Lesson 2 Test Bank – Solar energy, Earth-sun relationships, and the seasons

Multiple Choice Questions

1. The earth is closest to the sun on about
   1. January 4th
   2. March 21st
   3. July 4th
   4. June 21st

Correct Answer: A

1. Which point in Earth’s orbit is it closest to the Sun?
   1. Equinox
   2. Aphelion
   3. Perihelion
   4. Solstice

Correct Answer: C

1. The Earth's axis of rotation is tilted
   1. 23.5 degrees from perpendicular to the plane of the ecliptic
   2. 66.5 degrees from perpendicular to the plane of the ecliptic
   3. 0 degrees from perpendicular to the plane of the ecliptic
   4. 90 from perpendicular to the plane of the ecliptic

Correct Answer: A

1. Which term describes Earth’s consistent tilt and orientation during orbit?
   1. Parallelism
   2. Perihelion
   3. Analemma
   4. Axis lock

Correct Answer: A

1. The Earth rotates in a \_\_\_ direction when viewed from above the North Pole.
2. Clockwise
3. Counterclockwise
4. East to west
5. North to south

Correct Answer: B

1. What is the average solar constant at the top of Earth’s atmosphere?
   1. 768 W/m²
   2. 1368 W/m²
   3. 980 W/m²
   4. 1013 W/m²

Correct Answer: B

1. What effect does axial tilt have on seasons?
   1. Causes lunar phases
   2. Alters Earth’s distance from the Sun
   3. Creates unequal heating
   4. Changes orbital speed

Correct Answer: C

1. Why does Earth experience seasons?
   1. Elliptical orbit
   2. Axis tilt and revolution
   3. Magnetic field shifts
   4. Variations in insolation constant

Correct Answer: B

1. What would happen if Earth’s axial tilt were 0°?
   1. Days and nights would vary more
   2. More extreme seasons
   3. No seasons
   4. Higher tides

Correct Answer: C

1. The subsolar point on June 21st is
   1. 23.5 degrees north latitude
   2. 0 degrees (the equator)
   3. 23.5 degrees south latitude
   4. 66.5 degrees north latitude.

Correct Answer: A

1. What describes the movement of Earth around the Sun?
   1. Rotation
   2. Revolution
   3. Precession
   4. Convection

Correct Answer: B

1. What happens at the Tropic of Capricorn on December 22?
   1. 24-hour daylight
   2. Subsolar point
   3. Polar night
   4. Equal day and night

Correct Answer: B

1. Which location experiences 12 hours of daylight and 12 hours of darkness on an equinox?
   1. Only at the equator
   2. Tropic of Cancer
   3. Every location
   4. Only the poles

Correct Answer: C

1. There is 12 hours of day and 12 hours of night
   1. on June 21
   2. on December 22
   3. every day of the year at the equator
   4. none of the above.

Correct Answer: C

1. What happens to insolation when Sun angle decreases?
   1. Increases intensity
   2. Concentrates in smaller area
   3. Spreads over larger surface area
   4. Bounces off the atmosphere

Correct Answer: C

1. Tangent rays
   1. strike the north and south poles on the solstices
   2. strike the equator only on the solstice.
   3. strike the north and south poles on the equinox
   4. only strike the earth on the solstice

Correct Answer: C

1. 24 hours
   1. of daylight occurs at the South Pole on June 21
   2. of daylight occurs at the South Pole on March 21
   3. of darkness occurs at the South Pole on June 21
   4. of darkness does not occur anywhere

Correct Answer: C

1. The subtropical latitude zone is located
   1. 10 degrees N - 10 degrees S
   2. 10 degrees - 25 degrees N and S latitude
   3. 25 degrees - 35 degrees N and S latitude
   4. 35 degrees - 55 degrees N and S latitude

Correct Answer: C

1. Most greenhouse gases
   1. are good absorbers of solar radiation
   2. are good absorbers of radiation emitted by the Earth
   3. are known as "uniform absorbers"
   4. are all the above

Correct Answer: B

1. The largest sources of particulates entering the atmosphere is from
   1. salt from sea spray and bursting bubbles.
   2. windblown dust
   3. volcanoes
   4. biomass burning

Correct Answer: A

1. What do analemmas illustrate?
   1. Orbital speed
   2. Seasonal wind changes
   3. Sun’s position at a fixed time daily
   4. Moon phase cycle

Correct Answer: C

1. Earth's shape is described as
   1. a true sphere.
   2. an oblate ellipsoid.
   3. a disk.
   4. none of the above.

Correct Answer: B

1. How do seasonal energy imbalances affect climate?
   1. They create long-term balance
   2. Lead to constant temperatures
   3. Cause variations in atmospheric circulation
   4. Eliminate regional climates

Correct Answer: C

1. Which radiation is primarily absorbed by greenhouse gases?
   1. Visible light
   2. Shortwave
   3. Longwave
   4. Ultraviolet

Correct Answer: C

1. The equatorial bulge is due to
   1. the gravitation attraction of the Moon.
   2. the gravitation attraction of the Sun.
   3. the centrifugal force of Earth rotation
   4. none of the above.

Correct Answer: C

1. Which gas primarily allows shortwave radiation to pass through the atmosphere but absorbs longwave radiation?
   1. Oxygen
   2. Ozone
   3. Carbon dioxide
   4. Nitrogen

Correct Answer: C

1. Latent heat is transferred into the air by
   1. conduction
   2. convection
   3. radiation
   4. none of the above

Correct Answer: B

1. Which law states that hotter objects emit radiation at shorter wavelengths?
   1. Newton's Law
   2. Stefan-Boltzmann Law
   3. Wien’s Law
   4. Planck’s Law

Correct Answer: C

1. Which place likely receives the most insolation at noon (barring any effect of clouds)?
   1. 90 N on June 22nd
   2. 45 N on June 22nd
   3. 23.5 N on June 22nd
   4. 0 on June 22nd

Correct Answer: C

1. Which part of Earth receives the most concentrated solar energy throughout the year?
   1. Poles
   2. Mid-latitudes
   3. Tropics
   4. Temperate zones

Correct Answer: C

1. The highest amount of net radiation is found
   1. over polar seas
   2. over midlatitude continents
   3. over subtropical deserts
   4. over tropical oceans

Correct Answer: D

1. Which term refers to incoming solar radiation?
   1. Convection
   2. Insolation
   3. Radiation balance
   4. Reflection

Correct Answer: B

1. What causes day and night on Earth?
   1. Earth’s revolution
   2. Moon phases
   3. Earth’s rotation
   4. Solar flares

Correct Answer: C

1. At what time of year are both hemispheres equally illuminated?
   1. Summer solstice
   2. Winter solstice
   3. Equinoxes
   4. Aphelion

Correct Answer: C

1. The earth's maximum wavelength of emission is about
   1. .5 micrometers
   2. 1.0 micrometers
   3. 10 micrometers
   4. 100 micrometers

Correct Answer: C

1. Why do higher latitudes receive less insolation than lower latitudes?
   1. They are farther from the Sun
   2. The angle of incidence is lower
   3. More cloud cover
   4. Higher altitude

Correct Answer: B

1. The sun is directly overhead of 23.5 S at noon on
   1. March 21st
   2. June 22nd
   3. Sept. 23rd
   4. Dec. 22

Correct Answer: D

1. Which process powers the Sun’s energy output?

A. Combustion

B. Fission

C. Conduction

D. Nuclear fusion

Correct Answer: D

1. The hotter the emitting body
   1. the shorter the wavelength of maximum emission
   2. the longer the wavelength of maximum emission
   3. the less energy it will emit
   4. the more latent heat it will store

Correct Answer: A

1. \_\_\_\_\_\_\_\_ is the total energy associated with random atomic and molecular motions of a substance.
   1. radiation
   2. temperature
   3. potential energy
   4. heat

Correct Answer: D

1. Where would I expect to find the largest amount of latent heat transfer into the air?
   1. The west coast of the United States near Los Angeles
   2. The east coast of the United States near New York
   3. In the middle of the Sonoran Desert of Mexico
   4. In the tropical rain forest of Brazil

Correct Answer: B

1. Which of the following does not need an intervening medium to transfer energy?

A. conduction

B. convection.

C. radiation

D. all require an intervening medium

Correct Answer: C

1. The earth primarily emits \_\_\_\_ radiation while the sun primarily emits\_ radiation.

A. shortwave; shortwave

B. shortwave; longwave

C. longwave; shortwave

D. longwave; longwave

Correct Answer: C

1. Clouds

A. are good absorbers of shortwave radiation emitted by the sun.

B. are good absorbers of longwave radiation emitted by the earth.

C. are good absorbers of both longwave and shortwave radiation.

D. are poor absorbers of both longwave and shortwave radiation.

Correct Answer: B

1. The heat used to change the temperature of the air is called

A. potential heat.

B. sensible heat.

C. latent heat.

D. ground heat.

Correct Answer: B

1. A positive sensitive heat transfer means

A. heat is transfer from the surface into water.

B. heat is transferred from the surface downward into the subsurface.

C. heat is transfer from the surface into the air.

D. none of the above.

Correct Answer: C

1. The subsolar point on June 22 is

A. 23.5 degrees S

B. 0

C. 66.5 degrees N

D. 23.5 degrees N

Correct Answer: D

1. Net radiation for the year is greatest

A. over tropical oceans.

B. off the west coast of the United States

C. over the Arctic ocean

D. in the Sahara desert

Correct Answer: A

1. \_\_\_\_ heat is used in the evaporation process.

A. Sensible

B. Latent

C. Ground

D. Potential

Correct Answer: B

1. Insolation for the year is greatest

A. over tropical oceans.

B. off the west coast of the United States.

C. over the Arctic ocean.

D. in the Sahara desert.

Correct Answer: D

Written Response Questions

1. Describe how the greenhouse effect works.

Correct Answer: Shortwave radiation penetrates through the atmosphere and is absorbed by the surface. The surface radiates longwave radiation toward the atmosphere. The atmosphere absorbs this energy and radiates it back down toward the surface. Increasing "greenhouse gasses" though human activities traps more radiation causing an increase in near-surface temperatures.

1. Generally speaking, where is the highest and lowest amounts of insolation and net radiation on a global basis?

Correct Answer: Insolation: highest amount in the tropical/subtropical deserts; minimum at the poles. Net radiation: maximum in the tropical/subtropical oceans; minimum at the poles.

1. What is albedo and what determines the albedo of a surface?

Correct Answer: Albedo is the proportion of light reflected from the surface. It is mostly determined by the color of the surface though sun angle influences albedo for some surfaces like water.

1. What determines sun angle at a place?

Correct Answer: Sun angle is a largely determined by the tilt of Earth's axis. The sun angle varies by latitude, time of day. time of year, and slope of the surface.

1. Why do physical geographers refer to the gasses of the atmosphere as a "selective absorber" of radiation?

Correct Answer: A gas that is a selective absorber is one that absorbs only particular wavelengths of light. The gasses of Earth's atmosphere are considered selective absorbers as they tend to allow shortwave solar radiation through but absorbs longwave radiation emitted by the surface.

1. How does Earth's elliptical orbit influence insolation during different times of the year?

Correct Answer: Earth is closer to the Sun at perihelion (January), receiving slightly more insolation; farther at aphelion (July), receiving slightly less, though tilt has a stronger seasonal impact.

1. Explain why the maximum wavelength of emission for the Sun is different than that of the Earth.

Correct Answer: The maximum wavelength of emission depends on the temperature of the emitting body, the hotter the body the shorter the maximum wavelength of emission. The Sun being much warmer than the Earth emits most of its energy in the shortwave end of the electromagnetic spectrum while the Earth emits its energy in the longwave end of the electromagnetic spectrum.

1. Briefly describe how the vertical rays of the sun at noon change throughout the year.

Correct Answer:

March 21 and Sept 23: 0 latitude

June 22: 23.5 North latitude

Dec 22: 23.5 degrees South latitude

1. Interpret a graph showing net radiation distribution across Earth. What patterns do you observe?

Correct Answer: Equatorial regions absorb more energy than they lose; polar regions lose more energy than they gain; mid-latitudes are closer to balance.

1. Predict what would happen to global climates if Earth’s axial tilt were increased to 30°.

Correct Answer: Seasonal extremes would intensify—summers would be hotter and winters colder, especially at higher latitudes.

1. Summarize the major differences between solstices and equinoxes.

Correct Answer: Solstices mark the longest and shortest days, occurring when the subsolar point is farthest from the equator; equinoxes have equal day and night lengths, with the subsolar point at the equator.

1. What is the subsolar point, and how does it change throughout the year?

Correct Answer: It is where the Sun is directly overhead; it moves between 23.5°N (June solstice) and 23.5°S (December solstice) during the year.

1. Define solar declination and explain how it affects seasonal solar angles.

Correct Answer: Solar declination is the latitude where the Sun is directly overhead at noon; it shifts north and south annually, altering solar angles and seasons.

1. Briefly describe the latitudinal variation of the radiation balance.

Correct Answer: There is a net gain of radiation between about 38 North and South latitude. Poleward of these latitudes there is a net loss of radiation.

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