

Chapter 2

Energy that Drives the Storms

Multiple Choice Exam Questions

1. Energy of motion is also known as:
 - a. dynamic energy.
 - b. kinetic energy.
 - c. sensible heat energy.
 - d. static energy.
 - e. latent heat energy.

ANSWER: b

2. Heat is energy in the process of being transferred from:
 - a. hot objects to cold objects.
 - b. low pressure to high pressure.
 - c. cold objects to hot objects.
 - d. high pressure to low pressure.
 - e. regions of low density toward regions of high density.

ANSWER: a

3. The heat energy released when water vapor changes to a liquid is called:
 - a. latent heat of evaporation.
 - b. latent heat of fusion.
 - c. latent heat of fission.
 - d. latent heat of condensation.

ANSWER: d

4. This is released as sensible heat during the formation of clouds:
 - a. potential energy
 - b. longwave radiation
 - c. latent heat
 - d. shortwave radiation
 - e. kinetic energy

ANSWER: c

5. The cold feeling that you experience after leaving a swimming pool on a hot, dry, summer day represents heat transport by:
 - a. conduction.
 - b. convection.
 - c. radiation.
 - d. latent heat.

ANSWER: d

6. The processes of condensation and freezing:
- a. both release sensible heat into the environment.
 - b. both absorb sensible heat from the environment.
 - c. do not affect the temperature of their surroundings.
 - d. do not involve energy transport.

ANSWER: a

7. The transfer of heat by molecule-to-molecule contact is:
- a. conduction.
 - b. convection.
 - c. radiation.
 - d. ultrasonic.

ANSWER: a

8. A heat transfer process in the atmosphere that depends upon the movement of air is:
- a. conduction.
 - b. absorption.
 - c. reflection.
 - d. convection.
 - e. radiation.

ANSWER: d

9. Snow will usually melt on the roof of a home that is a:
- a. good radiator of heat.
 - b. good conductor of heat.
 - c. poor radiator of heat.
 - d. poor conductor of heat.

ANSWER: b

10. The temperature of a rising air parcel:
- a. always cools due to expansion.
 - b. always warms due to expansion.
 - c. always cools due to compression.
 - d. always warms due to compression.
 - e. remains constant.

ANSWER: a

11. The proper order from shortest to longest wavelength is:

- a. visible, infrared, ultraviolet.
- b. infrared, visible, ultraviolet.
- c. ultraviolet, visible, infrared.
- d. visible, ultraviolet, infrared.
- e. ultraviolet, infrared, visible.

ANSWER: c

12. If the average temperature of the sun increased, the wavelength of peak solar emission would:
- a. shift to a shorter wavelength.
 - b. shift to a longer wavelength.
 - c. remain the same.
 - d. impossible to tell from given information

ANSWER: a

13. Which of the following determine(s) the kind (wavelength) and amount of radiation that an object emits?
- a. temperature
 - b. thermal conductivity
 - c. density
 - d. latent heat

ANSWER: a

14. Often before sunrise on a clear, calm, cold morning, ice (frost) can be seen on the tops of parked cars, even when the air temperature is above freezing. This condition happens because the tops of the cars are cooling by:
- a. conduction.
 - b. convection.
 - c. latent heat.
 - d. radiation.

ANSWER: d

15. Evaporation is a _____ process.
- a. cooling
 - b. heating
 - c. can't tell – it depends on the temperature
 - d. both a and c

ANSWER: a

16. If you want to keep an object cool while exposed to direct sunlight, you should:
- a. put it inside a brown paper bag.
 - b. wrap it in black paper.
 - c. wrap it in aluminum foil with the shiny side facing inward.
 - d. wrap it in aluminum foil with the shiny side facing outward.

ANSWER: d

17. The sun emits its greatest intensity of radiation in:
- the visible portion of the spectrum.
 - the infrared portion of the spectrum.
 - the ultraviolet portion of the spectrum.
 - the x-ray portion of the spectrum.

ANSWER: a

18. Air that rises always:
- contracts and warms.
 - contracts and cools.
 - expands and cools.
 - expands and warms.

ANSWER: c

19. If the earth's average surface temperature were to increase, the amount of radiation emitted from the earth's surface would _____ and the wavelength of peak emission would shift toward _____ wavelengths.
- increase, shorter
 - increase, longer
 - decrease, shorter
 - decrease, longer

ANSWER: a

20. Without the atmospheric greenhouse effect, the average surface temperature would be:
- higher than at present.
 - lower than at present.
 - the same as it is now.
 - much more variable than it is now.

ANSWER: b

21. Which of the following gases are mainly responsible for the atmospheric greenhouse effect in the earth's atmosphere?
- oxygen and nitrogen
 - nitrogen and carbon dioxide
 - ozone and oxygen
 - water vapor and carbon dioxide

ANSWER: d

22. The combined albedo of the earth and the atmosphere is approximately:
- a. 4%.
 - b. 10%.
 - c. 30%.
 - d. 50%.
 - e. 90%.

ANSWER: c

23. The albedo of the moon is 7%. This means that:
- a. 7% of the sunlight striking the moon is reflected.
 - b. 7% of the sunlight striking the moon is absorbed.
 - c. the moon emits only 7% as much energy as it absorbs from the sun.
 - d. 93% of the sunlight striking the moon is reflected.

ANSWER: a

24. On the average, about what percentage of the solar energy that strikes the outer atmosphere eventually reaches the earth's surface?
- a. 5%
 - b. 15%
 - c. 30%
 - d. 50%
 - e. 70%

ANSWER: d

25. If the amount of energy lost by the earth to space each year were not approximately equal to that received,
- a. the atmosphere's average temperature would change.
 - b. the length of the year would change.
 - c. the sun's output would change.
 - d. the mass of the atmosphere would change.

ANSWER: a

26. The earth's radiative equilibrium temperature is:
- a. the temperature at which the earth is absorbing solar radiation and emitting infrared radiation at equal rates.
 - b. the temperature at which the earth is radiating energy at maximum intensity.
 - c. the average temperature the earth must maintain to prevent the oceans from freezing solid.
 - d. the temperature at which rates of evaporation and condensation on the earth are in balance.

ANSWER: a

27. Suppose you are outside in very cold temperatures, wearing a winter coat that is quite effective at keeping you warm. Which of the following is true?
- a. The coat is the source of the heat that keeps you warm.
 - b. Your body generates the heat that keeps you warm.
 - c. The coat prevents your body's heat from escaping to the surrounding air.
 - d. both (a) and (c) are true.
 - e. both (b) and (c) are true.

ANSWER: e

28. During the winter in the Northern Hemisphere, the "land of the midnight sun" would be found:
- a. at high latitudes.
 - b. at middle latitudes.
 - c. near the equator.
 - d. in the desert southwest.
 - e. on the West Coast.

ANSWER: a

29. In the Northern Hemisphere, this day has the fewest hours of daylight:
- a. summer solstice
 - b. winter solstice
 - c. vernal equinox
 - d. autumnal equinox

ANSWER: b

True/False Exam Questions

1. During an equinox, the days and nights are of equal length except at the poles.

ANSWER: true

2. On December 22, the equator (0° latitude) would experience fewer hours of daylight than the latitude 60° N.

ANSWER: false

3. Considering each hemisphere as a whole, seasonal temperature variations in the Southern Hemisphere are greater than those in the Northern Hemisphere.

ANSWER: false

4. The fact that solar energy is spread over a larger area in northern latitudes helps to explain why even though these latitudes experience 24 hours of sunlight on June 22, they are not warmer than latitudes further south.

ANSWER: true

5. When it is January and winter in the Northern Hemisphere, it is July and summer in the Southern Hemisphere.

ANSWER: false

6. The most important reason why summers in the Southern Hemisphere are not warmer than summers in the Northern Hemisphere is that over 80% of the Southern Hemisphere is covered with water.

ANSWER: true

7. The changing distance between the earth and the sun over the course of the year is the main cause of the seasons.

ANSWER: false

8. Although the polar regions radiate away more heat energy than they receive by insolation in the course of a year, the insulating properties of snow prevents them from becoming progressively colder each year.

ANSWER: false

9. The latitude 90°N is closer to the earth's axis than the latitude 40°N.

ANSWER: true

10. More solar radiation is received at the top of the atmosphere than at the earth's surface.

ANSWER: true

Essay/Critical Thinking Exam Questions

1. The earth radiates energy constantly. What prevents the earth from getting colder and colder?
2. Will a rising parcel of air always expand? Why? How does this expansion affect the air temperature? Why?
3. Explain how energy in the form of sunlight absorbed at the ground could be transferred upward in the atmosphere in the form of latent heat. How or when is the latent heat energy released in the

air above the ground?

4. Describe the atmospheric greenhouse effect. Is there any difference between the way the atmospheric greenhouse effect works on a clear night and on a cloudy night?
5. How could clouds increase the surface temperature? How could clouds decrease the surface temperature?
6. When you remove a cold beverage from a refrigerator in a humid room, water vapor will condense on the sides of the container. Would this act to warm or cool the beverage, or would the condensation have no effect on the beverage's temperature?
7. Many people will blow on a bowl of hot soup to try to cool it. What are the two most important heat transport processes being used to cool the soup?
8. When you place an ice cube in your hand, the ice cube melts and your hand cools. List all the heat transport processes that are taking place.
9. Which wavelengths of radiation does your body radiate most: ultraviolet, visible or infrared? Why?
10. Describe why noontime shadows are longer in New York City than they are in Cancun, Mexico.