

NAME: \_\_\_\_\_

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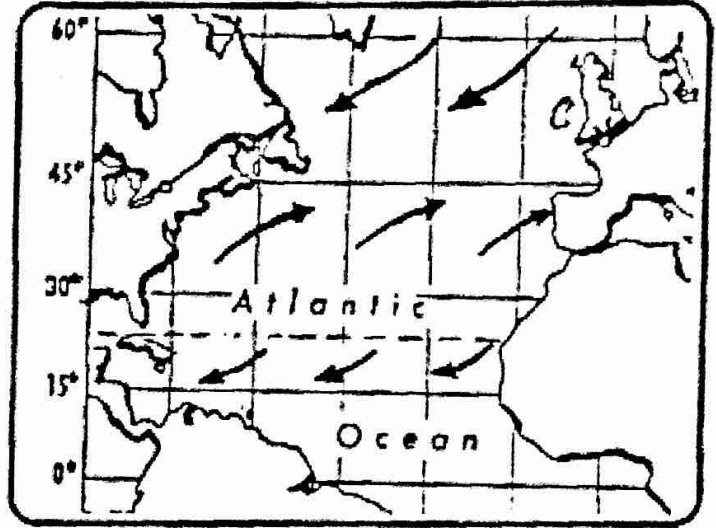
# \* GLOBAL WIND PATTERNS STUDY PACK + NOTES

The most common wind direction is called the prevailing winds.

When Columbus set sail for Asia (and "discovered" the Americas) he utilized the prevailing winds. He knew that at about 20° north latitude he would find dependable winds from the north-east which would carry his ships quickly westward across the Atlantic Ocean. On his return, he sailed northward to the zone of prevailing westerlies, that ferried him back to Europe. (See the diagram below.)

These wind belts soon became the avenues of the triangular trade routes. Merchants from England sent manufactured items to Africa, where they were traded for negro slaves.

The slaves were sailed across the Atlantic on the north-east trade winds. In the Americas, slaves were traded for rum and cotton, which shipped to England on the prevailing westerlies farther to the north. The rum and cotton were sold in England for a considerable profit to the owners and investors. The north-east trade winds and the mid-latitude westerlies are two zones of the world wide pattern of prevailing winds.

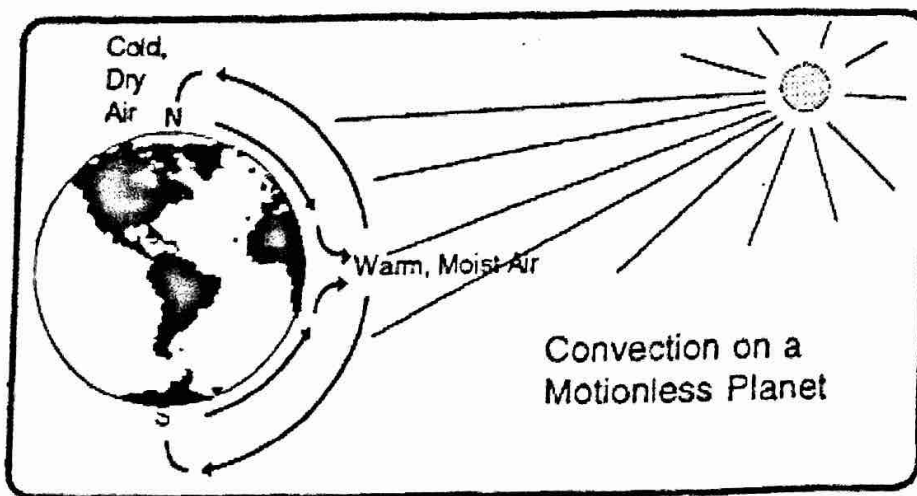


Prevailing Winds over the North Atlantic

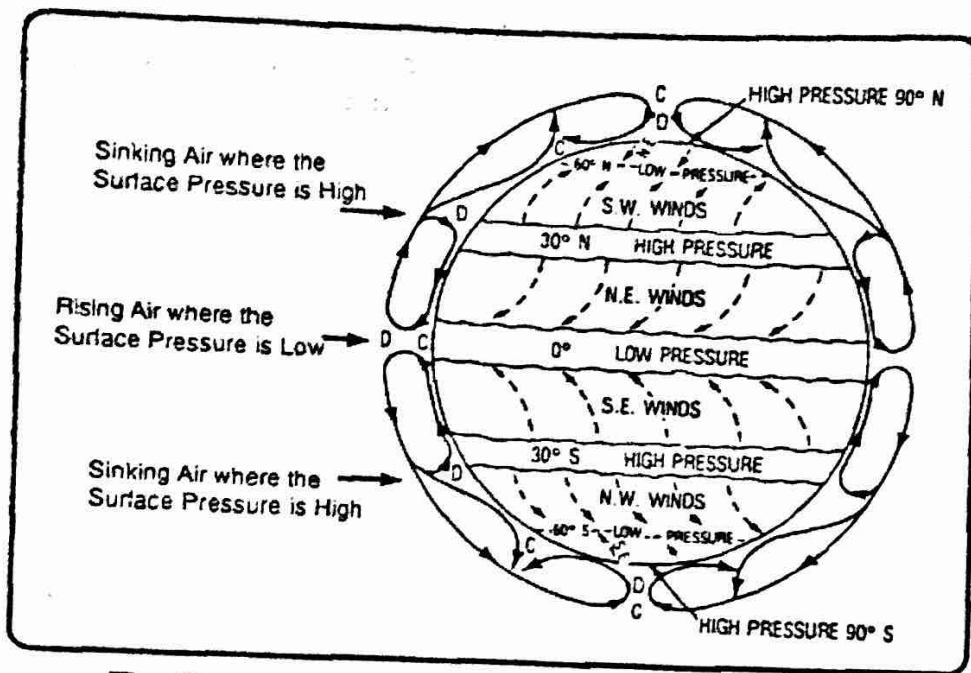
1. Why did Columbus sail south along Africa before he sailed west to the Americas?

2. What do we call winds from the most common wind direction?

3. Winds are heat flow by \_\_\_\_\_.



If the Earth were not in motion, the world wide pattern of winds would be very simple. As this diagram shows, we would have two giant convection cells. Warm, moist air would rise at the equator and travel toward the poles. At the poles, the air would cool, sink, and blow south to the equator. But the Earth is moving; it rotates. Therefore, the Coriolis force makes the actual pattern more complex.



The General Pattern of Prevailing Terrestrial Winds

This diagram shows the true pattern of Earth's prevailing winds.

Notice how the winds curve to the right in the northern hemisphere and to the left in the southern hemisphere.

4. In the Bay Area, the prevailing winds come from the \_\_\_\_\_

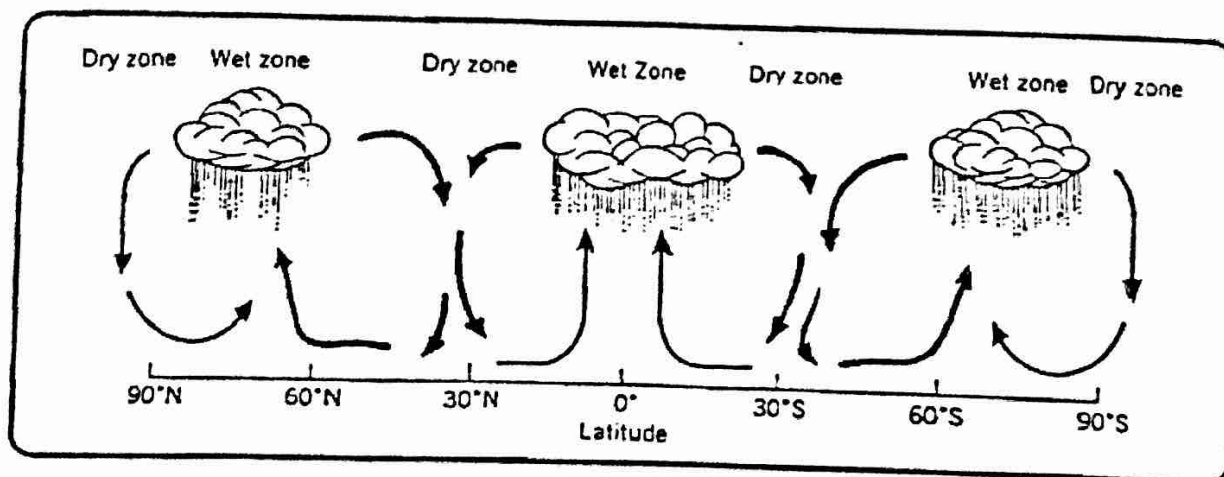
Notice how the winds in the southern hemisphere are a mirror reflection of the northern hemisphere winds.

Most of the wind belt names are easy to understand, but the doldrums may be unfamiliar. The doldrums are the regions of weak and undependable winds near the equator, where warm moist air is often rising.

5. According to the map above, near the poles, the winds usually blow from the \_\_\_\_\_

6. Winds always blow from \_\_\_\_\_ pressure toward \_\_\_\_\_ pressure, and they curve because of the \_\_\_\_\_ effect.

Vertical profiles of Earth's atmosphere from the North Pole to the South Pole.



7. Along the equator, the air moves mostly along the Earth, or up higher into the atmosphere.  
(Circle one choice)

8. Why is the climate often wet near the equator?

The Earth's surface is constantly being heated by energy from the sun. Because tropical regions are warmed more effectively than polar regions, differences in atmospheric pressure develop between these latitude extremes. Such pressure differences result in planetwide winds.

Air heated at the surface in the lower latitudes is lifted and replaced by cooler, denser air flowing from the higher latitudes. If the Earth did not rotate, if it was not inclined on its axis, and if the surface was uniform throughout, planetary atmospheric circulation would probably be relatively simple. Alas, such is not the case! In fact, global wind systems are extremely complex, and details of worldwide wind patterns are still not clearly understood by earth scientists. However, basic circulation patterns recognized by scientists do exist, and they are used to help understand certain worldwide climate and weather patterns.

The purpose of this activity is to examine the location and extent of some of the general planetary wind and pressure systems that are currently recognized by earth scientists. In order to complete this activity, you will need to keep three facts in mind:

1. Air tends to flow out of regions characterized by relative high pressure and into regions characterized by relative low pressure.
2. Because of the Earth's rotation, winds tend to be deflected or directed toward the right in the Northern Hemisphere and toward the left in the Southern Hemisphere.
3. Winds are named for the direction from which they originate. For example, a north wind is one that flows from the north.

Now refer to Figure 1, which represents a rough sketch of the Earth. Note that the locations of the equator (latitude 0°), the poles (latitude 90°), and latitudes 30° and 60° have been identified. Additional information will be added to the map as you complete this activity.

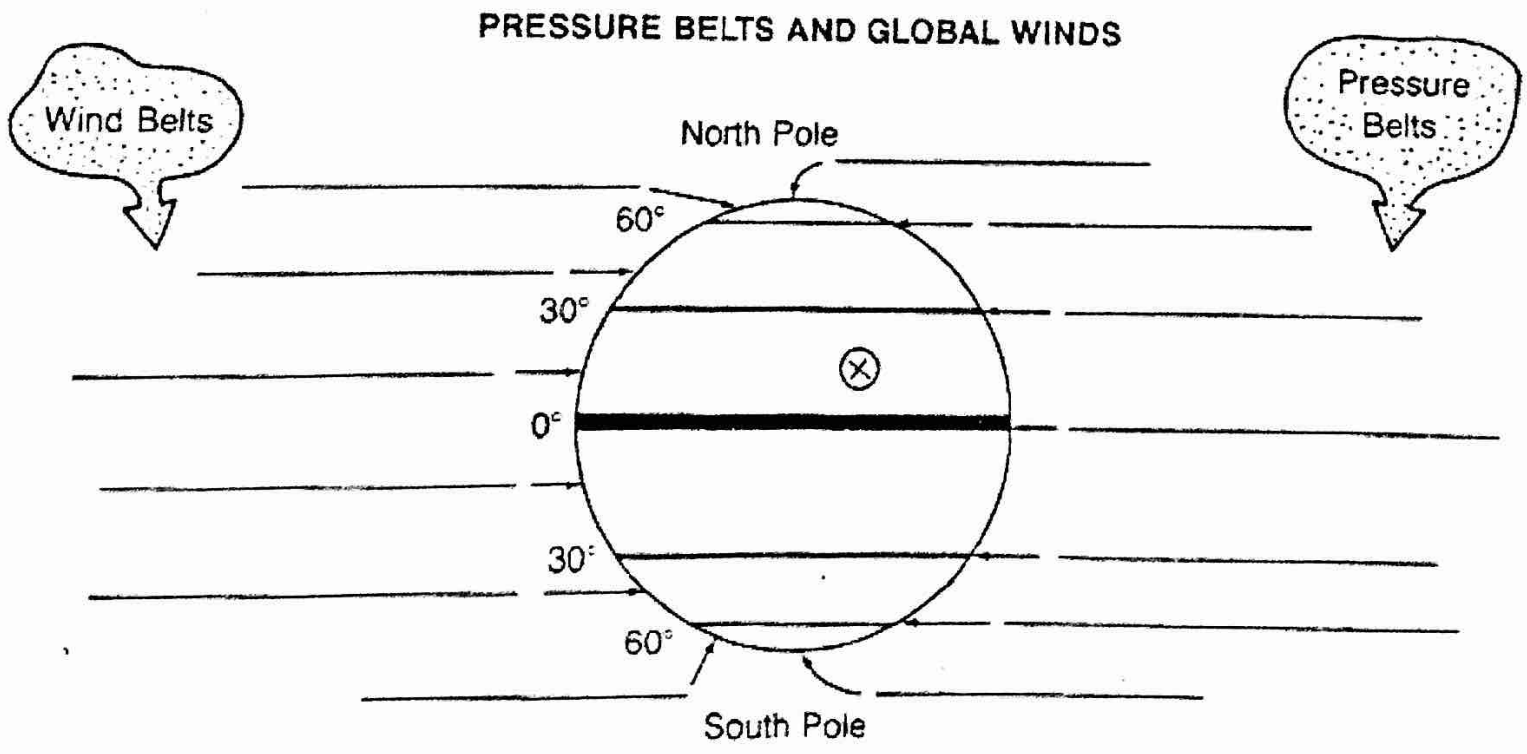
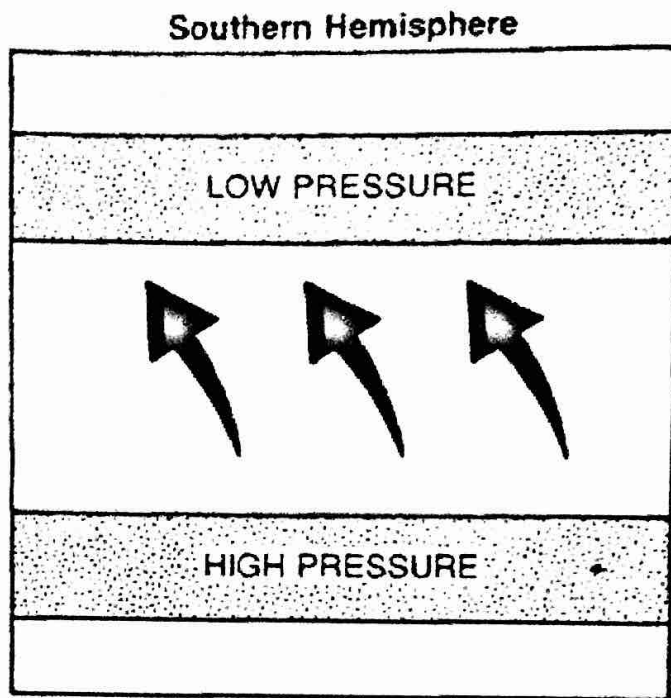
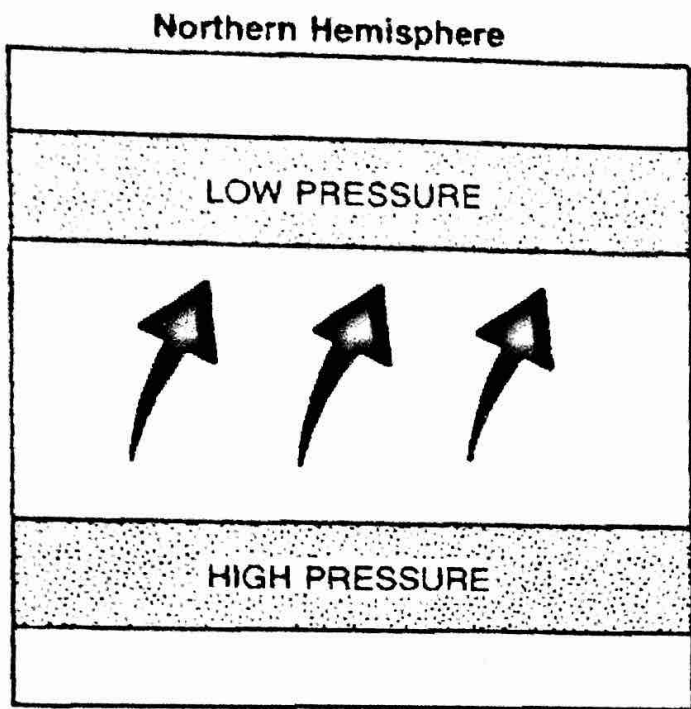


Figure 1

On the right side of Figure 1 and in the appropriate space provided, label each of the seven pressure belts. The equator is a low-pressure belt and is referred to as the equatorial low.

Latitudes 30° north and south are high-pressure zones and are each referred to as a sub-tropical high. Latitudes 60° north and south are low-pressure belts and are each known as a sub-polar low. Finally, the polar regions are high-pressure zones and each should be labeled as a polar high.

In the proper location, sketch in the direction of planetary wind movement within each global wind belt. Use several arrows in each zone to illustrate the direction of deflection, as shown in the following key. Be sure to place directional arrow, right on the map, within all six wind belt regions.



On the left side of Figure 1 and in the appropriate space provided, label the names of the wind belts. Remember that winds are named for the direction from which they flow. Winds located between latitudes 0° and 30° are known as trade winds. Thus, if winds within this zone originated in the northeast, they would be known as northeast trades. Winds located between latitudes 30° and 60° are referred to and named by the direction from which they originated. They are further described as prevailing winds. Thus, if winds within these zones originated in the northwest, they would be referred to as prevailing northwesterlies. Winds located between latitudes 60° and 90° (the North or South poles) are referred to as polar winds. Therefore, winds located in these zones, which originate in the east, are known as polar easterlies.

1. What causes winds to be deflected to the right or the left as they flow from high pressure to low pressure?

2. Name the wind belt in which you live.

3. Name the winds that would be found at location X (refer to Figure 1).

4. Why is air pressure generally lower over equatorial regions than over polar regions?

**SECTION 2-3 SECTION SUMMARY**

# Winds

## Guide for Reading

- ◆ What causes winds?
- ◆ What are local winds and global winds?
- ◆ Where are the major global wind belts located?

**A** wind is the horizontal movement of air from an area of high pressure to an area of lower pressure. **All winds are caused by differences in air pressure.** Most differences in air pressure are caused by unequal heating of the atmosphere. Cool, dense air has higher air pressure so it flows underneath warm, less dense air, forcing the warm air to rise.

Winds are described by their direction and speed. Wind direction is determined with a wind vane. The name of a wind is the direction the wind is coming from. Wind speed is measured with an **anemometer**.

Wind blowing over your skin removes body heat. The increased cooling that a wind can cause is called the **wind-chill factor**.

**Local winds** are winds that blow over short distances. **Local winds are caused by unequal heating of Earth's surface within a small area.** Local winds form only when no winds are blowing from farther away.

The sun heats land faster than water, so during the day air over land becomes warmer than air over water. The cool air blows inland from the water and moves underneath the warm air. The flow of air from an ocean or lake to the land is called a **sea breeze** or a lake breeze. At night, land cools more quickly than water, so air over land becomes cooler than air over water. The cool air blows toward the water from the land and moves underneath the warm air. The flow of air from land to a body of water is called a **land breeze**. Sea and land breezes over a large region that change direction with the seasons are called **monsoons**.

Winds that blow steadily from specific directions over long distances are called **global winds**. Warm air rises at the equator and cold air sinks at the poles, causing winds at Earth's surface to blow from the poles toward the equator. **The movement of air between the equator and the poles produces global winds.** Because Earth is rotating, global winds do not follow a straight path. The way Earth's rotation makes winds curve is called the **Coriolis effect**. In the Northern Hemisphere, global winds curve to the right. In the Southern Hemisphere, global winds curve to the left.

The Coriolis effect and other factors produce a pattern of calm areas and wind belts around Earth. The calm areas are called the doldrums and horse latitudes. **The major global wind belts are the trade winds, the prevailing westerlies, and the polar easterlies.** **Latitude** is a measure of distance north and south of the equator. The trade winds blow between the equator and 30° north and south latitude, the prevailing westerlies between 30° and 60° north and south latitude, and the polar easterlies between 60° north and south latitude and the poles.

About 10 kilometers above Earth's surface are bands of high-speed winds called **jet streams**. They blow from west to east.

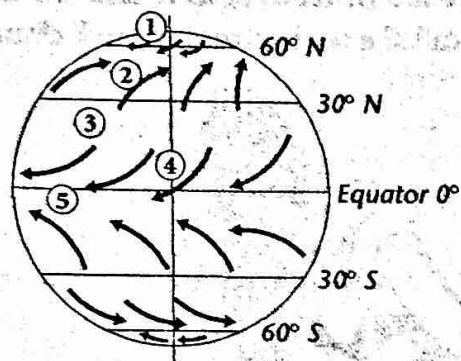
**SECTION 2-3 REVIEW AND REINFORCE**

# Winds

## ◆ Understanding Main Ideas

Identify the global wind belts in the figure below.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_



**21**

## ◆ Building Vocabulary

If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

- \_\_\_\_\_ 6. A wind is a horizontal movement of air from an area of high pressure to an area of lower pressure.
- \_\_\_\_\_ 7. Wind speed is measured with a wind vane.
- \_\_\_\_\_ 8. The increased cooling that a wind can cause is called the Coriolis effect.
- \_\_\_\_\_ 9. Local winds are winds that blow over short distances.
- \_\_\_\_\_ 10. The flow of air from an ocean or lake to the land is called a land breeze.
- \_\_\_\_\_ 11. The flow of air from land to a body of water is called a sea breeze.
- \_\_\_\_\_ 12. Sea and land breezes over a large region that change direction with the seasons are called global winds.
- \_\_\_\_\_ 13. Winds that blow steadily from specific directions over long distances are called doldrums.
- \_\_\_\_\_ 14. The way Earth's rotation makes winds curve is called the prevailing westerlies.
- \_\_\_\_\_ 15. Bands of high-speed winds about 10 kilometers above Earth's surface are called polar easterlies.

# ACTIVITY

## What Are Earth's Global Wind Patterns?

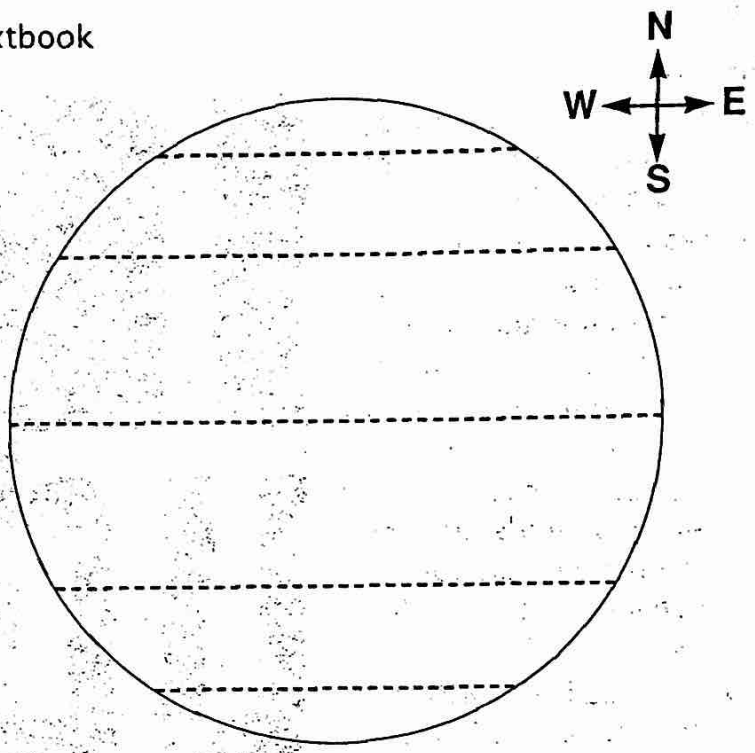
Worksheet 32  
Use after Section 11-4.

**Process Skills** identifying, analyzing

**Materials** pencil, globe diagram, textbook

### Procedure

- On the diagram shown, label the equator, 30° North and South Latitudes, 60° North and South Latitudes, and the North and South Poles.
- What is the latitude at the following locations?
  - equator \_\_\_\_\_
  - North Pole \_\_\_\_\_
  - South Pole \_\_\_\_\_
- On the globe, label the trade winds and the prevailing westerlies. Indicate their direction of flow using arrows.



- In which hemisphere do the northeast trade winds blow? \_\_\_\_\_  
In which hemisphere do the southeast trade winds blow? \_\_\_\_\_
- Are the global winds that blow across the United States northwesterlies, southwesterlies, northeasterlies, or southeasterlies? \_\_\_\_\_
- On the globe, mark the doldrums with a series of Xs. Why was this region troublesome to explorers sailing to new territories? \_\_\_\_\_  
\_\_\_\_\_
- Why are the global winds deflected eastward or westward as they move in a north-south direction? \_\_\_\_\_  
\_\_\_\_\_

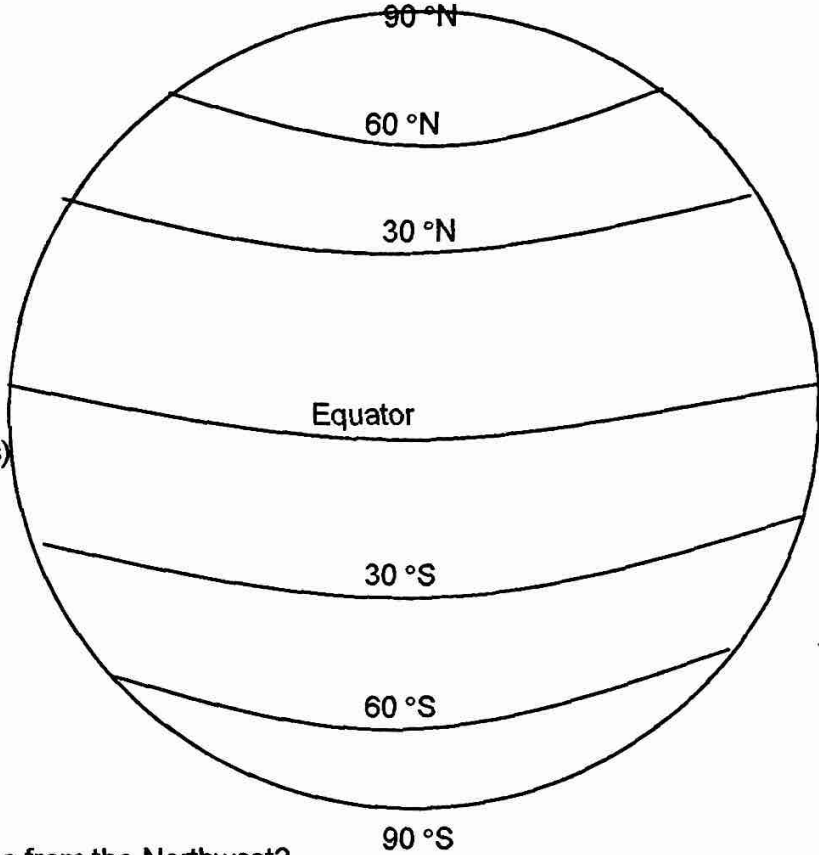
### Conclusion

- Study the arrows you drew on the globe for the trade winds and prevailing westerlies. From your knowledge of air movement based on differences in pressure, identify the following as areas of high pressure or low pressure.
  - equator \_\_\_\_\_
  - 30° North Latitude \_\_\_\_\_

**Winds on Our Big Blue Balloon: Analyzing Global and Local Wind Patterns**  
 Earth Science Mr. Traeger

4. Describe each of the following surface wind patterns. Which direction does each wind blow from?

- a. Polar Northeasterlies
- b. Prevailing Southwesterlies
- c. Prevailing Northeasterlies (Northeast Trade Winds)
- d. Prevailing Southeasterlies (Southeast Trade Winds)
- e. Prevailing Northwesterlies
- f. Polar Southeasterlies



5. Why do most of our storms here in California come from the Northwest?

6. American Airlines publishes the following timetable on aa.com for flights to and from New York. How much time does it take to go to New York? How much time does it take to fly back to LA? If the times are different, what could explain this adjustment in the timetable? New York is 3 hours ahead of LA.

**Departing**

Select	Carrier	Flight Number	Departing		Arriving		Aircraft Type	On Time	AAAdvantage Base Miles Earned	Flight Details
			City	Date & Time	City	Date & Time				
<input type="checkbox"/>	AMERICAN AIRLINES	10	LAX Los Angeles	06/08/2003 10:00 PM	JFK New York	06/09/2003 06:12 AM	762	90%	2475	

**Returning**

Select	Carrier	Flight Number	Departing		Arriving		Aircraft Type	On Time	AAAdvantage Base Miles Earned	Flight Details
			City	Date & Time	City	Date & Time				
<input type="checkbox"/>	AMERICAN AIRLINES	1	JFK New York	06/09/2003 09:00 AM	LAX Los Angeles	06/09/2003 11:58 AM	762	80%	2475	