

# Atmosphere An Introduction to Meteorology 13th Edition Lutgens Test Bank

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Exam

Name \_\_\_\_\_

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Wind is an example of: 1) \_\_\_\_\_  
A) conduction. B) advection. C) radiation.

Answer: B

Explanation: A)  
B)  
C)

- 2) If an imbalance occurs between incoming and outgoing energy at the earth's surface: 2) \_\_\_\_\_  
A) minimum temperatures occur. B) temperatures remain steady.  
C) maximum temperatures occur. D) temperatures either increase or decrease.

Answer: D

Explanation: A)  
B)  
C)  
D)

- 3) Which of the following correctly describes the equinoxes? 3) \_\_\_\_\_  
A) The length of daylight at the Arctic and Antarctic Circle is 24 hours.  
B) They occur in June and December.  
C) Days and nights are equal in length in all parts of the world.  
D) The Sun's vertical rays are striking either the Tropic of Cancer or the Tropic of Capricorn.

Answer: C

Explanation: A)  
B)  
C)  
D)

- 4) Clouds are most likely to \_\_\_\_\_ incoming solar radiation. 4) \_\_\_\_\_  
A) transmit B) conduct C) absorb D) reflect

Answer: D

Explanation: A)  
B)  
C)  
D)

- 5) Clouds play an important role in the earth's energy budget because they: 5) \_\_\_\_\_
- 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

- Explanation: A)  
B)  
C)  
D)  
E)

- 6) The vertical movements of air molecules that result in heat transfer are known as \_\_\_\_\_, while horizontal movements are known as \_\_\_\_\_. 6) \_\_\_\_\_
- A) advection, convection
  - B) convection, advection
  - C) conduction, advection
  - D) connection, radiation

Answer: B

- Explanation: A)  
B)  
C)  
D)

- 7) During natural processes, heat transfer is always from: 7) \_\_\_\_\_
- A) gases to solids.
  - B) solids to liquids.
  - C) warmer to cooler substances.
  - D) cooler to warmer substances.

Answer: C

- Explanation: A)  
B)  
C)  
D)

- 8) The atmosphere is largely \_\_\_\_\_ to terrestrial radiation that has a wavelength between 8 and 12 micrometers. 8) \_\_\_\_\_
- A) conductive
  - B) reflective
  - C) transparent
  - D) absorptive

Answer: C

- Explanation: A)  
B)  
C)  
D)

9) The date that the Sun "rises" at the North Pole is: 9) \_\_\_\_\_  
A) December 21.  
B) September 22.  
C) March 21.  
D) January 3.  
E) June 21.

Answer: C  
Explanation: A)  
B)  
C)  
D)  
E)

10) Flagstaff, AZ is at 35 degrees N latitude. What is the angle of the Sun's noon rays here on March 21? 10) \_\_\_\_\_  
A) 35 degrees                      B) 0 degrees                      C) 47 degrees                      D) 55 degrees

Answer: D  
Explanation: A)  
B)  
C)  
D)

11) Which of the following would be true if Earth did not have an inclined axis? 11) \_\_\_\_\_  
A) Earth would not have seasons.  
B) The equator would have 24 hours of daylight throughout the year.  
C) The Northern Hemisphere would always be tilted towards the sun.  
D) The poles would not have ice caps.

Answer: A  
Explanation: A)  
B)  
C)  
D)

12) The two types of heat recognized by meteorologists are: 12) \_\_\_\_\_  
A) latent heat and kinetic heat.                      B) latent heat and sensible heat.  
C) kinetic heat and radiative heat.                      D) sensible heat and conductive heat.

Answer: B  
Explanation: A)  
B)  
C)  
D)

13) When encountering terrestrial longwave radiation, clouds are most likely to \_\_\_\_\_ it. 13) \_\_\_\_\_  
A) scatter                      B) reflect                      C) absorb                      D) transmit

Answer: C  
Explanation: A)  
B)  
C)  
D)

14) The first day of the *climatological* season of summer is: 14) \_\_\_\_\_  
A) June 21. B) July 4 (perihelion).  
C) July 1. D) June 1.

Answer: D  
Explanation: A)  
B)  
C)  
D)

15) On the average, how much of the Sun's energy that is intercepted by the earth system is reflected to space? 15) \_\_\_\_\_  
A) 30 percent  
B) 45 percent  
C) 19 percent  
D) 51 percent  
E) 25 percent

Answer: A  
Explanation: A)  
B)  
C)  
D)  
E)

16) The transfer of heat through matter by molecular collisions is called: 16) \_\_\_\_\_  
A) convection. B) conduction. C) radiation.

Answer: B  
Explanation: A)  
B)  
C)

17) New York City has its greatest length of daylight on: 17) \_\_\_\_\_  
A) September 22. B) June 21. C) December 21. D) March 21.

Answer: B  
Explanation: A)  
B)  
C)  
D)

18) An *analemma* is best used to determine: 18) \_\_\_\_\_  
A) the tilt of Earth's axis on any day of the year.  
B) the distance between the sun and the earth 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  
Explanation: A)  
B)  
C)  
D)

19) Radiation is intercepted in the atmosphere and its wavelength is measured at 0.7 micrometers. This radiation was most likely emitted by: 19) \_\_\_\_\_

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

Answer: C  
Explanation: A)  
B)  
C)  
D)

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

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

Answer: B  
Explanation: A)  
B)  
C)  
D)  
E)

21) The longest wavelengths on the electromagnetic spectrum are: 21) \_\_\_\_\_

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

Answer: D  
Explanation: A)  
B)  
C)  
D)  
E)

22) Earth's *perihelion*: 22) \_\_\_\_\_

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

Answer: D  
Explanation: A)  
B)  
C)  
D)

23) While sitting outside at a picnic, you and your family start discussing how hot it is outside and plan to take a dip in the lake to cool off. What type of heat have you experienced in order to make this statement? 23) \_\_\_\_\_

- A) kinetic heat                      B) sensible heat                      C) potential heat                      D) latent heat

Answer: B

- Explanation: A)  
B)  
C)  
D)

24) Most of the solar energy absorbed by planet Earth and its atmosphere is absorbed by: 24) \_\_\_\_\_

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

Answer: C

- Explanation: A)  
B)  
C)  
D)

25) *Thermals* and *advection* are both types of: 25) \_\_\_\_\_

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

Answer: B

- Explanation: A)  
B)  
C)  
D)

26) The atmosphere is heated primarily by: 26) \_\_\_\_\_

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

Answer: D

- Explanation: A)  
B)  
C)  
D)

27) Earth's sky is blue during the day because: 27) \_\_\_\_\_

- A) the atmosphere absorbs blue wavelengths of light.  
B) the sun produces more blue wavelengths than it produces in any other color.  
C) red wavelengths are lost as solar radiation passes through the vacuum of space.  
D) the molecules in the atmosphere scatter blue wavelengths of light.

Answer: D

- Explanation: A)  
B)  
C)  
D)

- 28) In meteorological terminology, the primary difference between *convection* and *advection* is: 28) \_\_\_\_\_
- A) Convection represents upper atmosphere heat transfer and advection represents surface heat transfer.
  - B) Convection represents vertical heat transfer and advection represents horizontal heat transfer.
  - C) Convection represents surface heat transfer and advection represents upper atmosphere heat transfer.
  - D) Convection represents horizontal heat transfer and advection represents vertical heat transfer.
  - E) None of the above; the terms are used interchangeably.

Answer: B

Explanation: A)  
B)  
C)  
D)  
E)

- 29) What kind of energy does gravity give to hailstones suspended in a thunderstorm? 29) \_\_\_\_\_
- A) kinesthetic energy
  - B) latent energy
  - C) kinetic energy
  - D) potential energy

Answer: D

Explanation: A)  
B)  
C)  
D)

- 30) At 45 degrees S latitude, the angle of the noon Sun is lowest and the length of daylight is shortest on: 30) \_\_\_\_\_
- A) December 21.
  - B) June 21.
  - C) January 23.
  - D) September 22.
  - E) March 21.

Answer: B

Explanation: A)  
B)  
C)  
D)  
E)

- 31) Which of the following associations is INCORRECT? 31) \_\_\_\_\_
- A) autumnal equinox — shortest day of the year for the Arctic Circle
  - B) vernal equinox — equal day/equal night
  - C) summer solstice — solar declination at the Tropic of Cancer
  - D) aphelion — Earth furthest from the sun

Answer: A

Explanation: A)  
B)  
C)  
D)

32) What is the 'atmospheric window'? 32) \_\_\_\_\_  
A) The solar radiation wavelengths that are most easily absorbed by nitrogen.  
B) The range wavelengths of solar radiation that most easily pass through the atmosphere.  
C) The range of infrared wavelengths that can most easily escape Earth's atmosphere.  
D) The visible light spectrum.

Answer: C

Explanation: A)  
B)  
C)  
D)

33) Which of the following is a measurement of the average kinetic energy possessed by the atoms or molecules in a substance? 33) \_\_\_\_\_  
A) latent energy  
B) heat  
C) temperature  
D) potential energy

Answer: C

Explanation: A)  
B)  
C)  
D)

34) During the spring equinox in the northern hemisphere, the *circle of illumination* passes directly through the: 34) \_\_\_\_\_  
A) Tropic of Capricorn.  
B) equator.  
C) poles.  
D) Tropic of Cancer.

Answer: C

Explanation: A)  
B)  
C)  
D)

35) What is the only form of heat transfer that can operate in a vacuum? 35) \_\_\_\_\_  
A) convection  
B) conduction  
C) radiation  
D) advection

Answer: C

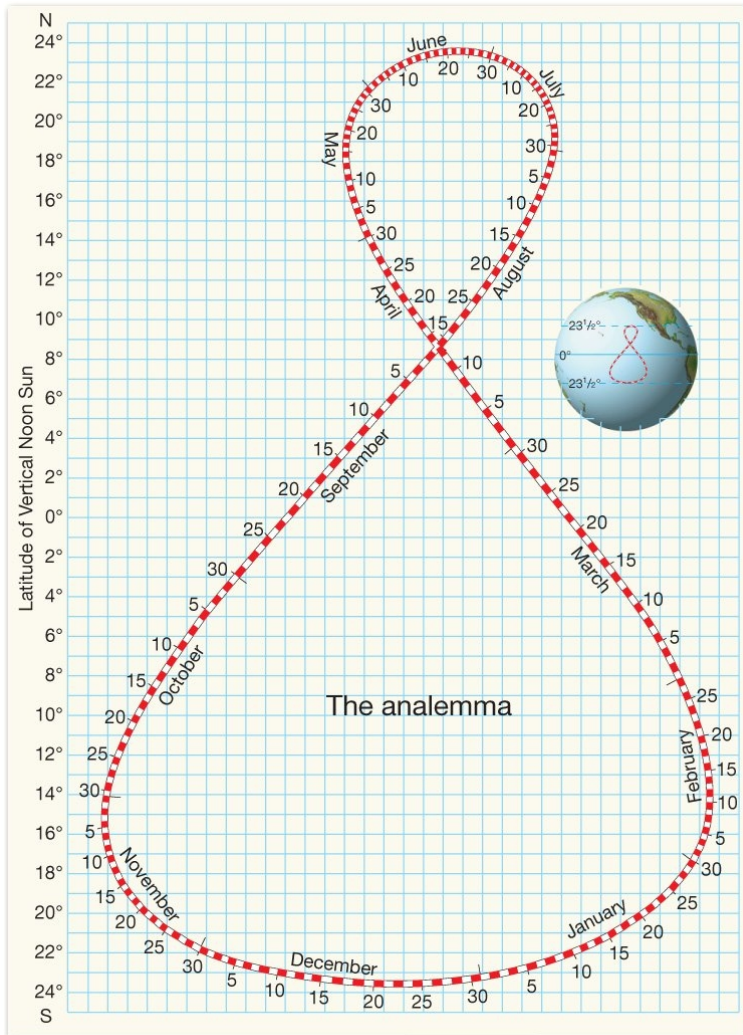
Explanation: A)  
B)  
C)  
D)

36) Most of the radiation emitted by the earth and its atmosphere is in the category of: 36) \_\_\_\_\_  
A) infrared.  
B) x-rays.  
C) ultraviolet.  
D) gamma.

Answer: A

Explanation: A)  
B)  
C)  
D)





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

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

Answer: C

Explanation: A)  
B)  
C)  
D)

38) At what time of year is the earth's axis not tilted either toward or away from the Sun? 38) \_\_\_\_\_  
A) aphelion  
B) autumnal equinox  
C) summer solstice  
D) winter solstice  
E) perihelion

Answer: B

Explanation: A)  
B)  
C)  
D)  
E)

39) 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? 39) \_\_\_\_\_

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

Answer: D

Explanation: A)  
B)  
C)  
D)

40) Which of the following does NOT happen to solar radiation as it passes through the atmosphere? 40) \_\_\_\_\_  
A) absorption                      B) intensification                      C) scattering                      D) transmission

Answer: B

Explanation: A)  
B)  
C)  
D)

41) Scattering: 41) \_\_\_\_\_  
A) is responsible for the redness of sunsets.  
B) prevents nearly half of incoming solar radiation from reaching the surface of the earth.  
C) is the primary mechanism of heat transfer in the atmosphere.  
D) changes the wavelength of light.

Answer: A

Explanation: A)  
B)  
C)  
D)

42) The energy associated with motion is called: 42) \_\_\_\_\_  
A) molecular motion energy. B) kinetic energy.  
C) potential energy. D) vibrational energy.

Answer: B

Explanation: A)  
B)  
C)  
D)

43) The length of daylight gets progressively longer going south from the equator on: 43) \_\_\_\_\_  
A) March 21. B) December 21. C) September 22. D) June 21.

Answer: D

Explanation: A)  
B)  
C)  
D)

44) What would happen on Earth if the Sun were 'turned off' and ceased to provide heat for the Earth? 44) \_\_\_\_\_  
A) Living organisms would slowly adapt to life without sunlight.  
B) Intense storms would develop and persist for weeks at a time.  
C) Winds and ocean currents would stop.  
D) The Earth would quickly overheat.

Answer: C

Explanation: A)  
B)  
C)  
D)

45) The date that the Sun "sets" at the North Pole is: 45) \_\_\_\_\_  
A) March 21. B) September 22. C) June 21. D) December 21.

Answer: B

Explanation: A)  
B)  
C)  
D)

46) Which of the following gases is the best absorber of ultraviolet light? 46) \_\_\_\_\_  
A) oxygen  
B) carbon dioxide  
C) carbon monoxide  
D) water vapor  
E) nitrogen dioxide

Answer: A

Explanation: A)  
B)  
C)  
D)  
E)

47) The earth emits terrestrial radiation: 47) \_\_\_\_\_  
A) only at night.  
B) only over the continents.  
C) only during the day.  
D) all the time.  
E) only during winter.

Answer: D

Explanation: A)  
B)  
C)  
D)  
E)

48) The earth receives energy from the Sun by: 48) \_\_\_\_\_  
A) radiation.                      B) scattering.                      C) convection.                      D) conduction.

Answer: A

Explanation: A)  
B)  
C)  
D)

49) The *spring equinox* in the Northern Hemisphere occurs on approximately: 49) \_\_\_\_\_  
A) December 21.  
B) January 3.  
C) March 21.  
D) June 21.  
E) September 22.

Answer: C

Explanation: A)  
B)  
C)  
D)  
E)

50) Objects with higher temperatures: 50) \_\_\_\_\_  
A) emit most of their energy in the form of longwave energy.  
B) radiate less total energy than cooler objects radiate.  
C) emit more shortwave radiation than cooler objects do.  
D) emit only shortwave radiation.

Answer: C

Explanation: A)  
B)  
C)  
D)

51) Which of the following is most likely to 'block' the atmospheric window and keep the the lower atmosphere warmer?

51) \_\_\_\_\_

A) ozone

B) air pollution

C) nitrogen

D) clouds

Answer: D

Explanation: A)  
B)  
C)  
D)

52) During reflection,

52) \_\_\_\_\_

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) radiation retains the same intensity and bounces back at the same angle with which it struck the surface.

D) a portion of radiation is absorbed by the surface and the rest bounces off of the surface.

Answer: C

Explanation: A)  
B)  
C)  
D)

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

53) \_\_\_\_\_

A) 40 percent of the Sun's energy is absorbed.

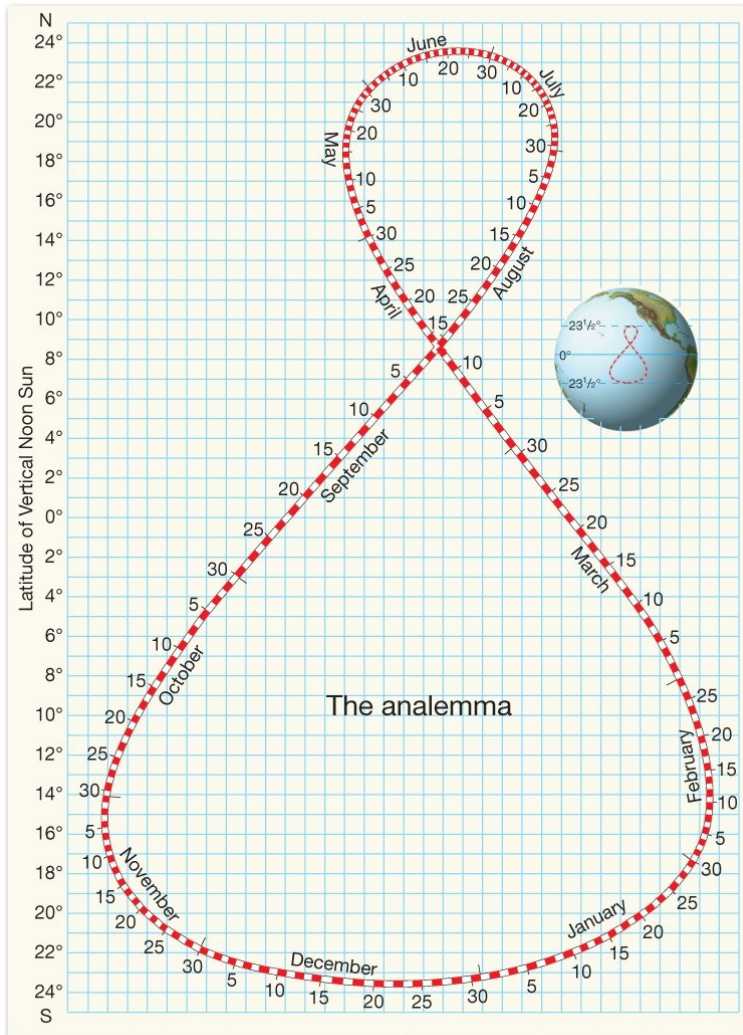
B) 60 percent of the Sun's energy is reflected.

C) more energy is reflected than absorbed.

D) 40 percent of the Sun's energy is reflected.

Answer: D

Explanation: A)  
B)  
C)  
D)



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54) Using the analemma above, calculate the noon Sun angle for a latitude of 40° N on February 14. Choose the correct answer below. 54) \_\_\_\_\_

- A) 15°                      B) 63°                      C) 0°                      D) 37°

Answer: D

- Explanation: A)  
B)  
C)  
D)

55) The type of energy that is responsible for sunburn is: 55) \_\_\_\_\_

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

Answer: B

- Explanation: A)  
B)  
C)  
D)

56) The primary factor which determines what type and how much radiation an object emits is its: 56) \_\_\_\_\_  
A) conductivity.  
B) size.  
C) color.  
D) temperature.  
E) density.

Answer: D

Explanation: A)  
B)  
C)  
D)  
E)

57) Low sun angles result in reduced solar energy because: 57) \_\_\_\_\_  
A) absorption is reduced. B) Sun - Earth distance is greater.  
C) energy is spread over a larger area. D) day lengths are shorter.

Answer: C

Explanation: A)  
B)  
C)  
D)

58) Over the course of this year, the tilt of Earth's polar axis will: 58) \_\_\_\_\_  
A) remain constant at 23.5 degrees. B) remains constant at 90 degrees.  
C) vary from 0 to 23.5 degrees. D) vary from 0 to 47 degrees.

Answer: A

Explanation: A)  
B)  
C)  
D)

59) The atmosphere is highly \_\_\_\_\_ with respect to solar radiation. 59) \_\_\_\_\_  
A) reflective B) transparent C) conductive D) absorptive

Answer: B

Explanation: A)  
B)  
C)  
D)

60) Of the following choices, the surface with the HIGHEST albedo is: 60) \_\_\_\_\_  
A) water (Sun near zenith). B) fresh snow.  
C) grass. D) sand.

Answer: B

Explanation: A)  
B)  
C)  
D)

- 61) The UV Index can tell you: 61) \_\_\_\_\_  
A) what percent of Earth's radiation is emitted as UV radiation.  
B) the relative change in UV production during a severe solar wind event.  
C) the expected rate of skin cancer occurrence in a given city.  
D) the approximate time it will take you to sunburn on a given day, based on your skin type.

Answer: D

Explanation: A)  
B)  
C)  
D)

- 62) *Crepuscular rays*: 62) \_\_\_\_\_  
A) occur when water droplets scatter all wavelengths of sunlight equally.  
B) occur only when no clouds, haze, or dust particles are present in the atmosphere.  
C) are emitted by objects with very low temperatures.  
D) are usually tinted blue.

Answer: A

Explanation: A)  
B)  
C)  
D)

- 63) The LONGEST period of daylight of the year in the United States occurs on: 63) \_\_\_\_\_  
A) December 4.  
B) June 21.  
C) September 30.  
D) March 3.  
E) November 18.

Answer: B

Explanation: A)  
B)  
C)  
D)  
E)

- 64) Earth's current *angle of inclination* is: 64) \_\_\_\_\_  
A) 23.5°.                      B) 66.5°.                      C) 90°.                      D) 15°.

Answer: A

Explanation: A)  
B)  
C)  
D)



65) The 90 degrees angle rays strike the Tropic of Cancer on: 65) \_\_\_\_\_  
A) March 21.  
B) July 4.  
C) June 21.  
D) December 21.  
E) September 22.

Answer: C

Explanation: A)  
B)  
C)  
D)  
E)

66) The absorption of longwave radiation by certain gases in the lower atmosphere is responsible for: 66) \_\_\_\_\_  
A) adiabatic effect. B) greenhouse effect.  
C) atmospheric window effect. D) photon effect.

Answer: B

Explanation: A)  
B)  
C)  
D)

67) Which of the following gases does NOT absorb any significant portion of incoming solar radiation? 67) \_\_\_\_\_  
A) ozone B) water vapor C) nitrogen D) oxygen

Answer: C

Explanation: A)  
B)  
C)  
D)

68) Early in January the earth is closer to the Sun than at any other time of year. This position is termed: 68) \_\_\_\_\_  
A) equinox.  
B) albedo.  
C) aphelion.  
D) revolution.  
E) perihelion.

Answer: E

Explanation: A)  
B)  
C)  
D)  
E)

69) The atmosphere is strongly \_\_\_\_\_ with respect to terrestrial radiation. 69) \_\_\_\_\_  
A) reflective B) transparent C) conductive D) absorptive

Answer: D

Explanation: A)  
B)  
C)  
D)

70) *Heat*: 70) \_\_\_\_\_  
A) is synonymous with *temperature*.  
B) is a transfer of energy from areas with high temperatures to those with low temperatures.  
C) measures the total kinetic energy in a substance.  
D) is a measure of the average kinetic energy possessed by molecules.

Answer: B  
Explanation: A)  
                  B)  
                  C)  
                  D)

71) Which of the following describes the role played by the water cycle in determining the earth's heat budget? 71) \_\_\_\_\_  
A) transfers heat from atmosphere to space                      B) transfers heat from atmosphere to surface  
C) transfers heat from surface to atmosphere                    D) has no significant role

Answer: C  
Explanation: A)  
                  B)  
                  C)  
                  D)

72) Wavelengths of the visible spectrum are between: 72) \_\_\_\_\_  
A) 0.4 and 0.7 micrometers.    B) 0.25 and 2.5 micrometers.  
C) 4 and 7 micrometers.    D) 0.4 and 0.7 meters.

Answer: A  
Explanation: A)  
                  B)  
                  C)  
                  D)

73) Earth is closest to the Sun during: 73) \_\_\_\_\_  
A) Northern hemisphere autumn.  
B) Southern hemisphere winter.  
C) Northern hemisphere winter.  
D) Southern hemisphere autumn.  
E) Northern hemisphere summer.

Answer: C  
Explanation: A)  
                  B)  
                  C)  
                  D)  
                  E)

74) The process of \_\_\_\_\_ involves the movement or circulation of a mass or substance. 74) \_\_\_\_\_  
A) conduction    B) convection    C) radiation

Answer: B  
Explanation: A)  
                  B)  
                  C)

- 75) The wavelengths emitted by the earth are: 75) \_\_\_\_\_  
A) about the same as those emitted by the Sun except when the Sun is experiencing sunspots.  
B) longer than those emitted by the Sun.  
C) ultraviolet.  
D) shorter than those emitted by the Sun.

Answer: B

Explanation: A)  
B)  
C)  
D)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 76) What energy transfer process is the most important in the transfer of energy from the earth's surface into the atmosphere? 76) \_\_\_\_\_

Answer: radiation

Explanation:

- 77) The brightness of the daytime sky is due to \_\_\_\_\_ of light. 77) \_\_\_\_\_

Answer: scattering

Explanation:

- 78) \_\_\_\_\_ is a measure of the average kinetic energy of the individual atoms or molecules in a substance. 78) \_\_\_\_\_

Answer: Temperature

Explanation:

- 79) The fraction of the total radiation encountered that is reflected by a surface is called its \_\_\_\_\_. 79) \_\_\_\_\_

Answer: albedo

Explanation:

- 80) The wavelengths of energy that can be detected by the human eye are called \_\_\_\_\_. 80) \_\_\_\_\_

Answer: visible light

Explanation:

- 81) Part of the cause of the greenhouse effect is the near \_\_\_\_\_ of the atmosphere to solar radiation. 81) \_\_\_\_\_

Answer: transparency

Explanation:

- 82) During a cold winter, snow can provide a useful shelter material for animals and humans because it is a poor \_\_\_\_\_. 82) \_\_\_\_\_

Answer: conductor

Explanation:

- 83) The blue color of the sky is due to \_\_\_\_\_ of the blue wavelengths of light. 83) \_\_\_\_\_

Answer: scattering

Explanation:

- 84) Light that is scattered and eventually reaches the earth's surface after having its direction changed is called \_\_\_\_\_. 84) \_\_\_\_\_  
 Answer: diffused light  
 Explanation:
- 85) What contributes the greatest amount of reflection to Earth's total albedo? 85) \_\_\_\_\_  
 Answer: clouds  
 Explanation:
- 86) The intensity of the Sun's rays at a place is determined by the time of year and the \_\_\_\_\_ of the place. 86) \_\_\_\_\_  
 Answer: latitude  
 Explanation:

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 87) Seasonal temperature variations are due primarily to the changing distance between the earth and the Sun. 87) \_\_\_\_\_  
 Answer: True  False   
 Explanation:
- 88) All objects emit radiation. 88) \_\_\_\_\_  
 Answer: True  False   
 Explanation:
- 89) The earth's axis is not perpendicular to the plane of its orbit around the Sun. 89) \_\_\_\_\_  
 Answer: True  False   
 Explanation:
- 90) In Australia, the summer solstice occurs a few days before Christmas (December 25). 90) \_\_\_\_\_  
 Answer: True  False   
 Explanation:
- 91) More solar energy is reflected back to space than is absorbed directly by the atmosphere. 91) \_\_\_\_\_  
 Answer: True  False   
 Explanation:
- 92) A 300-meter-thick cloud cover can reflect no more than 14 percent of incoming solar radiation. 92) \_\_\_\_\_  
 Answer: True  False   
 Explanation:
- 93) Sun angle is the angular distance from the observer's horizon to the Sun at noon. 93) \_\_\_\_\_  
 Answer: True  False   
 Explanation:
- 94) The atmosphere is heated chiefly by radiation emitted from the earth's surface. 94) \_\_\_\_\_  
 Answer: True  False   
 Explanation:

- 95) Deserts, with their very dry air, experience cool nighttime temperatures because of a weaker greenhouse effect. 95) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 96) As an object cools, the wavelengths of its maximum radiation shorten. 96) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 97) The equator receives vertical rays from the Sun year-round. 97) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 98) When an object absorbs radiant energy, its temperature increases. 98) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 99) A change in the temperature of an object signifies that its molecules have a stable amount of kinetic energy. 99) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 100) Although electromagnetic radiation is described with a variety of names and wavelengths, it is all fundamentally similar in behavior. 100) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 101) The North Pole remains pointed towards the sun at all times, regardless of where the Earth is in its orbit. 101) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 102) The primary reason why planet Earth radiates much less energy than the Sun is because of its much smaller size. 102) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 103) Meteorologically, conduction is the most important mechanism of heat transfer. 103) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 104) Microwaves have the shortest wavelengths in the electromagnetic spectrum. 104) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 105) Distance variations between the earth and the Sun are extremely important in understanding seasonal temperature variations. 105) \_\_\_\_\_  
Answer:  True  False  
Explanation:

- 106) Visible light comprises more than half of the total solar energy. 106) \_\_\_\_\_  
Answer: True  False  
Explanation:
- 107) Objects that are good absorbers of radiation are usually poor emitters of radiation. 107) \_\_\_\_\_  
Answer: True  False  
Explanation:
- 108) The Sun 'rises' at the South Pole on September 22. 108) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 109) Heat transfer by convection in the atmosphere is always downward, from air to ground. 109) \_\_\_\_\_  
Answer: True  False  
Explanation:
- 110) Fairbanks, Alaska (65°N), has more hours of daylight in June than Miami, Florida (26°N). 110) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 111) The higher the temperature of a radiating body, the shorter the wavelength of maximum radiation. 111) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 112) The troposphere warms as a direct result of shortwave energy passing into it. 112) \_\_\_\_\_  
Answer: True  False  
Explanation:
- 113) Pure white sunlight contains all of the colors of the visible light spectrum. 113) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 114) Snow-covered surfaces have a low albedo. 114) \_\_\_\_\_  
Answer: True  False  
Explanation:
- 115) Perihelion occurs during the Northern Hemisphere's winter. 115) \_\_\_\_\_  
Answer:  True  False  
Explanation:
- 116) Advection refers to vertical convection motions. 116) \_\_\_\_\_  
Answer: True  False  
Explanation:
- 117) Water vapor accounts for the majority of atmospheric warming in the lower troposphere. 117) \_\_\_\_\_  
Answer:  True  False  
Explanation:

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

118) \_\_\_\_\_

Answer:  True  False

Explanation:

119) The starting dates of climatological seasons are best defined by the solstices and equinoxes.

119) \_\_\_\_\_

Answer:  True  False

Explanation:

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

120) 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.

Answer Key  
Testname: C2

- 1) B
- 2) D
- 3) C
- 4) D
- 5) E
- 6) B
- 7) C
- 8) C
- 9) C
- 10) D
- 11) A
- 12) B
- 13) C
- 14) D
- 15) A
- 16) B
- 17) B
- 18) C
- 19) C
- 20) B
- 21) D
- 22) D
- 23) B
- 24) C
- 25) B
- 26) D
- 27) D
- 28) B
- 29) D
- 30) B
- 31) A
- 32) C
- 33) C
- 34) C
- 35) C
- 36) A
- 37) C
- 38) B
- 39) D
- 40) B
- 41) A
- 42) B
- 43) D
- 44) C
- 45) B
- 46) A
- 47) D
- 48) A
- 49) C
- 50) C



## Answer Key

Testname: C2

- 51) D
- 52) C
- 53) D
- 54) D
- 55) B
- 56) D
- 57) C
- 58) A
- 59) B
- 60) B
- 61) D
- 62) A
- 63) B
- 64) A
- 65) C
- 66) B
- 67) C
- 68) E
- 69) D
- 70) B
- 71) C
- 72) A
- 73) C
- 74) B
- 75) B
- 76) radiation
- 77) scattering
- 78) Temperature
- 79) albedo
- 80) visible light
- 81) transparency
- 82) conductor
- 83) scattering
- 84) diffused light
- 85) clouds
- 86) latitude
- 87) FALSE
- 88) TRUE
- 89) TRUE
- 90) TRUE
- 91) TRUE
- 92) FALSE
- 93) TRUE
- 94) TRUE
- 95) TRUE
- 96) FALSE
- 97) FALSE
- 98) TRUE
- 99) FALSE
- 100) TRUE

Answer Key

Testname: C2

- 101) FALSE
- 102) FALSE
- 103) FALSE
- 104) FALSE
- 105) FALSE
- 106) FALSE
- 107) FALSE
- 108) TRUE
- 109) FALSE
- 110) TRUE
- 111) TRUE
- 112) FALSE
- 113) TRUE
- 114) FALSE
- 115) TRUE
- 116) FALSE
- 117) TRUE
- 118) TRUE
- 119) FALSE
- 120) 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.