

Air Evidence File

Use evidence to compare atmospheric layers and gases.

S6E4.a "Analyze and interpret data to compare and contrast the composition of Earth's atmospheric layers (including the ozone layer) and greenhouse gases."

NAME _____ DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline details that compare the troposphere with the stratosphere, circle each named gas, and number facts that tell how ozone or greenhouse gases interact with energy.

A Layered Atmosphere

- 1 Earth’s atmosphere is a stack of gases held by gravity. The lowest layer, the troposphere, reaches from the ground to about 12 kilometers high. It contains most atmospheric mass and nearly all water vapor. Nitrogen and oxygen are its main gases, but changing water vapor, carbon dioxide, and other gases also mix through this layer.
- 2 Above the troposphere lies the stratosphere, which extends to about 50 kilometers. Its air is thinner and much drier than air below. This layer has an ozone-rich region. Ozone, O₃, is made of three oxygen atoms. It is only a tiny part of the air, yet it absorbs much of the Sun’s harmful ultraviolet radiation.

FIGURE 1. AVERAGE COMPOSITION OF DRY AIR NEAR SEA LEVEL

Gas	Approximate percent by volume	Greenhouse gas?
Nitrogen	78%	No
Oxygen	21%	No
Argon	0.93%	No
Carbon dioxide	0.04%	Yes

- 3 Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. These gases absorb some outgoing infrared energy from Earth’s surface. They then release energy in many directions, including downward. This natural greenhouse effect warms the lower atmosphere. Ozone is best known for absorbing ultraviolet radiation in the stratosphere, and it can also absorb infrared energy.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 According to Figure 1, how many percentage points more nitrogen than oxygen are in dry air?

2 Carbon dioxide is much less common than nitrogen in Figure 1. Use the figure and the passage to explain why carbon dioxide can still be important.

3 Compare the troposphere and stratosphere. Include one difference in their air and one feature that makes each layer important.

4 What radiation is ozone best known for absorbing, and what radiation do greenhouse gases absorb from Earth's surface?

3 YOUR TURN _____ Your own words

Complete the table to compare ozone and carbon dioxide. In the last column, explain how each gas can matter even though it is a small part of the atmosphere.

SUBSTANCE	AMOUNT IN AIR	INTERACTION WITH ENERGY	WHY IT MATTERS

PART 1 • READ AND MARK

Underline details that compare the troposphere with the stratosphere, circle each named gas, and number facts that tell how ozone or greenhouse gases interact with energy. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	According to Figure 1, how many percentage points more nitrogen than oxygen are in dry air?	Nitrogen makes up 57 percentage points more of dry air than oxygen, 78% minus 21%.
2	Carbon dioxide is much less common than nitrogen in Figure 1. Use the figure and the passage to explain why carbon dioxide can still be important.	Carbon dioxide is only about 0.04% of dry air, but it is a greenhouse gas that absorbs outgoing infrared energy. Changes in its amount can change how much energy the atmosphere retains.
3	Compare the troposphere and stratosphere. Include one difference in their air and one feature that makes each layer important.	The troposphere contains most atmospheric mass and nearly all water vapor, while the stratosphere has thinner, much drier air. The troposphere is where greenhouse gases warm the lower atmosphere, and the stratosphere has an ozone-rich region that absorbs harmful ultraviolet radiation.
4	What radiation is ozone best known for absorbing, and what radiation do greenhouse gases absorb from Earth's surface?	Ozone is best known for absorbing harmful ultraviolet radiation. Greenhouse gases absorb outgoing infrared energy from Earth's surface.

PART 3 • YOUR TURN (SAMPLE ANSWER)

SUBSTANCE	AMOUNT IN AIR	INTERACTION WITH ENERGY	WHY IT MATTERS
Ozone	A tiny part of the air	Absorbs much harmful ultraviolet radiation and can absorb infrared energy	Even a tiny amount matters because it absorbs energy that affects Earth.
Carbon dioxide	About 0.04% of dry air	Absorbs outgoing infrared energy	Even a small amount matters because changes can affect how much energy the atmosphere retains.

Accept equivalent comparisons supported by the passage and Figure 1. For the open table, students should identify ozone as tiny in amount and carbon dioxide as about 0.04%, then connect each gas to its energy role.