

KEY

Their funnel-shaped cloud extends down out of the cumulonimbus cloud of a thunderstorm. The center of the funnel is called the vortex. Winds move counter-clockwise around the vortex in speeds in excess of 600 km/hr (370 mph).

The "twisters" are fortunately small in size with a maximum diameter approximately 100 meters. These storms travel at 40-60 km/hr as they cause devastating damage in their unpredictable paths which vary from 25-65 kilometers in length. The National Severe Storm Forecast Center in Kansas City predicts and tracks tornadoes.

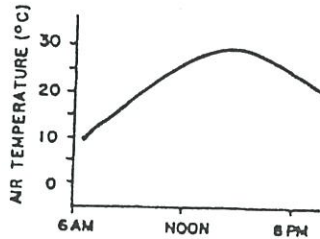


QUESTIONS FOR UNIT 6

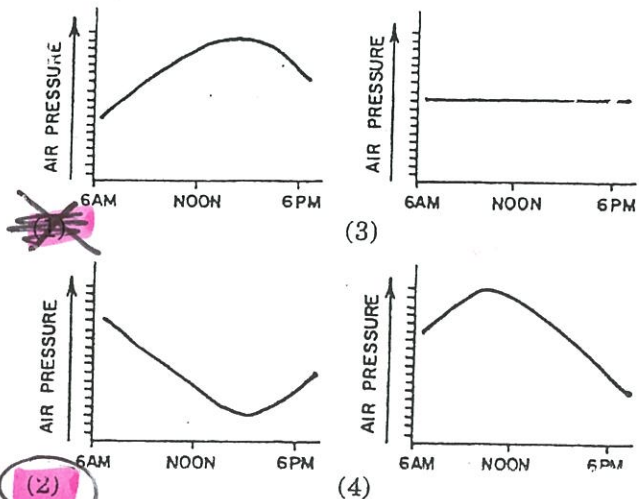
1 A balloon carrying weather instruments is released at the Earth's surface and rises through the troposphere. As the balloon rises, what will the instruments generally indicate? [Refer to the *Earth Science Reference Tables*.]

- 1 a decrease in both air temperature and air pressure
- 2 an increase in both air temperature and air pressure
- 3 an increase in air temperature and a decrease in air pressure
- 4 a decrease in air temperature and an increase in air pressure

2 The graph shows air temperature for an area near the Earth's surface during a 12-hour period.



Which graph best illustrates the probable change in air pressure during the same time period?



3 According to the *Reference Tables*, an air pressure of 29.65 inches of mercury is equal to

- (1) 984.0 mb
- (2) 999.0 mb
- (3) 1001.0 mb
- (4) 1004.0 mb

4 Wind moves from regions of

- 1 high temperature toward regions of low temperature
- 2 high pressure toward regions of low pressure
- 3 high precipitation toward regions of low precipitation
- 4 high humidity toward regions of low humidity

5 The wind speed between two nearby locations is affected most directly by differences in the

- 1 latitude between the location
- 2 longitude between the locations
- 3 air pressure between the locations
- 4 Coriolis effect between the locations

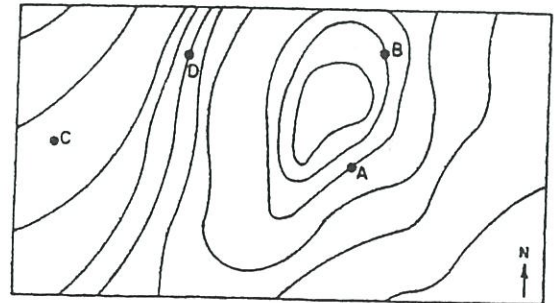
6 The Coriolis effect is caused by the

- 1 rotation of the Earth on its axis
- 2 revolution of the Earth around the Sun
- 3 movement of the Earth in relation to the Moon
- 4 movement of the Earth in relation to the Milky Way

7 In the Northern Hemisphere, a wind blowing from the north will be deflected toward the

- 1 northwest
- 2 northeast
- 3 southwest
- 4 southeast

8 The map represents a portion of an air-pressure field at the Earth's surface.



At which position is wind speed lowest?

- (1) A
- (2) B
- (3) C
- (4) D

9 As the amount of moisture in the air increases, the atmospheric pressure will probably

- 1 decrease
- 2 increase
- 3 remains the same

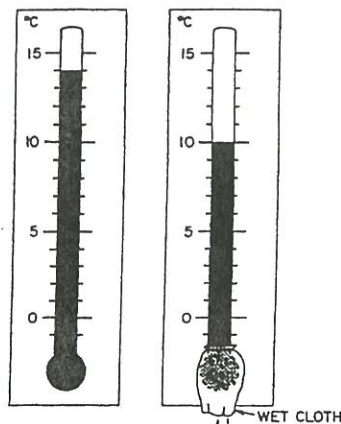
10 The air temperature and the wet bulb temperature were measured and both were found to be 18°C. Two hours later, measurements were taken again and the air temperature was 20°C, while the wet bulb temperature remained at 18°C. The relative humidity of the air during those two hours

- 1 decreased
- 2 increased
- 3 remained the same

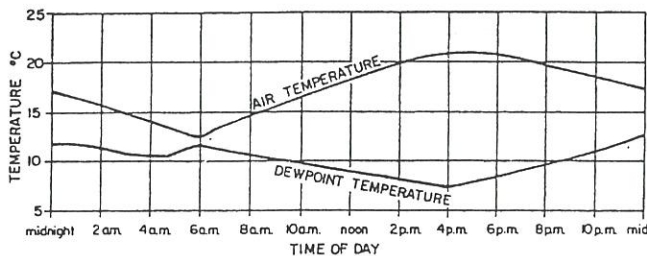
11 The two thermometers show the dry-bulb and wet-bulb temperatures of the air.

According to the Reference Tables, what is the approximate dew point temperature of the air?

- 1) -25°C
- 2) 6°C
- 3) 3°C
- 4) 4°C



12 The graph below shows changes in air temperature and dew point temperature over a 24-hour period at a particular location.



At what time was the relative humidity lowest?

- 1) midnight
- 2) 6 a.m.
- 3) 10 a.m.
- 4) 4 p.m.

13 Which conditions must exist for condensation to occur in the atmosphere?

- 1 The air is saturated and a condensation surface is available.
- 2 The air temperature is above the dew point and the air pressure is high.
- 3 The air is calm and the relative humidity is low.
- 4 The relative humidity is low and the air pressure is high.

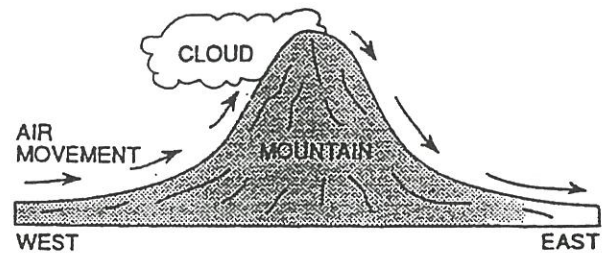
14 What is the approximate relative humidity if the dry-bulb temperature is 12°C and the wet-bulb temperature is 7°C?

- 1) 28%
- 2) 35%
- 3) 48%
- 4) 65%

15 Which event will most likely occur in rising air?

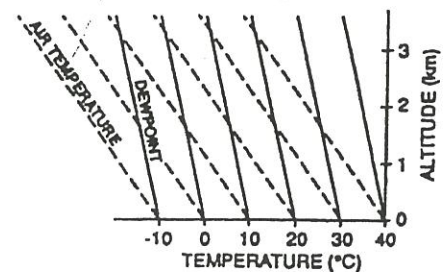
- 1 clearing skies
- 2 cloud formation
- 3 decreasing relative humidity
- 4 increasing temperature

16 Which statement best explains why a cloud is forming as shown in the diagram?



- 1 Water vapor is condensing.
- 2 Moisture is evaporating.
- 3 Cold air rises and compresses.
- 4 Warm air sinks and expands.

17 On a clear, dry day an air mass has a temperature of 20°C and a dew point temperature of 10°C.



According to the graph, about how high must this air mass rise before a cloud can form?

- 1) 1.6 km
- 2) 2.4 km
- 3) 3.0 km
- 4) 2.8 km

18 Which is a form of precipitation?

- 1 frost
- 2 snow
- 3 dew
- 4 fog

19 Why is it possible for no rain to be falling from a cloud?

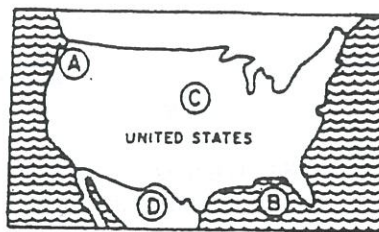
- 1 The water droplets are too small to fall.
- 2 The cloud is water vapor.
- 3 The dew point has not yet been reached in the cloud.
- 4 There are no condensation nuclei in the cloud.

20 The air temperature is 10°C . Which dew point temperature would result in the highest probability of precipitation?

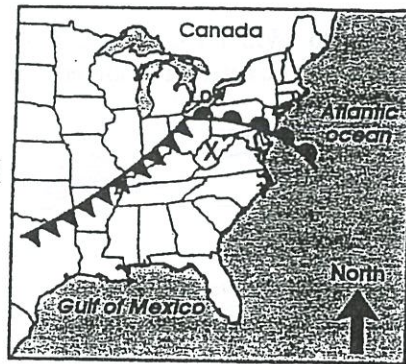
- (1) 8°C (3) 0°C
 (2) 6°C (4) -4°C

21 Which letter on the map at the right represents the area closest to the source region of a cT air mass?

- (1) A
 (2) B
 (3) C
 (4) D



22 The weather map shows a frontal system that has followed a typical storm track. The air mass located over point X most likely originated over the

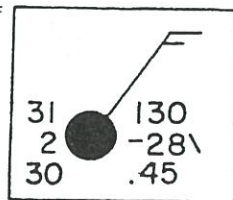


- 1 northern Atlantic Ocean
 2 central part of Canada
 3 Gulf of Mexico
 4 Pacific Northwest

23 An air mass located over central United States will most likely move toward the

- 1 northeast
 2 southeast
 3 northwest
 4 southwest

Base your answers to questions 24 and 25 on the Reference Tables and the diagram of the station model.



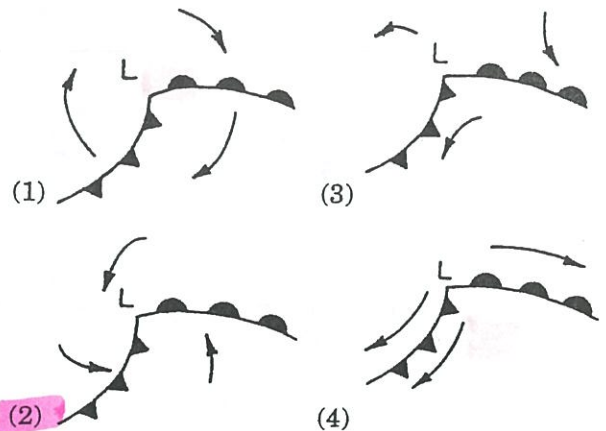
24 The barometric pressure is

- (1) 1013.0 mb
 (2) 913.0 mb
 (3) 130.0 mb
 (4) 10.28 mb

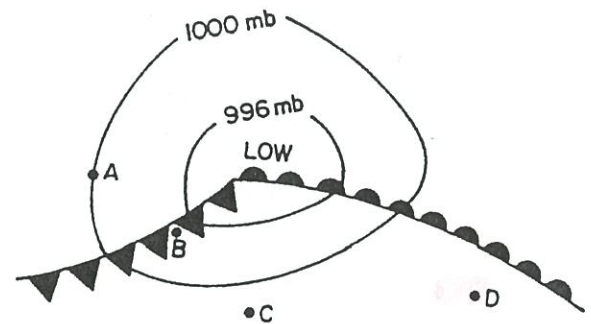
25 The weather forecast for the next six hours at this station most likely would be

- 1 overcast, hot, unlimited visibility
 2 overcast, hot, poor visibility
 3 overcast, cold, probable snow
 4 sunny, cold, probable rain

26 Which diagram below best represents the air circulation around a Northern Hemisphere low-pressure center?



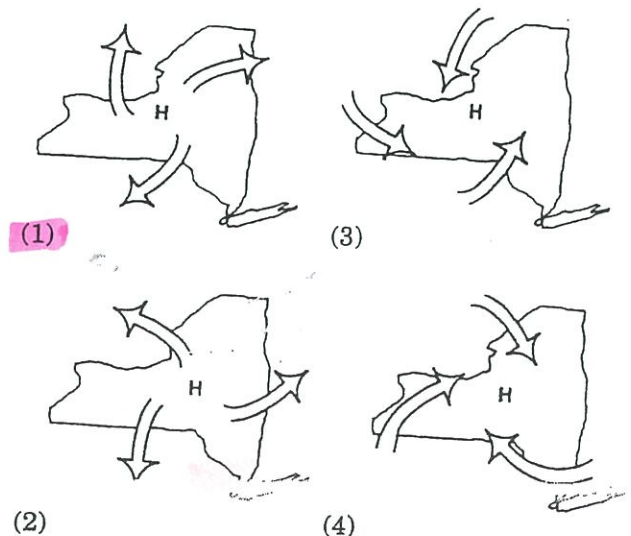
27 Cities A, B, C, and D on the weather map are being affected by a low-pressure system (cyclone).



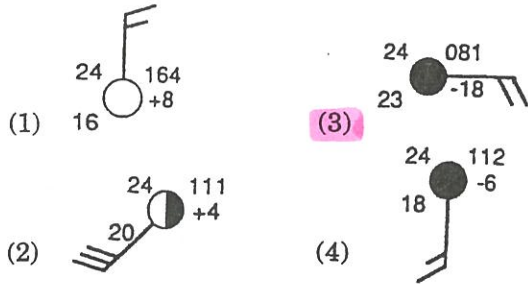
Which city would have the most unstable atmospheric conditions and the greatest chance of precipitation?

- (1) A (3) C
 (2) B (4) D

28 Which map best represents the normal air circulation around a high-pressure air mass located over central New York State?



29 Which weather station model indicates the greatest probability of precipitation?



30 A weather station reporting clear, cold weather with little wind is probably located

- 1 in the center of a high
- 2 in the center of a low
- 3 ahead of a warm front
- 4 at a cold front

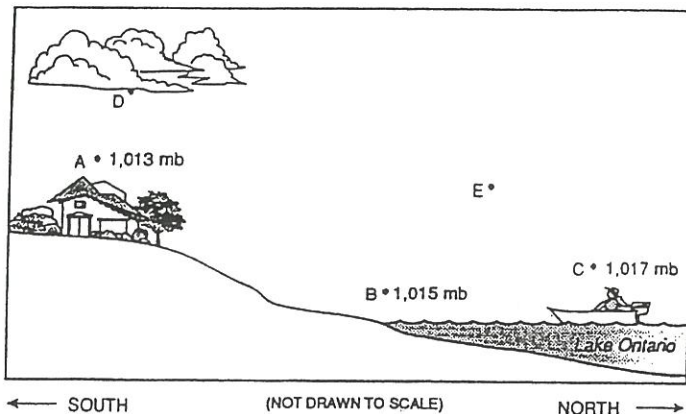
31 An observer reports the following data for a location in New York State:

Air temperature = 35°C
 Pressure = 996 mb
 Relative humidity = 84%

The weather conditions at this location would best be described as

- | | |
|-----------------|------------------|
| 1 hot and dry | 3 cool and dry |
| 2 hot and humid | 4 cool and humid |

Base your answers to questions 32 through 35 on the *Earth Science Reference Tables*, the diagram below, and your knowledge of Earth science. The diagram shows a section of the shore of Lake Ontario. Surface air-pressure readings are shown for three of the locations.



32 [Refer to the *Earth Science Reference Tables*.] When converted to inches of mercury, the air pressure reading of 1,017 millibars at C is equal to

- (1) 33.0 in
- (3) 30.03 in

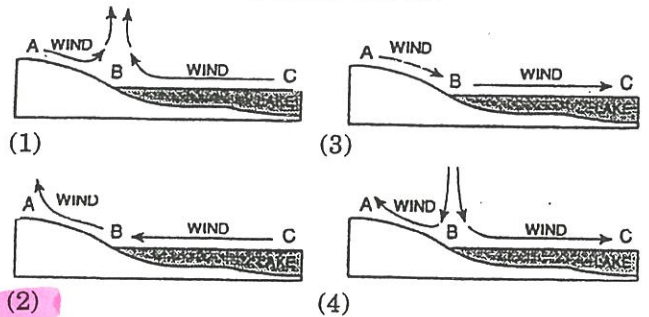
33 Why do the clouds begin to form at the elevation of D?

- 1 The air has cooled to the dew point temperature at this elevation.
- 2 The water droplets are too small to be seen below this elevation.
- 3 The temperature is 0°C at this elevation.
- 4 The air below this elevation does not have enough condensation nuclei for clouds to form.

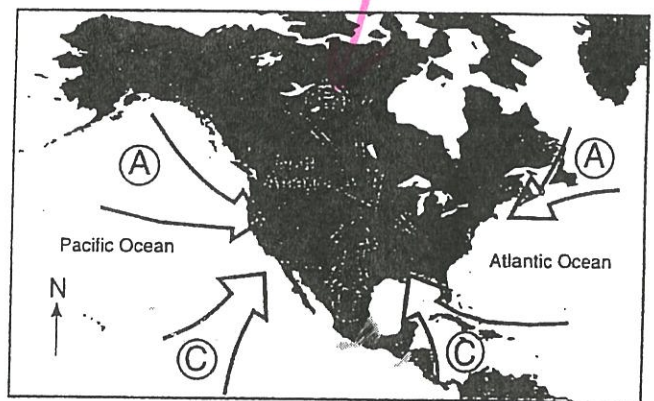
34 What is the dew point temperature at location E when the dry-bulb reading is 18°C and the wet-bulb reading is 11°C?

- | | |
|-----------|---------|
| (1) 1°C | (3) 7°C |
| (2) -10°C | (4) 4°C |

35 Which diagram best shows the probable wind direction for the conditions shown?



Base your answers to questions 36 through 38 on the *Earth Science Reference Tables*, the map below, and your knowledge of Earth science. The map shows the source regions for various types of air masses affecting the weather of the continental United States. Regions labeled with the same letter produce air masses with similar characteristics. Point X represents a location in the central United States.



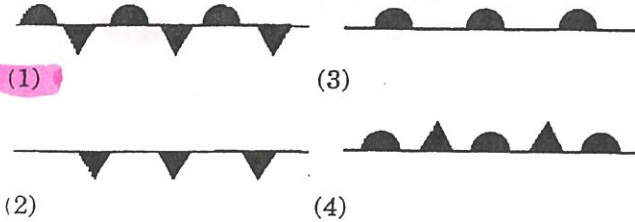
36 On a weather map, which symbol would be used to represent an air mass that formed in region B?

- | | |
|--------|--------|
| (1) mP | (3) cP |
| (2) mT | (4) cT |

37 Which atmospheric conditions will most likely exist when air masses from source regions B and C meet at point X?

- 1 clearing skies and little wind
- 2 cloudiness and precipitation
- 3 decreasing relative humidity and rising temperature
- 4 appearance of condensation nuclei and constant dew point temperature

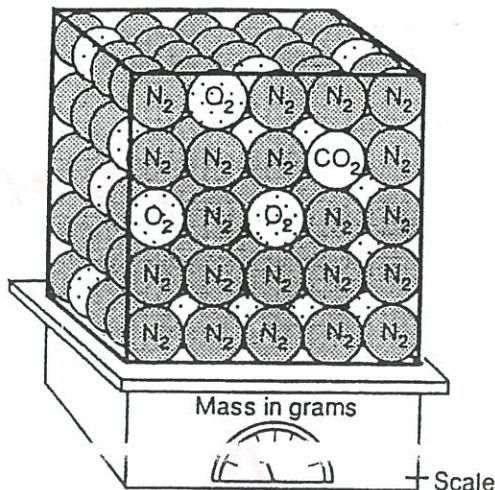
38 Which map symbol represents a stationary front that formed when an air mass from source region B met an air mass from source region D?



Base your answers to questions 39 through 41 on the *Earth Science Reference Tables*, the information and diagram below, and your knowledge of Earth science.

The diagram represents a model that shows how air density is affected by the addition of water vapor to the air. Marbles with different masses, representing nitrogen, oxygen, and carbon dioxide, were used to fill a container to show a certain volume of dry air. The container was placed on a scale to find the mass of this volume of dry air.

A few marbles representing nitrogen (N_2) and oxygen (O_2) were removed and replaced with marbles representing water vapor (H_2O) to show the same volume of air with water vapor present. The relative mass of each gas, as represented by the marbles, is shown in the data table.



DATA TABLE

Molecule Symbol	Gas	Mass
N_2	Nitrogen	28 g
O_2	Oxygen	32 g
CO_2	Carbon Dioxide	44 g
H_2O	Water Vapor	18 g

39 According to the data table, which gas molecule has the *least* mass?

- 1 nitrogen
- 2 oxygen
- 3 carbon dioxide
- 4 water vapor

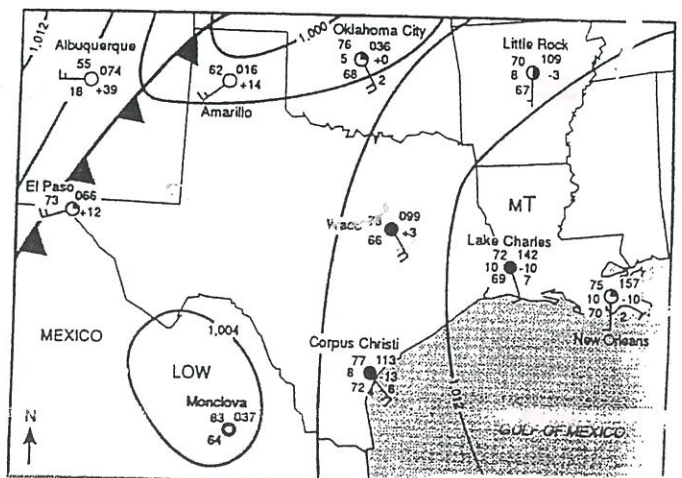
40 When a few of the marbles representing nitrogen and oxygen are replaced with marbles representing water vapor, the air model will become

- 1 lighter and less dense
- 2 lighter and more dense
- 3 heavier and less dense
- 4 heavier and more dense

41 After water vapor molecules enter the Earth's atmosphere, what conditions must occur before they can become liquid?

- 1 warming temperatures and condensation
- 2 warming temperatures and evaporation
- 3 cooling temperatures and condensation
- 4 cooling temperatures and evaporation

Base your answers to questions 42 through 44 (found on the next page) on the *Earth Science Reference Tables*, the weather map below, and your knowledge of Earth science. The map shows part of the southern United States and northern Mexico.



42 At which city is the visibility 8 miles?

- 1 Little Rock, Arkansas
- 2 Lake Charles, Louisiana
- 3 Oklahoma City, Oklahoma
- 4 New Orleans, Louisiana

43 The isolines on this map connect locations that have the same

- 1 dew point temperature
- 2 air temperature
- 3 barometric pressure
- 4 relative humidity

44 Which city has the *least* chance of precipitation during the next 3 hours?

- 1 Oklahoma City, Oklahoma
- 2 Waco, Texas
- 3 Lake Charles, Louisiana
- 4 Albuquerque, New Mexico

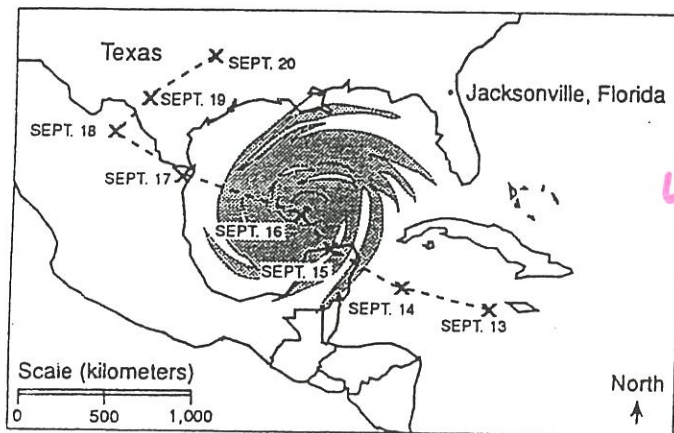
47 On September 18, Hurricane Gilbert changed direction. Which statement provides the most probable reason for this change?

- 1 The air mass was cooled by the land surface.
- 2 The storm entered the prevailing westerlies wind belt.
- 3 The amount of precipitation released by the storm changed suddenly.
- 4 The amount of insolation received by the air mass decreased.

48 The air mass that gave rise to Hurricane Gilbert would be identified as

- (1) cP
- (2) cT
- (3) mT
- (4) mP

Base your answers to questions 45 through 48 on the *Earth Science Reference Tables*, the diagram below, and your knowledge of Earth science. The diagram represents a satellite image of Hurricane Gilbert in the Gulf of Mexico. Each X represents the position of the eye of the storm on the date indicated.



45 The surface wind pattern associated with Hurricane Gilbert was

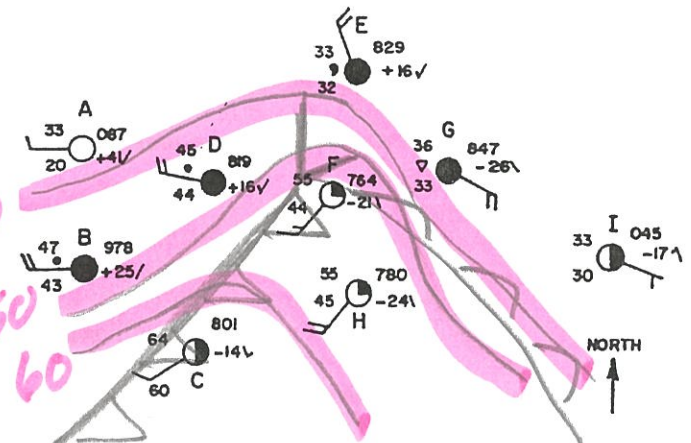
- 1 counterclockwise and toward the center
- 2 counterclockwise and away from the center
- 3 clockwise and toward the center
- 4 clockwise and away from the center

46 What was the probable source of moisture for this hurricane?

- 1 carbon dioxide from the atmosphere
- 2 winds from the coastal deserts
- 3 transpiration from tropical jungles
- 4 evaporation from the ocean

SKILL ASSESSMENTS

Base your answers to questions 1 through 9 on your knowledge of Earth science, the *Earth Science Reference Tables*, and the diagram which represents a section of a weather map for locations in the central United States. The letters A through I identify reporting weather stations.



Which station has a wind from the southeast at 5 knots? *I*

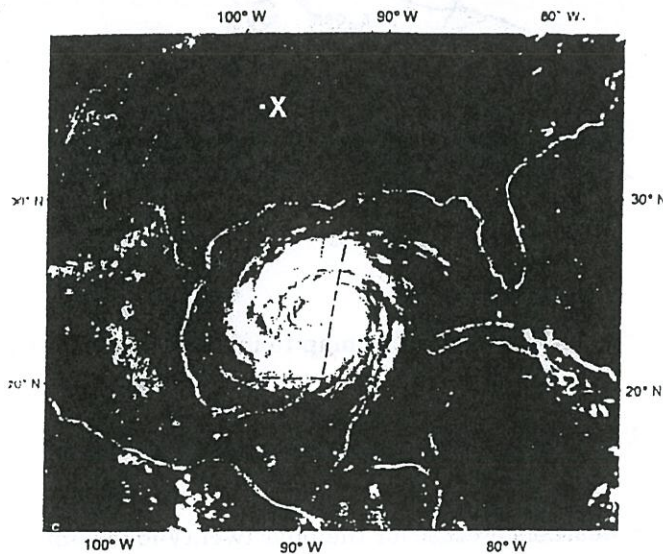
Which station shows the pressure has dropped 2.6 mb in the past three hours? *G*

What is the air pressure at station D? *981.7 mb*

In order to test the rate of evaporation, equal amounts of water are exposed to the open air outside weather stations B, E, H, and I. In a sentence explain at which station the water will probably evaporate the fastest.

H Driest + Warmest

Base your answers to questions 10 through 15 on your knowledge of Earth science and the satellite photograph of a tropical storm centered in the Gulf of Mexico. An outline of the southeastern United States and the latitude-longitude system have been drawn on the photograph.



Use one or two sentences to answer the following questions.

- 10 What is the approximate latitude and longitude of the center or eye of the tropical storm on the satellite photograph? *25°N, 90°W*
- 11 What type of air mass would most likely be associated with the storm? *mT*
- 12 Describe the weather conditions at point X at the time this photograph was taken. *cloudy, rain*
- 13 What will happen to barometric pressure along the coast of Texas as the storm approaches? *decrease*
- 14 What is the source of energy for this storm?

15 Describe the general direction of movement of the surface winds associated with this tropical storm.

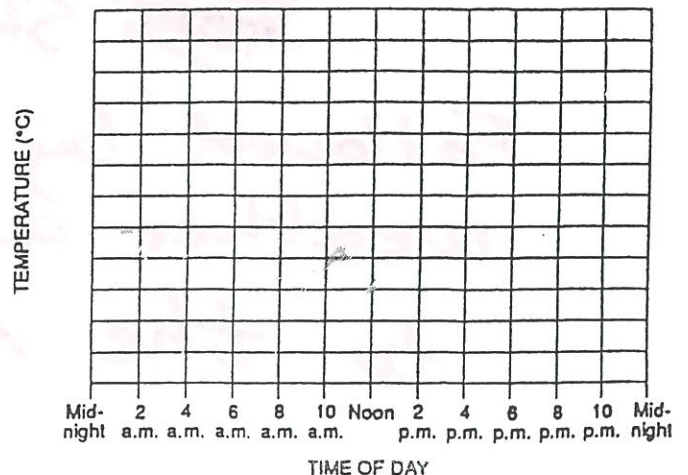
Counterclockwise inward

Base your answers to questions 16 and 17 on the data table below. The data table shows the air temperature and dew point over a 24-hour period for a particular location in New York State.

TIME OF DAY	AIR TEMPERATURE (°C)	DEWPOINT (°C)
12:00 MIDNIGHT	19	12
2:00 a.m.	17	11
4:00 a.m.	14	10
6:00 a.m.	13	12
8:00 a.m.	15	11
10:00 a.m.	17	10
12:00 NOON	18	9
2:00 p.m.	21	7
4:00 p.m.	23	6
6:00 p.m.	21	8
8:00 p.m.	19	10
10:00 p.m.	18	12
12:00 MIDNIGHT	17	13

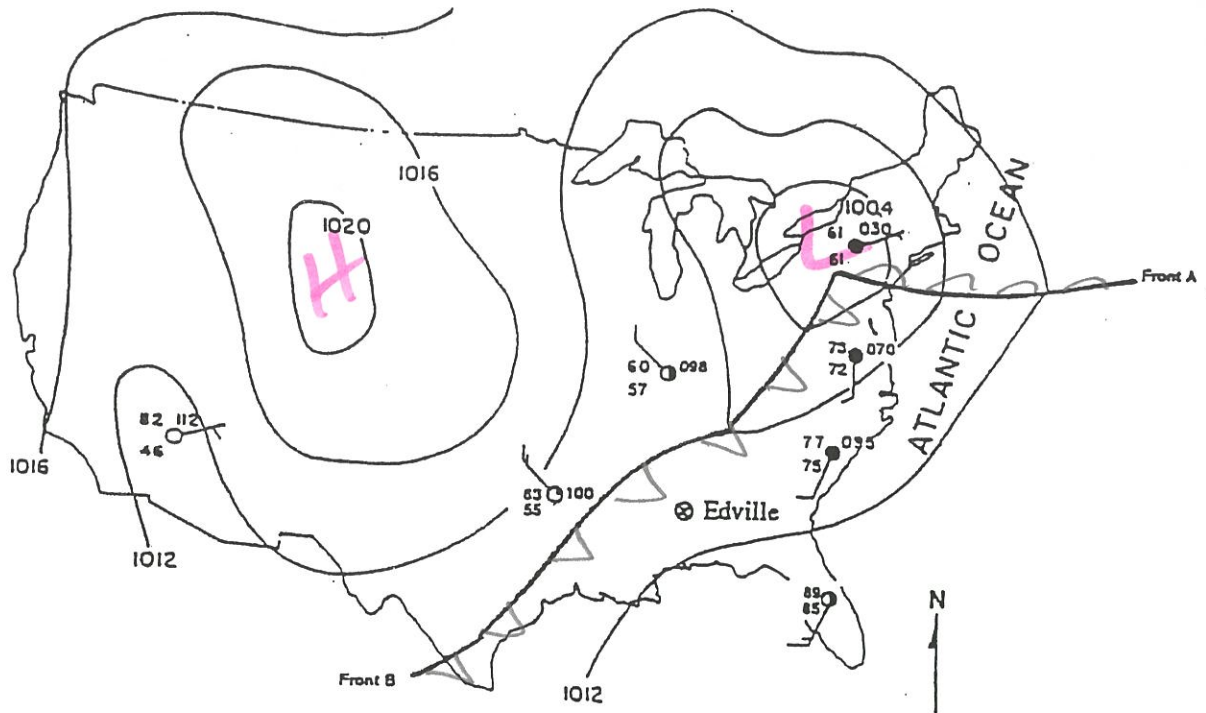
16 Use the data to construct a graph following the directions below.

- a Mark an appropriate scale on the axis labeled "Temperature."
- b Plot a line graph for air temperature and label the line "Air Temperature."
- c Plot a line graph for dew point and label the line "Dew Point."



17 Based on your graph, state the hour of the day when the relative humidity was *lowest*.

Base your answers to questions 18 and 20 on the *Earth Science Reference Tables*, the diagram below, and your knowledge of Earth science. The diagram represents a weather map of the United States. On the map, station models for selected cities indicate weather conditions and isobars indicate the air pressure pattern. Two fronts, A and B, have been identified.



- 18 On the map above, write the words "HIGH" and "LOW" directly on the map to indicate the high and low pressure centers.
- 19 On the map above, label both front A and front B with the correct symbol to indicate the type of front and its direction of motion.
- 20 In one or more complete sentences, write a short weather forecast for the next twenty-four hours at Edville. Include in your forecast any anticipated changes in: temperature and sky conditions.

~~Short~~ Short Heavy Rain
Followed by cooler drier
weather and wind shift
to the NW.