

The Atmosphere: An Introduction to Meteorology, 12e (Lutgens/Tarbuck/Tasa)
Chapter 2 Heating Earth's Surface and Atmosphere

1) Earth's *perihelion*:

- A) coincides with the summer solstice.
- B) would not exist if the earth's orbit were circular.
- C) coincides with the winter solstice.
- D) occurs when the earth is farthest from the Sun.

Answer: B

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Bloom's Taxonomy: Understand

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

2) Earth is closest to the Sun during:

- A) Northern hemisphere autumn.
- B) Southern hemisphere autumn.
- C) Southern hemisphere winter.
- D) Northern hemisphere winter.
- E) Northern hemisphere summer.

Answer: D

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Bloom's Taxonomy: Remember

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3) Early in January the earth is closer to the Sun than at any other time of year. This position is termed:

- A) equinox.
- B) perihelion.
- C) aphelion.
- D) albedo.
- E) revolution.

Answer: B

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4) Low sun angles result in reduced solar energy because:

- A) energy is spread over a larger area.
- B) Sun - Earth distance is greater.
- C) absorption is reduced.
- D) day lengths are shorter.

Answer: A

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5) Over the course of this year, the tilt of Earth's polar axis will:

- A) remains constant at 90 degrees.
- B) vary from 0 to 23.5 degrees.
- C) vary from 0 to 47 degrees.
- D) remain constant at 23.5 degrees.

Answer: D

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Bloom's Taxonomy: Remember

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6) Flagstaff, AZ is at 35 degrees N latitude. What is the angle of the Sun's noon rays here on March 21?

- A) 35 degrees
- B) 55 degrees
- C) 47 degrees
- D) 0 degrees

Answer: B

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Bloom's Taxonomy: Apply

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7) The 90 degrees angle rays strike the Tropic of Cancer on:

- A) June 21.
- B) March 21.
- C) September 22.
- D) December 21.
- E) July 4.

Answer: A

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8) Which of the following correctly describes the equinoxes?

- A) The length of daylight at the Arctic and Antarctic Circle is 24 hours.
- B) The Sun's vertical rays are striking either the Tropic of Cancer or the Tropic of Capricorn.
- C) Days and nights are equal in length in all parts of the world.
- D) They occur in June and December.

Answer: C

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9) At 45 degrees S latitude, the angle of the noon Sun is lowest and the length of daylight is shortest on:

- A) December 21.
- B) January 23.
- C) June 21.
- D) March 21.
- E) September 22.

Answer: C

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10) The first day of the *climatological* season of summer is:

- A) June 1.
- B) June 21.
- C) July 1.
- D) July 4 (perihelion).

Answer: A

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11) Which of the following associations is INCORRECT?

- A) aphelion — Earth furthest from the sun
- B) vernal equinox — equal day/equal night
- C) summer solstice — solar declination at the Tropic of Cancer
- D) autumnal equinox — shortest day of the year for the Arctic Circle

Answer: D

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Bloom's Taxonomy: Understand

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12) The *spring equinox* in the Northern Hemisphere occurs on approximately:

- A) June 21.
- B) March 21.
- C) September 22.
- D) December 21.
- E) January 3.

Answer: B

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Bloom's Taxonomy: Remember

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13) At what time of year is the earth's axis not tilted either toward or away from the Sun?

- A) autumnal equinox
- B) winter solstice
- C) summer solstice
- D) perihelion
- E) aphelion

Answer: A

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Bloom's Taxonomy: Understand

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14) The length of daylight gets progressively longer going south from the equator on:

- A) June 21.
- B) December 21.
- C) September 22.
- D) March 21.

Answer: B

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15) New York City has its greatest length of daylight on:

- A) March 21.
- B) September 22.
- C) June 21.
- D) December 21.

Answer: C

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16) During the spring equinox in the northern hemisphere, the *circle of illumination* passes directly through the:

- A) equator.
- B) Tropic of Capricorn.
- C) poles.
- D) Tropic of Cancer.

Answer: C

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17) The date that the Sun "sets" at the North Pole is:

- A) June 21.
- B) March 21.
- C) December 21.
- D) September 22.

Answer: D

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18) The date that the Sun "rises" at the North Pole is:

- A) January 3.
- B) June 21.
- C) March 21.
- D) September 22.
- E) December 21.

Answer: C

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19) The *longest* day of the year in the United States occurs on:

- A) June 21.
- B) March 3.
- C) November 18.
- D) December 4.
- E) September 30.

Answer: A

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20) The primary cause of Earth's seasons is:

- A) changes in atmospheric thickness.
- B) varying orbital speed.
- C) tilt of Earth's rotation axis, which causes sun angles and daylight length to vary.
- D) regular changes in radiation emitted by the Sun.
- E) varying distance from the Sun, which changes how much radiation Earth receives from the Sun.

Answer: C

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21) The energy associated with motion is called:

- A) kinetic energy.
- B) potential energy.
- C) vibrational energy.
- D) molecular motion energy.

Answer: A

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22) During natural processes, heat transfer is always from:

- A) warmer to cooler substances.
- B) cooler to warmer substances.
- C) solids to liquids.
- D) gases to solids.

Answer: A

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23) *Heat*:

- A) is a measure of the average kinetic energy possessed by molecules.
- B) is synonymous with *temperature*.
- C) is a transfer of energy from areas with high temperatures to those with low temperatures.
- D) measures the total kinetic energy in a substance.

Answer: C

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24) The two types of heat recognized by meteorologists are:

- A) latent heat and sensible heat.
- B) latent heat and kinetic heat.
- C) kinetic heat and radiative heat.
- D) sensible heat and conductive heat.

Answer: A

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25) The process of _____ involves the movement or circulation of a mass or substance.

- A) radiation
- B) conduction
- C) convection

Answer: C

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26) The transfer of heat through matter by molecular collisions is called:

- A) conduction.
- B) radiation.
- C) convection.

Answer: A

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27) The longest wavelengths on the electromagnetic spectrum are:

- A) gamma.
- B) ultraviolet.
- C) infrared.
- D) radio.
- E) visible light.

Answer: D

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28) The earth receives energy from the Sun by:

- A) convection.
- B) radiation.
- C) conduction.
- D) scattering.

Answer: B

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29) Wind is an example of:

- A) advection.
- B) conduction.
- C) radiation.

Answer: A

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Bloom's Taxonomy: Remember

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30) *Thermals* and *advection* are both types of:

- A) conduction
- B) radiation.
- C) convection.
- D) transmission.

Answer: C

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Bloom's Taxonomy: Remember

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31) Wavelengths of the visible spectrum are between:

- A) 0.4 and 0.7 meters.
- B) 0.25 and 2.5 micrometers.
- C) 0.4 and 0.7 micrometers.
- D) 4 and 7 micrometers.

Answer: C

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32) In meteorological terminology, the primary difference between *convection* and *advection* is:

- A) Convection represents vertical heat transfer and advection represents horizontal heat transfer.
- B) Convection represents horizontal heat transfer and advection represents vertical heat transfer.
- C) Convection represents upper atmosphere heat transfer and advection represents surface heat transfer.
- D) Convection represents surface heat transfer and advection represents upper atmosphere heat transfer.
- E) None of the above; the terms are used interchangeably.

Answer: A

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Bloom's Taxonomy: Understand

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33) The wavelengths emitted by the earth are:

- A) shorter than those emitted by the Sun.
- B) longer than those emitted by the Sun.
- C) ultraviolet.
- D) about the same as those emitted by the Sun except when the Sun is experiencing sunspots.

Answer: B

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

34) The type of energy that is responsible for sunburn is:

- A) infrared energy.
- B) ultraviolet energy.
- C) gamma ray energy.
- D) microwave energy.

Answer: B

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Bloom's Taxonomy: Understand

Nat. Geog. Stand: 15: Physical Systems Affect Human Systems

35) The earth emits terrestrial radiation:

- A) only over the continents.
- B) all the time.
- C) only at night.
- D) only during winter.
- E) only during the day.

Answer: B

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Bloom's Taxonomy: Understand

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

36) Most of the radiation emitted by the earth and its atmosphere is in the category of:

- A) x-rays.
- B) ultraviolet.
- C) gamma.
- D) infrared.

Answer: D

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

37) Radiation is intercepted in the atmosphere and its wavelength is measured at 1.0 micrometers. This radiation was most likely emitted by:

- A) the Earth.
- B) a cloud.
- C) the atmosphere.
- D) the Sun.

Answer: D

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Bloom's Taxonomy: Apply

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

38) Objects with higher temperatures:

- A) emit only shortwave radiation.
- B) emit more shortwave radiation than cooler objects do.
- C) emit most of their energy in the form of longwave energy.
- D) radiate less total energy than cooler objects radiate.

Answer: B

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

$$E = \sigma T^4$$

39) The equation shown above mathematically represents the:

- A) Wien's Displacement Law.
- B) Stefan-Boltzmann Law.
- C) Surface Albedo calculation.
- D) Radiation Displacement Theory.

Answer: B

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

40) The Stefan-Boltzmann Law states that:

- A) the rate of radiation emitted by a body is based on its size.
- B) the wavelength of radiation emitted by a body is determined by its temperature.
- C) all bodies emit equivalent wavelengths of energy, regardless of size or temperature.
- D) the rate of radiation emitted by a body is proportional to the fourth power of its temperature.

Answer: D

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

$$\lambda_{max} = C/T$$

41) In the equation for Wien's Displacement Law (shown above), the λ_{max} stands for:

- A) a radiating body's wavelength of maximum emission.
- B) a radiating body's maximum rate of energy emission.
- C) the maximum temperature associated with a given energy wavelength.
- D) the value of Wien's constant associated with a given energy wavelength.

Answer: A

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Bloom's Taxonomy: Remember

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42) The temperature of a pool of lava is measured at 1275 K. Given a Wien's constant value of $2898 \mu\text{mK}$, what is the wavelength of maximum emission from the lava?

A) $149838.63 \mu\text{m}$

B) $2.273 \mu\text{m}$

C) $0.213 \mu\text{m}$

D) The answer cannot be determined from the information given.

Answer: B

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Bloom's Taxonomy: Apply

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

43) The temperature of a cloud is measured at 280 K. Given the Stefan-Boltzmann constant of 5.67×10^{-8} , what is the rate of radiation emitted by the cloud?

A) 349 W/m^2

B) 10.4 W/m^2

C) $4.9 \times 10^{-8} \text{ W/m}^2$

D) The information cannot be determined with the information given.

Answer: A

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Bloom's Taxonomy: Apply

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

44) The primary factor which determines what type and how much radiation an object emits is its

A) color.

B) conductivity.

C) size.

D) density.

E) temperature.

Answer: E

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

45) The UV Index can tell you:

A) the expected rate of skin cancer occurrence in a given city.

B) the relative change in UV production during a severe solar wind event.

C) the approximate time it will take you to sunburn on a given day, based on your skin type.

D) what percent of Earth's radiation is emitted as UV radiation.

Answer: C

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 15: Physical Systems Affect Human Systems

46) Suppose the albedo of a planet is measured to be 40 percent. This means that:

- A) 60 percent of the Sun's energy is reflected.
- B) 40 percent of the Sun's energy is absorbed.
- C) 40 percent of the Sun's energy is reflected.
- D) more energy is reflected than absorbed.

Answer: C

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Bloom's Taxonomy: Understand

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

47) On the average, how much of the Sun's energy that is intercepted by the earth system is reflected to space?

- A) 19 percent
- B) 30 percent
- C) 25 percent
- D) 45 percent
- E) 51 percent

Answer: B

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

48) Most of the solar energy absorbed by planet Earth and its atmosphere is absorbed by:

- A) atmospheric dust.
- B) the earth's surface.
- C) clouds.
- D) atmospheric gases.

Answer: B

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

49) Which of the following does NOT happen to solar radiation as it passes through the atmosphere?

- A) Intensification
- B) Scattering
- C) Transmission
- D) Absorption

Answer: A

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

50) Clouds are most likely to _____ incoming solar radiation.

- A) conduct
- B) transmit
- C) reflect
- D) absorb

Answer: C

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Bloom's Taxonomy: Understand

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

51) During reflection,

- A) radiation is separated into several groups of weaker rays that travel in different directions.
- B) radiation retains the same intensity but bounces back from the surface at a random angle.
- C) a portion of radiation is absorbed by the surface and the rest bounces off of the surface.
- D) radiation retains the same intensity and bounces back at the same angle with which it struck the surface.

Answer: D

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Bloom's Taxonomy: Understand

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52) Of the following choices, the surface with the HIGHEST albedo is:

- A) fresh snow.
- B) grass.
- C) sand.
- D) water (Sun near zenith).
- E) thin cloud.

Answer: A

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Bloom's Taxonomy: Remember

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53) Scattering:

- A) prevents nearly half of incoming solar radiation from reaching the surface of the earth.
- B) changes the wavelength of light.
- C) is responsible for the redness of sunsets.
- D) is the primary mechanism of heat transfer in the atmosphere.

Answer: C

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54) *Crepuscular rays*:

- A) are emitted by objects with very low temperatures.
- B) are usually tinted blue.
- C) occur only when no clouds, haze, or dust particles are present in the atmosphere.
- D) occur when water droplets scatter all wavelengths of sunlight equally.

Answer: D

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Bloom's Taxonomy: Understand

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55) Which of the following gases does not absorb any portion of incoming solar radiation?

- A) nitrogen
- B) oxygen
- C) ozone
- D) water vapor

Answer: A

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

56) The atmosphere is strongly _____ with respect to terrestrial radiation.

- A) absorptive
- B) reflective
- C) transparent
- D) conductive

Answer: A

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

57) The atmosphere is highly _____ with respect to solar radiation.

- A) absorptive
- B) transparent
- C) reflective
- D) conductive

Answer: B

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Bloom's Taxonomy: Remember

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58) Which of the following gases is the best absorber of ultraviolet light?

- A) nitrogen dioxide
- B) water vapor
- C) carbon dioxide
- D) oxygen
- E) carbon monoxide

Answer: D

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

59) The atmosphere is _____ to terrestrial radiation that has a wavelength between 8 and 11 micrometers.

- A) reflective
- B) absorptive
- C) conductive
- D) transparent

Answer: D

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

60) The atmosphere is heated primarily by:

- A) absorption of Earth's longwave radiation.
- B) absorption of solar radiation.
- C) conduction from the ground.
- D) convection from the ground.

Answer: A

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Bloom's Taxonomy: Understand

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61) Clouds play an important role in the earth's energy budget because they:

- A) absorb longwave radiation and re-radiate it towards the surface.
- B) cool the air around them.
- C) reflect solar energy.
- D) reflect the earth's infrared energy.
- E) Both A and C

Answer: E

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

62) When encountering terrestrial longwave radiation, clouds are most likely to _____ it.

- A) transmit
- B) scatter
- C) reflect
- D) absorb

Answer: D

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Bloom's Taxonomy: Understand

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

63) The absorption of longwave radiation by certain gases in the lower atmosphere is responsible for:

- A) photon effect.
- B) greenhouse effect.
- C) atmospheric window effect.
- D) adiabatic effect.

Answer: B

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Bloom's Taxonomy: Remember

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64) An astronomer tells you that he has discovered a new planet that he calls Planet X. All he knows about Planet X so far is that it has a very dense atmosphere with a temperature approximately 5 times warmer than that of Earth. What hypothesis can you reasonably make regarding the atmosphere of Planet X?

- A) The atmosphere of Planet X must not contain any oxygen, so people couldn't live there.
- B) Planet X cannot contain water in any form.
- C) The nitrogen cycle does not operate on Planet X in the same way it does on Earth.
- D) The atmosphere of Planet X has a higher concentration of greenhouse gases than Earth's does.

Answer: D

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Bloom's Taxonomy: Apply

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65) If an imbalance occurs between incoming and outgoing energy at the earth's surface,

- A) temperatures remain steady.
- B) maximum temperatures occur.
- C) minimum temperatures occur.
- D) temperatures either increase or decrease.

Answer: D

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66) Which of the following describes the role played by the water cycle in determining the earth's heat budget?

- A) has no significant role
- B) transfers heat from atmosphere to space
- C) transfers heat from atmosphere to surface
- D) transfers heat from surface to atmosphere

Answer: D

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67) An *analemma* is best used to determine:

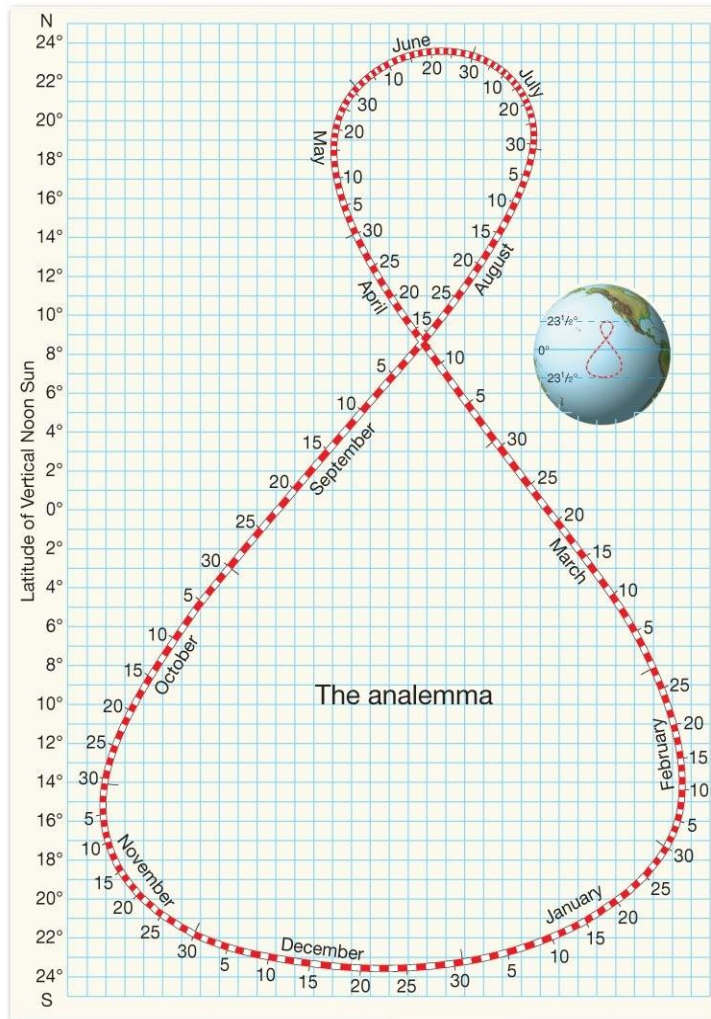
- A) the distance between the sun and the earth on any day of the year.
- B) the tilt of Earth's axis on any day of the year.
- C) the solar declination on any day of the year.
- D) solar altitude at any given time of the day.

Answer: C

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68) Based on the analemma above, what is the approximate location of the solar declination on August 26?

- A) 10° N
- B) 10° S
- C) 23.5° N
- D) 18°N

Answer: A

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Bloom's Taxonomy: Apply

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

69) Using the analemma above, calculate the noon Sun angle for a latitude of 40° N on February 14. Choose the correct answer below.

- A) 15°
- B) 0°
- C) 47°
- D) 63°

Answer: D

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Bloom's Taxonomy: Apply

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70) Perihelion occurs during the Northern Hemisphere's winter.

Answer: TRUE

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

71) Seasonal temperature variations are due primarily to the changing distance between the earth and the Sun.

Answer: FALSE

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

72) Low sun angles are associated with longer atmospheric path lengths.

Answer: TRUE

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Bloom's Taxonomy: Remember

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73) The North Pole remains pointed towards the sun at all times, regardless of where the Earth is in its orbit.

Answer: FALSE

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74) The earth's axis is not perpendicular to the plane of its orbit around the Sun.

Answer: TRUE

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

75) Sun angle is the angular distance from the observer's horizon to the Sun at noon.

Answer: TRUE

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76) The equator receives vertical rays from the Sun year 'round.

Answer: FALSE

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Bloom's Taxonomy: Remember

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77) In Australia, the summer solstice occurs a few days before Christmas.

Answer: TRUE

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Bloom's Taxonomy: Remember

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78) The Sun 'rises' at the South Pole on September 22.

Answer: TRUE

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Bloom's Taxonomy: Understand

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79) Fairbanks, Alaska, has more hours of daylight in June than Miami, Florida.

Answer: TRUE

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Bloom's Taxonomy: Apply

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

80) A change in the temperature of an object signifies that its heat (or energy) content is stable.

Answer: FALSE

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Bloom's Taxonomy: Understand

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81) Heat transfer by convection in the atmosphere is usually downward, from air to ground.

Answer: FALSE

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Bloom's Taxonomy: Understand

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82) Meteorologically, conduction is the most important mechanism of heat transfer.

Answer: FALSE

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Bloom's Taxonomy: Remember

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83) Advection refers to vertical convection motions.

Answer: FALSE

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84) Microwaves have the shortest wavelengths in the electromagnetic spectrum.

Answer: FALSE

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Bloom's Taxonomy: Remember

Nat. Geog. Stand: 7: Physical Processes that Shape Earth

85) *Conduction* in the oceans redistributes most of the "extra" heat from the equatorial regions to the polar regions.

Answer: FALSE

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Bloom's Taxonomy: Remember

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86) When an object absorbs radiant energy, its temperature increases.

Answer: TRUE

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Bloom's Taxonomy: Remember

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87) All objects emit radiation.

Answer: TRUE

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Bloom's Taxonomy: Remember

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88) Visible light comprises more than half of the total solar energy.

Answer: FALSE

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Bloom's Taxonomy: Remember

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89) Although electromagnetic radiation is described with a variety of names and wavelengths, it is all fundamentally similar in behavior.

Answer: TRUE

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Bloom's Taxonomy: Understand

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90) The primary reason why planet Earth radiates much less energy than the Sun is because of its much smaller size.

Answer: FALSE

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91) The higher the temperature of a radiating body, the shorter the wavelength of maximum radiation.

Answer: TRUE

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92) As an object cools, the wavelengths of its maximum radiation shorten.

Answer: FALSE

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Bloom's Taxonomy: Remember

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93) Snow-covered surfaces have a low albedo.

Answer: FALSE

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Bloom's Taxonomy: Remember

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94) A 300-meter-thick cloud cover can reflect no more than 14 percent of incoming solar radiation.

Answer: FALSE

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Bloom's Taxonomy: Understand

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95) Water vapor accounts for the majority of atmospheric warming in the lower troposphere.

Answer: TRUE

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96) The troposphere warms as a direct result of shortwave energy passing into it.

Answer: FALSE

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97) Deserts experience cool nighttime temperatures because of a weaker greenhouse effect.

Answer: TRUE

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Bloom's Taxonomy: Understand

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98) Distance variations between the earth and the Sun are extremely important in understanding seasonal temperature variations.

Answer: FALSE

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Bloom's Taxonomy: Understand

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99) The atmosphere is heated chiefly by radiation emitted from the earth's surface.

Answer: TRUE

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Bloom's Taxonomy: Remember

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100) More solar energy is reflected back to space than is absorbed directly by the atmosphere.

Answer: TRUE

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101) The atmosphere of Venus is composed primarily of carbon dioxide.

Answer: TRUE

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102) The intensity of the Sun's rays at a place is determined by the time of year and the _____ of the place.

Answer: latitude

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103) _____ is a measure of the average kinetic energy of the individual atoms or molecules in a substance.

Answer: Temperature

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Bloom's Taxonomy: Remember

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104) During a cold winter, snow can provide a useful shelter material for animals and humans because of its low _____.

Answer: conductivity

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105) The wavelengths of energy that can be detected by the human eye are called _____.

Answer: visible light

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Bloom's Taxonomy: Remember

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106) What contributes the greatest amount of reflection to Earth's total albedo?

Answer: clouds

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107) The fraction of the total radiation encountered that is reflected by a surface is called its _____.

Answer: albedo

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108) The blue color of the sky is due to _____ of light.

Answer: scattering

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Bloom's Taxonomy: Remember

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109) The brightness of the daytime sky is due to _____ of light.

Answer: scattering

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Bloom's Taxonomy: Remember

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110) Light that is scattered and eventually reaches the earth's surface after having its direction changed is called _____.

Answer: diffused light

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111) Part of the cause of the greenhouse effect is the near _____ of the atmosphere to solar radiation.

Answer: transparency

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112) What energy transfer process is the most important in the transfer of energy from the earth's surface into the atmosphere?

Answer: radiation

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113) You are building a new home in a climate where there is a persistent snow cover for the 6 coldest months of the year. In order to improve your energy efficiency, should you choose light colored shingles or dark colored shingles? Justify your answer using appropriate terminology.

Answer: While students might jump to the answer of dark shingles in order to help the roof absorb sunlight and thus be warmer in the winter, when energy bills are likely to be higher, the key is to remember the persistent snow cover. In an area with persistent winter snow cover, most roofs have an albedo above 90% all winter long because they are covered with snow. This is particularly true of new construction that is completed with good insulation in the attic, preventing heat loss to the roof. Therefore, the shingle color is most likely to play a role in the energy balance of a home during the summer when it is actually visible and interacting with incoming solar radiation. In that case, the lighter shingle is the better choice, as its higher albedo will ensure that the roof reflects a greater percentage of incoming solar radiation and stays cooler as a result.

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