

# Layers of the Earth's Atmosphere

## Lesson Overview

In this lesson, students will analyze the layers of the Earth's atmosphere. Students will conduct in-depth research about each layer including their distances from the earth's surface, their widths, their temperature conditions, and their possible modes of air travel. Students will then make group presentations about one layer of the Earth's atmosphere and the appropriate modes of air transportation.

## Objectives

- Observe the five layers of the Earth's atmosphere
- Research the temperature conditions of each layer, its width, and its distance from the Earth's surface
- Analyze possible modes of air transportation within each layer
- Create posters and give presentations about the layers of the Earth's atmosphere and their modes of transportation

## Standards (NGSS and Common Core)

For state specific standards visit [edu.zspace.com](http://edu.zspace.com)

## Next Generation Science Standards

- Earth and Space Science - Earth's Systems
  - 5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

## Common Core Connections

- Language Arts
  - RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
  - RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
  - SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
  - W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**Grade level: 4-6**

**Lesson Time: 150 minutes**

### Key Terms:

Atmosphere  
Exosphere  
Mesosphere  
Ozone layer  
Stratosphere  
Thermosphere  
Troposphere

### Resources:

Answer Key  
Layers of the Earth's  
Atmosphere Activity Questions  
Layers of the Earth's  
Atmosphere Research  
Layers of the Earth's  
Atmosphere Research--Answer  
Key

### Materials:

Research materials  
Large poster boards  
Photos of different modes of air  
transportation

- Math
  - 5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system and use these conversions in solving multi-step, real world problems.

## Differentiation (Δ)

- Group students heterogeneously to allow students with a strong command of the English language to assist in reading or interpreting questions
- Provide a handout with a list of vocabulary terms and definitions that will appear in the activity
- Work in partners or small groups
- Enrichment: Students could find real-world problems involving the concept and design solutions to those problems
- Enrichment: Students could build models of concept

## Introduction

The teacher will ask the students if they have ever wished that they could fly or ever thought about becoming a pilot or astronaut. In this lesson, the students will learn about the conditions that they would encounter if they traveled through the layers of the atmosphere and how these conditions would affect their modes of transportation.

## Activity

### Layers of the Earth's Atmosphere

This section will be completed in Studio along with Layers of the Earth's Atmosphere Activity Questions.

#### Scene 1

The Earth is surrounded by a thin layer of gases called the atmosphere. Let's take a closer look at the relative sizes of the Earth and its surrounding atmosphere.

- Use the cutting plane tool to divide the Earth in half.
- Use the straight ruler tool to measure and calculate the diameter of the Earth, not including the atmosphere. Take a screenshot of your answer. Hint: 1 m in zSpace = 10 km in real life.

#### Scene 2

The Earth's atmosphere is divided into different layers.

- How many layers are in the Earth's atmosphere? Hint: All layers end with "-sphere."
- Let's find out the order of the layers. Use the dissect tool to peel away each layer. Name the layers in order from the outermost to innermost layer.

### Scene 3

The International Space Station (ISS) is shown on this model. The ISS is a habitable artificial satellite that has been orbiting Earth since 1998.

- Dissect the layers again slowly, paying special attention to the location of the ISS. In which layer of the Earth's atmosphere does the ISS reside?

### Scene 4

Here is larger model of the International Space Station. Astronauts live on the ISS for extended periods of time to conduct research about the feasibility of future space living.

- In addition to the ISS, there are many other ways to travel through the air. Find models of other forms of air transportation and add them to the screen. Take a screenshot.

### Scene 5

- If you wanted to become a pilot or astronaut in the future, what other factors would you need to research about each layer of the Earth's atmosphere that would affect your air travel?

### Small Group Research

Students will work in small groups to further research the five layers of the Earth's atmosphere using textbooks and the Internet. Students will record their research on the Layers of the Earth's Atmosphere Research worksheet. For each layer, students will record its distance from the Earth's surface, its width, its temperature conditions, and its possible modes of transportation.

### Small Group Presentations

Each small group will choose one layer of the Earth's atmosphere to present to the class. Each group will create a large poster about their chosen layer, including information about its distance from the Earth's surface, its width, its temperature conditions, and its possible modes of transportation. Students may draw pictures or add real photos of the different modes of transportation. Students will then use these posters as visual aids for their class presentations.

## Closing

After listening to the group presentations, students will answer the following questions.

## Questions for Discussion

1. What did you like the most about the presentations of your classmates?

*Answers will vary. Sample Answer: I liked how one group added photos of hot air balloon on their poster.*

2. What are some things that you learned about the Earth's atmosphere?

*Answers will vary. Sample Answer: I learned that the Earth's atmosphere has five layers and that each layer has very different conditions and modes of transportation.*

#### Δ Investigate Further

Follow-Up Activity: Students could complete the "Space Living and Research" lesson in Studio.

Extension Activity: Students could research the importance of the ozone layer, the causes of its deterioration, and the detrimental effects. Students could make posters or videos describing the problem and promoting ways to help save the ozone layer.

Extension Activity: Students could make visual representations (clay, cake, jello, etc.) of the layers of the Earth's atmosphere with proportional widths and distances from the Earth's surface.

Extension Activity: Students could conduct further research about one mode of transportation, specifically its physical capabilities and limitations to fly within certain layers of the Earth's atmosphere.

Extension Activity: Students could pretend to be a pilot or an astronaut and write a journal about their preparations to take flight and what they encountered when they reached a certain layer of the Earth's atmosphere.

## Answer Key

### Activity Questions Provided in Studio

1. The Earth is surrounded by a thin layer of gases called the atmosphere. Besides breathing, what do you think are some other ways that the atmosphere helps us?

*Answers will vary. Sample Answer: The atmosphere protects us from many different things: the vacuum of space, the harmful electromagnetic radiation from the sun, and falling objects from space like meteoroids. The atmosphere holds the oxygen that we need to breathe. It also keeps the Earth from becoming too hot or too cold.*

2. Measure and calculate the diameter of the Earth, not including the atmosphere. Remember that 1 m = 10 km. What is the diameter of the Earth?

*Answers will vary. Sample Answer: The diameter of the Earth is approximately 12,742 km.*

3. In comparison, the Earth's atmosphere is only about 100 km thick. If the Earth was the size of a bowling ball, the atmosphere would be like a thin sheet of plastic wrap around it. How can something so thin play such an enormous role in our protection and survival?

*Answers will vary. Sample Answer: The atmosphere protects the earth just like our thin skin protects our body.*

4. How many layers are in the Earth's atmosphere? (Hint: All layers end with "-sphere.") Name the layers in order from the outermost to innermost layer.

*Correct Answer: There are five layers of the Earth's atmosphere. In order from the outermost to innermost layer are the exosphere, thermosphere, mesosphere, stratosphere, and troposphere.*

5. What formations do you notice in the layer closest to the Earth? In which layer do you think most air travel occurs?

*Answers will vary. Sample Answer: The troposphere layer contains cloud formations and the weather. I think most air travel occurs in the troposphere layer because it is the closest to the Earth.*

6. The ozone layer is actually part of the stratosphere layer and it plays an essential role in our survival. It protects us from harmful UV rays of the sun. You may have heard that pollution is slowly depleting our ozone layer. Why do you think it's important for us to act environmentally friendly and protect the ozone layer?

*Answers will vary. Sample Answer: If we do not do our part to protect the ozone layer, we will be exposed to harmful UV rays that will give us health problems like skin cancer and eye damage.*

7. In which layer of the Earth's atmosphere does the ISS reside? In addition to the ISS, what are some other modes of air transportation?

*Answers will vary. Sample Answer: The ISS resides in the thermosphere. Some other modes of air transportation are an airplane, helicopter, hot air balloon, and space shuttle.*

8. If you wanted to become a pilot or astronaut in the future, what other factors would you need to research about each layer that would affect your air travel?

*Answers will vary. Sample Answer: I would need to research the distances of each layer from the Earth's surface, their widths, their temperature conditions, their oxygen levels, and their possible modes of air transportation.*

Name \_\_\_\_\_ Date \_\_\_\_\_

## Layers of the Earth's Atmosphere Activity Questions

Complete this worksheet as you view the Layers of the Earth's Atmosphere tour in Studio.

The Earth is surrounded by a thin layer of gases called the atmosphere. Besides breathing, what do you think are some other ways that the atmosphere helps us?

Measure and calculate diameter of the Earth, not including the atmosphere. Show your calculations here. Remember that 1 m in zSpace = 10 km in real life. What is the diameter of the Earth?

In comparison, the Earth's atmosphere is only about 100 km thick. If the Earth was the size of a bowling ball, the atmosphere would be like a thin sheet of plastic wrap around it. How could something so thin play such an enormous role in our protection and survival?

How many layers are in the Earth's atmosphere? (Hint: All layers end with "-sphere.") Name the layers in order from the outermost to innermost layer.

What formations do you notice in the layer closest to the Earth's surface? In which layer do you think most air travel occurs?

The ozone layer is actually part of the stratosphere layer and it plays an essential role in our survival. It protects us from harmful UV rays of the sun. You may have heard that pollution is slowly depleting our ozone layer. Why do you think it's important for us to act environmentally friendly and protect the ozone layer?

In which layer of the Earth's atmosphere does the International Space Station reside? In addition to the ISS, what are some other modes of air transportation?

If you wanted to become a pilot or astronaut in the future, what other factors would you need to research about each layer that would affect your air travel?

Name \_\_\_\_\_ Date \_\_\_\_\_

## Layers of the Earth's Atmosphere Research

Research the five layers of the Earth's atmosphere and record your data below.

### EXOSPHERE

Distance from Earth's surface: \_\_\_\_\_ Width: \_\_\_\_\_

Temperature conditions: \_\_\_\_\_

Possible modes of transportation: \_\_\_\_\_

Other interesting facts: \_\_\_\_\_

### THERMOSPHERE

Distance from Earth's surface: \_\_\_\_\_ Width: \_\_\_\_\_

Temperature conditions: \_\_\_\_\_

Possible modes of transportation: \_\_\_\_\_

Other interesting facts: \_\_\_\_\_

### MESOSPHERE

Distance from Earth's surface: \_\_\_\_\_ Width: \_\_\_\_\_

Temperature conditions: \_\_\_\_\_

Possible modes of transportation: \_\_\_\_\_

Other interesting facts: \_\_\_\_\_

### STRATOSPHERE

Distance from Earth's surface: \_\_\_\_\_ Width: \_\_\_\_\_

Temperature conditions: \_\_\_\_\_

Possible modes of transportation: \_\_\_\_\_

Other interesting facts: \_\_\_\_\_

### TROPOSPHERE

Distance from Earth's surface: \_\_\_\_\_ Width: \_\_\_\_\_

Temperature conditions: \_\_\_\_\_

Possible modes of transportation: \_\_\_\_\_

Other interesting facts: \_\_\_\_\_



Name \_\_\_\_\_ Date \_\_\_\_\_

## Layers of the Earth's Atmosphere Research--Answer Key

Answers will vary. Sample answers:

### EXOSPHERE

Distance from Earth's surface: Approx. 320 km (or 195.6 mi)      **Width:** Unknown (Up to 10,000 km)

Temperature conditions: Places lit by sunlight are very hot, places in the shade are very cold

Possible modes of transportation: Hubble Space Telescope, rockets

Other interesting facts: Considered to be outer space after 50-80 miles from Earth's surface

### THERMOSPHERE

Distance from Earth's surface: Approx. 80 km (or 49.7 mi)      **Width:** Approx. 240 km (145.9 mi)

Temperature conditions: Extremely hot at around 1200 degrees C

Possible modes of transportation: Space shuttles, International Space Station, satellites

Other interesting facts: Air density is the lowest with only 0.0001% of total gases

### MESOSPHERE

Distance from Earth's surface: Approx. 50 km (or 21.1 mi)      **Width:** Approx. 30 km (or 28.6 mi)

Temperature conditions: Coldest layer of the atmosphere (about -90 degrees C) that forms ice clouds

Possible modes of transportation: Space shuttle traveling through to thermosphere

Other interesting facts: Falling meteorites burn up upon entry to this layer

### STRATOSPHERE

Distance from Earth's surface: Approx. 12 km (or 7.5 mi)      **Width:** Approx. 38 km (or 13.6 mi)

Temperature conditions: Warmer than the troposphere because the ozone layer absorbs a lot of UV rays

Possible modes of transportation: Supersonic plane, weather balloon

Other interesting facts: The ozone layer protects us from harmful sun rays, pollution is slowly destroying it

### TROPOSPHERE

Distance from Earth's surface: 0 km (or 0.0 mi)      **Width:** Approx. 12 km (or 7.5 mi)

Temperature conditions: Warmest layer because reflected sun rays heat up the air, gets colder as move up higher

Possible modes of transportation: Airplanes, helicopter, parachute jumps, gliders

Other interesting facts: Thinnest layer but also the densest at 80%, weather formed in this layer