CHAPTER 12

Study Guide

STUDY TO GO

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BIG Idea Weather patterns can be observed, analyzed, and predicted.

Section 12.1 The Causes of Weather

Vocabulary

- air mass (p. 316)
- climate (p. 314)
- source region (p. 316)
- weather (p. 314)

Key Concepts

MAIN Idea Air masses have different temperatures and amounts of moisture because of the uneven heating of Earth's surface.

- Meteorology is the study of atmospheric phenomena.
- Solar radiation is unequally distributed between Earth's equator and its poles.
- An air mass is a large body of air that takes on the moisture and temperature characteristics of the area over which it forms.
- Each type of air mass is classified by its source region.

Section 12.2 Weather Systems

- Coriolis effect (p. 318)
- front (p. 322)
- jet stream (p. 321)
- polar easterlies (p. 320)
- prevailing westerlies (p. 320)
- trade winds (p. 320)

MAIN Idea Weather results when air masses with different pressures and temperatures move, change, and collide.

- The three major wind systems are the polar easterlies, the prevailing westerlies, and the trade winds.
- Fast-moving, high-altitude jet streams greatly influence weather in the middle latitudes.
- The four types of fronts are cold fronts, warm fronts, occluded fronts, and stationary fronts.
- Air moves in a generally circular motion around either a high- or low-pressure center.

Section 12.3 Gathering Weather Data

- anemometer (p. 325)
- barometer (p. 324)
- Doppler effect (p. 327)
- hygrometer (p. 325)
- radiosonde (p. 326)
- thermometer (p. 324)

MAIN Idea Accurate measurements of atmospheric properties are a critical part of weather analysis and prediction.

- To make accurate weather forecasts, meteorologists analyze and interpret data gathered from Earth's surface by weather instruments.
- A radiosonde collects upper-atmospheric data.
- Doppler radar locates where precipitation occurs.
- Weather satellites use infrared, visible-light, or water-vapor imagery to observe and monitor changing weather conditions on Earth.

Section 12.4 Weather Analysis and Prediction

- analog forecast (p. 331)
- digital forecast (p. 331)
- isobar (p. 329)
- isotherm (p. 329)
- station model (p. 329)

MAIN Idea Several methods are used to develop short-term and long-term weather forecasts.

- A station model is used to plot different weather variables.
- Meteorologists plot lines on a map that connect variables of equal value to represent nationwide and global trends.
- Two kinds of forecasts are digital and analog.
- The longer the prediction period, the less reliable the weather forecast.

CHAPTER 12 Assessment

Vocabulary Review

Match each description below with the correct vocabulary term from the Study Guide.

1. lines of equal pressure on a weather map
2. current state of the atmosphere
3. a forecast that relies on numerical data
4. long-term variations in weather conditions over a particular area
5. large volume of air that takes on the characteristics of the area over which it forms
6. depiction of weather data for a particular location at a particular time

Complete the sentences below using vocabulary terms from the Study Guide.

7. A _____ is used to measure relative humidity.
8. _____ describes the narrow region separating two air masses of different densities.
9. The deflection of air due to the rotation of Earth is called the _____.
10. Lines of equal temperature on a weather map are called _____.

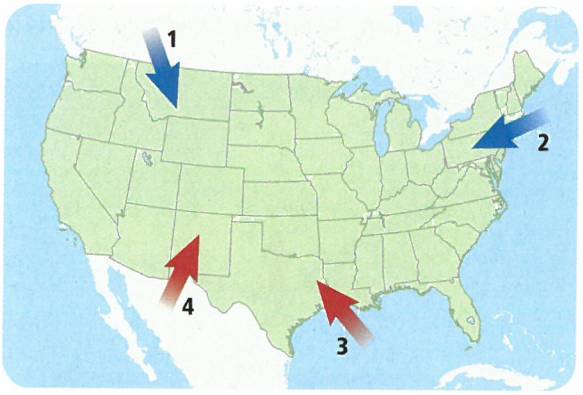
Each of the following sentences is false. Make each sentence true by replacing the italicized words with vocabulary terms from the Study Guide.

11. The *horse latitudes* are two belts of surface winds that occur between latitudes 30° N and 60° N, and 30° S and 60° S.
12. Meteorologists use a special kind of radar, which is based on the *polar easterlies,* to plot the movement of precipitation.
13. Narrow bands of fast winds are called *trade winds.*
14. A balloon-transported package of sensors is called a *source region.*
15. An instrument that measures wind speed is called a *barometer.*

Understand Key Concepts

16. What does a large temperature gradient at high altitudes of the atmosphere cause?
    - **A.** trade winds
    - **B.** Coriolis effect
    - **C.** ITCZ
    - **D.** polar jet streams

Use the diagram below to answer Questions 17 and 18.

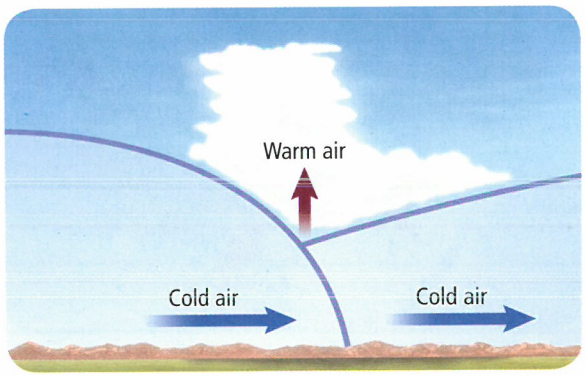


17. Which is probably the coldest air mass?
    - **A.** 1
    - **B.** 2
    - **C.** 3
    - **D.** 4
18. Which air mass is hot and dry?
    - **A.** 1
    - **B.** 2
    - **C.** 3
    - **D.** 4
19. Which is not one of Earth's three basic wind systems or zones?
    - **A.** polar easterlies
    - **B.** polar jet streams
    - **C.** trade winds
    - **D.** prevailing westerlies
20. Which location on Earth receives the most solar radiation in any given year?
    - **A.** the poles
    - **B.** the oceans
    - **C.** the tropics
    - **D.** the continents

21. Which is an example of climate?
   A. today's high temperature
   B. yesterday's rainfall
   C. tomorrow's highest wind speed
   D. average rainfall over 30 years

22. Which instrument is not used to measure surface weather?
   A. barometer
   B. hygrometer
   C. radiosonde
   D. thermometer

Use the diagram below to answer Questions 23 and 24.



23. Which type of front is illustrated above?
   A. cold front
   B. occluded front
   C. precipitation front
   D. stationary front

24. Which weather conditions occur as a result of this type of front?
   A. warm temperatures and precipitation
   B. cool temperatures and thunderstorms
   C. light winds and precipitation
   D. strong winds and precipitation

25. Which is the most accurate forecast?
   A. long-term digital forecast
   B. short-term digital forecast
   C. long-term analog forecast
   D. short-term analog forecast

26. What is a station model used to create?
   A. digital forecast
   B. depiction of a jet stream
   C. long-term forecast
   D. surface weather map

Constructed Response

27. **Infer** why weather ahead of a warm front might be cloudier and rainier than weather ahead of a cold front.

28. **Identify** the weather feature that might be indicated by a drastic temperature change over a short distance on a surface analysis.

29. **Generalize** the problems that could result from making a weather analysis based on observations at several locations made at different times.

30. **Discuss** why light to no winds characterize the horse latitudes and why they occur at those latitudes.

31. **Compare and contrast** the temperature and moisture properties of a continental polar air mass and a maritime tropical air mass.

32. **State** the main benefit of the digital forecast method.

33. **Describe** two different weather-data methods you could use to determine if it is a rainy day at a given location.

34. **Distinguish** between isobars and isotherms.

Use the table below to answer Question 35.

Air Mass Descriptions

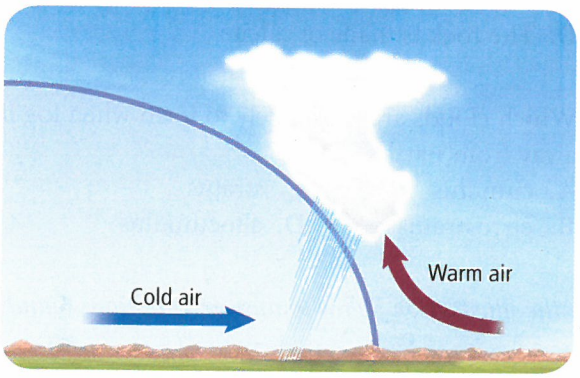
Air Mass	Source Region	Summer
Arctic	Siberia, Arctic Basin	cold, dry
Continental polar	interiors of Canada and Alaska	cool, dry
Continental tropical	southwest United States, Mexico	hot, dry
Maritime polar	North Pacific Ocean	mild, humid
	North Atlantic Ocean	cool, humid
Maritime tropical	Gulf of Mexico, Caribbean Sea, tropical and subtropical Atlantic Ocean and Pacific Ocean	hot, humid

35. **Choose** the summertime air mass that would most likely be associated with significant precipitation. Explain your choice.

Think Critically

36. **Propose** an ideal weather-data collection system for your school.

Use the diagram below to answer Question 37.



37. **Sequence** the weather changes that a person on the ground will observe for the front shown above.

38. **Compare** the challenges of forecasting weather for Seattle, Washington, with those of forecasting weather for New York City.

39. **CAREERS IN EARTH SCIENCE** Develop a one-day weather forecast for your city using the weather data on page 335. Role-play a television meteorologist, and give your weather report.

40. **Determine** the type of modification to an arctic air mass moving southward over the north Atlantic during the summer.

41. **Evaluate** whether temperature readings taken near an asphalt parking lot on a summer day would represent those for the entire city.

Concept Mapping

42. Create a concept map showing the relationships among the types of weather data collection.

Challenge Question

43. **Explain** why cold fronts become stationary and break down as they move through Florida.

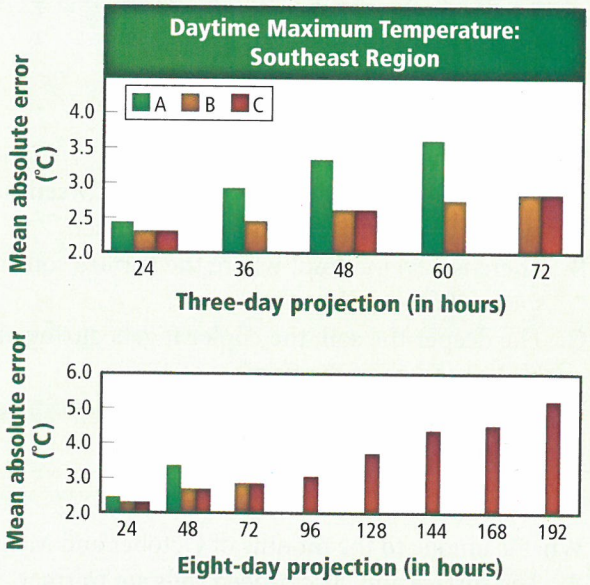
Additional Assessment

44. **WRITING in Earth Science** Research a local weather-related organization, and write a short essay about the kind of analyses that it performs.

DBQ Document–Based Questions

Data obtained from: National Weather Service, National Center for Environmental Prediction. January 2006. *NOAA.*

The graphs below show the accuracy of three numerical forecast models (A, B, and C) in predicting maximum daily temperatures during January 2006 for up to a period of eight days.



45. Which model had the greatest mean absolute error over the first 60 hours?

46. Which model could be used to find a maximum-temperature forecast for a week from now?

47. Which of the three models shown is the most valuable overall? Explain your answer.

Cumulative Review

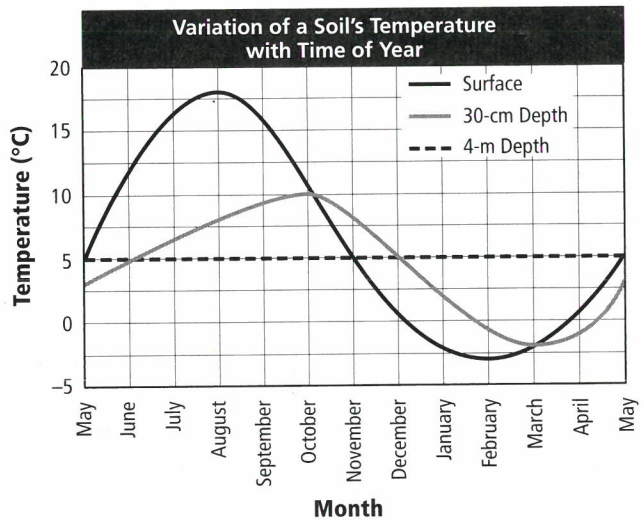
48. How is a hand-held GPS receiver used to locate a position? **(Chapter 2)**

49. What determines the maximum height to which water from an artesian well will rise? **(Chapter 10)**

Standardized Test Practice

Multiple Choice

Use the graph to answer Questions 1–3.



1. What can be inferred from the graph?
   - **A.** The temperature varies the greatest between surface and 30-cm-deep soil in the summer.
   - **B.** There is never a point where the surface soil and soil at 30cm are the same.
   - **C.** The deeper the soil, the cooler it gets during all of the seasons of the year.
   - **D.** All soil layers vary in temperature depending on the time of year.

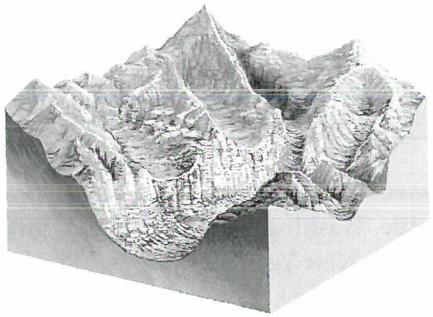
2. What is unique to the months of October and March?
   - **A.** The surface and 30-cm-deep soils are warmer than the 4-m-deep soil.
   - **B.** The surface and 30-cm-deep soils have the same temperature.
   - **C.** The surface and 30-cm-deep soils are colder than the 4-m-deep soil.
   - **D.** The soil is the same temperature at all depths.

3. Why is 4m deep in the soil an important spot to record?
   - **A.** The temperature of the soil never changes there.
   - **B.** No other layer of soil ever reaches that temperature.
   - **C.** It is the only soil that is always frozen.
   - **D.** It is the deepest that soil goes below Earth's surface.

4. Which observation about a rock could lead you to identify it as igneous?
   - **A.** The rock has well defined layers.
   - **B.** The rock has a glassy texture.
   - **C.** The rock contains pebbles.
   - **D.** The rock is made of calcite.

5. Which clouds are most likely to form when fog lifts away from Earth's surface?
   - **A.** cumulus
   - **B.** cirrostratus
   - **C.** stratus
   - **D.** altocumulus

Use the illustration below to answer Questions 6 and 7.



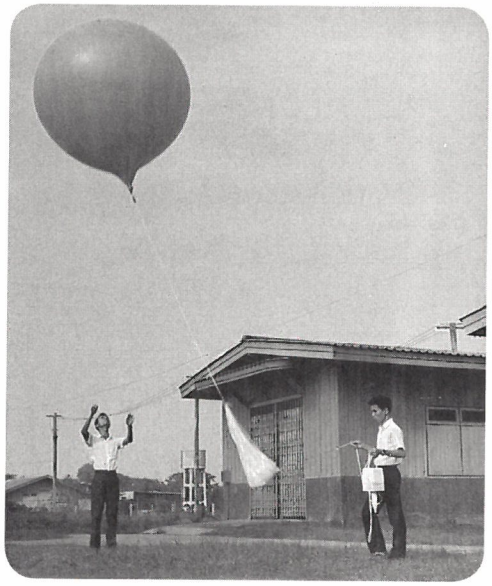
6. What event created the features shown above?
   - **A.** water erosion
   - **B.** wind erosion
   - **C.** glacial erosion
   - **D.** asteroid impact

7. What can scientists learn by studying areas similar to the illustration?
   - **A.** how rivers create U-shaped valleys
   - **B.** glacier history and its direction of movement
   - **C.** why glaciers moved
   - **D.** the impact of wind on mountainous features

8. Which statement is true about fossils found in previously undisturbed strata of sedimentary rock?
   - **A.** Fossils in the upper strata are younger than those in the lower strata.
   - **B.** Fossils in the upper strata are older than those in the lower strata.
   - **C.** Fossils in the upper strata generally are less complex than those in the lower strata.
   - **D.** There are no fossils in the upper strata that resemble those in the lower strata.

Short Answer

Use the image below to answer Questions 9 and 10.



9. What weather instrument is shown in the image above? How does it work?

10. Why is it important for meteorologists to use tools like the one shown for gathering weather data?

11. Suppose surface water that is not absorbed forms a channel and quickly dries up. What can happen over time?

12. Discuss ground subsidence and its threat to our water supply.

13. Suppose a stream is 6 m wide and 3 m deep with a velocity of 12 m/s. How could you determine the stream's discharge?

14. Differentiate between the mass of a brick and the weight of the same brick.

Reading for Comprehension

Another Use for Radar

Doppler radar tracks moving objects, such as raindrops, through the atmosphere, by bouncing electromagnetic energy off them and measuring the amplitude as well as the change in frequency. Radar doesn't distinguish between bats and hailstones. To the radar, the millions of bats emerging from their caves look like a huge storm that starts at a point on the ground and spreads rapidly up and over the landscape. "It didn't take long for word to get around among bat researchers that we could view bat colonies on the new radar," recalls Jim Ward, science and operations officer at New Braunfels. "We saw bats flying as high as 10,000 feet." Since bats in other locales pursue insects close to the ground, we wondered why the free-tails were flying as high as 10,000 feet. Again, Doppler radar offered clues by detecting the billions of insects that swarm high above Texas. Since the 1980s, researchers have used radar to map the flight patterns of some of North America's most destructive agricultural pests—fall armyworms, beet armyworms, tobacco budworms, and corn earworms.

Article obtained from: McCracken G. F. and J. K Westbrook. 2002. Bat patrol. *National Geographic Magazine* (April): 1.

15. What can be inferred from this passage?

A. Doppler radar is not useful for monitoring weather.

B. Doppler radar can track both a major storm and a swarm of bats.

C. Doppler radar should be used only for studying weather.

D. Doppler radar should be used only for studying bats.

16. What important insight about technology can you gain by reading this article?

NEED EXTRA HELP?														
If You Missed Question . . .	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Review Section . . .	7.3	7.3	7.3	5.1	11.3	8.3	8.3	6.1	12.3	12.3	9.1	10.3	9.1	1.2