

## THE REALM OF FLIGHT

Winds and changing weather constantly remind us that we live at the bottom of an ocean of air. This "atmosphere" is a mixture of gases which provides us with the pressure and oxygen we need to breathe, and protects us from the full heat and radiation of the sun.

As we move upward from the earth's surface in an airplane, the atmosphere thins gradually into the vacuum of space. Less than three miles above the earth, breathing becomes difficult, and oxygen and pressure must be artificially provided to permit man to continue upward. When we fly to an altitude of 100 miles, most of the atmosphere is beneath us, and we are at the fringes of space.

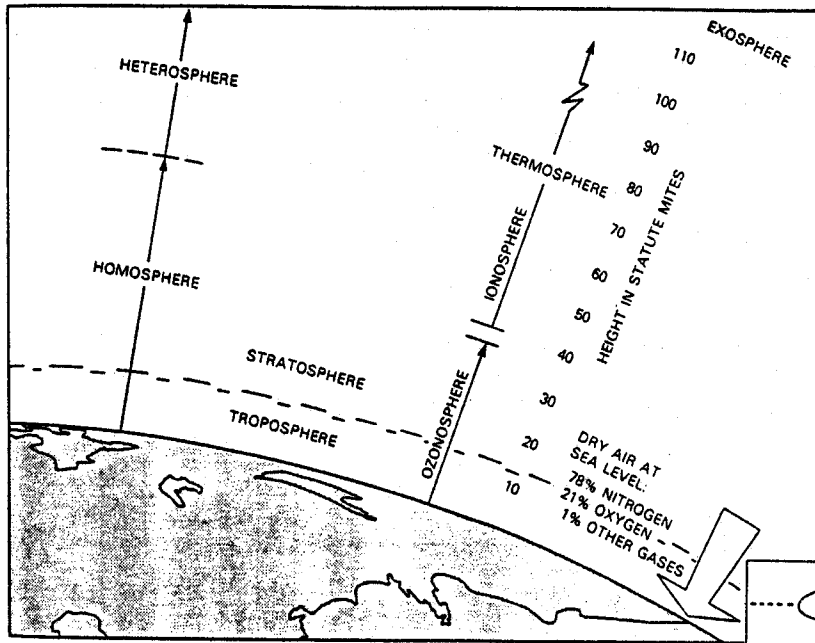
Space is that vast and unending region beyond the earth's atmosphere, through which the earth and planets, the sun and all other stars move. As man began to explore the fringes of space, clouds of gas and dust, fields of radiation and magnetic storms were discovered. Our atmospheric weather seems to have its counterparts in space.

Our environment, the place in which we live, is now called "aerospace", as it begins among familiar surroundings on earth, and extends outward through the air, into space, and beyond the most distant stars we can see. The beginning of aerospace exploration is giving us a new understanding of our place in the universe.

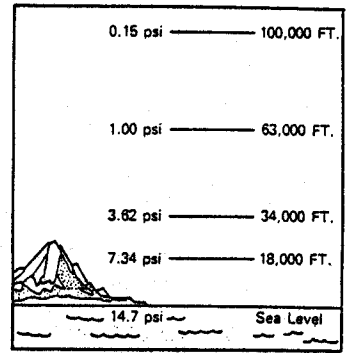


# THE REALM OF FLIGHT

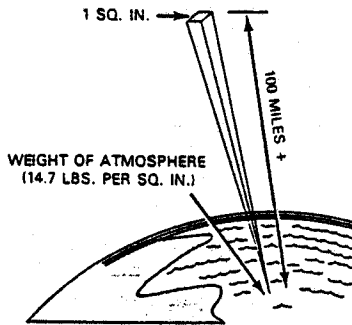
## The Atmosphere



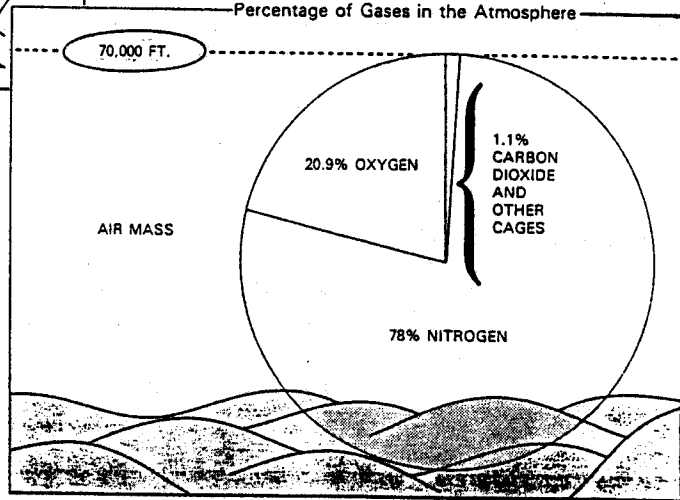
Pressure Varies with Altitude



THE PRESSURE OF THE ATMOSPHERE AT SEA LEVEL IS THE RESULT OF THE WEIGHT OF THE ENTIRE COLUMN OF ATMOSPHERE ABOVE.



Percentage of Gases in the Atmosphere



**Exercise:** Demonstrating to students effects of gravity

**Materials:** Two pieces of equal size paper

**Directions:** Have students crumple one piece of paper, have them then stand up, and hold the crumpled sheet in one hand and flat piece of paper in the other. Ask the students which one would hit the floor first if the papers were dropped from equal heights? Allow time for students to predict the outcome and then have them all drop their papers simultaneously. Ask students to explain why the crumpled paper took less time to fall, (fight the force of gravity,) even though both pieces of paper weighed the same amount. (Answer: The crumpled piece of paper had less surface area to resist the push of air aside as it fell; thus, it fell more slowly. (This is the same principle utilized by parachutes.)

## Investigation B: Global Wind Patterns



The region of Earth receiving the Sun's most direct rays is the equator. Here, air is heated and rises, leaving low-pressure areas behind. Moving to about 30 degrees north and south of the equator, the warm air from the equator finally begins to cool and sink. Between 30 degrees latitude and the equator, most of the cooling, sinking air moves back to the equator. The rest of the air flows toward the poles. The air movements toward the equator are called **trade winds** — warm, steady breezes that blow almost continuously. The Coriolis effect makes the trade winds appear to be curving to the west, whether they are traveling toward the equator from the south or the north.

The trade winds coming from the south and the north meet near the equator. These converging trade winds produce general upward winds as they are heated, so there are no steady surface winds. This area of calm is called the **doldrums**.

Between 30 and 60 degrees latitude, the winds that move toward the poles appear to curve to the east. Because winds are named for the direction from which they originate, these winds are called **prevailing westerlies**. Prevailing westerlies in the Northern Hemisphere are responsible for many of the weather movements across the United States and Canada.

At about 60 degrees latitude in both hemispheres, the prevailing westerlies join with **polar easterlies** to produce upward motion. The polar easterlies are formed when the atmosphere over the poles cools. This cold air then sinks and spreads out over the surface. As the air flows away from the poles, it is turned to the west by the Coriolis force. Again, because these winds begin in the east, they are called the easterlies. Many of these changes in wind direction are hard to visualize. Complete this exercise to see the patterns of the winds.

### Materials Needed:

- ✓ illustration below
- ✓ pencil
- ✓ colored pencils or markers

### Procedure

Carefully read the paragraphs above. Draw arrows to represent wind movement, being sure to show how the winds change direction at certain latitudes, which are labeled for you. Arrows representing the trade winds have already been drawn. Use orange to color the trade winds, green for the prevailing westerlies, and blue for the polar easterlies. You may need to look back at the results of Investigation A to be able to show the Coriolis effect.



### Questions

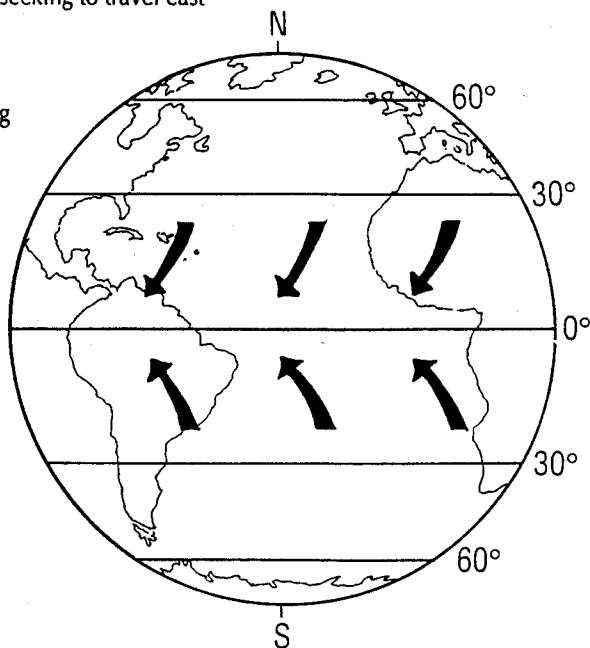


- ❶ What winds would Columbus have used to travel from Spain to the Caribbean?
- ❷ Which winds would he have needed to return to Europe?
- ❸ Would winds have favored European explorers seeking to travel east around the tip of Africa?

### Relating Science to . . .



**Mythology:** In your library, read about the following characters associated with the wind in Greek mythology: Aeolius, Zephyrus, Notus, Eurus, and Boreas. Report your findings to your class.



### Helping Mother Earth



Clothing can be recycled, too. Donate old clothes to a charity organization or sell them at a yard sale. When you do this, you are helping to preserve natural resources, such as cotton, wool, and silk. You are also reusing human-made materials, such as rayon, polyester, and dacron, which are made from oil.

# Earth's Mysterious Atmosphere

## Teacher's Guide

### **The Scene: The Mysterious Atmosphere**.....

- No. 1 - What is the atmosphere?.....
- No. 2 - What gases are in the atmosphere? How much of each gas is there? .....
- No. 3 - What is the structure of the atmosphere? .....
- No. 4 - Why is the atmosphere important? .....
- No. 5 - If we wore oxygen masks, would we still need the atmosphere? .....
- No. 6 - In what other ways is the atmosphere essential? .....
- No. 7 - How does the atmosphere affect the weather? .....

Answers: The Scene.....

### **The Crime: Harming the Atmosphere**.....

- No. 1 - What is the "greenhouse effect?" Is it bad? .....
- No. 2 - What is causing thinning of the ozone layer? .....
- No. 3 - Why are scientists concerned about thinning of the ozone layer? .....

Answers: The Crime.....

### **The Suspects: Natural and Anthropogenic Causes**.....

- No. 1 - What is causing the warming of the lower atmosphere? .....
- No. 2 - Are there anthropogenic causes of atmospheric warming? .....

Answers: The Suspects.....

### **The Detectives: Working to Solve the Mysteries**.....

- No. 1 - How are scientists investigating these mysteries? .....
- No. 2 - How can I help solve these atmospheric mysteries? .....

Answers: The Detectives .....

### **Home Activity** .....

## THE REALM OF FLIGHT

### WEATHER IS AN IMPORTANT FACTOR IN FLYING

#### SUGGESTED CONTENT

- A. What kind of weather information does the pilot need?
  1. Kinds of clouds.
  2. Height and thickness of clouds.
  3. Visibility.
  4. Air pressure.
  5. Temperature.
  6. Wind speed and direction.
  7. Precipitation.
  8. Forecasts.
- B. What instruments does the weather man use to find out about the weather?
- C. How often does he make weather "readings"?
- D. How are forecasts made?

#### SOME SUGGESTED ACTIVITIES

- Find out about air, moisture, and how clouds form by simple experiments and demonstrations; such as: running into the wind, making pin-wheels, flying kites, boiling water and watching steam form, watching water drops form on a cold glass of water, boiling water and watching little pieces of paper move around in the water. Children can construct paper gliders, blow up balloons and weigh a blown up one and an empty one to show that air has weight. Squeeze to show pressure.
- Build a simple weather station. (See materials and sources.)
- Look at cloud pictures and learn the basic cloud types.
- Clip newspaper weather reports. Compare with aviation weather reports for pilots.
- Learn basic weather map symbols.
- Make a calendar and record daily cloud conditions for several days.
- Visit the weather bureau and talk to the weathermen. Get old weather maps from the weather bureau.
- Learn to read thermometer; observe wind directions on the wind sock at the airport.
- Watch planes land according to how the wind is blowing.
- Select films available. See resources list for additional films.

#### SUGGESTED CORRELATIONS

- Many possibilities exist for drawing and painting clouds and weather conditions, singing songs about weather (see music book series for elementary grades) reading and writing reports, giving oral reports on weather, keeping records, and learning to use new words.
- Children could work together in groups in building a weather station, in compiling their own weather reports, and trying to forecast weather. They can also perform some of the experiments and demonstrations on air.