Geosystems: An Introduction to Physical Geography, Cdn 3e **(Christopherson)**
Chapter 2 Solar Energy to Earth and the Seasons

2.1 Multiple Choice Questions

1) Our planet and our lives are powered by
A) energy derived from inside Earth.
B) radiant energy from the Sun.
C) utilities and oil companies.
D) shorter wavelengths of gamma rays, X-rays, and ultraviolet.
E) internal combustion at Earth's core.
Answer: B
Diff: 1 Type: MC Page Ref: 44
Skill: Factual

2) Which of the following is true?
A) the Sun is the largest star in the Milky Way Galaxy.
B) the Milky Way is part of our Solar System.
C) the Sun produces energy through fusion processes.
D) the Sun is also a planet.
E) the Sun has a liquid atmosphere.
Answer: C
Diff: 1 Type: MC Page Ref: 44
Skill: Factual

3) Which of the following is false?
A) the planets orbit the Sun, and the Sun and Solar System are part of the Milky Way Galaxy.
B) the Sun produces energy through fusion.
C) the Sun is by far the largest star in the Milky Way Galaxy.
D) the Sun is average in colour, temperature, and size when compared to other stars.
E) the Sun constantly emits clouds of electrically charged particles.
Answer: C
Diff: 2 Type: MC Page Ref: 44
Skill: Applied

4) The Milky Way galaxy
A) is a conical galaxy.
B) is one of millions of galaxies in the universe.
C) contains approximately 20 billion stars.
D) is the centre of the universe.
E) cannot be seen from Earth.
Answer: B
Diff: 2 Type: MC Page Ref: 42
Skill: Factual

5) Which of the following is true of galaxies?
A) each galaxy has one star.
B) galaxies are measured by the speed of sound.
C) a typical galaxy, such as the Milky Way, is about 5 billion miles in diameter.
D) great clouds of gas and dust known as nebula occur within galaxies.
E) three galaxies exist in the universe.
Answer: D
Diff: 2 Type: MC Page Ref: 42
Skill: Applied

6) The planetesimal hypothesis pertains to the formation of the
A) universe.
B) galaxy.
C) planets.
D) ocean basins.
E) atmosphere.
Answer: C
Diff: 1 Type: MC Page Ref: 42
Skill: Applied

7) The planets in the solar system are believed to have formed as a result of a process known as _____ which is caused by _____.
A) acceleration; centrifugal force
B) fusion; gravity
C) fission; gravity
D) accretion; gravity
E) accretion; centrifugal
Answer: D
Diff: 3 Type: MC Page Ref: 42
Skill: Applied

8) The flattened structure of the Milky Way is revealed by
A) the constellations of the Zodiac.
B) a narrow band of hazy light that stretches across the night sky.
C) the alignment of the planets in the solar system.
D) the plane of the ecliptic.
E) axial tilt.
Answer: B
Diff: 2 Type: MC Page Ref: 42
Skill: Recall

9) Earth and the Sun formed specifically from
A) the galaxy.
B) unknown origins.
C) a nebula of dust and gases.
D) other planets.
E) transference of energy into matter through fission.
Answer: C
Diff: 2 Type: MC Page Ref: 42
Skill: Factual

10) The basic idea behind the planetesimal hypothesis is that
A) planets form as a direct result of the nuclear fusion of nebular gases and planetesimals.
B) planets form from the remains of super-giant planetesimals that undergo nuclear fission and blow apart, thereby creating smaller objects—the planets.
C) early in the solar system's history, a star passed near to the Sun and pulled off gases that eventually condensed to form planets.
D) matter in a nebula experiences mutual gravitational attraction, and this results in the gradual accretion of larger and larger bodies—planetesimals.
E) electrical space storms charged particles that were attracted together to form planets.
Answer: D
Diff: 3 Type: MC Page Ref: 42
Skill: Applied

11) Which of the following is true of stars?
A) they form in great clouds of gas and dust known as nebula.
B) very few violent physical phenomena occur in stars.
C) new atoms are created in space and attracted to stars.
D) nuclear fission destroys stars.
E) stars have a solid iron core.
Answer: A
Diff: 3 Type: MC Page Ref: 44
Skill: Applied

12) Light travels at a speed of approximately
A) 80 500 kilometres per hour.
B) 300 000 kilometres per hour.
C) 300 000 kilometres per second.
D) 1 000 000 000 kilometres per second.
E) 400 000 kilometres per year.
Answer: C
Diff: 1 Type: MC Page Ref: 42
Skill: Factual

13) Which of the following accurately describes Earth's distance from the Sun?
A) the Earth-Sun distance averages 150 million kilometers.
B) it takes light an average of 8 hours and 20 seconds to travel from the Sun to Earth.
C) Earth is closer to the Sun in July (perihelion) and farther away in January (aphelion).
D) it varies by up to 50% throughout its orbit
E) it remains constant through time.
Answer: A
Diff: 2 Type: MC Page Ref: 42
Skill: Applied

14) Which of the following is true?
A) It takes light about 100 000 years to cross our galaxy.
B) If you could see the most distant parts of our universe, you would be looking at least ten billion years back in time.
C) Because of the distances to the stars, it is impossible to see stars "in the present." Each is seen at a different point in time in the past.
D) All of the above are true.
E) None of the above are true.
Answer: D
Diff: 3 Type: MC Page Ref: 42
Skill: Applied

15) Which of the following statements is correct?
A) a star and the planets that orbit it make up a solar system.
B) it takes light about 10 000 years to cross our galaxy.
C) a galaxy consists of hundreds of solar systems.
D) when we look at the stars in the night sky, we are looking forward in time.
E) time and distance are not related in the universe.
Answer: A
Diff: 3 Type: MC Page Ref: 42
Skill: Applied

16) Of all the matter in the Solar System,
A) the Sun captured over 99 percent.
B) the bulk remains with all the planets and their satellites.
C) most resides in the planet Jupiter—the largest planet in the solar system.
D) most is scattered about the solar system as individual atoms and molecules.
E) there is no matter in our Solar System, only energy.
Answer: A
Diff: 2 Type: MC Page Ref: 42
Skill: Applied

17) During the process by which energy is produced inside of stars,
A) hydrogen is fused together to form helium.
B) helium is fused together to form hydrogen.
C) hydrogen splits to form helium.
D) helium splits to form hydrogen.
E) oxygen splits from ozone.
Answer: A
Diff: 2 Type: MC Page Ref: 44
Skill: Applied

18) The solar wind consists principally of
A) neutral hydrogen and helium atoms.
B) planetesimals.
C) free neutrons.
D) positively charged hydrogen nuclei and free electrons.
E) oxygen and carbon dioxide.
Answer: D
Diff: 2 Type: MC Page Ref: 45
Skill: Factual

19) Which of the following is true of Earth's orbit about the Sun?
A) it is perfectly circular.
B) it is elliptical.
C) it takes approximately the same time for Earth to orbit the Sun as it does for the rest of the planets in the solar system to orbit the Sun.
D) the orbit does not vary over millions of years.
E) it gets shorter every year.
Answer: B
Diff: 2 Type: MC Page Ref: 42
Skill: Factual

20) The Sun produces which of the following?
A) mainly visible light and infrared energy
B) mainly ultraviolet and X-rays
C) only solar wind
D) only radiant energy that is beneficial to life
E) only heat
Answer: A
Diff: 2 Type: MC Page Ref: 46
Skill: Applied

21) Stars give off electromagnetic radiation because
A) matter is converted into energy.
B) matter and energy totally annihilate one another in matter-antimatter reactions.
C) energy is converted into matter.
D) kinetic energy is converted into potential energy.
E) energy is subsumed by the vacuum of space.
Answer: A
Diff: 2 Type: MC Page Ref: 46
Skill: Applied

22) Sunspots
A) can be several times larger than Earth.
B) can produce flares and prominences.
C) are brighter than the rest of the Sun's surface.
D) origins and dynamics are not fully understood.
E) result in the increased diameter of the Sun.
Answer: C
Diff: 2 Type: MC Page Ref: 44
Skill: Applied

23) A magnetic disturbance on the Sun's surface is called
A) the electromagnetic spectrum.
B) the solar wind.
C) a sunspot.
D) a magnetospheric cyclone.
E) emerging radiation.
Answer: C
Diff: 2 Type: MC Page Ref: 44
Skill: Applied

24) On its way to Earth, the solar wind first encounters
A) the ozonosphere.
B) the magnetosphere.
C) Earth's surface.
D) the lower atmosphere.
E) the ionosphere.
Answer: B
Diff: 2 Type: MC Page Ref: 44
Skill: Applied

25) Earth's magnetosphere is generated by
A) nuclear fusion in Earth's core.
B) nuclear fission in Earth's core.
C) dynamo-like motions in Earth's interior.
D) gravitational accretion.
E) advection.
Answer: C
Diff: 2 Type: MC Page Ref: 45
Skill: Factual

26) Auroras
A) have not been seen as far south as Jamaica.
B) are created by solar wind interacting with the magnetosphere.
C) are related to energy, but not matter.
D) are an important component of Earth's energy budget.
E) result from volcanic ash burning up in the stratosphere.
Answer: B
Diff: 3 Type: MC Page Ref: 45
Skill: Applied

27) The auroras in the upper atmosphere are caused by
A) the interaction of electromagnetic energy with atmospheric gases.
B) AM radio broadcasts.
C) various weather phenomena.
D) the interaction of the solar wind and atmospheric gases.
E) interaction of television broadcast waves with the magnetosphere.
Answer: D
Diff: 2 Type: MC Page Ref: 45
Skill: Applied

28) Which of the following is a consequence of the solar wind?
A) halos
B) disruption of radio communications
C) charging of electrical systems
D) creation of Earth's magnetosphere
E) growth spurts of plants in the boreal forest.
Answer: B
Diff: 2 Type: MC Page Ref: 45
Skill: Applied

29) Which of the following is true of the relationship between sunspots and certain cyclic weather effects?
A) the connection between sunspot cycles and weather is well established.
B) the correlation between the two phenomena is interesting, but a direct link remains unconfirmed.
C) the existence of a sunspot cycle has yet to be confirmed.
D) there is no record of sunspot activity prior to this century.
E) the connection between sunspot cycles and tectonic activity is documented.
Answer: B
Diff: 2 Type: MC Page Ref: 44
Skill: Applied

30) Which of the following have been correlated with sunspot cycles?
A) abnormally wet years
B) droughts
C) both A and B
D) none of the above
Answer: C
Diff: 2 Type: MC Page Ref: 44
Skill: Factual

31) Experiments involving pieces of aluminum foil placed on the lunar surface by the Apollo XI astronauts proved that
A) sunspots actually occur.
B) sunspots exhibit a cycle.
C) the solar wind consists of charged particles.
D) nuclear fission occurs in the Sun's interior.
E) sunspots transfer energy, but not matter.
Answer: C
Diff: 2 Type: MC Page Ref: 45
Skill: Recall

32) Astronauts deployed a solar wind measuring experiment on the Moon because
A) the lunar surface is protected by an atmosphere.
B) there is no electromagnetic energy arriving there.
C) the experiment would not work if deployed at Earth's surface due to protective aspects of Earth's atmosphere.
D) the Moon is closer to the Sun, so it is easier to measure the effect of solar wind.
E) there is no solar wind arriving at the lunar surface.
Answer: C
Diff: 2 Type: MC Page Ref: 45
Skill: Applied

33) Radio waves have a _____ wavelength than visible light and are therefore _____ energetic.
A) longer; less
B) longer; more
C) shorter; less
D) shorter; more
Answer: A
Diff: 3 Type: MC Page Ref: 46
Skill: Applied

34) Which of the following is true of the Sun's electromagnetic spectrum?
A) it consists exclusively of radiant energy made of gamma ray, X-ray, and ultraviolet wavelengths.
B) it consists exclusively of streams of charged particles.
C) it is capable of sustaining life on Earth even though some portions of the spectrum are actually harmful to living organisms.
D) it consists exclusively of visible light and infrared energy.
E) it spans a spectrum beginning with microwaves and ending with sound.
Answer: C
Diff: 2 Type: MC Page Ref: 46
Skill: Applied

35) The two main portions of the solar spectrum which enter the atmosphere are
A) X-rays and visible light.
B) visible and infrared energy.
C) infrared and gamma rays.
D) ultraviolet and visible light.
E) gamma rays and thermal infrared energy.
Answer: B
Diff: 2 Type: MC Page Ref: 46
Skill: Applied

36) The dominant wavelength of energy emitted by the Sun is
A) shorter than that emitted by Earth.
B) longer than that emitted by Earth.
C) the same length as that emitted by Earth.
Answer: A
Diff: 1 Type: MC Page Ref: 46
Skill: Applied

37) Electromagnetic energy
A) is incapable of travelling through outer space.
B) is made up of wavelengths of energy that travel at the same speed.
C) can be seen throughout the entire spectrum.
D) consists of wavelengths which are directly proportional to the temperature of the emitter; i.e., as temperature of the emitting object increases, the wavelength also increases.
E) is emitted in greater amounts at all wavelengths by hotter objects.
Answer: E
Diff: 3 Type: MC Page Ref: 46
Skill: Applied

38) Which of the following is correctly matched?
A) Sun—longwave radiation—infrared
B) Sun—shortwave radiation—radio waves
C) Earth—longwave radiation—infrared
D) Earth—shortwave radiation—infrared
E) Earth—longwave radiation—ultraviolet
Answer: C
Diff: 3 Type: MC Page Ref: 46
Skill: Applied

39) The dominant wavelength emitted by Earth is
A) gamma radiation.
B) X-ray radiation.
C) visible light.
D) infrared.
E) ultraviolet.
Answer: D
Diff: 2 Type: MC Page Ref: 47
Skill: Factual

40) Which of the following sequences is arranged in order from shorter wavelength to longer wavelength?
A) infrared, visible, ultraviolet, X-rays
B) X-rays, ultraviolet, visible, infrared
C) gamma rays, microwaves, visible, X-rays
D) radio waves, light, heat, X-rays
E) microwaves, ultraviolet, infrared, visible
Answer: B
Diff: 2 Type: MC Page Ref: 46
Skill: Applied

41) Intercepted solar radiation is called
A) solar wind.
B) thermosphere.
C) solar constant.
D) insolation.
E) displacement.
Answer: D
Diff: 2 Type: MC Page Ref: 47
Skill: Factual

42) 1372 watts per square metre (2 calories per cm^2 per minute) refers to the
A) solar constant, which is the average value of energy received at the thermopause.
B) solar wind input to the atmosphere.
C) average energy receipt at Earth's surface.
D) amount of energy absorbed by the atmosphere.
E) the amount of energy required to raise the temperature of 1 g of water by 1 celsius degree.
Answer: A
Diff: 2 Type: MC Page Ref: 47
Skill: Factual

43) The solar constant is measured at
A) the Sun's surface.
B) the edge of the Sun's atmosphere.
C) the tropopause.
D) sea level.
E) the thermopause.
Answer: E
Diff: 2 Type: MC Page Ref: 47
Skill: Recall

44) The solar constant is measured at
A) the outer boundary of the exosphere.
B) the outer boundary of the thermosphere.
C) the top of the stratosphere.
D) the top of the troposphere.
E) Earth's surface at the equator.
Answer: B
Diff: 2 Type: MC Page Ref: 47
Skill: Recall

45) The solar constant is the value obtained
A) for Earth's average distance from the Sun.
B) when Earth is closest to the Sun.
C) when Earth is furthest from the Sun.
D) none of the above
E) at any time during Earth's orbit around the Sun.
Answer: A
Diff: 2 Type: MC Page Ref: 47
Skill: Applied

46) A langley is
A) an expression of the amount of energy received per unit area (cal/cm^2).
B) another name for the visible light spectrum.
C) solar wind input to the atmosphere.
D) the average energy receipt at Earth's surface.
E) a term used to measure the weight of water in the atmosphere (g/cm^2).
Answer: A
Diff: 2 Type: MC Page Ref: 47
Skill: Applied

47) The uneven distribution of insolation by latitude is primarily a result of
A) variability in the Sun's output.
B) the changing distance of Earth from the Sun.
C) variation in the value of a watt.
D) Earth's sphericity, which presents varied angles to parallel solar rays.
E) the longterm decrease in the Sun's energy output.
Answer: D
Diff: 2 Type: MC Page Ref: 48
Skill: Applied

48) Do high latitudes receive less energy than the equatorial regions? Why?
A) yes; the orientation of Earth's surface relative to the Sun's rays diminishes the intensity of solar radiation at high latitudes.
B) no; the Sun's rays must pass through more atmosphere at higher latitudes.
C) yes; the poles point toward the sun for a significant time each year.
D) no; each latitude receives the same amount of energy at the surface
Answer: A
Diff: 3 Type: MC Page Ref: 48
Skill: Applied

49) Which of the following is correct relative to insolation at the thermopause?
A) in June, the North Pole receives over 500 watts per m^2 per day.
B) in June, the South Pole receives over 550 watts per m^2 per day.
C) throughout the year, the equatorial receipt varies between 100 and 400 watts per m^2 per day.
D) it receives an average amount of insolation equal to 100 watts per m^2 per day.
E) in October, the North Pole receives over 500 watts per m^2 per day.
Answer: A
Diff: 3 Type: MC Page Ref: 48
Skill: Applied

50) What is the name of the location on the surface of Earth that receives insolation when the Sun is directly overhead? (When this occurs, the Sun's rays are perpendicular to this surface.)
A) solar point
B) zenith
C) subsolar point
D) North Polar point
E) Arctic Circle
Answer: C
Diff: 1 Type: MC Page Ref: 48
Skill: Applied

51) Which of the following is true relative to net radiation at the thermopause?
A) net radiation is evenly distributed with little change by latitude.
B) positive values in lower latitudes and negative values toward the poles.
C) negative values along the equator and positive values toward the poles.
D) net radiation is composed of shortwave energy only.
E) net radiation quantifies the outgoing portion of the energy balance.
Answer: B
Diff: 3 Type: MC Page Ref: 49
Skill: Applied

52) On the northern hemisphere's summer solstice, the north polar region receives _____ daily insolation than areas nearer the equator because _____.
A) more; the Sun does not set.
B) more; the Sun is higher in the sky.
C) less; the Sun does not rise.
D) less; the Sun does not set.
E) less, the Sun is lower in the sky.
Answer: A
Diff: 3 Type: MC Page Ref: 50
Skill: Applied

53) The term "net radiation" refers to
A) the total amount of energy received by Earth.
B) the total amount of energy radiated by Earth.
C) the difference in amount of incoming and outgoing radiation.
D) radiation emitted by satellite networks.
E) the average amount of energy emitted by the Sun.
Answer: C
Diff: 2 Type: MC Page Ref: 49
Skill: Applied

54) The amount of energy received above the South Pole during the southern hemisphere's summer solstice is _____ than that received above the North Pole during the northern hemisphere's summer solstice because _____.
A) more; the atmosphere is thinner above the South Pole
B) more; Earth is closer to the Sun during the southern hemisphere's summer solstice
C) less; the atmosphere is thicker above the South Pole
D) less; Earth is further from the Sun during the southern hemisphere's summer solstice
E) more; Earth is farther from the Sun during the southern hemisphere's summer solstice
Answer: B
Diff: 3 Type: MC Page Ref: 54
Skill: Applied

55) Changes in daylength and the Sun's altitude above the horizon over the course of the year
A) produce Earth's rotation.
B) are phenomena that occur only at the equator.
C) are responsible for the seasons.
D) are factors that follow an irregular, random cycle.
E) are controlled by the longwave energy output at the poles.
Answer: C
Diff: 2 Type: MC Page Ref: 51
Skill: Applied

56) At all times during the year, the circle of illumination
A) divides Earth between northern and southern hemispheres.
B) divides Earth into eastern and western halves.
C) separates winter from summer.
D) divides Earth between equal halves of lightness and darkness.
E) marks the edge of polar night.
Answer: D
Diff: 2 Type: MC Page Ref: 51
Skill: Applied

57) Earth's diameter is
A) about 10 000 km.
B) about 20 000 km.
C) about 40 000 km.
D) about 50 000 km.
E) about 100 000 km.
Answer: C
Diff: 2 Type: MC Page Ref: 51
Skill: Applied

58) The plane of Earth's orbit about the Sun is called the plan of the
A) perihelion.
B) aphelion.
C) ecliptic.
D) great circle.
E) election.
Answer: C
Diff: 1 Type: MC Page Ref: 52
Skill: Factual

59) Which of the following is true?
A) the polar regions experience an annual net energy surplus.
B) the equatorial regions experience an annual net energy surplus.
C) Areas in the midlatitudes (36°-55°) experience an annual net negative energy balance.
D) polar regions are perfectly balanced between energy received and energy emitted.
E) energy receipt and energy emitted in perfectly balanced at all latitudes.
Answer: B
Diff: 2 Type: MC Page Ref: 49
Skill: Applied

60) Which of the following results from radiation imbalances at different latitudes?
A) hurricanes
B) global winds
C) ocean currents
D) all of the above.
E) none of the above.
Answer: D
Diff: 2 Type: MC Page Ref: 46
Skill: Applied

61) The Sun's altitude refers to
A) the angular distance from the equator to the latitude at which direct overhead insolation is received.
B) the angular height of the Sun above the horizon.
C) the subsolar point.
D) how far the Sun is from Earth.
E) the distance from the Sun's centre to its outer surface.
Answer: B
Diff: 2 Type: MC Page Ref: 50
Skill: Applied

62) The Sun's declination refers to
A) the angular distance from the equator to the latitude at which direct overhead insolation is received.
B) the angular height of the Sun above the horizon.
C) how far the Sun is from Earth.
D) its altitude, in thousands of feet, above the horizon.
E) the distance from the subsolar spot to the poles.
Answer: A
Diff: 2 Type: MC Page Ref: 50
Skill: Applied

63) The sun's declination migrates through
A) 23.5°.
B) 30°.
C) 47°.
D) 66.5°.
E) 133°.
Answer: C
Diff: 2 Type: MC Page Ref: 50
Skill: Factual

64) Which of the following is true of the number of hours of daylight?
A) the number of hours of daylight includes the hours between dawn and twilight, not just the hours from sunrise to sunset.
B) the number of hours of daylight varies depending on the latitude of the observer.
C) the number of hours of daylight varies the most along the equator.
D) the number of hours of daylight varies the least at higher latitudes.
E) the number of hours of daylight is constant along the international date line.
Answer: B
Diff: 2 Type: MC Page Ref: 50
Skill: Applied

65) Which of the following is true regarding daylength?
A) the equator experiences at least six-hours difference in daylength from winter to summer.
B) nowhere on Earth does daylength vary by as much as 24 hours.
C) daylength varies more at the equator than at higher latitudes.
D) the people living at 40° N or S latitude experience about six-hours difference in daylength from winter to summer.
E) daylength is constant throughout the year for all latitudes south of 49°.
Answer: D
Diff: 2 Type: MC Page Ref: 50
Skill: Applied

66) Which of the following characterizes Earth's revolution?
A) it takes approximately 24 hours.
B) it is responsible for creating the circle of illumination, and hence, day/night relationships.
C) it is clockwise when viewed from above the North Pole.
D) it determines the timing of seasons and length of the year.
E) it takes exactly 365 days to complete.
Answer: D
Diff: 2 Type: MC Page Ref: 51
Skill: Applied

67) Earth's rotation is responsible for
A) daylength.
B) reflection of the winds.
C) development of the ocean currents.
D) rise and fall of tides.
E) volcanic eruptions.
Answer: D
Diff: 2 Type: MC Page Ref: 51
Skill: Applied

68) Earth's rotation is described as
A) east to west.
B) north to south.
C) west to east.
D) clockwise when viewed from above the North Pole.
E) south to north
Answer: C
Diff: 2 Type: MC Page Ref: 51
Skill: Factual

69) Which of the following is true regarding Earth's axis?
A) the amount of axial tilt fluctuates during the year and forms the basis for seasonal changes.
B) the axis remains parallel to the plane of the ecliptic.
C) axial tilt is unrelated to the phenomenon of seasonal change.
D) the axis is tilted 23.5° from a perpendicular to the plane of the ecliptic.
Answer: D
Diff: 2 Type: MC Page Ref: 52
Skill: Applied

70) Rotational velocities vary at different latitudes by what range of values?
A) from 1675 km · h^{-1} at the equator to 0 km · h^{-1} at the poles.
B) from 1675 km · h^{-1} at the poles to 0 km · h^{-1} at the equator.
C) because the day is 24 hours long, there is no variation in rotational values.
D) At 45° latitude, the rotational velocity is is greatest and diminishes toward the pole and equator.
E) from 100 km · h^{-1} at the poles to 50 km · h^{-1} at the equator.
Answer: A
Diff: 2 Type: MC Page Ref: 51
Skill: Applied

To answer the following questions, refer to the figure below. Assume that it shows the orbit of a hypothetical planet in another part of the galaxy and that this planet has an axial tilt of 20°. (Note the direction of the axial tilt and the direction of the orbit.)

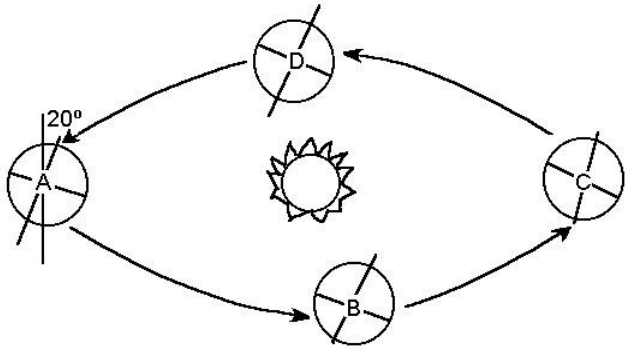

Figure MC2

71) In Figure MC2, what position corresponds to the winter solstice for observers in the northern hemisphere? (Assume north is toward the top of the page.)
A) A
B) B
C) C
D) D
Answer: C
Diff: 2 Type: MC Page Ref: 53
Skill: Applied

72) According to Figure MC2, at what position does the Sun cross the planet's equator moving south, and what is the name for this position in the northern hemisphere?
A) position B; Spring Equinox
B) position B; Autumn Equinox
C) position D; Spring Equinox
D) position D; Autumn Equinox
E) position A; Spring Solstice
Answer: B
Diff: 3 Type: MC Page Ref: 53
Skill: Applied

73) According to Figure MC2, given the tilt of the axis (20°), the Arctic Circle would be located at
A) 20° N.
B) 20° S.
C) 70° N.
D) 70° S.
Answer: C
Diff: 2 Type: MC Page Ref: 53
Skill: Applied

74) According to Figure MC2, given the tilt of the axis (20°), the Tropic of Capricorn would be located at
A) 110° N.
B) 20° N.
C) 20° S.
D) 70° N.
E) 70° S.
Answer: C
Diff: 2 Type: MC Page Ref: 53
Skill: Applied

75) According to Figure MC2, at what position would daylight last for 24 hours for observers located north of the Arctic Circle?
A) A
B) B
C) C
D) D
Answer: A
Diff: 2 Type: MC Page Ref: 53
Skill: Applied

76) According to Figure MC2, at what two locations would daylight last for 12 hours for all locations on the planet?
A) A and B
B) C and D
C) A and C
D) B and D
Answer: D
Diff: 2 Type: MC Page Ref: 53
Skill: Applied

77) According to Figure MC2, if the hypothetical planet requires 20 months to complete one orbit around the star, how many months after the Summer Solstice would the Sun cross the equator moving north?
A) 5
B) 10
C) 15
D) 20
E) 9
Answer: C
Diff: 2 Type: MC Page Ref: 53
Skill: Applied

78) On Earth, the Sun passes directly overhead at 25° north latitude _____ times a year.
A) 0
B) 1
C) 2
D) 4
E) 6
Answer: A
Diff: 2 Type: MC Page Ref: 48
Skill: Applied

79) While standing at the Tropic of Cancer, Emma's shadow points north at noon (Sun time). Based on this, which of the following can be definitely concluded?
A) It must be the June solstice.
B) It must be the December solstice.
C) It must be one of the equinoxes.
D) It must not be the June solstice.
E) It must not be the December solstice.
Answer: D
Diff: 3 Type: MC Page Ref: 55
Skill: Applied

80) On June 21, the Sun never sets at Finn's location. Based on this, it can be concluded that Finn lives
A) between the Tropic of Cancer and the Arctic Circle.
B) between the Tropic of Capricorn and the Antarctic Circle.
C) above the Arctic Circle.
D) below the Antarctic Circle.
E) in northern Newfoundland.
Answer: C
Diff: 3 Type: MC Page Ref: 53
Skill: Applied

81) Which of the following statements is true?
A) December 21 = vernal equinox.
B) September 22 = summer solstice in Australia.
C) March 21 = equal day and nights everywhere on Earth.
D) June 21 = equal day and nights everywhere on Earth.
E) December 21 = subsolar point at the Tropic of Cancer.
Answer: C
Diff: 3 Type: MC Page Ref: 53
Skill: Applied

82) During which time period would the number of daylight hours always be greater than, or equal to, the number of nighttime hours for observers in the northern hemisphere?
A) From the summer solstice, to the autumn equinox, to the winter solstice
B) From the autumn equinox, to the winter solstice, to the spring equinox
C) From the spring equinox, to the summer solstice, to the autumn equinox
D) From the winter solstice, to the spring equinox, to the summer solstice
Answer: C
Diff: 3 Type: MC Page Ref: 53
Skill: Applied

83) The Tropic of Cancer refers to
A) the parallel that occurs at 23.5° south latitude.
B) the location of the subsolar point on September 22.
C) the parallel that is the farthest northern location for the subsolar point during the year.
D) 0° latitude when the Sun crosses the equator.
E) the latitude which receives the greatest input of ultraviolet radiation.
Answer: C
Diff: 3 Type: MC Page Ref: 55
Skill: Applied

84) The equinox
A) occurs four times during the year.
B) has 12 hours of day and 12 hours of night for all locations.
C) is the longest day of the year at any given place.
D) is when the subsolar point is at one of the tropics.
E) is when there is the greatest range of time between sunrise and sunset.
Answer: B
Diff: 2 Type: MC Page Ref: 53
Skill: Applied

85) The Tropic of Capricorn refers to
A) that parallel that is 23.5° south latitude.
B) the location of the subsolar point on September 22.
C) the parallel that is the farthest northern location for the subsolar point during the year.
D) that parallel that is 66.5° south latitude.
E) the latitude which receives the greatest input of ultraviolet radiation.
Answer: A
Diff: 2 Type: MC Page Ref: 55
Skill: Applied

86) The longest days of the year in the southern hemisphere are experienced during the northern hemisphere's
A) Summer solstice.
B) Spring equinox.
C) Winter solstice.
D) Autumn equinox.
E) days are always longer in the southern hemisphere.
Answer: C
Diff: 3 Type: MC Page Ref: 55
Skill: Applied

87) The longest days of the year in the northern hemisphere are experienced during the
A) time of 24-hour days at the South Pole.
B) vernal equinox.
C) winter solstice.
D) autumnal equinox.
E) time that the Sun is directly overhead at the Tropic of Cancer.
Answer: E
Diff: 3 Type: MC Page Ref: 55
Skill: Applied

88) Which of the following relationships is correctly matched?
A) December solstice - subsolar point at 23.5 N latitude
B) March equinox - subsolar point at 23.5° S latitude
C) December 21 - subsolar point at 23.5 N latitude
D) June solstice - subsolar point at 23.5 N latitude
E) September equinox - subsolar point at 23.5° S latitude
Answer: D
Diff: 3 Type: MC Page Ref: 55
Skill: Applied

89) According to the text, which of the following is true regarding the point of sunrise for a location in the northern hemisphere?
A) it migrates from southeast to northeast from winter to summer.
B) it remains fixed throughout the year; only the Sun's altitude changes.
C) it moves to the south from winter to summer.
D) it is along the western horizon in summer, and the eastern horizon in winter.
E) it always appears on the northern horizon.
Answer: A
Diff: 2 Type: MC Page Ref: 55
Skill: Recall

90) Which of the following is true regarding dawn and twilight?
A) dawn and twilight last longest at the equator—approximately 2.5 hours.
B) the polar regions do not experience dawn and twilight.
C) 60° north and south latitudes receive the most dawn and twilight.
D) the duration of both increases with increasing latitude.
E) there is no variation in the length of dawn and twilight throughout the year.
Answer: D
Diff: 2 Type: MC Page Ref: 55
Skill: Applied

91) On June 21st, the Sun's declination is at
A) the equator.
B) Rio de Janeiro, Brazil and Alice Springs, Australia.
C) the Tropic of Capricorn.
D) the Tropic of Cancer.
E) Iqaluit, Nunavut and Helsinki, Finland.
Answer: D
Diff: 2 Type: MC Page Ref: 55
Skill: Applied

2.2 True/False Questions

1) The Solar System, Sun, and Earth formed about 4.6 to 5 billion years ago.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Factual

2) Our galaxy contains about 400 billion stars.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Factual

3) The most distant galaxies yet observed are at least 10 billion light years away.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Factual

4) At the speed of light, Earth is an average of only 8 minutes and 20 seconds from the Sun.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Factual

5) If we can see galaxies 12 billion light years away, that means that the universe must be at least 12 billion years old because that is how long it took the light from these galaxies to reach us.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Applied

6) Earth is at perihelion in early January when it is closest to the Sun.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Factual

7) We live on a continent on a small planet, that orbits about an average star, that is located near the trailing edge of a galaxy, that is in a local group of galaxies in the Universe.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Factual

8) Earth is farthest from the Sun at perihelion and closest at aphelion.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 42
Skill: Applied

9) A plane intersecting all points of Earth's orbit is called the plane of the Sun.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 52
Skill: Applied

10) The Sun and Earth formed from a collapsing cloud of dust and gas.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 42
Skill: Factual

11) The planetesimal hypothesis has no observational evidence to support it.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 42
Skill: Applied

12) Energy is liberated within the Sun's interior through a process known as nuclear fusion.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 44
Skill: Factual

13) Sunspots are associated with magnetic storms.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 44
Skill: Factual

14) The Sun emits streams of charged particles that are collectively referred to as the electromagnetic spectrum.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 45
Skill: Applied

15) The electromagnetic spectrum of radiant energy travels in waves at the speed of light in all directions from the Sun.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 46
Skill: Factual

16) Large magnetic disturbances on the Sun's surface are called sunspots and produce increased amounts of solar wind.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 44
Skill: Factual

17) Sunspots vary in a cycle from 7 to 17 years, averaging 11 years from a maximum to maximum peak.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 44
Skill: Factual

18) Auroras in the upper atmosphere are stimulated by streams of charged (ionized) particles emitted by the Sun.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 45
Skill: Factual

19) The magnetosphere deflects the solar wind toward Earth's two poles.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 45
Skill: Factual

20) There is no evidence for a correlation between sunspot activity and weather conditions on Earth.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 45
Skill: Factual

21) The correct order for wavelengths of electromagnetic radiation, from shortest to longest is: X-rays, infrared, radio waves, visible light, and ultraviolet.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 36
Skill: Applied

22) The Sun produces more gamma rays than Earth.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 46
Skill: Applied

23) Insolation occurs primarily in the ultraviolet portion of the spectrum.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 46
Skill: Applied

24) Intercepted solar energy is called insolation and is measured as the solar constant at the top of the atmosphere.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 47
Skill: Factual

25) The uneven distribution of insolation at the thermopause is caused by Earth's curvature, with only the subsolar point receiving sunlight from directly overhead.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 48
Skill: Factual

26) The amount of the solar energy received by a given location is not really constant-it varies depending upon the season and Earth's distance from the Sun.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 48
Skill: Factual

27) All points on Earth's surface experience the subsolar point at some moment during the year.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 48
Skill: Applied

28) The seasons are caused by the changing amounts of energy received at Earth as a result of Earth's elliptical orbit.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 50
Skill: Applied

29) The 28-ton stones assembled at Stonehenge in England were evidently used by ancients to mark seasonal changes. In other words, Stonehenge is an ancient calendar.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 50
Skill: Factual

30) The Sun's height in the sky above the horizon is termed its altitude.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 50
Skill: Applied

31) Seasonality involves the variability of both daylength and the altitude of the Sun.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 50
Skill: Factual

32) Rotation is Earth's motion on its axis; revolution is its motion about the Sun.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 50
Skill: Factual

33) Earth's axis is tilted 23.5° from a perpendicular to the plane of the ecliptic.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 51
Skill: Factual

34) Earth's spherical shape is not a factor with regards to seasonality.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 51
Skill: Applied

35) Earth rotates east to west, or clockwise, when viewed from above the North Pole.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 51
Skill: Applied

36) The subsolar point is at the Tropic of Cancer on December 21.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 53
Skill: Factual

37) All places on Earth receive the same period of day and night on March 21.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 53
Skill: Factual

38) The Sun is directly overhead north of 23.5° north latitude twice a year.
Answer: FALSE
Diff: 1 Type: TF Page Ref: 53
Skill: Applied

39) The duration of dawn and twilight tends to increase with increasing latitude.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 53
Skill: Applied

40) On the northern hemisphere's summer solstice, the north polar region receives more total daily energy than the equator.
Answer: TRUE
Diff: 1 Type: TF Page Ref: 53
Skill: Factual

2.3 Essay Questions

1) Briefly list and describe the main components of the planetesimal hypothesis.
Diff: 3 Type: ES Page Ref: 42
Skill: Applied

2) Why is the light year a useful unit of measurement for astronomical distances?
Diff: 3 Type: ES Page Ref: 42
Skill: Applied

3) First describe the process of fusion inside stars. Then define the terms "solar wind" and "sunspot."
Diff: 3 Type: ES Page Ref: 44
Skill: Applied

4) What evidence points to a correlation between solar-wind intensity and Earth's weather?
Diff: 3 Type: ES Page Ref: 44
Skill: Applied

5) Why does Earth emit longer-wave radiation than the Sun?
Diff: 3 Type: ES Page Ref: 46
Skill: Applied

6) Define these terms: thermopause, insolation, solar constant, subsolar point.
Diff: 3 Type: ES Page Ref: 47
Skill: Factual

7) How does latitude tend to affect net radiation?
Diff: 3 Type: ES Page Ref: 48
Skill: Applied

8) Why does Earth have seasons?
Diff: 3 Type: ES Page Ref: 50
Skill: Applied

9) For where you live, how do daylength and the Sun's altitude vary throughout the year?
Diff: 3 Type: ES Page Ref: 51
Skill: Applied

10) Why are seasonal changes less noticeable near the equator than at mid-latitudes?
Diff: 3 Type: ES Page Ref: 51
Skill: Applied

11) Draw and label a diagram of the Earth-Sun relationship for the four seasons. Include the average distance from Earth to the Sun, the location of the subsolar point for each seasonal event, and the name and date for each of the solstices and equinoxes.
Diff: 3 Type: ES Page Ref: 53
Skill: Applied