titled, "What I learned."
3. Ask students to draw a circle under "What I Think." Then instruct students to make a circle graph showing how much of each gas they think is in the air. Students should share their graphs with the class. Students should discuss their reasoning.
4. Show a diagram on the Presentation Station or overhead of the actual Composition of the Air. Use a web site such as:

Enchanted Learning: Earth's Atmosphere

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Atmosphere.shtml>

5. Model how to make a circle graph on Microsoft Excel using the following information found at the websites: Nitrogen- 78%, Oxygen- 21%, Argon- .9%, other gases such as carbon dioxide- .1%. Point out that the number of colored pieces of paper students used during the Exploration activity were close to the actual percentages.
6. Students will draw the circle graph to match the graph on the Presentation Station. Students should create their revised graph under “What I learned.”
7. **Ask and discuss:**
 - **What surprises you about the gases?**
 - **What is nitrogen and how is it important?**
 - **What do you know about the nitrogen cycle?**
 - **Explain why is air important?**
 - **Is it possible to use all the air in the atmosphere up? Explain.**
8. Since air is used over and over again, it is considered a **reusable resource**. Students should add this to their Journals.
9. Use the following website to learn more about the gases of the atmosphere. Students should add information to their Journals. Students may also visit the site individually.

Atmosphere

http://sunshine.chpc.utah.edu/labs/atmosphere/atm_gases1.html

10. Encourage students to ask more questions about the atmosphere. Record their questions on chart paper.
 - **Can the atmosphere be damaged?**
 - **Can the atmosphere ever go away?**
 - **Why doesn't the atmosphere float away?**



1. Students will complete **one** of the following:
 - *Earth's Atmosphere: Layers of the Atmosphere Assessment.*
 - Students will assume the job of an astronaut taking off in the space shuttle on an important mission through our atmosphere. As the astronaut takes off in the shuttle, he/she must record what they are reporting back to NASA. Include the names of each layer, what can be seen out the window of the shuttle, temperatures, characteristics, and other information about each layer.
2. Students may place their plates in the hallway to create a large model of the atmosphere that includes labels and descriptions.



Assessment

1. *Earth's Atmosphere Record Sheet* or student Journals
2. Circle graph of Composition of Air
3. Labeled diagram of the layers of the atmosphere
4. *Earth's Atmosphere: Layers of the Atmosphere Assessment* or astronaut report

TAKS Formatted Assessment

<u>Resources</u>	<u>Pages</u>
Kamico	247, 248; 214-216
Step up to the TAKS	117, 118, 122, 128
TAKS Science Dailies	97, 98



Extension

Part One:

1. Explain: **All things on earth are made of atoms and molecules, including our atmosphere. We will start our investigation by exploring atoms.**
 - a. **What is an atom?**
 - b. **How big is an atom?**
 - c. **Can you see one?**
2. Follow the directions for *The Phantom's Portrait Parlor Paper Cutting* from the *Atom's Family Website*.
<http://www.miamisci.org/af/sln/phantom/papercutting.html>
 - a. Give each student a 28 cm long strip of paper. This is the length of a piece of copy paper.
 - b. Students will record their results in their Journals or the *Earth's Atmosphere: What is Air Made of?* record sheet. Students should use cm and/or mm to measure each strip.
 - c. Once students have cut and recorded as far as they can go, share the results with the class.
 - d. Students may be able to make as many as 7 or 8 cuts. By cut 8 the strip size should be 1 mm.
 - e. Ask students to infer how small the pieces would be if they continued to cut each piece in half. Show the chart found at the website so students can identify how many cuts it would take to equal the size of an atom.
<http://www.miamisci.org/af/sln/phantom/papercutting.html>
 - f. It would take 31 cuts to match the size of an atom!
 - g. For further observation of an atom, visit the *Atom's Family* at
<http://www.miamisci.org/af/sln/phantom/spectroscope.html>

Part Two:

1. Ask and discuss:

a. What do atoms have to do with the atmosphere?

2. Explain that students will make models showing how different atoms combine to form the molecules that make up our atmosphere.
3. Organize students into small groups or pairs. Give each group of students red, yellow, and green gumdrops.
4. Ask the students to identify one of the gases they think is in the air. Write oxygen on the board followed by its chemical formula O_2 . Explain that scientists use this as another way to represent oxygen. The oxygen in the air is a molecule of 2 oxygen atoms which is why the chemical formula is followed by a 2.
5. Ask students to connect two green gumdrops with a toothpick to make a molecule of oxygen. Students will then make a diagram of oxygen in their Journals or record chart. Students may put their oxygen molecule aside.
6. Write the chemical formula N_2 . Ask students what gas they think this might be. Write the word Nitrogen on the board.
7. Ask students to make a Nitrogen molecule using red gumdrops and a toothpick. Ask students to share the molecules they made and explain how many gumdrops they used and why. Students will then make a diagram of nitrogen in their Journals or record chart. Students may put their nitrogen molecule aside.
8. Write the chemical formula CO_2 on the board. Ask students what gas they think this represents. Students should use green and yellow gumdrops and two toothpicks to make the carbon dioxide molecule. Ask students to share their molecules and explain how many gumdrops they used.
9. Students may want to investigate other molecules such as H_2O .
10. Display the molecules in the room.
11. Use websites to look at diagrams of the molecules students created.



Lesson 2: Earth's Atmosphere *Record Sheet*

Materials:

Construction paper pieces (red, green, yellow)

Four paper plates

Procedure:

Nitrogen, oxygen, and other gases are found in our atmosphere. You will use construction paper pieces to represent these gases.

1. Label each plate mesosphere, stratosphere, thermosphere, and troposphere.
2. Use the following table to glue the construction paper pieces on each plate or "layer." Leave equal spaces between the pieces of construction paper as you glue them to each plate.

Layer	Nitrogen (red)	Oxygen (green)	Other gases (yellow)	Total Number of Molecules
Mesosphere	6	1	0	
stratosphere	11	3	1	
Thermosphere	2	0	0	
troposphere	19	5	1	

3. Look inside each layer. Write the fraction that represents the amount of each gas inside the layers of your model of the atmosphere.

Layer	Nitrogen (red)	Oxygen (green)	Other gases (yellow)
Mesosphere			
stratosphere			
Thermosphere			
troposphere			

4. Place your plates in order based on where you think each layer is located in the atmosphere.
5. Draw how you organized your plates (layers) below.

6. What can you conclude about the atmosphere based on your plates?



Lesson 2: Earth's Atmosphere

Layers of the Atmosphere Assessment

1. Illustrate and label the layers of the atmosphere.
2. Draw and label the following inside the correct layers:
 - where people live
 - where weather occurs
 - where planes fly
 - where ozone occurs

3. Explain what ozone is and why it is important.

4. Explain what type of natural resource is air? Explain why.

5. Draw a circle graph showing the gases in the atmosphere. Explain the importance of one of the gases.



Lesson 2: Earth's Atmosphere

“What is Air Made of?”

From The Atom's Family

<http://www.miamisci.org/af/sln/phantom/papercutting.html>

Materials:

1 strip of paper 28 cm long

Scissors

rulers

Procedure:

1. Cut the strip in to equal halves.
Each piece is _____ long. Use your ruler to confirm the measurement.
2. Cut one of the remaining pieces in half.
Each piece is _____ long. Use your ruler to confirm the measurement.
3. Continue to cutting strips into equal halves as many times as you can. Complete the table below. How far can you go?

Cut	Length of half strip	About the size of a
1	14 cm	child's hand
2		
3		
4		
5		
6		
7		
8		
31	.0001 micron	an atom

Materials:

Red, yellow, green gumdrops
Toothpicks

Procedure:

Use the key to make molecules found in the atmosphere:

O = yellow gumdrop

N = red gumdrop

C = green gumdrop

Molecule name _____	chemical formula _____
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Molecule name _____	chemical formula _____
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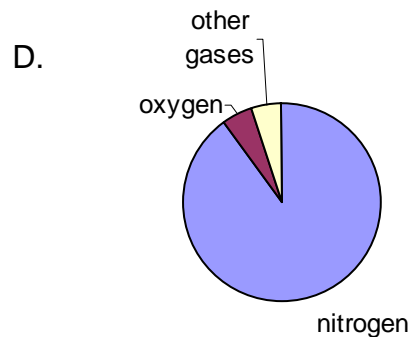
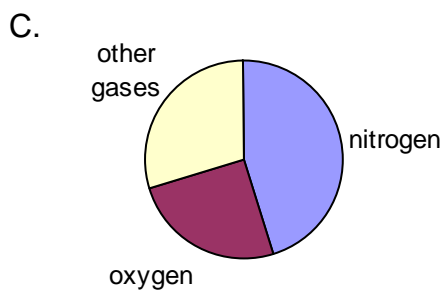
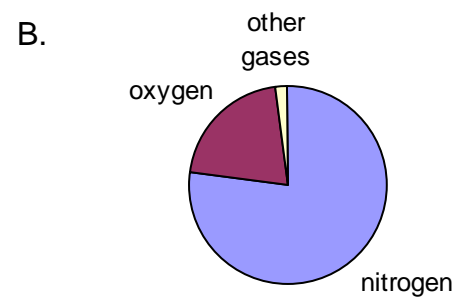
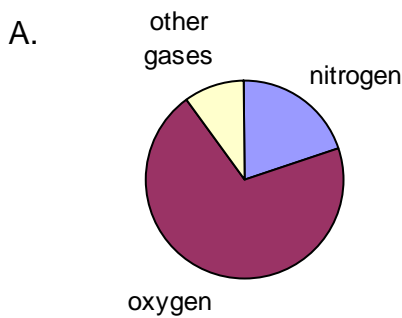
Molecule name _____	chemical formula _____
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Lesson 1: Earth's Atmosphere TAKS Review

Students will identify and describe the importance of gases of the atmosphere and classify them as renewable, nonrenewable, or inexhaustible resources. (3.11A)

- Danny made a graph showing the composition of Earth's atmosphere. About 77% is nitrogen, about 21% is oxygen, and about 2% is other gases. Which graph is probably Danny's?



- Based on your answer to #1, the atmosphere contains _____.
 - the same amount of carbon dioxide molecules and oxygen molecules
 - more carbon dioxide molecules than oxygen molecules.
 - fewer carbon dioxide molecules than oxygen molecules.
 - no carbon dioxide

3. Gases in our atmosphere are important resources on Earth. The gases found in our atmosphere perform an important function when they _____.
- A. make up a large percentage of the human body.
 - B. help dispose of waste products.
 - C. prevent crops from growing.
 - D. act as a “blanket” to hold heat close to the Earth’s surface.