



Activity #23: What is Wind?

Did You Know?

Because wind funnels through mountains, it may be stronger in a mountain pass than on a peak. At Pali Lookout in Hawaii near Honolulu, a sightseer can throw a hat or cap over the cliff and the wind will throw it back immediately.

Wind is caused by air in the earth’s atmosphere moving from one place to another. The air moves from areas of high pressure to areas of low pressure, rather like letting air out of a balloon. The pressure differences are caused by the sun heating up the air. Warm air is less dense or “lighter” than cool air, so it rises, creating low pressure. Cool air is more dense or “heavier.” It sinks down and presses on the ground, creating high pressure. When warm air, which is light, is pushed up by cool air, which is heavier, the movement is called convection (or circulation). Two kinds of convection produce wind: (a) “general circulation,” which extends around the earth in the form of global wind patterns; and (b) “secondary circulation,” where winds occur only in one place in the form of local winds.

1. Wind is not always reported in a separate area on the weather page of your daily newspaper, unless high winds are experienced or predicted for the region. However, wind is usually mentioned under the marine forecast, if your newspaper includes one. Look at today’s weather page to see if you can find a wind forecast, marine forecast, or any other mention of wind.
2. List any information you find on the chart below. What have you learned about wind from today’s weather page? (Sometimes wind speed is reported in nautical miles or knots. One land mile is 5,280 feet. One nautical mile is 6,076.115 feet. A wind with a 20-knot speed is moving at 20 nautical miles an hour. Can you convert nautical miles per hour to land miles per hour or to kilometers per hour?)

WIND PATTERNS	MARINE FORECAST	WIND SPEED (knots)	WIND SPEED (mph or kph)	OTHER WIND INFORMATION

Extension Activity: Perform a simple experiment to see how warm air rises and cool air sinks! Attach a paper bag, open end down, to each end of a yardstick. Tie a string to the middle of the yardstick, which you will use to suspend it. Hold a candle under one of the bags, being careful not to let it burn. The warmed bag of air will become lighter and rise. Next, take an empty jar out of the freezer and immediately hold it over, or near, one of the bags. The cooled bag of air will sink. Now, imagine you are the science reporter for your local newspaper. Write a news story about this experiment after you have performed it. Be sure to include the who, what, when, where, why, and how!



Activity #24: Local Winds

Did You Know?

Wind affects weather differently in different parts of the world. A scirocco wind is a hot, dry, southerly wind that blows across North Africa from the Sahara Desert. Scirocco wind becomes very hot and sticky as it reaches the sea.

Local winds arise only in specific areas on the earth. Local winds that result from the heating of land during summer and the cooling of land during winter are called *monsoons*. They blow from the ocean during summer and toward the ocean during winter. Monsoons control the climate in Asia, producing wet summers and dry winters. A warm, dry local wind that blows down the side of a mountain is called a *chinook* in the western United States and a *foehn* in Europe. A very hot northeast summer wind that blows dust and sand across Australia is called a *brickfielder*. The Arabic name for a violent wind which raises sandstorms, especially in North Africa is called a *haboob*. A pleasant, moist, easterly wind that brings mild weather to the Mediterranean is a *levanter*. The violent, dry, cold, northwest wind that blows along the coasts of Spain and France is called a *mistral*.

1. The names of some local winds tell you something about their characteristics. For instance, *monsoon* comes from "*mausim*," the Arab word for season. Using this lesson, a dictionary, and/or other sources in the library, complete columns 2, 3, and 4 on the chart below.
2. Look in today's newspaper to find synonyms for the wind name, meaning, or any of its characteristics. List the synonyms from the newspaper in the last column.

LOCAL WIND NAME	ROOT WORD & ORIGIN	EXACT MEANING	CHARACTERISTICS OF WIND TYPE	SYNONYMS FROM THE NEWSPAPER
Scirocco				
Monsoon				
Chinook				
Foehn				
Brickfielder				
Haboob				
Levanter				
Mistral				

Extension Activity: Suppose there was a new and unusual wind blowing in the state, region, or area where you live. Based on local information in today's newspaper, name the new wind. Then, describe this new wind's characteristics! (Refer to your region's weather on the weather page in your daily newspaper. The new wind should relate in some way to the weather patterns of your local area.)



Activity #25: Global Wind Patterns

Did You Know? According to legend, ships sailing from Spain to the Americas in the 1500s became becalmed in the still air at approximately 30°N latitude. In order to have enough drinking water for the people on the ships, horses were thrown overboard. This is how the Horse Latitudes were named.

Over the whole globe, the world’s winds move in a certain pattern. Hot air around the equator heats up, rises, and moves toward the poles. As it cools it sinks back down, some returning to the equator and some moving on to the poles. Cold air at the poles sinks and moves toward the equator. Because the earth is spinning around eastward, winds blow from east to west (easterlies) as air moves toward the faster moving equator. Winds blow from west to east (westerlies) as air moves away from the equator toward the poles. The apparent force resulting from the earth’s rotation which deflects air currents to the right in the Northern Hemisphere and to the left in the Southern Hemisphere is known as the Coriolis effect.

1. Using the Global Wind Patterns illustration (see page 31), identify the prevailing wind pattern for the area where you live. (Hint: you must know the continent where you live and the approximate line of latitude.)
2. Look through today’s newspaper for a news story (check the dateline) from one city located on each of continents listed below. Using a globe or world map, determine the latitude and longitude for each city. Then, using the Global Wind Patterns illustration, identify the prevailing wind pattern at each location.

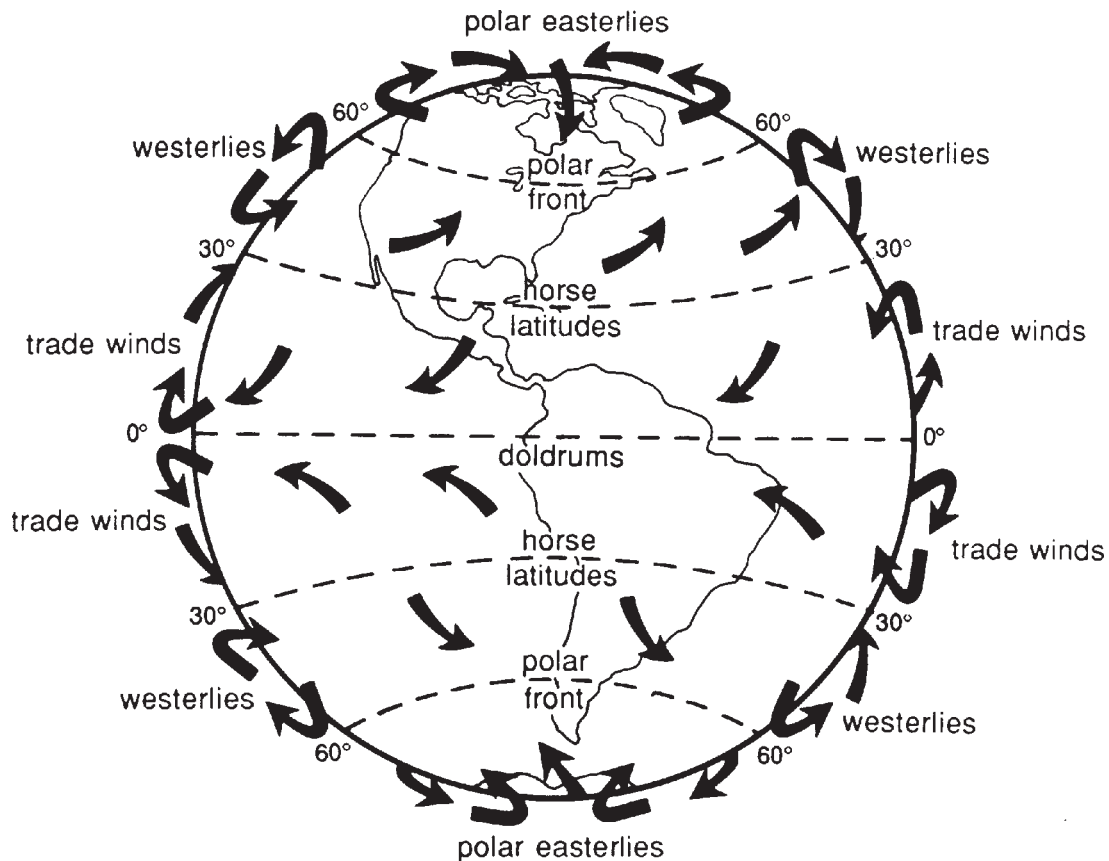
CONTINENT	DATETIME CITY	LATITUDE/LONGITUDE	PREVAILING WIND
South America			
Europe			
Asia			
Africa			
Australia			

Extension Activity: The poet, Samuel Taylor Coleridge (1772-1834), wrote about the feeling of being becalmed (without wind) in a ship in the doldrums. (The doldrums are an area of calm winds or light breezes near the equator.) In his poem, *The Rime of the Ancient Mariner*, he wrote:

“Day after day, day after day, We stuck, nor breath nor motion:
As idle as a painted ship, Upon a painted ocean.”

Try writing a poem of your own about the prevailing wind in the geographic area of one of your news story selections above. (Read the news story for any cultural and economic clues to make your poem as interesting as possible!)

Activity #25: Global Wind Patterns



Resulting from the earth's rotation, there are six belts of wind around the earth that form where the air heats and rises or cools and sinks. These belts determine the prevailing direction of the wind in any area. If the earth did not rotate, the winds would flow in one continuous north-south cycle from the equator toward each pole, where they would become cold and sink back toward the equator. Instead, the air flows in six bands, or prevailing patterns, because it travels at different speeds depending on its latitude.

- DOLDRUMS:** The doldrums are near the equator. The air is calm here because there is little change in temperature.
- TRADE WINDS:** Above the equator the trade winds are steady northeast winds. Below the equator, the trade winds are steady southeast winds.
- HORSE LATITUDES:** The horse latitudes are another area of calm. The air is cooling and sinking here.
- WESTERLIES:** The westerlies are the prevailing wind over much of the middle and higher latitudes.
- POLAR FRONT:** The polar front is where the warm air of the westerlies meets the cold air of the polar easterlies. This causes unstable weather in the region where the westerlies prevail.
- POLAR EASTERLIES:** The polar easterlies blow from east to west between each pole and the high latitudes. Surface air moving away from the poles moves westward across faster-moving points nearer the equator.



Activity #26: Wind Speed & Direction

Did You Know?

Winds high above the earth's surface are measured by sending up helium-filled balloons. A balloon moves with the same speed and direction as the wind. Its motion is measured either by sight or by radar.

Two features of wind, its speed and its direction, are used in describing and forecasting weather. Wind speed is measured with an instrument called an anemometer. Several kinds of anemometers are used today. The most common kind has three or four cups attached to spokes on a rotating shaft. The spokes turn the shaft as the wind blows. The wind speed is indicated by the speed of the spinning shaft. Wind speeds are usually stated in miles, knots (nautical miles), or kilometers per hour. Wind direction is measured with an instrument called a weather vane. A weather vane has a broad, flat blade attached to a spoke pivoted at one end. Wind blowing on the blade turns the spoke so that the blade lines up in the wind direction. The wind direction may be indicated by an arrow fastened to the spoke, or by an electric meter remotely controlled by the weather vane. Wind directions are often indicated by using the 360 degrees of a circle. (North is indicated by 0 degrees, an east wind from 90 degrees, a south wind from 180 degrees, and a west wind blows from 270 degrees.)

1. Wind speed is described by its measurement (in miles, knots, or kilometers per hour). Can you think of other items that are described by or with some form of measurement?
2. Look through today's newspaper for examples of items, objects, or even people described by or with measurement. (Be sure to scan the weather page, the business section, the sports section, and the classified advertisement section!) List your examples below.

ITEM, OBJECT, OR PERSON	MEASUREMENT DESCRIPTION	HOW IS THE MEASUREMENT MADE?	EXPLANATION & ADDITIONAL INFORMATION

Extension Activity: A weather vane shows wind direction. If we know the direction the wind is blowing, we can forecast the weather that usually comes with it. East winds generally bring rain, west winds clearing. North winds mean cold weather, and south winds bring heat. (In the Southern Hemisphere, it is exactly the opposite for every direction.) Make your own homemade weather vane. Use a compass to make sure your N-S-E-W letters are set up correctly. Then, observe your weather vane! Is there a relationship between wind direction and the daily weather? Check your findings each day against the information reported on the weather page in your newspaper. What conclusions can you draw?



Activity #27: The Wind Chill Factor

Did You Know?

Wind chill is the cooling effect of the wind on the skin. The stronger the wind the more heat is lost from the body and the colder a person feels. If human skin were exposed to winds of 30 mph (48 kph) in a temperature of -30°F (-34°C) it would freeze solid in 30 seconds.

Wind chill is an estimate of how cold the wind makes a person feel in cold weather. The faster the wind blows, the faster the body loses heat. Therefore, the feeling of cold increases as the speed of the wind increases. For example, when the temperature is 10°F and the wind is blowing at a speed of 10 mph, the wind chill temperature is equal to -9°F. This means that with a 10 mph wind at 10°F, people lose as much heat and feel as cold as they do when the temperature is -9°F and the wind is calm. Wind chill is not an exact measurement of cold because temperature and wind are not the only conditions that make people feel cold. Someone who is thin or whose clothes are damp will lose more heat and feel colder than another person. But wind chill temperatures can give a better idea of how cold it feels.

1. Turn to the weather page in today’s newspaper (if it is late Fall, Winter, or early Spring). Find yesterday’s temperatures for the following U.S. cities: New York, San Francisco, Green Bay, Chicago, Anchorage, Boise, Boston, Denver, Tulsa, Pittsburgh, Des Moines, and Atlanta. Write the temperatures down.
2. Next, using the wind chill chart below, determine how cold it would have felt in those cities yesterday with the wind speed at 5 mph, 15 mph, 25 mph, and 35 mph.

WIND SPEED (MPH)	THERMOMETER READINGS (°F)									
	50	40	30	20	10	0	-10	-20	-30	-40
	EQUIVALENT TEMPERATURES (F°)									
Calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116

Extension Activity: Determine yesterday’s wind chill equivalent temperature for your hometown! What are the effects of wind chill on your body? What precautions should you take against getting too cold?



Activity #28: The Beaufort Wind Scale

Did You Know?

The strongest wind ever recorded was 231 mph (371 kph) at the summit of Mount Washington, New Hampshire on April 12, 1934. The windiest place in the world is the George V Coast in Antarctica. Here gales of 200 mph (320 kph) have been recorded.

The Beaufort Wind Scale is a guide for estimating wind speed. It is actually a series of numbers, ranging from 0 to 17, used to indicate wind speeds. The scale was devised in 1805 by British Rear Admiral Sir Francis Beaufort. Beaufort defined the numbers in terms of the effect of various winds on sailing vessels. For example, wind indicated by the number 12 was defined as *“That which no canvas could withstand.”* Today the Beaufort scale is defined in terms of wind speeds measured about 33 feet (10 meters) above the ground. Using the Beaufort scale (see page 35), we can estimate the speed of the wind by watching how it affects things outside, like trees, flags, and chimney smoke.

1. Go outside and observe the wind’s effects at the same time of day for a week (or at various predetermined times). Then, refer to The Beaufort Wind Scale (page 35). Record your observations and your estimate of the wind speed on the chart below.
2. At the end of the week, check your findings against the information reported each day on the weather page in your newspaper. What conclusions can you draw? How accurate were your estimates?

DAY OF WEEK	NAME OF WIND	MPH/KPH	OBSERVATIONS
Sunday			
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			

Extension Activity: For a variation of the experiment above, record your observations of the wind twice a day, once in the morning and once in the afternoon. (Winds tend to increase in the afternoon, due to vertical mixing of warm and cool air.) At the end of the week, compare the morning readings with the afternoon readings. Then, check your findings against the information reported each day on the weather page in your newspaper. What conclusions can you draw? Were your estimates more accurate with two readings?

Activity #28: The Beaufort Wind Scale

BEAUFORT NUMBER	NAME OF WIND	MILES PER HOUR	KILOMETERS PER HOUR	EFFECT ON LAND
0	Calm	minus 1	minus 1	Calm: smoke rises vertically.
1	Light Air	1-3	1-5	Weather vanes inactive; smoke drifts with air.
2	Light Breeze	4-7	6-11	Weather vanes active; wind felt on face; leaves rustle.
3	Gentle Breeze	8-12	12-19	Leaves and small twigs move; light flags extend.
4	Moderate Breeze	13-18	20-28	Small branches sway; dust and loose paper blow about.
5	Fresh Breeze	19-24	29-38	Small trees sway; waves break on inland waters.
6	Strong Breeze	25-31	39-49	Large branches sway; umbrellas difficult to use.
7	Moderate Gale	32-38	50-61	Whole trees sway; difficult to walk against the wind.
8	Fresh Gale	39-46	62-74	Twigs broken off trees; walking against wind very difficult.
9	Strong Gale	47-54	75-88	Slight damage to buildings; shingles blown off roofs.
10	Whole Gale	55-63	89-102	Trees uprooted; considerable damage to buildings.
11	Storm	64-73	103-117	Widespread damage to buildings.
12-17	Hurricane	74 plus	117 plus	Violent, general destruction and devastation.

Extension Activity: Create a Beaufort Wind Scale newspaper clipping file! In other words, begin a clipping file of newspaper photos, headlines and type, articles, comics, charts, graphs, and advertisements representative of any level on the chart above. (This may take many weeks of newspaper collection.) Sort your newspaper clippings by category: 0-12. After acquiring several examples of each of the 13 categories, create a poster display illustrating the Beaufort Wind Scale. Decorate the classroom bulletin board with your wind scale posters.