



# SCIENCE

STUDENT BOOK

▶ **7th Grade | Unit 7**

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# SCIENCE 707

## Climate

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# Climate

## Introduction

This LIFE PAC® is the third in a related series: *atmosphere*, *weather*, and *climate*. Each subject is broader than the preceding one; *climate* is widest in scope.

First, we shall consider the relationship between climate and weather. This relationship is vital to understanding climate. Next, we shall cover the separate parts that make up climate. In studying these parts you will receive an in-depth understanding of climate. The section dealing with conditions affecting a given climate will provide you with the tools for analyzing a region with respect to its climatic makeup. The last section is essentially one of application. You will take the facts about climate and apply them to your own locale. This extended activity will help you to remember what you have learned about climate, as it will demonstrate how facts about climate affect you as an individual.

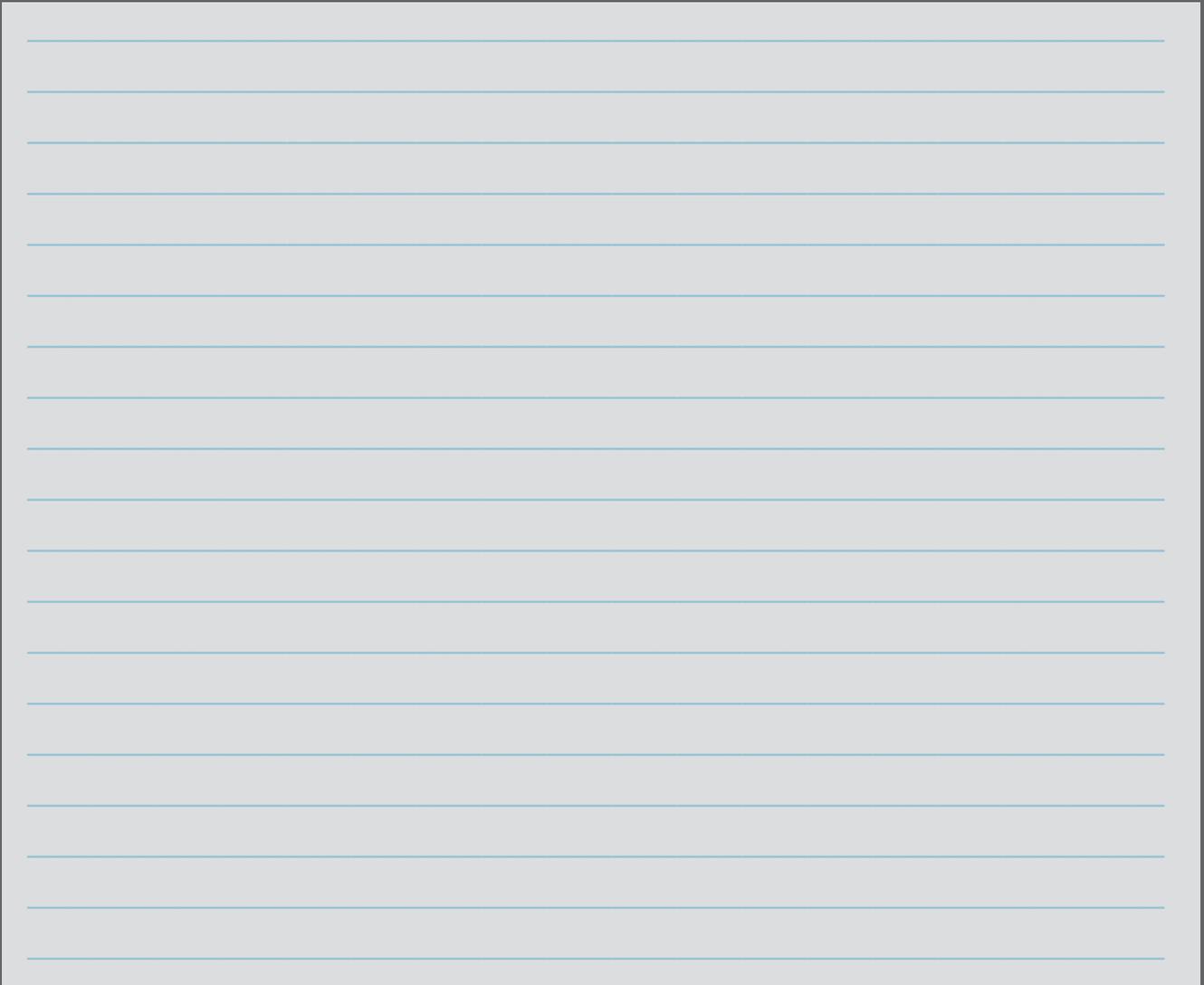
This LIFE PAC can provide you both an enjoyable and an informative study. Perhaps you may even decide to study *meteorology* (the study of weather conditions) and make it your career.

## Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFE PAC. When you have finished this LIFE PAC, you should be able to:

1. State the difference between climate and weather.
2. List the parts of climate.
3. Tell what causes wind, temperature, pressure, and precipitation.
4. State the factors affecting climate.
5. Read a weather map with isotherms and isobars.
6. Label the general climate areas on a globe.
7. Describe the major types of climate.
8. State the major climate areas of each continent.
9. Describe three ways climate affects people.
10. Give an example of at least one lifestyle specialized by climate.
11. Analyze and classify the climate of a given region.

Survey the LIFEPAK. Ask yourself some questions about this study and write your questions here.

A large rectangular area with horizontal blue lines for writing. The lines are evenly spaced and extend across the width of the box, providing a template for students to write their questions.

# 1. CLIMATE: GENERAL

**Climate** is similar in many ways to **weather**, but they are not the same. In this section we shall learn how climate is related to weather and how it differs from weather. We also shall

break down weather into its four parts. Then, we shall consider how these parts relate to one another.

## SECTION OBJECTIVES

**Review these objectives.** When you have completed this section, you should be able to:

1. State the differences between climate and weather:
  - 1.1 Define climate.
  - 1.2 Define weather.
  - 1.3 Tell how climate and weather are related.
2. List the parts of climate.
3. Tell what causes wind, temperature, pressure, and precipitation.

## VOCABULARY

**Study these words to enhance your learning success in this section.**

**axis** (ak´ sis). An imaginary line through the middle of the earth from the north pole to the south pole. The earth rotates around this line.

**barometric pressure** (bar u met´ rik presh´ ur). The air pressure as measured by a barometer.

**climate** (klī´ mit). The average weather condition of a region over a period of years.

**Coriolis force** (kôr ē õ´ lus fôrs). The movement of air to the left caused by the clockwise rotation of the earth.

**latitude** (lat´ u tüd). The distance north or south of the equator, measured in degrees.

**precipitation** (pri sep u tā´ shun). A deposit of rain, sleet, snow, ice, or hail.

**radiation** (rā dē ā´ shun). The energy sent out by the sun as light and heat.

**rotation** (rō tā´ shun). The act of turning around a center or axis.

**temperature** (tem´ pur u chur). The amount of heat or cold as measured in degrees.

**weather** (weFH´ ur). The condition of the air around and above a certain person or place.

**wind** (wind). Air in motion.

**Note:** All vocabulary words in this LIFEPAAC appear in **boldface** print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.

**Pronunciation Key:** hat, āge, cāre, fā; let, ēqual, tērm; it, Īce; hot, ōpen, ôrder; oil; out; cup, pūt, rüle; child; long; thin; /FH/ for then; /zh/ for measure; /u/ represents /a/ in about, /e/ in taken, /i/ in pencil, /o/ in lemon, and /u/ in circus.

## WEATHER

As you learned in Science LIFEPAK 705, **weather** is the condition of the atmosphere at any point in time. When we consider weather, we are thinking of conditions during a short period of time, for instance, a day or a week.

Weather is composed of **temperature, barometric pressure, precipitation**, and **wind** conditions. When each of these conditions has

been analyzed, the weather for an area can be stated.

Weather changes rapidly. The weather in a certain area can be completely different from one day to the next; however, weather projections or predictions can be made. These predictions help people decide what to wear and what to do on a certain day.



Look up these words in the vocabulary and write the definitions.

- 1.1 temperature \_\_\_\_\_  
\_\_\_\_\_
- 1.2 barometric pressure \_\_\_\_\_  
\_\_\_\_\_
- 1.3 precipitation \_\_\_\_\_  
\_\_\_\_\_
- 1.4 wind \_\_\_\_\_  
\_\_\_\_\_

Complete these sentences.

- 1.5 Weather is measured over a \_\_\_\_\_ period of time.
- 1.6 Weather is predicted to help people decide a. \_\_\_\_\_ and  
b. \_\_\_\_\_.

## CLIMATE AND WEATHER

When the Williams family left on a vacation trip, the weather was lovely and sunny. The temperature was about 70°F (20°C); however, they packed their car with heavy winter clothes, including coats, scarves, mittens, and boots. They were being practical. Traveling from southern Alabama, the Williams planned to camp high in the Rocky Mountains. Since winter was nearly over, the temperature had climbed to almost 70°F (20°C) at the family's home near

the Gulf Coast. In contrast, the temperature still could easily be below freezing in the Rockies.

To plan their vacation properly, the Williams needed more than a knowledge of their local weather conditions. They needed a knowledge of **climate**. Local weather conditions can vary remarkably from day to day. This fact is suggested in many places by this statement, "If you don't like the weather here, wait five minutes!"

Climate, however, does not change from day to day. It remains almost constant year after year.

The climate of a region can be determined by observing the weather of that region over a period of several years. The weather experienced in a region during each season of the year is averaged and the climate can then be

described. Thus, climate is the weather that can be expected in a region.

The Williams family knew their climate was warm and damp in late winter and early spring. They also knew winter could be expected to be much longer and more severe high in the Rockies. They packed cold-weather gear because they knew the climate of their vacation area.



### Answer true or false.

1.7 \_\_\_\_\_ At the end of winter, the weather is always warm.

1.8 \_\_\_\_\_ Climates change from day to day.

### Write the correct answer in the blank.

1.9 High in the mountains the climate is \_\_\_\_\_ than by the seashore.  
a. cooler                      b. warmer

1.10 The average of weather conditions over a period of years is \_\_\_\_\_.  
a. climate                      b. weather

1.11 Atmospheric conditions that can change very quickly are \_\_\_\_\_.  
a. climate                      b. weather

## PARTS OF CLIMATE

Like weather, climate has four basic parts: temperature, pressure, wind, and precipitation. After reviewing how each of these conditions is caused, you will learn how they affect climate.

**Temperature.** The planet earth revolves around the sun. The sun is hot and sends out **radiation** that travels to the earth. Some of the radiation is reflected by, or bounced off, the atmosphere. Some is absorbed, or soaked up, by the atmosphere. This radiation travels through the air until it reaches the earth's surface. As the sun's radiation is absorbed, the earth is warmed. The warmed earth then warms the air around it (the troposphere).

The temperature of an area depends upon two factors:

1. The amount of solar (sun) radiation reaching the area and
2. The way the surface absorbs the radiation and warms the air above it.

The sun's rays travel in straight paths to the earth. They strike the earth at different angles because of the earth's curved surface.

Look at the rays. More rays strike the earth at the equator than at the poles. In addition, the rays make larger angles with the earth at the equator than at the poles. In areas where the angles are larger, more direct solar radiation is received. When an area receives more solar radiation than other locations, it is warmer than they are. Thus, the equator is warmer than the poles.



Figure 1 | Radiation Reaching Earth

Different surfaces absorb different amounts of radiation. Land with little or no vegetation usually gets warm very quickly. Therefore, the air over this type of surface can become quite hot. Land with large amounts of vegetation warms up more slowly. Thus, the air over this type of surface tends to be cooler. Water heats up very slowly. The air over water surfaces is cooler than any other air.

Varying surfaces on the earth cause differences in temperature. These differences are the main cause of weather and climate.

**Pressure.** Although the air above the earth is not seen, it has weight and mass. The earth's gravity pulls on the air to cause its weight. The atmosphere is so high that a column of air extending from the earth to outer space is many miles high. A small amount of air does not weigh much. Miles and miles of air weigh much more. As you have learned in another LIFE PAC, air pressure is expressed in terms of pressure at sea level. This uniform standard enables everyone to understand what a certain pressure means. At sea level, normal air pressure is about 14.7 pounds per square inch (1 kg per square cm). Think of a person standing at sea level. Picture a column of air one inch square pressing on each side of the person's head. That column of air would actually extend to outer space. Its weight would be 14.7 lbs. Perhaps that makes you wonder why you do

not feel heavy weights pressing on you. You do not feel this weight because you have never been without it. You are accustomed to it. Were gravity to stop and this air to suddenly *stop* pressing, you would certainly notice the difference. Astronauts must learn to do without the weight of air on their bodies. It is not an easy task because human beings are accustomed to this air pressure.

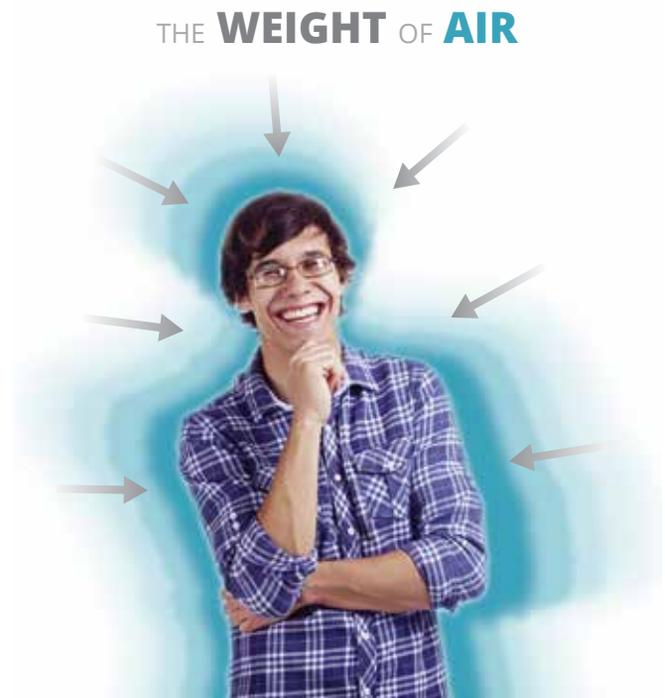


Figure 2 | The Weight of Air

Air is a gas. Its molecules are free to move either farther apart or closer together; that is, air can become less dense or more dense. If air molecules are closer together, more of them can fit into a certain space. If the molecules are farther apart, fewer can fit into that space.

The fewer molecules a certain quantity of air has, the less weight it will have. The less its weight, the lower the amount of pressure it exerts on the earth's surface.

Temperature is important to air pressure. When objects are warmed, they expand (grow larger). When they are cooled, they contract (grow smaller). Air expands and contracts with variations in temperature. When air is heated and expands, the molecules move farther apart. Air pressure is lower when the air is hot.

Air pressure is not the same over the whole earth. This difference occurs partly because temperatures are not the same. Warmer areas have lower air pressure than cooler areas. Other factors, which are not completely understood, also affect air pressure. Thus, variations in temperature and other factors cause variations in air pressure. These variations then cause the other conditions of weather and climate.

On the planet Earth, several regular belts of pressure form. At the poles the pressure is high. At 60° **latitude** north and south, low pressure belts exist. High pressure belts exist at north and south 30° latitude. A low pressure belt is located over the equator. Notice how the high-pressure areas and low-pressure areas alternate. You will learn later in this LIFEPAK how these variations in pressure affect the other factors of climate.

**Wind.** Winds are affected by pressure and the **rotation** of the earth about its **axis**. If the earth did not rotate, winds would flow directly north or south. Wind would move from high-pressure areas to low-pressure areas in a straight line. Since the earth does rotate toward the east, its rotation causes winds to move to the right in

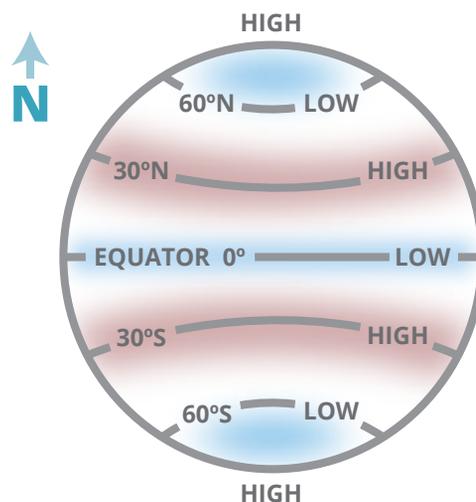
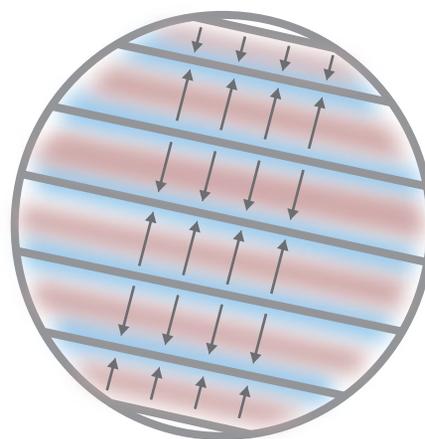


Figure 3 | High and Low Pressure Patterns

the northern hemisphere and to the left in the southern hemisphere.

If a person who is north of the equator is facing the same direction as the wind, the rotation of the earth will be moving the wind to that person's *right*. If the person is south of the equator, the rotation will be moving the wind to his or her *left*. The movement of air to the left caused by the clockwise (towards the east) rotation of the earth is called the **Coriolis force**. Notice in Figure 4 that each arrow is turned toward the right.



| Wind Direction Without the Earth's Rotation

The arrows that seem to point the wrong way will point correctly if you are looking in the same direction the arrow is pointing. Turn your LIFEPAK upside down to understand this concept.

Meteorologists (people who study weather) have names for the different world-wide winds. Winds are named for the direction *from which they blow*. Thus, a wind blowing from west to east is a *westerly*.

At the poles the winds blow from the east. These winds are called the *polar easterlies*. Between  $60^\circ$  and  $30^\circ$  for both north and south latitudes, the winds blow from the west. These winds are called the *prevailing westerlies*. Between  $30^\circ$  north latitude and the equator the winds blow from the northeast. These winds are the *northeast trades* (or trade winds). The *southeast trades* occur between  $30^\circ$  south latitude and the equator. They blow from the southeast.

Remember that these belts of pressure and wind may vary. Unequal temperature and uneven land surfaces cause such variation; but, generally, the earth's winds blow as shown in Figure 5.

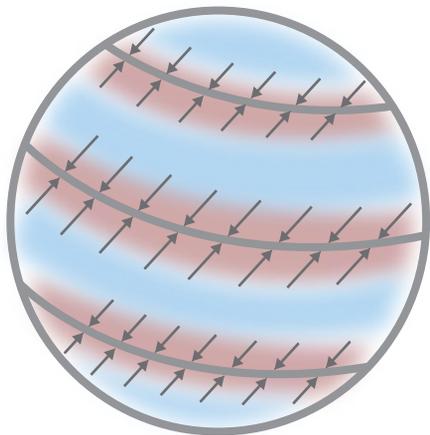


Figure 4 | Wind Direction due to Earth Rotation

**Precipitation.** Precipitation is moisture falling to the earth from the atmosphere. It is mainly in the form of rain, sleet, snow, or hail. Precipitation is an important part of the climate of a region.

All air in the troposphere contains moisture in the form of water vapor. These tiny drops of water (droplets) are lighter than air and, therefore, float. If many droplets come close together, we can see a cloud. When air cools, it contracts. Water vapor droplets draw closer together and join around tiny dust particles in the air. When a water droplet grows too large and heavy to float, it falls as rain. If the air is below freezing when the droplets are formed, they fall as snow. If raindrops fall through a layer of cold air, they freeze. These frozen drops of rain are called sleet. Hail starts as tiny ice particles. When these ice particles are bounced up and down in a windy cloud, more ice particles join them. This process continues and forms *hailstones* which grow larger until they become too heavy for the air to support. The hailstones then fall to the earth. Hailstones can become very large and do much damage, especially to farm crops, when they fall.

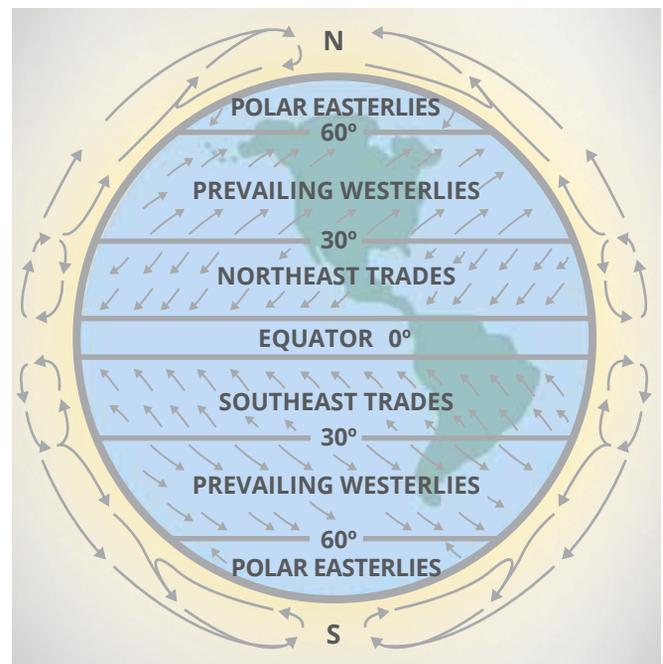


Figure 5 | Global Wind Pattern



### Complete these sentences.

- 1.12 The four parts of climate are a. \_\_\_\_\_, b. \_\_\_\_\_, c. \_\_\_\_\_, and d. \_\_\_\_\_.
- 1.13 The temperature of an area depends on the amount of direct solar \_\_\_\_\_ reaching it.
- 1.14 The troposphere is warmed by the \_\_\_\_\_.
- 1.15 An area with little vegetation warms up \_\_\_\_\_ quickly than an area with much vegetation.
- 1.16 Normal air pressure at sea level is \_\_\_\_\_.
- 1.17 Air expands as it is \_\_\_\_\_.
- 1.18 Cool areas tend to be areas of \_\_\_\_\_ pressure.
- 1.19 Air pressure over polar areas is \_\_\_\_\_.
- 1.20 The earth rotates about its \_\_\_\_\_.

### Match these terms.

- |   |                          |
|---|--------------------------|
| 1.21 _____ rain turned to ice as it falls                     | a. men who study weather |
| 1.22 _____ moisture falling from the air                      | b. prevailing westerlies |
| 1.23 _____ between 30° and 60°N and<br>30° and 60°S           | c. sleet                 |
| 1.24 _____ droplets formed in below-<br>freezing temperatures | d. trade winds           |
| 1.25 _____ between 30°N and 30°S                              | e. snow                  |
|   | f. precipitation         |



**Write the answers to these questions in complete sentences (use your own words).**

**1.26** How are hailstones formed? \_\_\_\_\_

\_\_\_\_\_

**1.27** How does the rotation of the earth affect the winds? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## TEACHER CHECK



\_\_\_\_\_ initials

\_\_\_\_\_ date



**Review the material in this section in preparation for the Self Test.** The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

## SELF TEST 1

**Answer true or false** (each answer, 1 point).

- 1.01** \_\_\_\_\_ The air directly above the earth is heated by solar radiation.
- 1.02** \_\_\_\_\_ Sleet occurs as water droplets form in below-freezing temperatures.
- 1.03** \_\_\_\_\_ Winds blowing toward the east are called easterlies.
- 1.04** \_\_\_\_\_ Winds are turned to the right in the Northern Hemisphere.
- 1.05** \_\_\_\_\_ Trade winds occur between 30° N and 30°S.
- 1.06** \_\_\_\_\_ Warm air weighs less than cold air.
- 1.07** \_\_\_\_\_ Winds move from high to low pressure areas.
- 1.08** \_\_\_\_\_ If the sun's rays hit the earth at a large angle, the area is warm.
- 1.09** \_\_\_\_\_ The earth rotates towards the east.
- 1.010** \_\_\_\_\_ Air pressure is measured in terms of pressure at one hundred feet above sea level.

**Complete these sentences** (each answer, 3 points).

- 1.011** Normal sea level air pressure is \_\_\_\_\_ .
- 1.012** Balls of ice falling from the sky are called \_\_\_\_\_ .
- 1.013** The earth \_\_\_\_\_ on its axis.
- 1.014** The sun's radiation hits the earth most directly at the \_\_\_\_\_ .
- 1.015** The condition of the air above a certain area at a certain time is called \_\_\_\_\_ .
- 1.016** The condition of the air over a region averaged through a period of years is called \_\_\_\_\_ .
- 1.017** The temperature of the air depends partly on the amount of \_\_\_\_\_ hitting the earth.
- 1.018** The type of surface that warms up the slowest is \_\_\_\_\_ .
- 1.019** The winds that occur between the equator and 30°N or 30°S latitude are called \_\_\_\_\_ .
- 1.020** The prevailing westerlies blow out of the a. \_\_\_\_\_ toward the b. \_\_\_\_\_ .

Complete this diagram (each answer, 2 points).

- polar easterlies                      southeast trades
- prevailing westerlies              southwest trades
- northeast trades

- 1.021 \_\_\_\_\_
- 1.022 \_\_\_\_\_
- 1.023 \_\_\_\_\_
- 1.024 \_\_\_\_\_
- 1.025 \_\_\_\_\_
- 1.026 \_\_\_\_\_

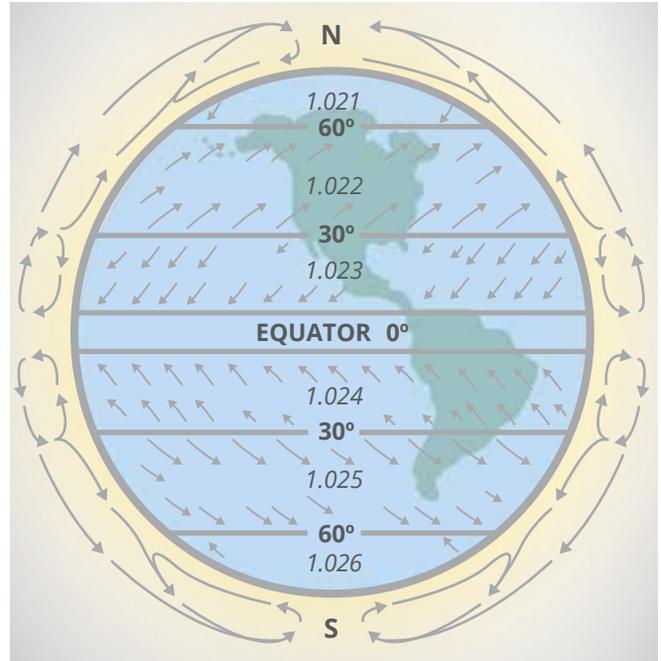


Figure 6 | Prevailing Winds and Their Locations

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