

THE ATMOSPHERE

AIM 2: How are winds and clouds created?

HW

- Read "What Causes the Wind?" p148-155
- Do all questions on Part A on p155

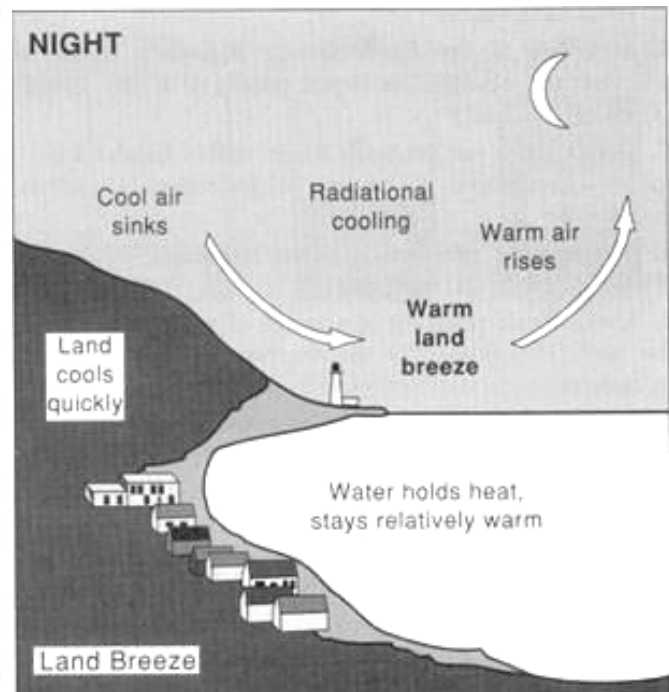
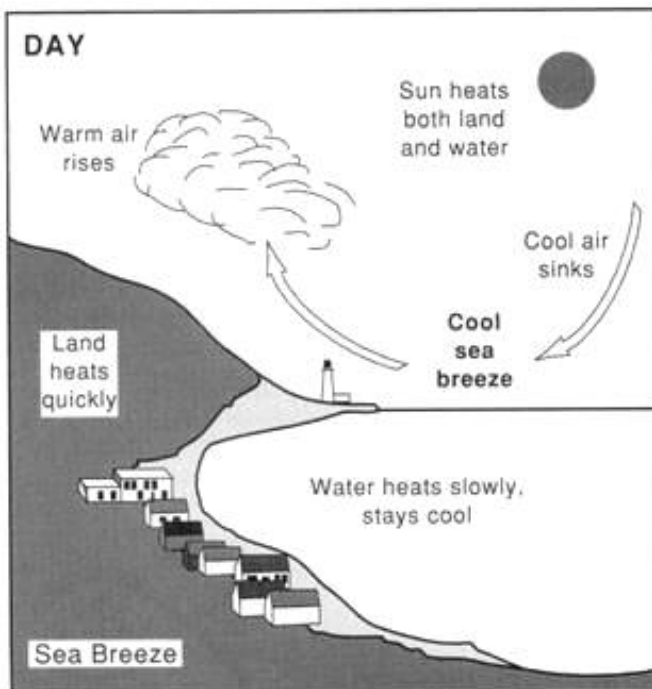
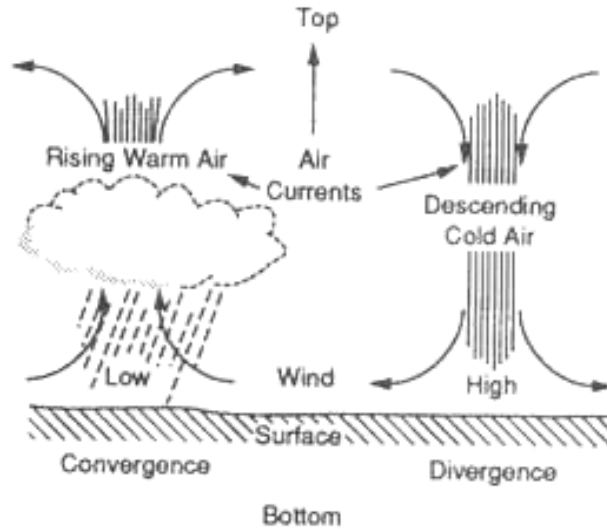
Review Unit

- Do all Chapter Review Questions p155-162

Winds are created by a difference in air temperature.

When a mass of air increases in temperature its density decreases and it rises. As warm air rises it is replaced by cooler air and a current of air (a wind) is created.

Winds always blow from a region of high pressure (cool air) to a region of low pressure (warm air).

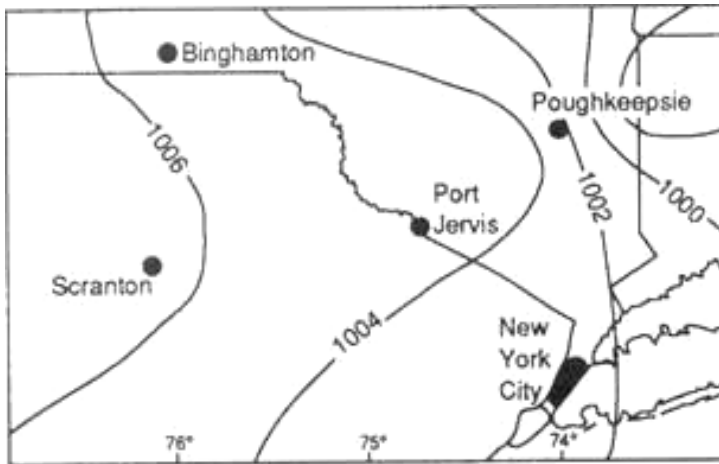


Note:

- Land absorbs and releases heat quickly because its specific heat capacity is low. See ESRT page 1 (land = granite)
- Water absorbs and releases heat slowly because its specific heat capacity is high. See ESRT page 1 (liquid water)

Winds blow fastest where the gradient in air pressure is greatest, where the isobars (lines of equal atmospheric pressure) are close together.

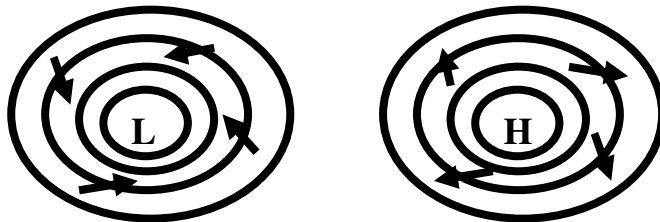
Ex:



The Coriolis Effect is the curvature of winds due to Earth's rotation. See reference tables "Planetary Wind and Moisture Belts in the Troposphere"

- Winds in the Northern Hemisphere curve to the right of their moving direction.

Ex:



L and H in Northern hemisphere

- Winds in the Southern Hemisphere curve to the left of their moving direction.

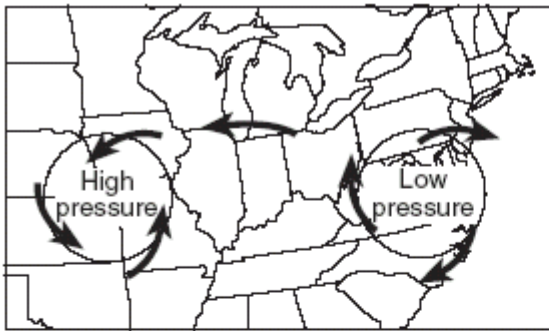
Cloud Formation

When a mass of air rises it expands and cools. As the dew point is reached the moisture in the air condenses on condensation nuclei (very small particles) to form tiny droplets which form clouds.

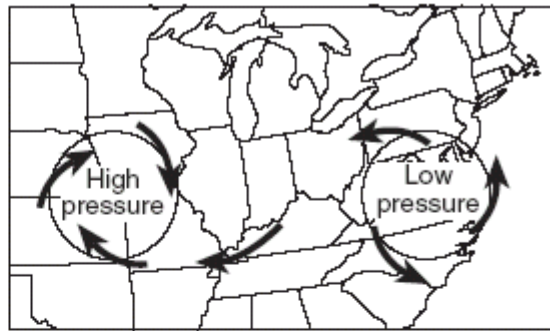
TEST YOUR UNDERSTANDING

1/07

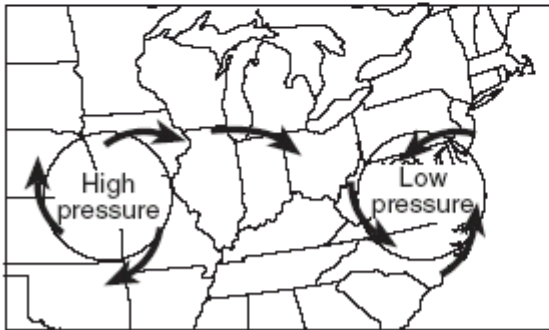
14 Which map best represents the surface wind pattern associated with high-pressure and low-pressure systems in the Northern Hemisphere?



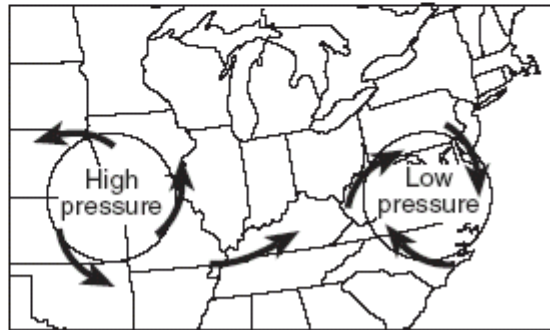
(1)



(3)



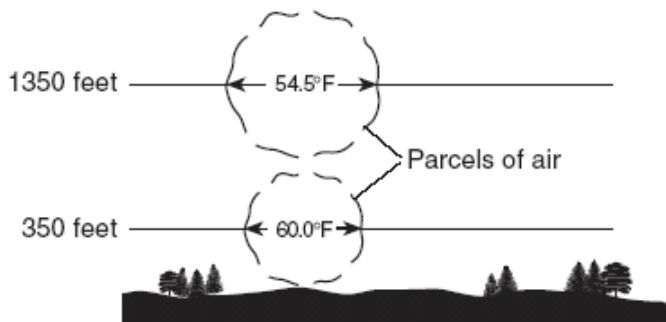
(2)



(4)

Base your answers to questions 70 through 72 on the diagram below, which shows the temperature change when a parcel of air warms, rises, and expands to form a cloud. Location A is at the base of the cloud.

Cloud Formation



70 Explain why the warmer air rises.

71 Assume the cooling rate of the rising parcel of air is constant. Determine the temperature of the air parcel at the 3350-foot altitude. Express your answer to the *nearest tenth of a degree*.

72 State the relative humidity of the air at location A.

6/07

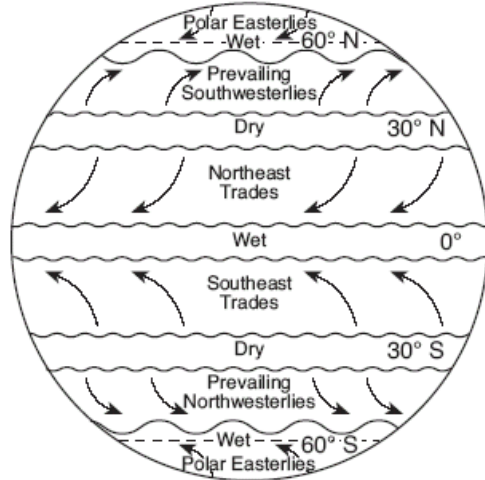
10 Which weather condition most directly determines wind speeds at Earth's surface?

- (1) visibility changes
- (2) amount of cloud cover
- (3) air-pressure gradient
- (4) dewpoint differences

11 Which statement best explains why an increase in the relative humidity of a parcel of air generally increases the chance of precipitation?

- (1) The dewpoint is farther from the condensation point, causing rain.
- (2) The air temperature is closer to the dewpoint, making cloud formation more likely.
- (3) The amount of moisture in the air is greater, making the air heavier.
- (4) The specific heat of the moist air is greater than the drier air, releasing energy.

Base your answers to questions 45 through 47 on the map below, which shows Earth's planetary wind belts.



45 The curving of these planetary winds is the result of

- (1) Earth's rotation on its axis
- (2) the unequal heating of Earth's atmosphere
- (3) the unequal heating of Earth's surface
- (4) Earth's gravitational pull on the Moon

46 Which wind belt has the greatest effect on the climate of New York State?

- (1) prevailing northwesterlies
- (2) prevailing southwesterlies
- (3) northeast trades
- (4) southeast trades

47 Which climatic conditions exist where the trade winds converge?

- (1) cool and wet
- (2) cool and dry
- (3) warm and wet
- (4) warm and dry

8/07

2 The Coriolis effect causes winds in New York State to generally curve

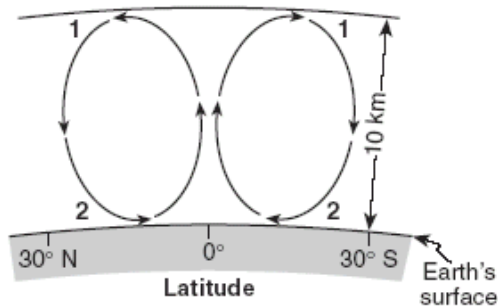
- (1) to the right of the direction of travel
- (2) to the left of the direction of travel
- (3) upward away from Earth's surface
- (4) downward toward Earth's surface

1-06

16 In which direction do the surface winds blow around a high-pressure system in the Northern Hemisphere?

- (1) clockwise and inward
- (2) clockwise and outward
- (3) counterclockwise and inward
- (4) counterclockwise and outward

Base your answers to questions 47 through 50 on the cross section below and on your knowledge of Earth science. The cross section shows the general movement of air within a portion of Earth's atmosphere located between 30° N and 30° S latitude. Numbers 1 and 2 represent different locations in the atmosphere.



(Not drawn to scale)

47 Which temperature zone layer of Earth's atmosphere is shown in the cross section?

- (1) troposphere
- (2) stratosphere
- (3) mesosphere
- (4) thermosphere

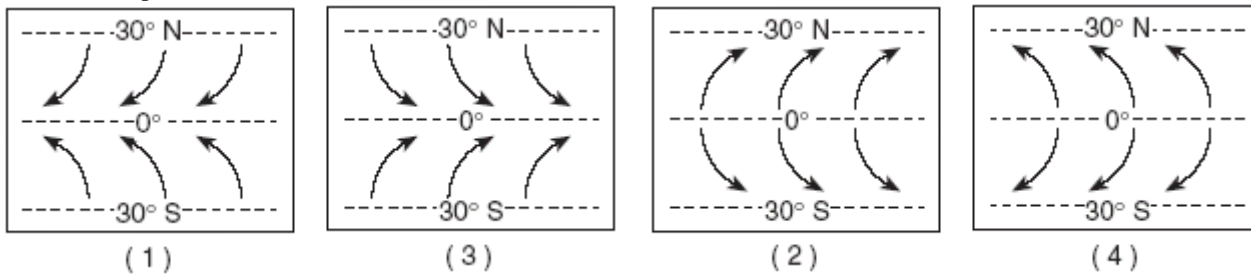
48 The air movement shown in the cross section is due to the process of

- (1) condensation
- (2) conduction
- (3) evaporation
- (4) convection

49 What is the approximate percentage by volume of oxygen present in Earth's atmosphere at location 2?

- (1) 10%
- (2) 21%
- (3) 33%
- (4) 46%

50 Which map best shows the surface movement of winds between 30° N and 30° S latitude?



6-06

11 In the Northern Hemisphere, planetary winds blowing from north to south are deflected, or curved, toward the west. This deflection is caused by the

- (1) unequal heating of land and water surfaces
- (2) movement of low-pressure weather systems
- (3) orbiting of Earth around the Sun
- (4) spinning of Earth on its axis

15 Most of the Gulf Stream Ocean Current is

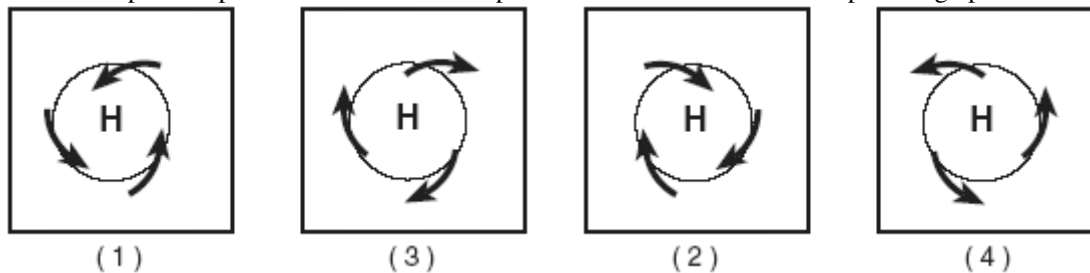
- (1) warm water that flows southwestward
- (2) warm water that flows northeastward
- (3) cool water that flows southwestward
- (4) cool water that flows northeastward

19 Snowfall is rare at the South Pole because the air over the South Pole is usually

- (1) rising and moist
- (2) rising and dry
- (3) sinking and moist
- (4) sinking and dry

8-06

8 Which map best represents the surface wind pattern around a Northern Hemisphere high pressure center?



2003-1

9 Most of Earth's surface ocean current patterns are primarily caused by

- (1) the force of gravity
- (2) the impact of precipitation
- (3) prevailing winds
- (4) river currents

11 In which direction do surface winds around low- pressure centers in the Northern Hemisphere generally move?

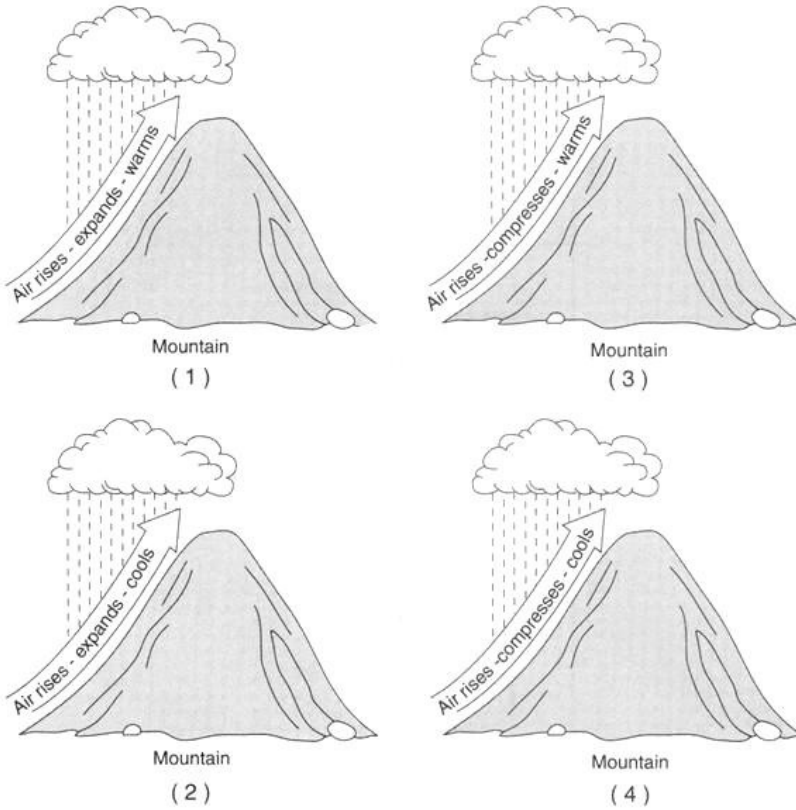
- (1) counterclockwise, toward the center of the low
- (2) clockwise, toward the center of the low
- (3) counterclockwise, away from the center of the low
- (4) clockwise, away from the center of the low

2003-6

1 The planetary winds in Earth's Northern Hemisphere generally curve to the right due to Earth's

- (1) orbit around the Sun
- (2) spin on its axis
- (3) magnetic field
- (4) force of gravity

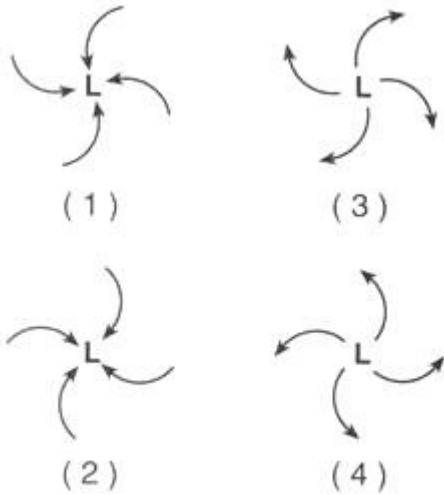
6 Which diagram best illustrates how air rising over a mountain produces precipitation?



9 Why are the beaches that are located on the southern shore of Long Island often considerably cooler than nearby inland locations on hot summer afternoons?

- (1) A land breeze develops due to the lower specific heat of water and the higher specific heat of land.
- (2) A sea breeze develops due to the higher specific heat of water and the lower specific heat of land.
- (3) The beaches are closer to the Equator than the inland locations are.
- (4) The beaches are farther from the Equator than the inland locations are.

17 Which map view best shows the movement of surface air around a low-pressure system in the Northern Hemisphere?

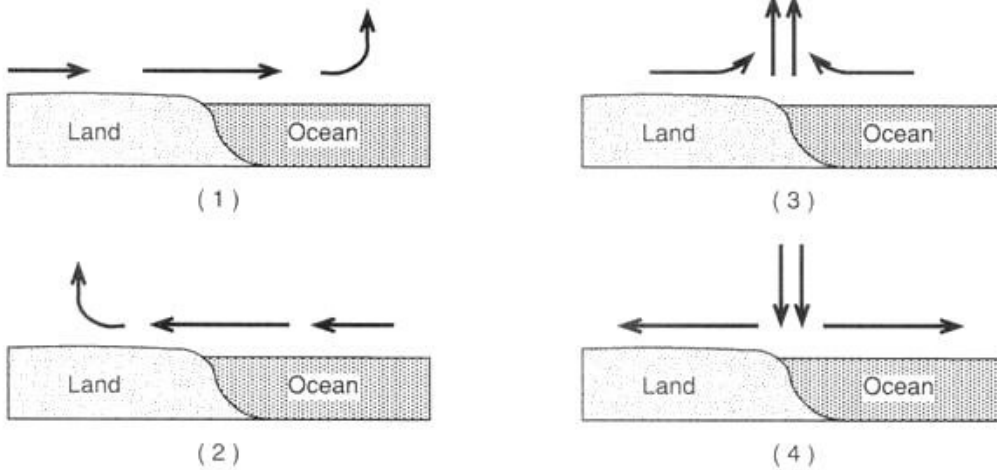


2003-8

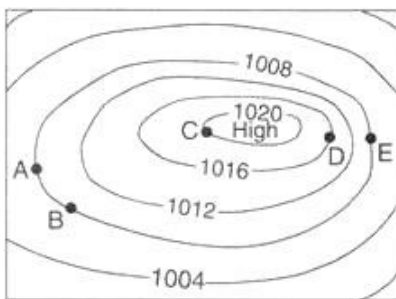
5 Surface ocean currents curve to the right in the Northern Hemisphere because

- (1) the Moon spins on its axis
- (2) the Moon travels in an orbit around Earth
- (3) Earth spins on its axis
- (4) Earth travels in an orbit around the Sun

10 Adjacent land and ocean surfaces have the same temperature at sunrise on a clear, calm, summer day. Then the land and water are heated by the Sun for several hours. Which cross section shows the most likely direction of surface winds that will develop at this ocean shore?



13 The air-pressure field map below represents a high-pressure system over the central United States. Isobars show the air pressure, in millibars. Letters A through E represent locations on Earth's surface.



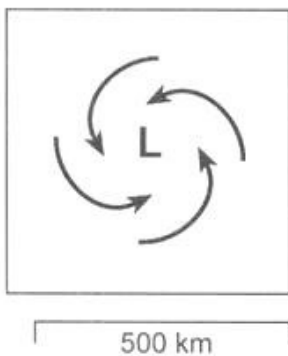
Between which two locations is the wind speed greatest? (1) A and B (2) B and C (3) C and D (4) D and E

14 Surface ocean currents located at 40° south latitude, 90° west longitude generally flow toward the

- (1) northeast (2) southeast (3) southwest (4) west

2002-1

6 A map view of surface air movement in a low- pressure system is shown below.



The air near the center of this low-pressure system usually will

- (1) evaporate into a liquid (2) reverse direction (3) rise and form clouds (4) squeeze together to form a high-pressure system

29 Clouds usually form when

- (1) air temperature reaches the dewpoint (2) evaporation has warmed the surrounding air
- (3) relative humidity is 0% (4) condensation nuclei have been removed from the air

2002-6

12 Which atmospheric conditions would cause smoke from a campfire on a beach to blow toward the ocean?

- (1) warm air over the land and cool air over the ocean
- (2) humid air over the land and dry air over the ocean
- (3) low-density air over the land and high- density air over the ocean
- (4) high air pressure over the land and low air pressure over the ocean

16 Which weather change usually occurs when the difference between the air temperature and the dewpoint temperature is decreasing?

- (1) The amount of cloud cover decreases. (2) The probability of precipitation decreases.
- (3) The relative humidity increases. (4) The barometric pressure increases.

23 The Coriolis effect provides evidence that Earth (1) rotates (2) has a tilted axis (3) has seasons (4) revolves

24 Which interaction between the atmosphere and the hydrosphere causes most surface ocean currents?

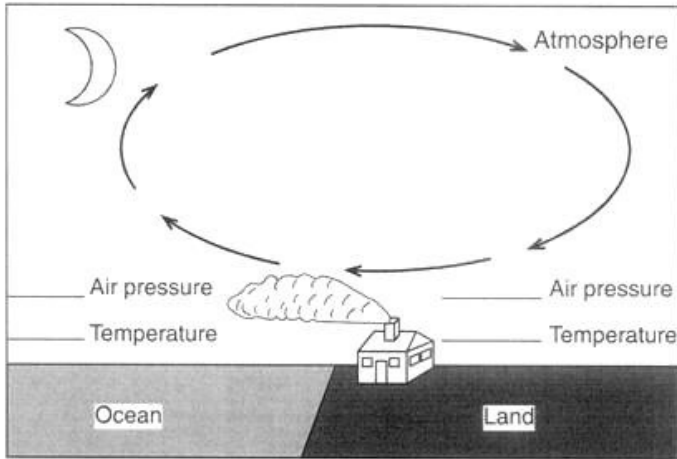
- (1) cooling of rising air above the ocean surface
- (2) evaporation of water from the ocean surface
- (3) friction from planetary winds on the ocean surface
- (4) seismic waves on the ocean surface

2002-8

17 On a certain day, the isobars on a weather map are very close together over eastern New York State. To make the people of this area aware of possible risk to life and property in this situation, the National Weather Service should issue

- (1) a dense-fog warning
- (2) a high-wind advisory
- (3) a heat-index warning
- (4) an air-pollution advisory

Base your answers to questions 67 and 68 on the cross section provided in your answer booklet, which represents a house at an ocean shoreline at night. Smoke from the chimney is blowing out to sea.

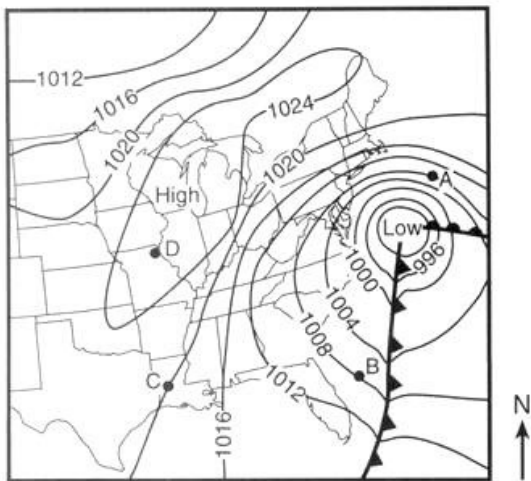


67 Label the two lines provided on the cross section in your answer booklet to show where air pressure is relatively "high" and where it is relatively "low."

68 Assume that the wind blowing out to sea on this night is caused by local air-temperature conditions. Label the two lines provided on the cross section in your answer booklet to show where Earth's surface air temperature is relatively "warm" and where it is relatively "cool."

2001-6

Base your answers to questions 36 through 37 on the weather map below. Points A, B, C, and D are locations on Earth's surface.

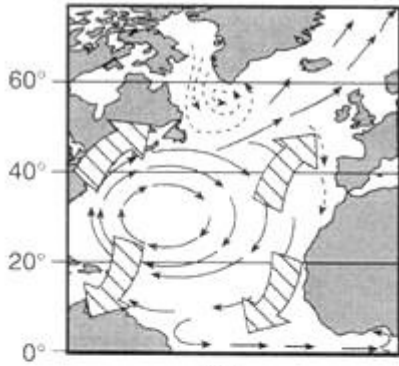


36 The isolines on the map represent values of air (1) density (2) humidity (3) pressure (4) temperature

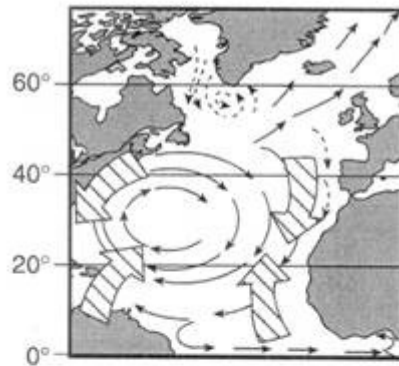
37 The strongest winds are closest to location (1) A (2) B (3) C (4) D

2001-8

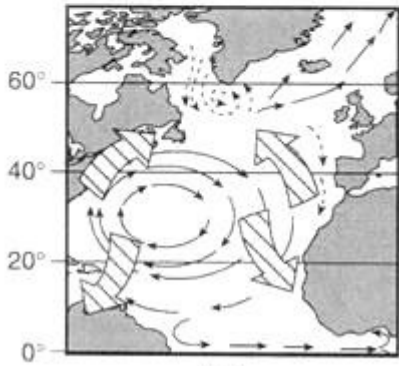
46 Which map best represents the global prevailing surface wind patterns responsible for generating Atlantic Ocean currents?



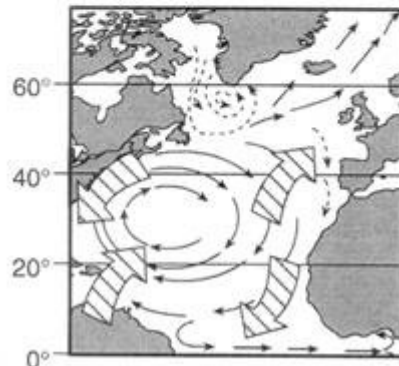
(1)



(3)



(2)



(4)

