Name _____ Date_____

Activity 15: History of Earth's Atmosphere

Guiding Question: Has Earth's atmosphere always been the same as it is today?

Key Words: *atmospheric scientist, climatologist*

Get Started:

1. Do you think that the composition of Earth's atmosphere has always been the same in Earth's past as it is today? Explain your reasoning.

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2. Read the introduction and Guiding Question to Activity 15, "History of Earth's Atmosphere," in your Student Book.

Atmospheric scientists and climatologists use evidence from Earth's ice and rock layers to measure past levels of atmospheric gases and to determine when certain major events on Earth occurred. Air bubbles trapped in ice and rock layers provide a record of the composition of Earth's atmosphere at different times in the past. Since deeper layers were formed before upper layers, samples from deep layers are likely to contain older air than samples from upper layers.

Do the Activity:

1. Cut out the Atmosphere Cards, which are attached to this packet. Carefully read the information on each Atmosphere Card.

2. Place each card in order from oldest to most recent.

3. If available, ask a family member to review the order you chose. Discuss whether they agree or disagree with the order.

3. Record your final order for the Atmosphere Cards in the table on the next page, "Earth's Atmosphere Through Time." Complete the table by writing down information about the gases in the atmosphere and important events during that time.

Name _____ Date_____

Earth's Atmosphere through Time

Card	*Gases present in the atmosphere (and percentage, if listed)*	*Important date and event*

Name _____ Date_____

Build Understanding:

1. Has Earth's atmosphere always been the same as it is today?

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2. Look at Visual Aid 15.1, "Composition of Earth's Atmosphere," which is attached to this packet, to see the composition of the modern atmosphere.

Analysis:

1. Look carefully at your completed table.
    a. How has the amount of carbon dioxide gas in the atmosphere changed over Earth's history?
    b. How has the amount of oxygen gas in the atmosphere changed over Earth's history?

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2. What effect have living organisms (including people) had on the composition of Earth's atmosphere? Support your answer with examples from this activity.

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3. **Reflection:** Do you think that the atmosphere will have different amounts of oxygen and carbon dioxide in the future? Explain your reasoning.

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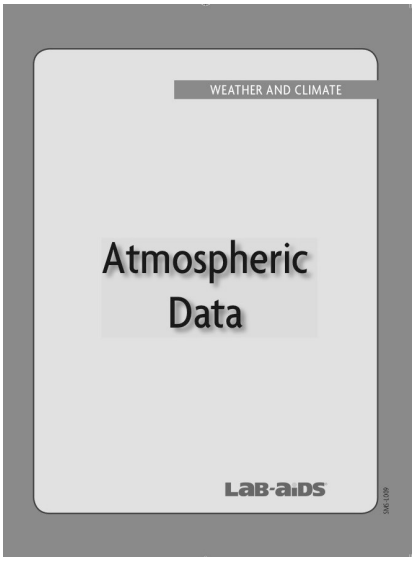
Name _____ Date_____

Atmosphere cards:



A

The modern atmosphere is 78%, nitrogen gas, 21% oxygen gas, and less than 1% carbon dioxide gas.

B

The earth is more than 4.5 billion years old. At first, it contained large amounts of hydrogen and helium gases. Most of these gases escaped into space.

C

The earth began to cool down and water vapor condensed into liquid water. Liquid water began to collect on the earth's surface in lakes and oceans. The amount of water vapor in the atmosphere decreased. The atmosphere was about 70% carbon dioxide gas and 30 % nitrogen gas.

D

The first land plants appeared on the earth about 400—500 million years ago. The plants took in carbon dioxide and produced oxygen gas through photosynthesis. The amount of oxygen gas in the atmosphere continued to increase, approaching 21%.

E

The earth was very hot, and there were many erupting volcanoes releasing gases. These gases—water vapor, carbon dioxide, nitrogen, and sulfur dioxide—created the atmosphere. There was no oxygen gas in this atmosphere.

F

The amount of carbon dioxide gas in the modern atmosphere is less than 1%, but recent measurements taken at a Hawaiian laboratory show that it is slowly increasing. In 1959, the percentage of carbon dioxide in the atmosphere was 0.0316%. In 2015, carbon dioxide levels exceeded 0.04%. This is a 27% increase since 1959 and the level of carbon dioxide in the atmosphere is still increasing.

G

About 2–3 billion years ago, some living organisms began to use energy from sunlight to turn carbon dioxide gas and water into sugar and oxygen gas (a process called photosynthesis). The amount of carbon dioxide gas was about 15%, but it began to decrease. The amount of oxygen gas was less than 1%, but it began to grow because of the oxygen produced by living organisms.

H

Gradually, the oceans absorbed a lot of carbon dioxide. By about 3.5 billion years ago, the amount of carbon dioxide in the atmosphere had been reduced to around 20%.

Name _____ Date_____

VISUAL AID 15.1

COMPOSITION OF EARTH'S ATMOSPHERE

Gases in the Earth's Atmosphere	Percent (by volume)
Nitrogen	78.1
Oxygen	20.9
Water vapor*	0–4.0
Argon	0.9
Carbon dioxide	0.04
Neon	0.002
Helium	0.0005
Methane*	0.0002
Krypton	0.0001
Hydrogen	0.00005
Nitrous oxide*	0.00003
Xenon	0.000009
Ozone*	0.000004

*percentage varies with location and time