

MULTIPLE CHOICE QUESTIONS

1. In which layer of Earth's atmosphere does most weather occur?
(a) Troposphere
(b) Stratosphere
(c) Mesosphere
(d) Thermosphere
(e) Lithosphere
2. Which of the following best explains why polar regions are colder than tropical regions?
(a) Polar regions have lower albedo values.
(b) Polar regions receive less solar energy per unit of surface area.
(c) Tropical regions receive less direct sunlight throughout the year.
(d) Sunlight travels through more atmosphere and loses more energy in tropical regions.
(e) Tropical regions rotate at a faster speed than polar regions.
3. Which of the following statements about patterns of temperature and precipitation is not correct?
(a) The air in a Hadley cell rises where sunlight strikes Earth most directly.
(b) The greatest amount of precipitation occurs at the intertropical convergence zone.
(c) The air in a Hadley cell descends near 30° N and S, causing the formation of deserts.
(d) The air of a polar cell rises near 60° latitude.
(e) Along Earth's surface, the air of a Hadley cell moves away from the equator.
4. Which of the following processes is not characteristic of oceanic circulation?
(a) Counterclockwise gyres in the Northern Hemisphere
(b) Slow thermohaline circulation of surface and deep ocean waters
(c) Unequal heating of tropical versus polar ocean waters
(d) El Niño–Southern Oscillation
(e) Coriolis effect
5. Which of the following statements about rain shadows is correct?
(a) They occur on the western sides of mountain ranges in the Northern Hemisphere.
(b) Air gains water vapor as it rises.
(c) As air rises over a mountain range, water vapor condenses into precipitation.
(d) They occur on the eastern sides of mountain ranges in the Southern Hemisphere.
(e) The rain shadow side of a mountain range receives the most rain.
6. Why do scientists use dominant plant growth forms to categorize terrestrial biomes?
(a) Plants with similar growth forms are always closely related genetically.
(b) Different plant growth forms indicate climate differences, whereas different animal forms do not.
(c) Plants from similar climates evolve different adaptations.
(d) Similar plant growth forms are found in climates with similar temperatures and amounts of precipitation.
(e) Similar plant growth forms exist in terrestrial and aquatic biomes.

7. Which information is not found in climate diagrams?
- (a) Average annual temperature
 - (b) Seasonal changes in temperature
 - (c) Average annual humidity**
 - (d) The months when plant growth is limited by precipitation
 - (e) The length of the growing season
8. Which of the following statements about tundras and boreal forests is correct?
- (a) Both are characterized by slow plant growth, so there is little accumulation of organic matter.
 - (b) Tundras are warmer than boreal forests.
 - (c) Boreal forests have shorter growing seasons than tundras.
 - (d) Plant growth in both biomes is limited by precipitation.
 - (e) Boreal forests have larger dominant plant growth forms than tundras.**
9. Which of the following statements about temperate biomes is not correct?
- (a) Temperate biomes have average annual temperatures above 20°C.**
 - (b) Temperate rainforests receive the most precipitation, whereas cold deserts receive the least precipitation.
 - (c) Temperate rainforests can be found in the northwestern United States.
 - (d) Temperate seasonal forests are characterized by trees that lose their leaves.
 - (e) Temperate shrublands are adapted to frequent fires.
10. Which of the following statements about tropical biomes is correct?
- (a) Tropical seasonal forests are characterized by evergreen trees.
 - (b) Tropical rainforests have the highest precipitation due to the proximity of the ITCZ.**
 - (c) Savannas are characterized by the densest forests.
 - (d) Tropical rainforests have the slowest rates of decomposition due to high rainfall.
 - (e) Subtropical deserts have the highest species diversity.
11. Which of the following statements about aquatic biomes is correct?
- (a) They are characterized by dominant plant growth forms.
 - (b) They can be categorized by temperature and precipitation.
 - (c) Lakes contain littoral zones and intertidal zones.
 - (d) Freshwater wetlands have emergent plants in their deepest areas, whereas ponds and lakes do not.**
 - (e) Coral reefs have the lowest diversity of species.

FREE RESPONSE QUESTIONS

1. As the greenhouse effect continues to warm the planet slowly, the glaciers of Greenland are melting at a rapid rate. Scientists are concerned that this melting may dilute the salt water in that region of the ocean enough to shut down thermohaline circulation. Use what you know about climate to answer the following questions:

- (a) Explain how shutting down thermohaline circulation would affect the temperature of western Europe. (2 points)

Shutting down the thermohaline circulation would reduce the amount of warm surface water flowing from the Gulf of Mexico to Europe and this would cause western Europe

experience colder temperatures.

(b) Explain the consequences such a temperature change might have for agriculture in western Europe. (2 points)

Colder temperatures in western Europe would cause shorter growing seasons and reduced crop production.

(c) Explain why there would be large populations of fish along the west coasts of most continents. (3 points)

Surface currents separate from one another, causing deeper waters to rise and replace the water that has moved away. These deep waters bring with them nutrients from the ocean bottom that support large populations of producers. The producers then support large populations of fish.

(d) Explain how shutting down thermohaline circulation would affect the transport of nutrients among the oceans of the world. (3 points)

Shutting down the thermohaline circulation would reduce the amount of nutrient flow among the world's oceans.

2. A number of Earth's features determine the locations of biomes around the world.

(a) Explain why the regions of the world that receive the most direct sunlight contain tropical rainforests. (4 points)

The most direct sunlight produces the warmest temperatures. The most direct sunlight is also the driving force behind the primary Hadley cells which release large amounts of precipitation at the intertropical convergence. Thus, these locations have both very warm temperatures and very high precipitation, and these two conditions favor the growth of tropical rain forests.

(b) Describe the role that the movement of the ITCZ over the year plays in creating seasonal forests in tropical regions. (2 points)

The intertropical zone is typified by dense clouds and intense thunderstorm activity. In tropical regions that are north and south of the equator, the ITCZ passes overhead twice each year, producing two seasons of high rainfall and two seasons of low rainfall.

(c) Identify the mechanisms by which albedo and the angle of the Sun's rays cause colder temperatures to occur on Earth near the North and South Poles. (2 points for each mechanism)

The sun's angle is the least direct near the poles and this causes the least amount of solar energy per unit area and this causes lower temperatures. The high albedo effect near the poles, largely due to the high reflectance of snow, allows little absorption of solar energy and further reinforces the cold temperatures that favor the growth of tundra and boreal plants.