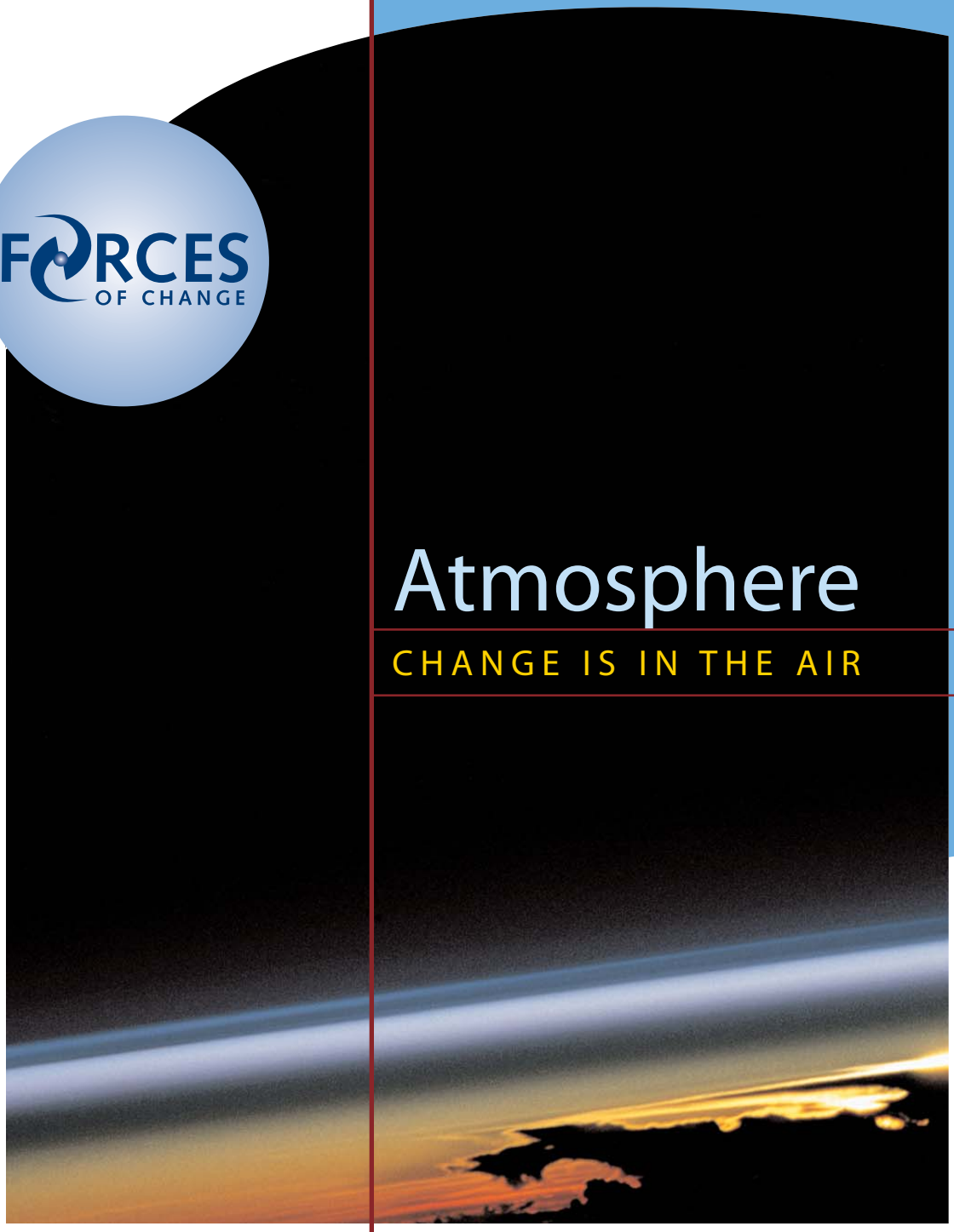
Activity 1
What's Up? The Atmosphere!

FORCES OF CHANGE

Atmosphere

CHANGE IS IN THE AIR



Smithsonian
National Museum of Natural History

ACTIVITY 1

What's Up? The Atmosphere!

In one of 80 experiments performed on the space shuttle Columbia before its tragic loss during reentry in 2003, Israeli astronaut Ilan Ramon tracked desert dust in the atmosphere as it moved around the earth

Overview

Students learn the distinctions of each layer of the atmosphere and sketch the layers.

Suggested Grade Level

6–8

National Standards Alignment

National Science Education Standards
Earth and Science Standard, Content Standard D: Grades 5–8
Structure of the Earth System: The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.

Time

One class period (40–50 minutes)

Materials

- Graph paper
- Activity sheet

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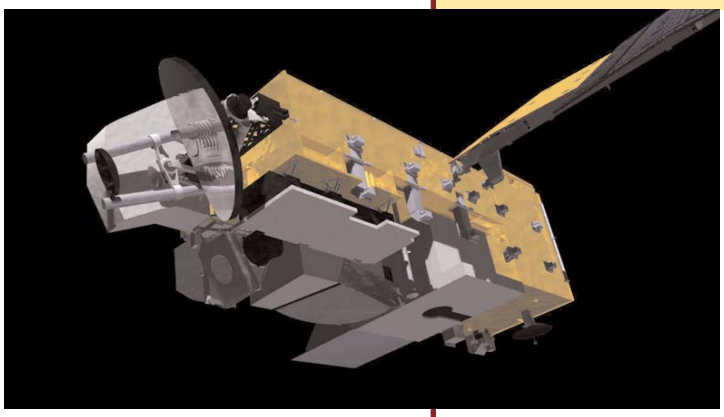
OBJECTIVES

Students will be able to:

1. Describe the main layers of Earth's atmosphere, the proportion of each in the atmosphere, and what role each plays in atmospheric phenomena.
2. Define how the temperature varies from layer to layer of atmosphere.
3. Calculate the quantities of gases in a particular volume of air, such as their classroom.



The Aura Earth-observing satellite launched in July 2004 is the latest in a line of NASA instruments and satellites that give us the ability to measure changes in climate and air quality

Photo courtesy of NASA/GSFC

Background

What we call the atmosphere comes in five main layers: exosphere, thermosphere, mesosphere, stratosphere, and troposphere. In the exosphere (640 to 64,000 km, or 400 to 40,000 mi), air dwindles to nothing as molecules drift into space. The thermosphere (80 to 640 km or 50 to 400 mi) is very hot despite being very thin because it absorbs so much solar radiation. The thermosphere contains the ionosphere and the magnetosphere. The exosphere and thermosphere make up the atmosphere's outer layer. The ionosphere contains electrically charged particles that can interfere with radio broadcasts. Charged particles in the magnetosphere are affected by Earth's magnetic field and under the right conditions, create the beautiful, shimmering Northern and Southern Lights.

The mesosphere (50 to 80 km or 31 to 50 mi) is where debris entering the atmosphere begins to burn up. The stratosphere (14.5 to 50 km or 9 to 31 mi) contains the ozone layer that absorbs nearly all the Sun's ultraviolet radiation. Without the protection of the ozone layer, life could not exist on land. The mesosphere and stratosphere make up the middle layer of the atmosphere.

Storms form in the troposphere (up to 14.5 km, or 9 mi), the layer of atmosphere closest to Earth's surface.

The air we breathe consists of 78 percent nitrogen and 21 percent oxygen. The remaining one percent is a mixture of traces gases including the greenhouse gases (carbon dioxide, methane, and water), hydrogen, argon, neon, and helium.

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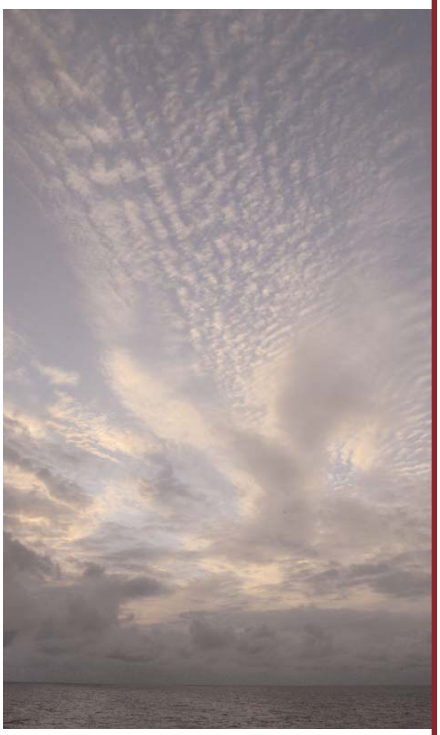
Activity

1. Before providing the worksheet or any background information, ask each student to draw what the atmosphere looks like. This could be creative/artistic on art paper or more scientific/detailed on graph paper.
2. Hang the representations around the classroom.
3. Describe the activity, provide background information, and pass out the activity sheet.
4. Using graph paper and the descriptions of the atmosphere from the worksheet, students should draw the layers of the atmosphere proportionally on a graph. (The exosphere may not fit on a single sheet of graph paper without making the other layers too small.)
5. Design a symbol for each of the functions of the atmosphere on the worksheet. Write the symbol on the graph in the appropriate part of the atmosphere.
6. Design a thermometer to show the temperature of each layer.
7. Measure the height, width, and length of your classroom. Compare the atmospheric levels on the graph to the height of your classroom. Where would the stratosphere, etc., begin?
8. Compute the volume of your classroom by multiplying the height by the width by the length and list in cubic meters or cubic feet. How much nitrogen and oxygen are in your classroom? Use the internet to determine the cost of nitrogen, oxygen, and argon, say that argon is 0.9 percent of the air. Which gas is most valuable?



Clouds do more than create amazing artistic patterns as they form and move in earth's atmosphere. NASA scientists study clouds for clues to earth's weather and climate.

Accommodation for younger learners

1. Provide a worksheet with the layers of the atmosphere already drawn in proportion and labeled according to the height of each level. Students can then proceed with 2 and 3 above.
2. Students measure the height of their classroom. If nitrogen is almost 4/5 of the atmosphere, how high would a column of nitrogen reach on the classroom wall? If oxygen is slightly more than 1/5, how high would the oxygen column reach?

Learning More

The Aura satellite was launched by NASA in 2004 to monitor air quality. It is one of several Earth-observing satellites (EOS). To learn more about what a satellite orbiting 705 km (438 mi) above Earth see, visit the NASA Aura website at http://www.nasa.gov/vision/earth/lookingatearth/aura_?rst.html.

ACTIVITY 1

Activity Sheet

What's in the Atmosphere?

Layers of the Atmosphere

Exosphere: 640 to 64,000 km (400 to 40,000 mi)
Thermosphere: 80 to 640 km (50 to 400 mi)
Mesosphere: 50 to 80 km (31 to 50 mi)
Stratosphere: 14.5 to 50 km (9 to 31 mi)
Troposphere: up to 14.5 km (9 mi)

Temperatures

Exosphere:
Thermosphere: 230˚ C (440˚ F)
Mesosphere: -90˚ C (-130˚ F) at the top
Stratosphere: -3˚ C (26.6˚ F) at the top
Troposphere: -75˚ C (-103˚ F) near the top

What goes on in the atmosphere

Planes fly: 9 km (5.7 miles)
Earth-observing satellites fly: 705 km (438 mi)
Rain clouds: 2 km (1.2 mi)
Northern lights form: 100 km (62 mi)
Meteorites burn up: 80–100 km (50–62 mi)
Reflects radio waves: 96.5 km (60 mi)
Protective ozone layer: 22 km (14 mi)

What's in the air?

The air we breathe consists of 78 percent nitrogen and 21 percent oxygen. The remaining one percent is a mixture of traces gases including the greenhouse gases (carbon dioxide, methane, and water), hydrogen, argon, neon, and helium.