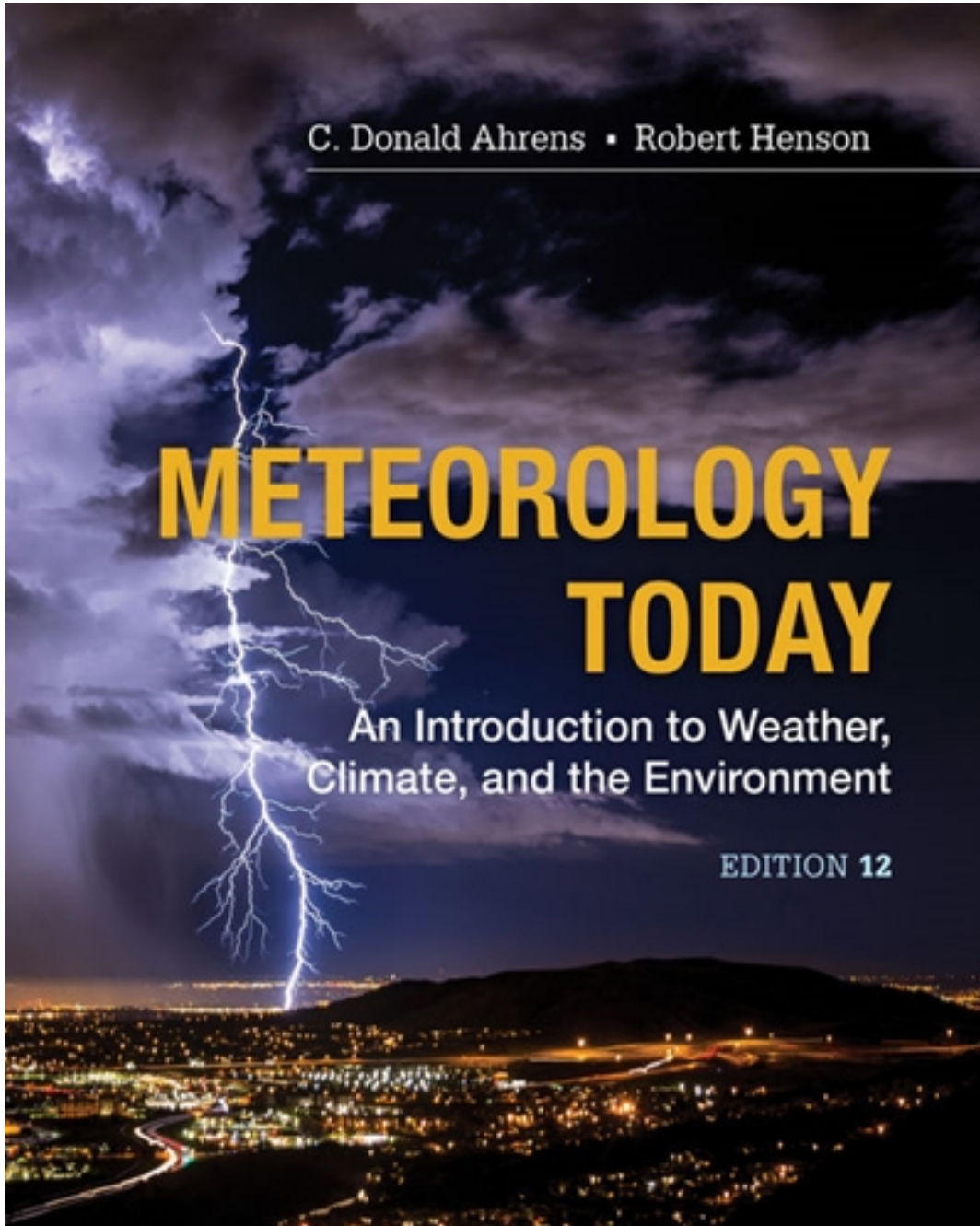


# Test Bank for Meteorology Today 12th Edition by Ahrens

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# Test Bank

## Chapter 02

1. Each year, Earth's surface radiates away more energy than it receives from the Sun.
- a. True
  - b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

*DATE CREATED:* 1/23/2018 10:58 AM

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2. Good absorbers of radiation are usually poor emitters of radiation.
- a. True
  - b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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## Chapter 02

3. Clouds strongly emit infrared radiation back to Earth's surface.

- a. True
- b. False

*ANSWER:* True

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Understand

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4. The atmosphere near Earth's surface is "heated from below" by heat energy from Earth's interior.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

*DATE CREATED:* 1/23/2018 10:58 AM

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## Chapter 02

5. Occasionally, the aurora can be observed in the United States.

- a. True
- b. False

*ANSWER:* True

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.12 - Identify the differences between solar winds and storms and their respective phenomena as observed in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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6. A temperature of 250 Kelvin is considered extremely hot.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.2 - Compare the Fahrenheit, Celsius, and Kelvin temperature scales and outline their scientific backgrounds and uses today.

*OTHER:* Bloom's: Understand

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## Chapter 02

7. Heat is transferred in Earth's atmosphere by radiation.

- a. True
- b. False

*ANSWER:* True

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.9 - Examine the effect that conduction, convection, scattering, and reflection have on Earth's radiant energy budget.

*OTHER:* Bloom's: Analyze

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8. Even though Earth is cooler than the Sun, it emits much more radiation than the Sun.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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## Chapter 02

9. In the atmosphere, convection is horizontal and advection is vertical.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Heat Transfer in the Atmosphere

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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10. The ultraviolet portion of the electromagnetic spectrum carries the most energy.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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## Chapter 02

11. Carbon dioxide and water vapor are called selective absorbing greenhouse gases.

- a. True
- b. False

*ANSWER:* True

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Understand

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12. Both the Earth and the Sun can be treated as blackbodies.

- a. True
- b. False

*ANSWER:* True

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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## Chapter 02

13. The aurora usually occurs more frequently above Maine than above Washington state.
- a. True
  - b. False

*ANSWER:* True

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.11 - Describe the solar wind and its interaction with Earth's magnetic field.

*OTHER:* Bloom's: Remember

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14. The solar wind is not responsible for solar storms. Solar wind and solar storm are simply different names for the same phenomena.
- a. True
  - b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.12 - Identify the differences between solar winds and storms and their respective phenomena as observed in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

15. Without water vapor to absorb Earth's emitted infrared radiation, Earth would lose more heat.

- a. True
- b. False

*ANSWER:* True

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Understand

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16. Visible radiation is more successful in dislodging electrons from air atoms and molecules than ultraviolet radiation.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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## Chapter 02

17. Most of the solar wind emitted by the Sun never reaches Earth because of Earth's tilt.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.11 - Describe the solar wind and its interaction with Earth's magnetic field.

*OTHER:* Bloom's: Remember

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18. Temperature and heat describe the same characteristic of Earth's atmosphere.

- a. True
- b. False

*ANSWER:* False

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* True / False

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.1 - Define the terms energy, potential energy, kinetic energy, radiant energy, temperature and heat, and describe their relationships in the context of Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

19. A change of 1 degree on the Celsius scale is \_\_\_\_ a change of 1 Kelvin.
- equal to
  - larger than
  - smaller than
  - in the opposite direction of
  - insignificant in comparison to

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.2 - Compare the Fahrenheit, Celsius, and Kelvin temperature scales and outline their scientific backgrounds and uses today.

*OTHER:* Bloom's: Understand

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20. If the temperature of the air is said to be at absolute zero, one might conclude that the \_\_\_\_.
- motion of the molecules is at a maximum
  - molecules are occupying a large volume
  - molecules contain a minimum amount of energy
  - temperature is 0 degrees Fahrenheit
  - air temperature is 0 degrees Celsius

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.2 - Compare the Fahrenheit, Celsius, and Kelvin temperature scales and outline their scientific backgrounds and uses today.

*OTHER:* Bloom's: Understand

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## Chapter 02

21. A lake behind a dam contains energy by virtue of its position. This energy is known as \_\_\_\_.
- potential energy
  - kinetic energy
  - sensible heat energy
  - static energy
  - latent heat energy

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.1 - Define the terms energy, potential energy, kinetic energy, radiant energy, temperature and heat, and describe their relationships in the context of Earth's atmosphere.

*OTHER:* Bloom's: Remember

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22. The heat energy released when water vapor changes to a liquid is called \_\_\_\_.
- specific heat of evaporation
  - latent heat of fusion
  - latent heat of fission
  - latent heat of condensation
  - specific heat of condensation

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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## Chapter 02

23. When water changes from a solid to a vapor, without going through a liquid state, we call this process \_\_\_\_.

- a. freezing
- b. condensation
- c. sublimation
- d. deposition
- e. evaporation

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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24. What is released as sensible heat during the formation of clouds?

- a. Deposition
- b. Longwave radiation
- c. Latent heat
- d. Shortwave radiation
- e. Sublimation

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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## Chapter 02

25. The processes of condensation and freezing \_\_\_\_.
- a. both release sensible heat into the environment
  - b. both absorb sensible heat from the environment
  - c. do not affect the temperature of their surroundings
  - d. do not involve energy transport
  - e. are both negative processes

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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26. Which of the following is the poorest conductor of heat?
- a. Soil
  - b. Snow
  - c. Ice
  - d. Water
  - e. Still air

*ANSWER:* e

*POINTS:* 1

*REFERENCES:* Heat Transfer in the Atmosphere

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

27. Horizontal transport by the wind is called \_\_\_\_.

- a. advection
- b. radiation
- c. conduction
- d. latent heat
- e. reflection

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Heat Transfer in the Atmosphere

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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28. The amount of heat energy required to bring about a change in temperature in a substance is called the \_\_\_\_.

- a. heat capacity
- b. dead heat
- c. conduction heat
- d. latent heat
- e. radiative equilibrium

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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## Chapter 02

29. Snow will usually melt on the roof of a home that is \_\_\_\_.

- a. facing south
- b. a good conductor of heat
- c. well insulated
- d. poorly insulated
- e. a poor radiator of heat

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Heat Transfer in the Atmosphere

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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30. A vertical exchange of heat is called \_\_\_\_.

- a. convection
- b. evaporation
- c. compression
- d. condensation
- e. expansion

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Heat Transfer in the Atmosphere

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

31. The temperature of a rising air parcel \_\_\_\_.
- a. always cools due to expansion
  - b. always warms due to expansion
  - c. always cools due to compression
  - d. always warms due to compression
  - e. remains constant.

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Heat Transfer in the Atmosphere

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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32. The proper order from longest to shortest wavelength is \_\_\_\_.
- a. visible, infrared, and ultraviolet
  - b. infrared, visible, and ultraviolet
  - c. ultraviolet, visible, and infrared
  - d. visible, ultraviolet, and infrared

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Remember

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## Chapter 02

33. The rising air bubbles from convection are known as \_\_\_\_.

- a. advection
- b. expansion
- c. convection
- d. friction
- e. thermals

*ANSWER:* e

*POINTS:* 1

*REFERENCES:* Heat Transfer in the Atmosphere

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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34. How do red and blue light differ?

- a. Blue light has a higher speed of propagation.
- b. Red light has a lower intensity.
- c. Red light has a higher intensity.
- d. The wavelength of red light is longer.
- e. The wavelength of blue light is longer.

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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35. Solar radiation reaches Earth's surface as \_\_\_\_.
- a. visible radiation only
  - b. ultraviolet radiation only
  - c. infrared radiation only
  - d. visible and infrared radiation only
  - e. ultraviolet, visible, and infrared radiation

*ANSWER:* e

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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36. What determines the type (wavelength) and amount of radiation an object emits?
- a. Temperature
  - b. Thermal conductivity
  - c. Density
  - d. Latent heat
  - e. Specific heat

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.5 - Define electromagnetic energy and radiant energy, and illustrate the relationship between radiation and temperature.

*OTHER:* Bloom's: Remember

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## Chapter 02

37. Often before sunrise on a clear, calm, cold morning, ice (frost) can be seen on the tops of parked cars, even when the air temperature is above freezing, because the tops of cars are cooling by a loss of \_\_\_\_.
- conduction
  - convection
  - latent heat
  - radiation
  - condensation

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.5 - Define electromagnetic energy and radiant energy, and illustrate the relationship between radiation and temperature.

*OTHER:* Bloom's: Apply

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38. To keep an object cool while exposed to direct sunlight, \_\_\_\_.
- put it inside a brown paper bag
  - wrap it in black paper
  - wrap it in plastic wrap
  - wrap it in aluminum foil with the shiny side facing outward
  - put it inside a clear container

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.5 - Define electromagnetic energy and radiant energy, and illustrate the relationship between radiation and temperature.

*OTHER:* Bloom's: Remember

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## Chapter 02

39. What type of energy has a wavelength longer than that of red light?

- a. Green visible radiation
- b. Blue visible radiation
- c. Infrared radiation
- d. Red visible radiation
- e. Ultraviolet radiation

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Remember

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40. At which temperature would Earth be radiating energy at the greatest rate or intensity?

- a. -5 degrees Fahrenheit
- b. -40 degrees Fahrenheit
- c. 60 degrees Fahrenheit
- d. 32 degrees Fahrenheit
- e. 105 degrees Fahrenheit

*ANSWER:* e

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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## Chapter 02

41. Most of the radiation emitted by a human body is in the form of \_\_\_\_.
- a. ultraviolet radiation and is invisible
  - b. visible radiation but is too weak to be visible
  - c. infrared radiation and is invisible
  - d. the entire electromagnetic spectrum
  - e. N/A; humans do not emit electromagnetic radiation

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.5 - Define electromagnetic energy and radiant energy, and illustrate the relationship between radiation and temperature.

*OTHER:* Bloom's: Remember

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42. Clouds form by the process of \_\_\_\_.
- a. deposition only
  - b. condensation only
  - c. evaporation only
  - d. both deposition and condensation (not evaporation)
  - e. deposition, condensation, and evaporation

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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## Chapter 02

43. The Sun emits its greatest intensity of radiation in the \_\_\_\_.

- a. visible portion of the spectrum
- b. infrared portion of the spectrum
- c. ultraviolet portion of the spectrum
- d. X-ray portion of the spectrum
- e. gamma ray portion of the spectrum

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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44. Earth emits radiation with greatest intensity at \_\_\_\_.

- a. infrared wavelengths
- b. radio wavelengths
- c. visible wavelengths
- d. ultraviolet wavelengths
- e. X-ray wavelengths

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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## Chapter 02

45. Which principle best describes why melting occurs first in snow around tree trunks?
- a. Snow is a good absorber of infrared energy.
  - b. Snow is a poor emitter of infrared energy.
  - c. Snow is a poor reflector of visible light.
  - d. Snow is a poor absorber of visible light.
  - e. Snow is a poor absorber of ultraviolet light.

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Apply

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46. Without the atmospheric greenhouse effect, the average surface temperature would be \_\_\_\_.
- a. higher than at present
  - b. lower than at present
  - c. the same as it is now
  - d. static
  - e. radiative

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Radiation - Absorption, Emission, Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.8 - Discuss the atmospheric greenhouse effect, and assess its impact on climate and life on Earth.

*OTHER:* Bloom's: Understand

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## Chapter 02

47. Photons of which of the following wavelengths of radiation are the main ones that cause skin tanning?

- a. UVC
- b. UVB
- c. UVA
- d. Visible
- e. Infrared

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Understand

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48. Suppose last night was clear and calm. Tonight's forecast indicates that low clouds will be present. From this, you would conclude that tonight's minimum temperature will be \_\_\_\_.

- a. higher than last night's minimum temperature
- b. lower than last night's minimum temperature
- c. the same as last night's minimum temperature
- d. above freezing
- e. below freezing

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.8 - Discuss the atmospheric greenhouse effect, and assess its impact on climate and life on Earth.

*OTHER:* Bloom's: Understand

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## Chapter 02

49. Which gases are primarily responsible for the atmospheric greenhouse effect in Earth's atmosphere?

- a. Oxygen and ozone
- b. Nitrogen and carbon dioxide
- c. Ozone and nitrogen
- d. Water vapor and carbon dioxide
- e. Ozone and chlorofluorocarbons.

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Understand

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50. The combined albedo of Earth and the atmosphere is approximately \_\_\_\_ percent.

- a. 4
- b. 10
- c. 30
- d. 50
- e. 90

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.9 - Examine the effect that conduction, convection, scattering, and reflection have on Earth's radiant energy budget.

*OTHER:* Bloom's: Remember

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## Chapter 02

51. The albedo of the Moon is 7 percent. This means that \_\_\_\_.
- the Moon can absorb seven times more energy than Earth
  - 7 percent of sunlight striking the Moon is absorbed
  - the Moon emits only 7 percent as much energy as it absorbs from the Sun
  - 93 percent of sunlight striking the Moon is reflected
  - 7 percent of sunlight striking the moon is reflected

*ANSWER:* e

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.9 - Examine the effect that conduction, convection, scattering, and reflection have on Earth's radiant energy budget.

*OTHER:* Bloom's: Analyze

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52. As ocean temperatures increase, water vapor greenhouse gas increases and enhances the atmospheric greenhouse effect, thereby illustrating which of the following?
- Albedo
  - Equilibrium
  - Blackbody effect
  - A positive feedback process
  - A sulfide negative feedback process

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Understand

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## Chapter 02

53. On average, what percentage of solar energy striking the outer atmosphere eventually reaches Earth's surface?
- a. 5 percent
  - b. 15 percent
  - c. 30 percent
  - d. 50 percent
  - e. 70 percent

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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54. If the amount of energy lost by Earth to space each year were not approximately equal to that received, \_\_\_\_.
- a. the atmosphere's average temperature would change
  - b. the length of the year would change
  - c. the Sun's output would change
  - d. the mass of the atmosphere would change
  - e. nothing would change

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Radiation - Absorption, Emission and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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## Chapter 02

55. Sunlight that bounces off a surface is said to be \_\_\_\_ from the surface.

- a. radiated
- b. absorbed
- c. emitted
- d. reflected
- e. conducted

*ANSWER:* d

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.9 - Examine the effect that conduction, convection, scattering, and reflection have on Earth's radiant energy budget.

*OTHER:* Bloom's: Analyze

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56. The main process responsible for warming in the lower atmosphere is \_\_\_\_.

- a. the release of latent heat during condensation
- b. the conduction of heat upward from the surface
- c. the absorption of infrared radiation
- d. the direct absorption of sunlight by the atmosphere
- e. related to Earth's albedo

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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## Chapter 02

57. Earth's radiative equilibrium temperature is the \_\_\_\_.
- average temperature at which Earth is absorbing solar radiation and emitting infrared radiation at equal rates
  - average temperature at which Earth is radiating energy at maximum intensity
  - average temperature Earth must maintain to prevent oceans from freezing solid
  - temperature at which rates of evaporation and condensation on Earth are in balance
  - temperature in which humans and animals can survive on Earth

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Remember

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58. A feeble atmospheric luminescence known as airglow is detected at \_\_\_\_.
- $\pm 20^\circ$  latitude and higher
  - $\pm 40^\circ$  latitude and higher
  - $\pm 60^\circ$  latitude and higher
  - $\pm 80^\circ$  latitude and higher
  - everywhere on Earth

*ANSWER:* e

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.12 - Identify the differences between solar winds and storms and their respective phenomena as observed in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

59. Earth's magnetic field protects Earth from some of the \_\_\_\_.
- a. pollutants found in the atmosphere
  - b. dangerous ozone present in the atmosphere
  - c. dangerous gamma rays emitted by the Sun
  - d. ultraviolet radiation
  - e. particles emitted by the Sun in the form of solar winds and storms

*ANSWER:* e

*POINTS:* 1

*REFERENCES:* Solar particles, the Aurora, and Space Weather

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.11 - Describe the solar wind and its interaction with Earth's magnetic field.

*OTHER:* Bloom's: Remember

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60. Solar winds are composed of \_\_\_\_.
- a. charged particles
  - b. aerosols and other pollutants
  - c. water vapor
  - d. a variety of gases that have no charge
  - e. electromagnetic waves

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.11 - Describe the solar wind and its interaction with Earth's magnetic field.

*OTHER:* Bloom's: Remember

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## Chapter 02

61. The magnetosphere is \_\_\_\_.
- composed of greenhouse gases
  - a thin, magnetic layer surrounding the Sun
  - a tear-dropped shaped cavity when it interacts with the solar wind
  - a tiny magnetic field found surrounding the particles in solar winds and storms
  - the Moon's magnetic field

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.11 - Describe the solar wind and its interaction with Earth's magnetic field.

*OTHER:* Bloom's: Remember

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62. Normally, solar wind approaches Earth at an average speed of \_\_\_\_.
- 300 km/sec
  - 400 km/sec
  - 500 km/sec
  - 100 km/sec
  - 1000 km/sec

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.11 - Describe the solar wind and its interaction with Earth's magnetic field.

*OTHER:* Bloom's: Remember

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## Chapter 02

63. Airlines sometimes reroute planes away from polar regions during solar storms because \_\_\_\_.
- a. radio communication can be affected by solar storms
  - b. solar storms decrease air temperature, which can present a danger
  - c. solar storms increase air temperature, which can present a danger
  - d. solar storms can lead to severe turbulence
  - e. the sky can become too bright for safe navigation

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Solar particles, the Aurora, and Space Weather

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.12 - Identify the differences between solar winds and storms and their respective phenomena as observed in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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64. The ability or capacity to do work on some form of matter is called \_\_\_\_.
- a. temperature
  - b. energy
  - c. specific heat
  - d. latent heat
  - e. thermal heat

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.1 - Define the terms energy, potential energy, kinetic energy, radiant energy, temperature and heat, and describe their relationships in the context of Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

65. The faster something moves, \_\_\_\_.

- a. the greater its kinetic energy
- b. the lower its kinetic energy
- c. the greater its potential energy
- d. the lower its potential energy
- e. the lower its temperature

*ANSWER:* a

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.1 - Define the terms energy, potential energy, kinetic energy, radiant energy, temperature and heat, and describe their relationships in the context of Earth's atmosphere.

*OTHER:* Bloom's: Remember

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66. What is the lowest possible temperature on any of the three common temperature scales?

- a. -273 degrees Fahrenheit
- b. 0 Kelvin
- c. -100 degrees Celsius
- d. -273 Kelvin
- e. -100 degrees Fahrenheit

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.2 - Compare the Fahrenheit, Celsius, and Kelvin temperature scales and outline their scientific backgrounds and uses today.

*OTHER:* Bloom's: Understand

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## Chapter 02

67. In most of the world, temperature is recorded in \_\_\_\_.

- a. Fahrenheit
- b. Kelvin
- c. Celsius
- d. equal proportions - all three scales are used
- e. both Kelvin and Celsius

*ANSWER:* c

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.2 - Compare the Fahrenheit, Celsius, and Kelvin temperature scales and outline their scientific backgrounds and uses today.

*OTHER:* Bloom's: Understand

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68. Temperature is a measure of the average speed of \_\_\_\_\_ and \_\_\_\_\_.

*ANSWER:* atoms; molecules  
molecules; atoms

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.1 - Define the terms energy, potential energy, kinetic energy, radiant energy, temperature and heat, and describe their relationships in the context of Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

69. If Earth's average surface temperature were to increase, the amount of radiation emitted from Earth's surface would \_\_\_\_\_, and the wavelength of peak emission would shift toward \_\_\_\_\_ wavelengths.

*ANSWER:* increase; shorter

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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70. In the Northern Hemisphere, we call the green-yellow light show observed in the sky the \_\_\_\_\_; its counterpart in the Southern Hemisphere is the \_\_\_\_\_.

*ANSWER:* aurora borealis; aurora australis  
northern lights; southern lights

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.12 - Identify the differences between solar winds and storms and their respective phenomena as observed in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

71. \_\_\_\_\_ can have adverse effects on electrical systems, satellites, and radio communications.

*ANSWER:* Solar storms

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.12 - Identify the differences between solar winds and storms and their respective phenomena as observed in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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72. \_\_\_\_\_ is energy in the process of being transferred from one object to another because of the \_\_\_\_\_ difference between them.

*ANSWER:* Heat, temperature

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.1 - Define the terms energy, potential energy, kinetic energy, radiant energy, temperature and heat, and describe their relationships in the context of Earth's atmosphere.

*OTHER:* Bloom's: Remember

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## Chapter 02

73. A small increase in temperature results in a large \_\_\_\_\_ in the amount of radiation emitted because doubling the absolute temperature of an object \_\_\_\_\_ the maximum energy output by a factor of 16, or 24.

*ANSWER:* increase; increases

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.5 - Define electromagnetic energy and radiant energy, and illustrate the relationship between radiation and temperature.

*OTHER:* Bloom's: Remember

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74. Because Earth is \_\_\_\_\_ than the Sun, it emits \_\_\_\_\_ radiation than the Sun.

*ANSWER:* cooler; less  
colder; less

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.5 - Define electromagnetic energy and radiant energy, and illustrate the relationship between radiation and temperature.

*OTHER:* Bloom's: Remember

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## Chapter 02

75. The atmospheric greenhouse effect occurs because the atmosphere allows \_\_\_\_\_ radiation to pass through, but inhibits to some degree the passage of \_\_\_\_\_ radiation leaving Earth's surface.

*ANSWER:* visible; infrared

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Understand

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76. Trifluoromethyl sulfur pentafluoride,  $\text{CF}_3\text{SF}_5$ , is known as a super greenhouse gas, and pound for pound it absorbs about \_\_\_\_\_ times more infrared radiation than  $\text{CO}_2$  does.

*ANSWER:* 18,000

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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## Chapter 02

77. An \_\_\_\_\_ in cloud cover surrounding Earth would increase Earth's albedo, yet would not necessarily lead to a lower Earth surface temperature.

*ANSWER:* increase

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.8 - Discuss the atmospheric greenhouse effect, and assess its impact on climate and life on Earth.

*OTHER:* Bloom's: Analyze

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78. Earth's surface temperature often \_\_\_\_\_ on a calm night as a low cloud moves overhead.

*ANSWER:* increases

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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79. Solar wind is composed of \_\_\_\_\_, or \_\_\_\_\_, travelling through space.

*ANSWER:* charged particles; plasma  
plasma; charged particles

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.11 - Describe the solar wind and its interaction with Earth's magnetic field.

*OTHER:* Bloom's: Remember

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## Chapter 02

80. The lower atmosphere is warmed from the surface upward through longwave radiation from Earth, \_\_\_\_\_, and \_\_\_\_\_.

*ANSWER:* conduction; convection  
convection; conduction

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.9 - Examine the effect that conduction, convection, scattering, and reflection have on Earth's radiant energy budget.

*OTHER:* Bloom's: Analyze

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81. Carbon dioxide, \_\_\_\_\_, nitrous oxide, and \_\_\_\_\_ are the greenhouse gases that appear to be responsible for the enhancement of Earth's atmospheric greenhouse effect.

*ANSWER:* methane; chlorofluorocarbons  
chlorofluorocarbons; methane

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Understand

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## Chapter 02

82. When water vapor condenses into clouds, \_\_\_\_\_ is released into the atmosphere. This provides a tremendous amount of heat in storms, such as thunderstorms and hurricanes.

*ANSWER:* latent heat

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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83. When a body reaches a radiative equilibrium temperature, the amount of radiation entering the surface of the body \_\_\_\_\_ the amount exiting the surface of the body.

*ANSWER:* equals

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.7 - Define the terms blackbody, radiative equilibrium temperature, selective absorber, atmospheric window, and describe their relationship to the atmospheric greenhouse effect.

*OTHER:* Bloom's: Analyze

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## Chapter 02

84. On average, the albedo of clouds is \_\_\_\_\_ percent.

*ANSWER:* 60  
sixty

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Completion

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.9 - Examine the effect that conduction, convection, scattering, and reflection have on Earth's radiant energy budget.

*OTHER:* Bloom's: Analyze

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85. In the discussion of Earth's annual energy balance, we saw that Earth absorbed approximately 51 units of solar energy but emitted 117 units of infrared energy. What prevents Earth from getting colder and colder?

*ANSWER:* Although Earth receives solar radiation only during the day, it constantly emits infrared energy both during the day and at night. The atmosphere above allows only a small fraction of this energy (6 units) to pass through into space. The majority (111 units) is absorbed mainly by the greenhouse gases water vapor and CO<sub>2</sub> and by clouds. Much of this energy (96 units) is radiated back to Earth, producing the atmospheric greenhouse effect. Hence, Earth's surface receives nearly twice as much longwave infrared energy from its atmosphere as it does shortwave radiation from the sun. In all of these exchanges, the energy lost at Earth's surface (147 units) is exactly balanced by the energy gained (147 units), which is why the average temperature on Earth stays constant.

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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## Chapter 02

86. Will a rising parcel of air always expand? Does this expansion cause the air temperature to increase or decrease?

**ANSWER:** Rising air always expands, whereas sinking air always shrinks. The reason is that air pressure decreases as we move up into the atmosphere. Consequently, as air rises, it enters a region where the surrounding air pressure is lower. To equalize the pressure, air molecules inside a rising parcel push the parcel walls outward causing expansion. Expansion causes a decrease in air temperature. Because there is no other energy source, air molecules inside the parcel use some of their own energy to expand the parcel. This energy loss shows up as slower molecular speeds, representing a lower parcel temperature.

**POINTS:** 1

**REFERENCES:** Heat Transfer in the Atmosphere

**QUESTION TYPE:** Essay

**HAS VARIABLES:** False

**LEARNING OBJECTIVES:** METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

**OTHER:** Bloom's: Remember

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87. Explain how energy in the form of sunlight absorbed at the ground could be transferred upward in the atmosphere in the form of latent heat. How or when is the latent heat energy released in the air above the ground?

**ANSWER:** Latent heat is an important source of atmospheric energy. Latent heat energy can be released into the atmosphere through the evaporation of vapor molecules from Earth's surface. After vapor molecules become separated from Earth's surface, they are swept away by the wind, much like dust in front of a broom. Rising to high altitudes where the air is cold, the vapor changes into liquid and ice cloud particles. During these processes, a tremendous amount of heat energy is released into the environment. The heat provides energy for storms such as hurricanes, middle latitude cyclones, and thunderstorms. Furthermore, water vapor evaporated from warm, tropical water can be carried into polar regions, where it condenses and gives up its heat energy. Thus, evaporation-transportation-condensation is an extremely important mechanism for the relocation of heat energy (as well as water) in the atmosphere.

**POINTS:** 1

**REFERENCES:** Energy, Temperature, and Heat

**QUESTION TYPE:** Essay

**HAS VARIABLES:** False

**LEARNING OBJECTIVES:** METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

**OTHER:** Bloom's: Understand

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## Chapter 02

88. Describe and give examples of the various ways in which heat can be transported in the atmosphere.

*ANSWER:*

The main methods of transporting heat in the atmosphere are conduction, convection, and radiation.

Conduction is heat transferred from a warmer region to a colder region. Air is a very poor heat conductor; thus, in calm weather hot ground actually only warms a shallow layer of air a few centimeters thick.

Convection is the transfer of heat by the mass movement of a fluid (such as water and air). Because liquids and gases are able to move freely, heat transfer occurs.

Convection occurs naturally in the atmosphere. On a warm, sunny day certain areas of Earth's surface absorb more heat from the sun than others. As a result, the air near Earth's surface is heated somewhat unevenly. Air molecules adjacent to these hot surfaces bounce against them, thereby gaining some extra energy by conduction. The heated air expands and becomes less dense than the surrounding cooler air. The expanded warm air is buoyed upward and rises. In this manner, large bubbles of warm air rise and transfer heat energy upward. Cooler, heavier air flows toward the surface to replace the rising air. This cooler air becomes heated and rises, and the cycle is repeated. In meteorology, the vertical exchange of heat is called convection, and rising air bubbles are known as thermals.

Radiant energy is the energy Earth receives from the Sun. Radiation travels in the form of waves that release energy when they are absorbed by objects. Because these waves have magnetic and electrical properties, they are called electromagnetic waves. Electromagnetic waves do not need molecules to propagate them but can move through a vacuum.

*POINTS:*

1

*REFERENCES:*

Heat Transfer in the Atmosphere

*QUESTION TYPE:*

Essay

*HAS VARIABLES:*

False

*LEARNING OBJECTIVES:*

METT.AHRE.12.2.4 - Describe the principles of conduction, convection, and advection and summarize their roles in Earth's atmosphere.

*OTHER:*

Bloom's: Remember

*DATE CREATED:*

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## Chapter 02

89. Describe the atmospheric greenhouse effect. Is there any difference between the way the atmospheric greenhouse effect works on a clear night and on a cloudy night?

**ANSWER:** The atmospheric greenhouse effect is defined as the absorption of infrared radiation from Earth by water vapor, CO<sub>2</sub>, and other greenhouse gases. As these gases absorb infrared radiation emitted from Earth's surface, they gain kinetic energy (the energy of motion). Gas molecules share this energy by colliding with neighboring air molecules, such as oxygen and nitrogen (both of which are poor absorbers of infrared energy). Collisions increase the average kinetic energy of the air, resulting in an increase in air temperature.

Clouds can enhance the atmospheric greenhouse effect. Tiny liquid cloud droplets are selective absorbers in that they are good absorbers of infrared radiation but poor absorbers of visible solar radiation. Clouds even absorb wavelengths between 8 and 11 μm, which are otherwise passed up by water vapor and CO<sub>2</sub>. Thus, they have the effect of enhancing the atmospheric greenhouse effect by closing the atmospheric window.

**POINTS:** 1

**REFERENCES:** Radiation: Absorption, Emission, and Equilibrium

**QUESTION TYPE:** Essay

**HAS VARIABLES:** False

**LEARNING OBJECTIVES:** METT.AHRE.12.2.8 - Discuss the atmospheric greenhouse effect, and assess its impact on climate and life on Earth.

**OTHER:** Bloom's: Understand

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90. When you remove a cold beverage from a refrigerator in a humid room, water vapor will condense on the sides of the container. Would this act to warm or cool the beverage, or would the condensation have no effect on the beverage's temperature?

**ANSWER:** Condensation is a warming process; therefore, the temperature of the beverage will increase. If the beverage contains ice, the temperature of the beverage does not change because all the energy is used to melt the ice.

**POINTS:** 1

**REFERENCES:** Energy, Temperature, and Heat

**QUESTION TYPE:** Essay

**HAS VARIABLES:** False

**LEARNING OBJECTIVES:** METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

**OTHER:** Bloom's: Understand

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## Chapter 02

91. Imagine that the temperature of the Sun changed. Describe or discuss some of the effects this might have on Earth's energy budget and Earth's climate.

*ANSWER:* Changes in the Sun's temperature and energy would affect how much energy could reach Earth's system and would alter Earth's climate. Earth's energy budget would change in the sense that less or more energy would be absorbed and emitted.

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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92. Use a small spoonful of boiling water and a large jug of boiling water to illustrate the difference between heat and temperature.

*ANSWER:* A small spoonful of boiling water and a large jug of boiling water have the same temperature, because the temperature of a substance does not depend on the amount. However, spilling a small spoonful of boiling water on your skin will hurt much less than spilling a large jug of boiling water on your skin. This is because the large jug of boiling water has much more mass and therefore much more heat.

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.3 - Differentiate heat capacity, specific heat, latent heat and sensible heat, and explain how they relate to evaporation-transportation-condensation cycles in Earth's atmosphere.

*OTHER:* Bloom's: Understand

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## Chapter 02

93. In what ways is the atmospheric greenhouse different from an agricultural greenhouse?

**ANSWER:** In a greenhouse, glass allows visible radiation to enter but inhibits, to some degree, the passage of outgoing infrared radiation. For this reason, the absorption of infrared radiation from Earth by water vapor and CO<sub>2</sub> is popularly called the greenhouse effect. However, scientific research indicates that the warm air inside a greenhouse is likely caused by the air's inability to circulate and mix with cooler outside air rather than by the entrapment of infrared energy. Because of these findings, some scientists suggest that the greenhouse effect should be called the atmospheric effect. To accommodate everyone, we generally use the term atmospheric greenhouse effect to describe the roles water vapor, CO<sub>2</sub>, and other greenhouse gases play in keeping Earth's mean surface temperature higher than it would be otherwise.

**POINTS:** 1

**REFERENCES:** Radiation: Absorption, Emission, and Equilibrium

**QUESTION TYPE:** Essay

**HAS VARIABLES:** False

**LEARNING OBJECTIVES:** METT.AHRE.12.2.8 - Discuss the atmospheric greenhouse effect, and assess its impact on climate and life on Earth.

**OTHER:** Bloom's: Understand

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94. What are other factors, in addition to increasing CO<sub>2</sub> concentrations, that affect global warming?

**ANSWER:** The main cause of global warming is thought to be the greenhouse gas CO<sub>2</sub>, whose concentration has been increasing primarily because of the burning of fossil fuels and deforestation. However, increasing concentrations of other greenhouse gases such as methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and chlorofluorocarbons (CFCs) have collectively been shown to have an effect approaching that of CO<sub>2</sub>. Overall, water vapor accounts for almost 60 percent of the atmospheric greenhouse effect. CO<sub>2</sub> accounts for ~26 percent, methane ~7 percent, and remaining greenhouse gases ~7 percent.

**POINTS:** 1

**REFERENCES:** Radiation: Absorption, Emission, and Equilibrium

**QUESTION TYPE:** Essay

**HAS VARIABLES:** False

**LEARNING OBJECTIVES:** METT.AHRE.12.2.8 - Discuss the atmospheric greenhouse effect, and assess its impact on climate and life on Earth.

**OTHER:** Bloom's: Understand

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## Chapter 02

95. Explain how Earth and its atmosphere balance incoming energy with outgoing energy.

*ANSWER:* On a sunny day, Earth's surface warms by absorbing more energy from the Sun and the atmosphere than it radiates, whereas at night Earth cools by radiating more energy than it absorbs from its surroundings.

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.10 - Investigate the roles of energy absorption and emission with regard to Earth's energy balance, and in this context, explain latitudinal temperature fluctuations observed on Earth.

*OTHER:* Bloom's: Analyze

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96. What would have the greatest impact on Earth's greenhouse effect: removing all of the CO<sub>2</sub> from the atmosphere or removing all of the water vapor? Explain your reasoning.

*ANSWER:* Students should describe that removing water vapor would have the greatest impact because water vapor is a strong absorber of infrared radiation and because atmospheric concentrations of H<sub>2</sub>O are much higher than concentrations of CO<sub>2</sub>.

*POINTS:* 1

*REFERENCES:* Radiation: Absorption, Emission, and Equilibrium

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.8 - Discuss the atmospheric greenhouse effect, and assess its impact on climate and life on Earth.

*OTHER:* Bloom's: Understand

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## Chapter 02

97. Suppose the Sun's surface temperature suddenly cools to 2,000 degrees Celsius. Why would the sky appear more red than blue?

*ANSWER:* Based on Wien's law, if the Sun were to cool to a lower temperature, the Sun would emit a peak in radiation at longer wavelengths. The longer wavelengths would be shifted toward the lower energy red portion of the visible spectrum. At present, the top of Earth's atmosphere reflects shorter blue wavelengths of light. If the Sun's energy spectrum were to be shifted, the Earth's atmosphere would be affected by longer wavelengths of light and create a redder atmosphere.

*POINTS:* 1

*REFERENCES:* Radiant Energy

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.6 - Apply the principles of radiant energy to the Sun and Earth.

*OTHER:* Bloom's: Apply

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98. Explain why the Kelvin temperature scale is also called the absolute temperature scale.

*ANSWER:* The Kelvin scale is named after Lord Kelvin (1824-1907), a famous British scientist who first introduced it. Absolute zero is the starting point for this temperature scale, which is why it is called the absolute scale. Because the Kelvin scale begins at absolute zero, it contains no negative numbers and is therefore quite convenient for scientific calculations. Absolute zero or 0 Kelvin (-273 degrees Celsius; -459 degrees Fahrenheit) is the lowest temperature possible; at this temperature atoms and molecules would possess a minimum amount of energy and theoretically no thermal motion.

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.2 - Compare the Fahrenheit, Celsius, and Kelvin temperature scales and outline their scientific backgrounds and uses today.

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## Chapter 02

99. Explain how an aurora is produced.

*ANSWER:* An aurora is produced by solar wind disturbing the magnetosphere. The disturbance involves high-energy particles within the magnetosphere being ejected into Earth's upper atmosphere, where they excite atoms and molecules. The excited atmospheric gases emit visible radiation, which causes the sky to glow like a neon light.

*POINTS:* 1

*REFERENCES:* Solar Particles, the Aurora, and Space Weather

*QUESTION TYPE:* Essay

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.12 - Identify the differences between solar winds and storms and their respective phenomena as observed in Earth's atmosphere.

*OTHER:* Bloom's: Remember

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100. Which measurement indicates the average speed of air molecules?

- a. Pressure
- b. Temperature
- c. Density
- d. Heat
- e. Gravity

*ANSWER:* b

*POINTS:* 1

*REFERENCES:* Energy, Temperature, and Heat

*QUESTION TYPE:* Multiple Choice

*HAS VARIABLES:* False

*LEARNING OBJECTIVES:* METT.AHRE.12.2.1 - Define the terms energy, potential energy, kinetic energy, radiant energy, temperature and heat, and describe their relationships in the context of Earth's atmosphere.

*OTHER:* Bloom's: Remember

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