

Test bank for Blue Planet 3e

NB: For all multiple choice questions, the correct answer is A. The questions will need to be scrambled before publication. For fill in the blank questions, the words in bold will become blanks.

Chapter 2

Essay questions (2)

1. Give one example each for how radiation, convection, and conduction transfer heat in the Sun-Earth system. For each example, give the path of heat flow: the source and where it is traveling to. Finally, give the ultimate source of energy for each example.
2. Consider the three major regions of the Sun's radiation: ultraviolet, visible and infrared. For each, describe the possible fates of the energy once it reaches the Earth's atmosphere, and be sure to highlight how their fates differ.

Fill in the blank (18)

1. **Energy** is the capacity to do work, to move matter, to make things happen.
2. Thermal energy, or **heat**, is the vibrational movement of atoms and molecules.
3. **Temperature** is a measure of heat, the vibrational motion of particles.
4. **Conduction** is the process by which heat moves directly from one object to an adjacent object with which it is in contact.
5. **Convection** is a mechanism of heat transfer in which heat content is physically carried from one location to another.
6. **Radiation** is the process in which energy in the electromagnetic spectrum is transferred from a radiating or emitting body through a surrounding gas, liquid, or vacuum.
7. Whenever an electrically charged particle is accelerated, it radiates energy in the form of **electromagnetic** radiation.
8. A group of electromagnetic rays arranged in order of increasing or decreasing wavelength is called a **spectrum**.
9. A perfect **blackbody** is one that absorbs all light that strikes it, and reflects none.
10. **Gravity** is the mutual physical attraction between the masses of the Moon and Earth.
11. The increase in temperature as you go deeper is called the **geothermal** gradient.
12. **Radiogenic** heat is produced by the spontaneous breakdown, or decay, of radioactive elements such as uranium and thorium that are naturally occurring inside Earth.
13. For any planetary body, the percentage of incoming radiation that is reflected unchanged is called the **albedo**.
14. **Radiatively active** gases selectively absorb radiation in the longer-wavelength, infrared portions of the spectrum of outgoing terrestrial energy.
15. The **energy** cycle encompasses the inputs and outputs, pathways, and reservoirs for the energy that drives all of the other cycles of the Earth system.
16. **Fossil fuels** come from the remains of plants and animals that have been trapped in sedimentary rocks and chemically altered to form fuels such as coal, oil, and natural gas.

17. **Geothermal** energy is drawn from Earth's own internal heat sources.
18. **Nuclear** energy is the heat energy produced during controlled splitting, or fission, of radioactive isotopes.

True/False (20)

1. The energy stored in a compressed spring is a type of stored mechanical energy (True).
2. Lifting a heavy rock above your head increases the potential energy of the rock and is an example of doing work (True).
3. When plants perform photosynthesis, new energy is created (False).
4. According to the second law of thermodynamics, electric cars should be 100% efficient (False).
5. Because entropy is always increasing, when a glass of ice melts in an isolated room, the entropy of both the glass of ice and the room increase (False).
6. The conversion of hydrogen into helium by thermonuclear reactions is the source of the Sun's energy (True).
7. The luminosity of the Sun is constant (False).
8. The gamma rays created by nuclear fusion inside the Sun directly reach the surface of the Earth (False).
9. The hotter a radiating body, the shorter the wavelength of its peak radiation is (True).
10. All of the ultraviolet radiation from the Sun that reaches the top of the Earth's atmosphere is absorbed by the stratospheric ozone layer (False).
11. The ocean's tides are primarily caused by changes in the Sun's gravitational field (False).
12. As you go deeper into the Earth's interior, the temperature of the rock increases (True).
13. If the Sun's luminosity suddenly dropped to zero, the surface of the Earth would not cool much due to terrestrial energy sources (False).
14. Deep inside the Earth, rock becomes so hot that convection is possible (True).
15. The Sun alone could supply all the energy necessary for human activities into the foreseeable future (True).
16. A significant portion of the energy from the Sun is converted into heat and stored within the deep interior of the Earth (False).
17. Low concentration or diffuse reservoirs are important when they are massive in size (True).
18. Before humans began to burn fossil fuels, there was no greenhouse effect in the Earth's atmosphere (False).
19. The Sun is the ultimate energy source for biomass, solar, and wind power (True).
20. The second law of thermodynamics constraints the efficiency of energy conversions by human activities (True).

Multiple choice (35)

1. Which of the following is not a type of potential energy?
 - a. radiant energy
 - b. chemical energy
 - c. nuclear energy
 - d. gravitational energy

- e. stored mechanical energy
2. Which of the following is not a type of kinetic energy?
 - a. stored mechanical energy
 - b. radiant energy
 - c. electrical energy
 - d. thermal energy
 - e. motion of objects
 3. The observation that some of the chemical energy in gasoline is lost as heat instead of being converted into kinetic energy (the motion of a car) is an example of:
 - a. the second law of thermodynamics
 - b. the first law of thermodynamics
 - c. the third law of thermodynamics
 - d. the law of gravity
 4. A proposed invention that would create an infinite amount of energy without any inputs would violate:
 - a. the first law of thermodynamics
 - b. the second law of thermodynamics
 - c. the third law of thermodynamics
 - d. the law of gravity
 5. The fact that entropy is always increasing is demonstrated by
 - a. all of the above
 - b. clocks run down
 - c. dead organisms decay
 - d. ice melts
 - e. mountains crumble
 6. In which of the following processes is the local entropy of an object decreasing?
 - a. A crystal is formed.
 - b. A match is burned.
 - c. Dead organisms decay.
 - d. Mountains crumble.
 7. Why is the Kelvin temperature scale special compared to other temperature scales?
 - a. It's an absolute scale.
 - b. It's used in scientific research.
 - c. It's based on the freezing and melting points of water.
 - d. It is based on the human experience of temperature.
 8. Which of the following potential energy sources is the source of the Sun's energy?
 - a. nuclear energy
 - b. chemical energy
 - c. gravitational energy
 - d. stored mechanical energy
 9. When 4 hydrogen protons combine with 2 electrons to form helium in the Sun, energy is _____ while the mass _____.

- a. released; decreases
 - b. released; increases
 - c. released; stays the same
 - d. absorbed; decreases
 - e. absorbed; increases
10. The Sun will run out of the hydrogen fuel to burn in about:
- a. a thousand years.
 - b. a million years.
 - c. a billion years.
 - d. never—the supply is endless.
11. Nuclear fusion within the Sun process what type of electromagnetic radiation?
- a. gamma rays
 - b. ultraviolet radiation
 - c. visible light
 - d. infrared radiation
 - e. microwaves
12. The Earth intercepts what fraction of the Sun's total output of energy?
- a. one 2 billionth
 - b. one millionth
 - c. one percent
 - d. ten percent
13. Which of the following is not a layer within the Sun?
- a. stratosphere
 - b. corona
 - c. chromosphere
 - d. photosphere
 - e. convective layer
14. Which layer of the Sun is responsible for emitting the visible light that reaches Earth?
- a. photosphere
 - b. corona
 - c. chromosphere
 - d. convective layer
 - e. core
15. Which layer of the Earth's atmosphere absorbs ultraviolet radiation from the Sun?
- a. stratospheric ozone layer
 - b. photosphere
 - c. corona
 - d. chromosphere
 - e. convective layer
16. Which of the following statements most accurately describes the causes of tides on Earth?
- a. The source of energy for the tides is the influence of gravity on the Earth's rotation.
 - b. The source of energy for the tides is gravity itself.

- c. The tides are simply caused by the Moon's gravity pulling in one direction.
 - d. The tides are simply caused by the Sun's gravity pulling in one direction.
17. In most places on the Earth, how many oceanic tides are there per day (i.e., number of high tides)?
- a. 1
 - b. 2
 - c. 3
 - d. 4
18. The geothermal gradient tells us that:
- a. The interior of the Earth is a source of heat, so temperature increases with depth.
 - b. The interior of the Earth is a source of heat, so temperature decreases with depth.
 - c. The Sun's energy is warming the interior of the Earth, so temperature increases with depth.
 - d. The Sun's energy is warming the interior of the Earth, so temperature decreases with depth.
19. Heat that is flowing through the outer-most solid layer of the Earth does so by:
- a. conduction
 - b. convection
 - c. radiation
 - d. none of these
20. Inside the Earth, the geothermal gradient is greatest (largest change in temperature with a change in depth) in areas of:
- a. conduction
 - b. convection
 - c. radiation
 - d. none of these
21. Which of the following is not a terrestrial source of energy?
- a. solar heating
 - b. radiogenic heat
 - c. accretionary heat
 - d. tidal heating
 - e. core formation
22. _____ is produced by the spontaneous breakdown, or decay, of radioactive elements such as uranium and thorium that are naturally occurring inside Earth.
- a. radiogenic heat
 - b. solar heating
 - c. accretionary heat
 - d. tidal heating
 - e. core formation
23. This is internal heat left over from the origins of Earth and other planets of our solar system:
- a. accretionary heat
 - b. radiogenic heat

- c. solar heating
 - d. tidal heating
 - e. core formation
24. Heat released from gravitational settling within the Earth and from liquid iron crystallizing into the solid core is called:
- a. core formation
 - b. accretionary heat
 - c. radiogenic heat
 - d. solar heating
 - e. tidal heating
25. Shortwave radiation energy from the Sun powers all of the following except:
- a. tides
 - b. winds
 - c. rainfall
 - d. ocean currents
 - e. waves
26. Which of the following materials has the highest albedo?
- a. snow
 - b. rocks
 - c. pavement
 - d. vegetation
27. Which of the following most accurately describes the Earth's energy cycle?
- a. Energy is received from the Sun, some is reflected back to space, and some is absorbed, degraded and eventually reradiated back to space.
 - b. Energy is received from the Sun, and all of it is absorbed, degraded and eventually reradiated back to space.
 - c. Energy is received from the Sun, and all of it is eventually reflected back to space.
 - d. Little energy is received from the Sun, and instead the surface is warmed through terrestrial energy sources.
28. Which of the following statements about the Earth's energy cycle is true?
- a. Incoming solar radiation and the terrestrial energy sources equal reflected solar radiation and emitted infrared radiation.
 - b. Incoming solar radiation and reflected solar radiation equal the terrestrial energy sources and emitted infrared radiation.
 - c. Incoming solar radiation and emitted infrared radiation equal reflected solar radiation and terrestrial energy sources.
 - d. Incoming solar radiation, reflected solar radiation and the terrestrial energy sources equal emitted infrared radiation.
29. Comparing the spectrum of radiation received from the Sun to the spectrum emitted by the Earth, which of the following statements is most true?
- a. The peak wavelength emitted by the Earth is higher than the peak for the Sun.
 - b. The peak wavelength emitted by the Earth is lower than the peak for the Sun.

- c. Some of the Earth's radiation is absorbed by the atmosphere, but this is not true for the Sun.
 - d. Some of the Sun's radiation is absorbed by the atmosphere, but this is not true for the Earth.
30. Which of the following is radiatively active gas?
- a. all of the above
 - b. ozone
 - c. water vapor
 - d. carbon dioxide
31. Which of the following is not a significant reservoir of heat in the Earth's energy cycle?
- a. oceans
 - b. glaciers
 - c. atmosphere
 - d. solid ground
 - e. all of the above are significant reservoirs
32. Which of the following selections give the correct order from highest to lowest for society's energy sources:
- a. fossil fuels, biomass energy, solar energy
 - b. biomass energy, fossil fuels, solar energy
 - c. fossil fuels, solar energy, biomass energy
 - d. biomass energy, solar energy, fossil fuels
 - e. solar energy, fossil fuels, biomass energy
33. Which of the following sources of energy is drawn from the Earth's own internal heat source?
- a. geothermal energy
 - b. solar energy
 - c. fossil fuels
 - d. tidal energy
 - e. nuclear energy
34. Which of the following statements is true about nuclear energy used for producing electricity?
- a. Nuclear energy is produced through the process of fission, while the Sun produces energy through the process of fusion
 - b. Nuclear energy is produced through the process of fusion, while the Sun produces energy through the process of fission
 - c. Nuclear energy and the Sun both use fission to produce energy
 - d. Nuclear energy and the Sun both use fusion to produce energy
35. Which power source is recovered from the potential energy of water?
- a. hydroelectric power
 - b. tidal power
 - c. wind power
 - d. solar power