

Exercise 2 (Modules 34.3–34.4)

Abiotic and biotic factors influence the distribution and abundance of organisms. Organisms adapt to these factors via natural selection. Complete the following chart listing physical and chemical (abiotic) factors that shape organisms and ecosystems. In each case, list an organism, the factor that affects it, and how the organism is adapted to that aspect of its environment. Some examples are taken from the text modules; others are new examples.

<i>Organism</i>	<i>Abiotic Factor</i>	<i>Adaptation</i>
Cactus	1.	Thick cuticle
2.	Cold of Himalayas	3.
4.	5.	Enzymes that function in very hot water
Pine tree	6.	Cones release seeds only after being heated
Noble rhubarb	Ultraviolet radiation	7.
Blue poppy	8.	Grows low to ground, next to rocks
Tropical rain forest tree shades out competing plants	9.	Rapid growth
Carp	10.	Able to gulp air
11.	12.	Coat of hollow hairs

Exercise 3 (Module 34.5)

Practice using concepts and terminology of climate by filling in the blanks in the following paragraphs.

The continent of North America stretches almost from the North Pole to the equator. Its life forms—from polar bears to iguanas—reflect this diversity in climate. The climate is warmest nearest the equator, where the sun's rays strike the Earth most ¹ _____. Near the ² _____, the sun's rays strike at more of an angle, so their energy is spread out over a larger area. The ³ _____ of the Earth in relation to the sun causes the seasons. In ⁴ _____, the Northern Hemisphere is tilted toward the sun. In ⁵ _____, North America tilts away from the sun.

In addition to temperature differences, wind and rain are important aspects of climate. The sun's heat ⁶ _____ air and evaporates ⁷ _____ near the equator. The warm air is less dense than cold air, so it ⁸ _____. The rising air near the equator creates an area of calm, light winds called the ⁹ _____. The moist air cools as it ascends, and its moisture condenses and falls as ¹⁰ _____, watering the tropical forests of Guatemala, Costa Rica, and Panama. After losing their moisture, the high-altitude air masses spread away from the equator. Cool air is denser than warm air, so the air ¹¹ _____ around ¹² _____ degrees north and south of the equator. This dry air is responsible for the ¹³ _____ landscape of Mexico and the southwest United States. Some of the dry air spreads back toward the equator, and some picks up ¹⁴ _____ and spreads toward temperate latitudes. This air will cool and drop its moisture as it spreads farther from the equator, into areas such as the eastern United States.

The rise and fall of air masses and their resulting spread from place to place is deflected by the ¹⁵ _____ of the Earth to create the ¹⁶ _____ winds. Wind rushes back to replace rising air at the equator, creating the ¹⁷ _____, which dominate the tropics. The Earth's rotation causes the trade winds to blow from the ¹⁸ _____ in the Northern Hemisphere.

Ocean ¹⁹ _____ are created by the combined effects of unequal heating of surface waters, ²⁰ _____, the Earth's ²¹ _____, and the locations of the ²² _____. Currents profoundly affect local climate. The cold Japanese current creates the foggy conditions that water the redwood forests of northern California. The ²³ _____ warms the southeastern United States, as well as western Europe. Thus, ²⁴ _____ moderate the climate of nearby land.

Landforms shape local climate. Altitude influences temperature and ²⁵ _____. Moisture may be captured as air masses move over mountain ranges, creating dry ²⁶ _____ downwind. The sagebrush landscape of Nevada lies behind the Sierra Nevadas, for example. The forests of the California mountains and the Nevada desert are just two examples of ²⁷ _____, major types of ecological associations that cover large regions. As this example illustrates, these large ecosystems are shaped mostly by ²⁸ _____ and ²⁹ _____.

Exercise 7 (Modules 34.8–34.17)

Match each of the phrases on the left with one of the biomes from the list on the right.

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|-------|---|-------------------------------|
| _____ | 1. Grows around the Mediterranean | A. Tundra |
| _____ | 2. Among the most complex and diverse of all biomes | B. Desert |
| _____ | 3. North American prairies and Asian steppes | C. Tropical forest |
| _____ | 4. The taiga of Canada, Alaska, Siberia | D. Temperate broadleaf forest |
| _____ | 5. May be hot or cold but is always dry | E. Chaparral |
| _____ | 6. Permafrost occurs here. | F. Coniferous forest |
| _____ | 7. May occur in rain shadows | G. Temperate grassland |
| _____ | 8. Characterized by deciduous trees such as maples and oaks | H. Savanna |
| _____ | 9. Richest farmland in the United States | |
| _____ | 10. Antelope, zebras, lions, and cheetahs live here. | |
| _____ | 11. Where kangaroos live | |
| _____ | 12. Unlike other biomes, this one is growing in size. | |
| _____ | 13. Characterized by mild, rainy winters and hot, dry summers with fires. | |
| _____ | 14. Some characteristics of savannas but in colder areas than savannas | |
| _____ | 15. Straddles the equator | |
| _____ | 16. Grassland with scattered trees | |
| _____ | 17. The biome of most of the northeastern United States | |
| _____ | 18. Scrubland of dense, spiny shrubs | |
| _____ | 19. Moose, elk, snowshoe hares, beavers, bears, and wolves live here. | |
| _____ | 20. The warmest, rainiest biome | |
| _____ | 21. Closest to the North Pole | |
| _____ | 22. Rainfall can vary, but not much change in temperature or day length | |
| _____ | 23. In North America, nearly all of this biome was cleared, but it's coming back. | |
| _____ | 24. Includes temperate rain forests of California, Pacific NW, Alaska | |

Exercise 9 (Module 34.17)

The global water cycle connects water and land, and is one of the major factors shaping the distribution of terrestrial biomes. Review the water cycle by completing the following statements.

1. Energy from the _____ drives the water cycle.
2. The biggest part of the water cycle is evaporation of water from the _____.
3. Water in the air is in the form of _____.
4. Most of the water that evaporates from the sea falls as precipitation over the _____.
5. Some of the water vapor evaporated from the sea is carried by _____ over land.
6. Precipitation over land is much _____ than precipitation over the sea.
7. Most of the rainfall over land returns to the air via _____ and _____.
8. Cutting tropical forests changes the amount of _____ in the air.
9. Some of the precipitation over land "pools" a while as _____ water and groundwater.
10. Pumping _____ for irrigation may alter the water cycle.
11. Much of the precipitation that falls over land eventually flows back to the _____.
12. Water that flows down rivers may carry _____ and chemicals.

Test Your Knowledge

Multiple Choice

- Which of the following is the most complex?
 - community
 - individual
 - species
 - ecosystem
 - population
- Change of seasons is caused by
 - change in the distance of the Earth from the sun.
 - the tilt of the Earth.
 - variations in output of solar energy.
 - changes in wind patterns.
 - gravitational pull of the sun and moon.
- The kind of tropical forest in a given area—thorn forest, deciduous forest, or rain forest—depends mostly on
 - rainfall.
 - average temperature.
 - temperature difference between day and night.
 - distance from the equator.
 - prevalence of fire.
- The tundra biome gets little precipitation, but during the short summer season it is very wet, with many marshy areas, ponds, and bogs. Why?
 - Water cannot soak into the frozen ground.
 - It does not rain much, but the tundra gets a lot of snow.
 - The ground is so flat that the water cannot run downhill.
 - It is flooded by melting snow from the surrounding mountains.
 - The tundra does not look wet; it is a cold desert.
- If you were to compare the source (beginning) of a river to its mouth (end), you would probably find that
 - the water is colder near the mouth.
 - there are more nutrients in the water near the source.
 - there are more phytoplankton in the water near the mouth.
 - the current is swifter near the mouth.
 - silt accumulates near the source.
- Which of the following occurs in areas too warm for coniferous forest and too dry for temperate forest?
 - desert
 - tropical thorn forest
 - temperate grassland
 - chaparral
 - tundra
- Which of the following is dominated by plants that drop their leaves in the winter to conserve water?
 - desert
 - coniferous forest
 - tropical rain forest
 - temperate broadleaf forest
 - savanna
- Surface winds tend to blow toward the equator because
 - this is a very rainy area.
 - equatorial air is heated by the sun and rises.
 - air flows “downhill” from the North Pole.
 - the Earth’s rotational speed is fastest at the equator.
 - the oceans are broadest at the equator.
- Which of the following describes the climatic conditions characteristic of the coniferous forest?
 - mild with occasional drought and fires
 - cold and dry
 - hot or cold but always rainy
 - cold and snowy
 - mild, rainy winters and hot, dry summers
- The primary ecological factor determining the distribution of deserts is
 - windiness.
 - elevation.
 - moisture.
 - temperature.
 - fertility of soil.
- Which of the following is *not* an abiotic factor that shapes ecosystems?
 - soil minerals
 - predators
 - fire
 - rainfall
 - storms
- Which of the following would you expect to find in a rain shadow?
 - a desert
 - an ocean
 - a rain forest
 - a river system
 - tundra

Essay

- In the post–World War II period (the 1940s through the 1960s) there was a widespread belief in the United States that technology could provide a simple solution to many of our human problems. How and why has that attitude changed?
- Explain why rain forests occur along the equator, while deserts are found 30 degrees north and south of the equator.
- Which biomes in North America have been most affected by human activities? How have they been changed, and what kinds of activities have changed them?
- Using two specific biomes as examples, explain the conditions that determine why a particular biome occurs in a specific area.
- Briefly describe the global water cycle, and explain how it affects the distribution of biomes on land.
- Which of the following might eat phytoplankton?
 - great white shark
 - beaver
 - seal
 - shrimp
 - seagull
- Which of the following lists only abiotic environmental factors?
 - food, temperature, fire, wind
 - soil minerals, oxygen level, light, predators
 - food, parasites, predators, competitors
 - wind, temperature, soil minerals, light
 - light, rainfall, food, temperature
- In the Sierra foothills of California, between the flat valley floors and mountain forests, there is a zone of grassland with scattered oak trees. Although it is too narrow to show on our biome map, this “oak woodland” would probably be classed as an example of
 - coniferous forest.
 - savanna.
 - temperate deciduous forest.
 - chaparral.
 - tropical deciduous forest.

Apply the Concepts

Multiple Choice

- Which of the following shows how biotic environmental factors can affect an organism?
 - Mice have the highest reproductive rate of any common mammal.
 - Maple trees will not grow in waterlogged soil.
 - Some shrubs grow only where forest fires scorch their seeds.
 - Trout cannot live in shallow, warm water.
 - Monarch butterflies live only where there are milkweed plants for food.
- An ecologist studying how cattle grazing affects population dynamics of native animals like pronghorns and prairie dogs is focusing on
 - populations.
 - the biome.
 - the ecosystem.
 - the community.
 - individuals.
- Which of these biomes has been most altered by human activities in North America?
 - temperate broadleaf forest
 - coniferous forest
 - desert
 - tundra
 - None of the above has been altered much in North America.
- Which of the following countries is *not* paired with a biome that occurs there?
 - Ecuador—tropical forest
 - Australia—desert
 - Argentina—temperate grassland
 - Panama—coniferous forest
 - France—temperate broadleaf forest
- Which of these biomes generally lies between tundra and temperate broadleaf forest?
 - savanna
 - coniferous forest
 - desert
 - tropical forest
 - chaparral
- Most _____ must live in both the benthic realm and photic zone.
 - sharks
 - seaweeds
 - clams
 - whales
 - phytoplankton