

***Elements of Ecology, Cdn. Ed. (Smith/Smith/Havelka)***  
**Chapter 2 Climate**

**2.1 Short Answer Questions**

1) The ability of the physical environment to support life is known as its \_\_\_\_\_.

Answer: habitability

Type: SA

Topic: Introduction to Chapter 2

2) The temperature, humidity, precipitation, wind, cloudiness, and other atmospheric conditions that occur at a specific place and time are referred to as \_\_\_\_\_.

Answer: weather

Type: SA

Topic: Introduction to Chapter 2

3) The average pattern of local, regional, or global weather conditions over a long period of time is \_\_\_\_\_.

Answer: climate

Type: SA

Topic: Introduction to Chapter 2

4) \_\_\_\_\_ and water vapour are the major gases in the atmosphere that absorb energy from the sun.

Answer: Carbon dioxide

Type: SA

Topic: Section 2.1

5) The absorption and reradiation of infrared radiation by gases in the atmosphere is called the \_\_\_\_\_.

Answer: greenhouse effect

Type: SA

Topic: Section 2.1

6) \_\_\_\_\_ is the portion of the electromagnetic spectrum that is used by plants to power photosynthesis.

Answer: Visible light or Photosynthetically active radiation (PAR)

Type: SA

Topic: Section 2.1

7) In the Northern Hemisphere, the summer \_\_\_\_\_ occurs when solar rays fall directly on the Tropic of Capricorn.

Answer: solstice

Type: SA

Topic: Section 2.2

8) Radiation at higher latitudes is spread out over a larger area because of the angle of incidence and the \_\_\_\_\_.

Answer: air depth or distance it must travel through the atmosphere

Type: SA

Topic: Section 2.2

9) The amount of force exerted over a given area of surface is called atmospheric \_\_\_\_\_.

Answer: pressure

Type: SA

Topic: Section 2.3

10) As altitude above sea level increases, both air pressure and density \_\_\_\_\_.

Answer: decrease

Type: SA

Topic: Section 2.3

11) The deflection of air masses to the right in the Northern Hemisphere and to the left in the Southern Hemisphere is called the \_\_\_\_\_.

Answer: Coriolis Effect

Type: SA

Topic: Section 2.4

12) The \_\_\_\_\_ are formed by the air that reaches Earth's poles, slowly sinks to the surface, and flows southward is deflected by the Coriolis Effect.

Answer: polar easterlies

Type: SA

Topic: Section 2.4

13) In the Northern Hemisphere, oceanic gyres circulate in a \_\_\_\_\_ direction.

Answer: clockwise

Type: SA

Topic: Section 2.5

14) \_\_\_\_\_ is the amount of water vapour in the air expressed as a percentage of the saturation vapour pressure.

Answer: Relative humidity

Type: SA

Topic: Section 2.6

15) The amount of energy lost or gained per gram during a change of state is known as \_\_\_\_\_.

Answer: latent heat

Type: SA

Topic: Section 2.6

16) The \_\_\_\_\_ is the temperature at which atmospheric water condenses.

Answer: dew point

Type: SA

Topic: Section 2.6

17) The narrow region near the Equator where trade winds meet is referred to as the \_\_\_\_\_.

Answer: intertropical convergence zone

Type: SA

Topic: Section 2.7

18) Identify two benefits that snow cover has for vegetation.

Answer:

1. recharge effect of melting snow in spring

2. insulation effect, minimizing frost penetration

Type: SA

Topic: Section 2.8

19) Air loses most of its water content as it moves up and over a mountain range and causes a \_\_\_\_\_ to form on the leeward side of the same range.

Answer: rain shadow

Type: SA

Topic: Section 2.9

20) An east-west oscillation in weather patterns across the Pacific Ocean is referred to as the \_\_\_\_\_-Southern Oscillation.

Answer: El Niño

Type: SA

Topic: Section 2.10

21) During an El Niño event, the waters of the eastern Pacific Ocean are unusually \_\_\_\_\_.

Answer: warm

Type: SA

Topic: Section 2.10

22) Most organisms live in habitats that provide specific conditions or a \_\_\_\_\_ that may be very different than regional weather patterns.

Answer: microclimate

Type: SA

Topic: Section 2.11

23) The \_\_\_\_\_ effect can raise temperatures from 6°C to 8°C above those in the surrounding countryside.

Answer: urban heat or heat island

Type: SA

Topic: Ecological Issues: Urban Microclimates

## 2.2 Multiple-Choice Questions

### 1) Habitability

A) is the ability of an organism to survive in a particular habitat.

B) is the ability of the physical environment to support life.

C) is the ability of the organism to take in resources.

D) is the ability of the physical environment to change.

Answer: B

Type: MC

Topic: Introduction to Chapter 2

2) Water vapour and \_\_\_\_\_ are the two major atmospheric gases that absorb energy from the sun.

A) oxygen

B) nitrogen

C) hydrogen

D) carbon dioxide

Answer: D

Type: MC

Topic: Section 2.1

3) Without the greenhouse effect, the Earth would

A) be much warmer than it currently is.

B) be much colder than it currently is.

C) have uniform temperatures and would lack seasons.

D) have constant sunlight.

Answer: B

Type: MC

Topic: Section 2.1

4) What percentage of incoming solar radiation actually reaches Earth's surface?

A) 100 percent

B) 51 percent

C) 15 percent

D) 3 percent

Answer: B

Type: MC

Topic: Section 2.1

5) Of the 51 units of solar radiation that reach the Earth's surface, \_\_\_\_\_ units are lost to the evaporation of water.

- A) 51
- B) 30
- C) 23
- D) 7

Answer: D

Type: MC

Topic: Section 2.1

6) Photosynthetically active radiation (PAR)

- A) is the longwave radiation emitted from the Earth's surface.
- B) includes wavelengths that are shorter than ultraviolet (UV) light.
- C) includes only the solar energy with wavelengths of 400-700 nm.
- D) is the energy that is absorbed by Earth's atmosphere.

Answer: C

Type: MC

Topic: Section 2.1

7) In which of the following areas is the solar radiation the greatest in June?

- A) at the equator
- B) at the Tropic of Cancer
- C) at 90° in the southern hemisphere
- D) at 90° in the northern hemisphere

Answer: D

Type: MC

Topic: Section 2.2

8) Seasonal variation in temperature and daylength is due to the

- A) tilt of the Earth's axis.
- B) greenhouse effect.
- C) spinning of the Earth on its axis.
- D) latitudinal variation in solar radiation striking the Earth's surface.

Answer: A

Type: MC

Topic: Section 2.2

9) All the following could be used to describe or define "environmental lapse rate" EXCEPT

- A) this rate ignores the affect of moving air.
- B) this is the rate at which air temperature decreases with increasing altitude.
- C) this rate takes into account the influence of moisture on air temperature.
- D) this rate is influenced by air pressure.

Answer: C

Type: MC

Topic: Section 2.3

10) The rate of adiabatic cooling depends on the

- A) amount of moisture in the air.
- B) temperature of the air.
- C) latitude.
- D) season.

Answer: A

Type: MC

Topic: Section 2.3

11) The atmospheric region that is furthest from the Earth's surface is called the

- A) mesosphere.
- B) stratosphere.
- C) thermosphere.
- D) troposphere.

Answer: C

Type: MC

Topic: Section 2.3

12) Of the following areas on Earth's surface, which area moves fastest and has the greatest linear velocity?

- A) the North Pole ( $90^\circ$  north)
- B) Barcelona, Spain ( $41^\circ$  north)
- C) the Tropic of Capricorn ( $23.5^\circ$  south)
- D) the Equator ( $0^\circ$ )

Answer: D

Type: MC

Topic: Section 2.4

13) Between  $30$ - $60^\circ$  north latitude, wind currents typically

- A) blow from west to east and are deflected toward the left.
- B) blow from east to west and are deflected toward the left.
- C) blow from west to east and are deflected toward the right.
- D) blow from east to west and are deflected toward the right.

Answer: C

Type: MC

Topic: Section 2.4

14) Which of the following is an incorrect match?

- A) equatorial low: rising air heated in the equatorial zone
- B) subtropical high: semipermanent high-pressure belt of air at  $30^\circ$  north and south of the equator
- C) Coriolis effect: deflection in the pattern of wind flow
- D) subpolar low: right-deflected, southward-flowing stream of air

Answer: D

Type: MC

Topic: Section 2.4

15) Surface currents in the ocean typically

- A) flow most strongly from west to east in equatorial regions.
- B) are colder on the western side of continents.
- C) flow counterclockwise in gyres in the Northern Hemisphere.
- D) flow unimpeded from east to west just north of Antarctica.

Answer: B

Type: MC

Topic: Section 2.5

16) The systematic patterns of water movement are known as

- A) circulations.
- B) currents.
- C) gyres.
- D) trade winds.

Answer: B

Type: MC

Topic: Section 2.5

17) Relative humidity is the

- A) amount of pressure at a given temperature at which water transforms from a liquid to a gaseous state.
- B) amount of pressure that water vapour exerts independent of the pressure of dry air.
- C) temperature at which saturation vapour pressure is achieved.
- D) amount of water vapour in the air relative to the saturation vapour pressure.

Answer: D

Type: MC

Topic: Section 2.6

18) The transformation of water vapour to a liquid state is known as

- A) condensation.
- B) evaporation.
- C) saturation.
- D) solidification.

Answer: A

Type: MC

Topic: Section 2.6

19) In the vicinity of the Equator, air typically

- A) rises, cools, and precipitates.
- B) descends, warms, and precipitates.
- C) rises, cools, and is dry.
- D) descends, warms, and is dry.

Answer: A

Type: MC

Topic: Section 2.7

- 20) During winter in the Southern Hemisphere, the intertropical convergence zone (ITCZ)
- A) sits directly over the equator.
  - B) is shifted into the northern latitudes.
  - C) is shifted into the southern latitudes.
  - D) does not exist.

Answer: B

Type: MC

Topic: Section 2.7

- 21) Snow can be \_\_\_\_\_ of the total annual precipitation in the prairies.

- A) 5%
- B) 10%
- C) 25%
- D) 35%

Answer: C

Type: MC

Topic: Section 2.8

- 22) Precipitation is generally greater

- A) in the Northern Hemisphere than in the Southern Hemisphere.
- B) in coastal areas than in interior areas.
- C) at horse latitudes (approximately 30° of latitude) than at equatorial latitudes.
- D) on the leeward side of mountains than on the windward side.

Answer: B

Type: MC

Topic: Sections 2.7 and 2.9

- 23) Air loses moisture as it rises over a mountain for all the following reasons, EXCEPT that

- A) as air cools it loses its ability to hold moisture.
- B) air has a lower saturation of water vapour at higher altitudes.
- C) air that encounters a mountain is too heavy to rise up and over unless it loses excess water vapour.
- D) water converts from a gaseous to liquid state.

Answer: C

Type: MC

Topic: Sections 2.3, 2.6, 2.9

- 24) Some variation in the solar radiation striking the Earth's surface is linked to \_\_\_\_\_ activity.

- A) sunspot
- B) El Niño
- C) La Niña
- D) glacial

Answer: A

Type: MC

Topic: Section 2.10



- 25) During El Niño conditions,
- A) surface water temperatures are warmer in the eastern Pacific Ocean.
  - B) less rainfall occurs in the eastern Pacific Ocean.
  - C) trade winds across the Pacific Ocean are strong.
  - D) increased upwelling of nutrient-rich water occurs in the eastern Pacific Ocean.

Answer: D

Type: MC

Topic: Section 2.10

- 26) \_\_\_\_\_ is considered a primary influence on local climate.

- A) Aspect
- B) Soil temperature
- C) Rainfall
- D) Vegetation

Answer: A

Type: MC

Topic: Section 2.11

- 27) Habitats in the Northern Hemisphere that are positioned on north-facing slopes generally \_\_\_\_\_ than those habitats situated on south-facing slopes.

- A) have a higher rate of evaporation
- B) have a greater soil moisture
- C) experience higher air temperatures
- D) experience greater fluxes in weather conditions

Answer: B

Type: MC

Topic: Section 2.11

- 28) Densely populated urban areas tend to have

- A) higher relative humidity than rural areas.
- B) higher temperatures than rural areas.
- C) higher wind speeds than rural areas.
- D) less fog than rural areas.

Answer: B

Type: MC

Topic: Ecological Issues: Urban Microclimates

## 2.3 True/False Questions

1) The physical environment influences organisms on a generational timescale.

Answer: TRUE

Type: TF

Topic: Introduction to Chapter 2

2) Weather is the long-term average of local, regional, or global conditions.

Answer: FALSE

Type: TF

Topic: Introduction to Chapter 2

3) Most of the energy from the sun that strikes Earth is used to power living systems.

Answer: FALSE

Type: TF

Topic: Section 2.1

4) A hotter object emits higher energy wavelengths than a cooler object.

Answer: TRUE

Type: TF

Topic: Section 2.1

5) Solar radiation is more direct in tropical latitudes than in temperate latitudes.

Answer: TRUE

Type: TF

Topic: Section 2.2

6) Mean global temperatures change with latitude and season.

Answer: TRUE

Type: TF

Topic: Section 2.2

7) Atmospheric temperature increases with an increase in altitude.

Answer: FALSE

Type: TF

Topic: Section 2.3

8) Cooler air is denser than warmer air.

Answer: TRUE

Type: TF

Topic: Section 2.3

9) Masses of air and water are deflected to the left in the Northern Hemisphere and to the right in the Southern Hemisphere.

Answer: FALSE

Type: TF

Topic: Section 2.4

10) The complicated circulation of air in Earth's atmosphere is due to both the Earth's rotation and irregular land masses on Earth's surface.

Answer: TRUE

Type: TF

Topic: Section 2.4

11) Trade winds are instrumental in forming the oceanic currents that originate at the Equator.

Answer: TRUE

Type: TF

Topic: Section 2.5

12) The water vapour capacity of air cannot be exceeded.

Answer: TRUE

Type: TF

Topic: Section 2.6

13) Cold air can hold more water than warm air.

Answer: FALSE

Type: TF

Topic: Section 2.6

14) Rainfall in the Southern Hemisphere is greater than rainfall in the Northern Hemisphere because the oceans cover a greater proportion of the Southern Hemisphere.

Answer: TRUE

Type: TF

Topic: Section 2.7

15) Precipitation is highest in polar regions.

Answer: FALSE

Type: TF

Topic: Section 2.7

16) The intertropical convergence zone (ITCZ) tends to migrate toward regions of the globe with the warmest surface temperature.

Answer: TRUE

Type: TF

Topic: Section 2.7

17) Vegetation is usually more dense and vigorous on the leeward side of mountains than on the windward side.

Answer: FALSE

Type: TF

Topic: Section 2.9

18) Surface temperatures in the eastern Pacific Ocean are cooler during El Niño conditions than during La Niña conditions.

Answer: FALSE

Type: TF

Topic: Section 2.10

19) In temperate regions of the Northern Hemisphere, north-facing slopes are more humid than south-facing slopes.

Answer: TRUE

Type: TF

Topic: Section 2.11

20) The average temperature in a city is greater than in the surrounding open countryside.

Answer: TRUE

Type: TF

Topic: Ecological Issues: Urban Microclimates

## 2.4 Essay Questions

1) Explain the differences between weather, climate, and microclimate. Which is most important for individual organisms? Give an example.

Type: ES

Topic: Introduction to Chapter 2 and Section 2.11

2) Explain how or why the Earth's surface emits more energy than it receives from the sun.

Type: ES

Topic: Section 2.1

3) Explain why seasonality occurs and why it is more pronounced at temperate and polar latitudes.

Type: ES

Topic: Section 2.2

4) Explain why air temperature decreases as one moves further from Earth's surface into higher altitudes.

Type: ES

Topic: Section 2.3

5) Explain how the trade winds develop and why these were so important to 17th century merchant sailors.

Type: ES

Topic: Section 2.4

6) Explain why the saturation vapour pressure increases with air temperature. How does relative humidity change in response to air warming or cooling?

Type: ES

Topic: Section 2.6

7) Why is it that, in general, more rain falls in the Southern Hemisphere than in the Northern Hemisphere?

Type: ES

Topic: Section 2.7

8) Define albedo and explain its significance concerning the ice caps and global climate change.

Answer: Albedo is the ability of a surface to reflect solar radiation. Ice and snow have a high albedo and reflect large portions of solar radiation, preventing the surface of the Earth from heating up and keeping the planet cool. Melting ice caps will allow more solar radiation to be absorbed by the planet, thus heating the surface. Continual warming will melt ice caps further and a positive feedback towards a warming planet will ensue.

Type: ES

Topic: Section 2.8

9) Why do the amount of rainfall and the composition of vegetation differ greatly on the opposite sides of a mountain range?

Type: ES

Topic: Section 2.9

10) Compare the causes and effects of the El Niño and La Niña events.

Type: ES

Topic: Section 2.10

11) You study two neighboring plant populations growing at 200 meters above sea level. One population is situated on a north-facing slope, while the other population grows on a south-facing slope. Compare the environmental conditions and microclimates that each population experiences.

Type: ES

Topic: Section 2.11

12) Why does the climate of urban areas differ from that of the surrounding countryside?

Type: ES

Topic: Ecological Issues: Urban Microclimates