**Chapter 1**

**Earth and Its Atmosphere**

1. The primary source of energy for the earth's atmosphere is

|  |  |
| --- | --- |
| a. | energy from within the earth. |
| b. | the sun. |
| c. | erupting volcanoes. |
| d. | lightning discharges associated with thunderstorms. |
| e. | latent heat released during the formation of hurricanes. |

ANSWER: B

2. The most abundant gases in the earth's atmosphere by volume are

|  |  |
| --- | --- |
| a. | carbon dioxide and nitrogen. |
| b. | oxygen and water vapor. |
| c. | nitrogen and oxygen. |
| d. | oxygen and helium. |
| e. | oxygen and ozone. |

ANSWER: C

3. Water vapor is

|  |  |
| --- | --- |
| a. | a gas. |
| b. | a cloud droplet. |
| c. | a rain drop. |
| d. | a snowflake. |

ANSWER: A

4. In a volume of air near the earth's surface, \_\_\_\_ occupies 78 percent and \_\_\_\_ nearly 21 percent.

|  |  |
| --- | --- |
| a. | nitrogen, oxygen |
| b. | hydrogen, oxygen |
| c. | oxygen, hydrogen |
| d. | nitrogen, water vapor |
| e. | hydrogen, helium |

ANSWER: A

5. The earth's rotation has \_\_\_\_ to do with the behavior of atmospheric storms.

|  |  |
| --- | --- |
| a. | nothing |
| b. | little |
| c. | much |

ANSWER: C

6. Which of the following is considered a variable gas in the earth's atmosphere?

|  |  |
| --- | --- |
| a. | water vapor |
| b. | nitrogen |
| c. | oxygen |
| d. | argon |
| e. | helium |

ANSWER: A

7. The gas that shows the most variation from place to place and from time to time in the lower atmosphere is

|  |  |
| --- | --- |
| a. | ozone (O3). |
| b. | carbon dioxide (CO2). |
| c. | water vapor (H2O). |
| d. | methane (CH4). |
| e. | argon (Ar). |

ANSWER: C

8. Water vapor

|  |  |
| --- | --- |
| a. | is invisible. |
| b. | colors the sky blue. |
| c. | makes clouds white. |
| d. | is very small drops of liquid water. |

ANSWER: A

9. Typically, water vapor occupies about what percentage of the air's volume near the earth's surface?

|  |  |
| --- | --- |
| a. | about 78 percent |
| b. | about 21 percent |
| c. | close to 10 percent |
| d. | less than 4 percent |

ANSWER: D

10. The only substance near the earth's surface that is found naturally in the atmosphere as a solid, liquid, and a gas is

|  |  |
| --- | --- |
| a. | carbon dioxide. |
| b. | water. |
| c. | molecular oxygen. |
| d. | ozone. |
| e. | carbon. |

ANSWER: B

11. The most abundant greenhouse gas in the earth's atmosphere is

|  |  |
| --- | --- |
| a. | carbon dioxide (CO2). |
| b. | nitrous oxide (N2O). |
| c. | water vapor (H2O). |
| d. | methane (CH4). |
| e. | chlorofluorocarbons (CFCs). |

ANSWER: C

12. Since the turn of this century, CO2 in the atmosphere has

|  |  |
| --- | --- |
| a. | been increasing in concentration. |
| b. | been decreasing in concentration. |
| c. | remained at about the same concentration from year to year. |
| d. | disappeared entirely. |

ANSWER: A

13. Which of the following processes acts to remove carbon dioxide from the atmosphere?

|  |  |
| --- | --- |
| a. | lightning |
| b. | deforestation |
| c. | photosynthesis |
| d. | burning fossil fuels |

ANSWER: C

14. The primary source of oxygen for the earth's atmosphere during the past half billion years or so appears to be

|  |  |
| --- | --- |
| a. | volcanic eruptions. |
| b. | photosynthesis. |
| c. | photodissociation. |
| d. | exhalations of animal life. |
| e. | transpiration. |

ANSWER: B

15. \_\_\_\_ holds a planet's atmosphere close to its surface.

|  |  |
| --- | --- |
| a. | Radiation |
| b. | Gravity |
| c. | Cloud cover |
| d. | Moisture |
| e. | Pressure |

ANSWER: B

16. Much of Tibet lies at altitudes over 18,000 feet where the pressure is about 500 mb. At such altitudes, the Tibetans are above roughly

|  |  |
| --- | --- |
| a. | 10 percent of the air molecules in the atmosphere. |
| b. | 25 percent of the air molecules in the atmosphere. |
| c. | 50 percent of the air molecules in the atmosphere. |
| d. | 75 percent of the air molecules in the atmosphere. |
| e. | 90 percent of the air molecules in the atmosphere. |

ANSWER: C

17. The unit of pressure most commonly found on a surface weather map is

|  |  |
| --- | --- |
| a. | inches of mercury (Hg). |
| b. | millibars or hectopascals. |
| c. | pounds per square inch. |
| d. | millimeters of mercury (Hg). |

ANSWER: B

18. Which of the following weather elements ALWAYS decreases as we climb upward in the atmosphere?

|  |  |
| --- | --- |
| a. | wind |
| b. | temperature |
| c. | pressure |
| d. | moisture |
| e. | all of the above |

ANSWER: C

19. The gas responsible for the greenhouse effect on Venus is

|  |  |
| --- | --- |
| a. | carbon dioxide (CO2). |
| b. | oxygen (O2). |
| c. | ozone (O3). |
| d. | nitrogen (N2). |
| e. | water vapor (H2O). |

ANSWER: A

20. The planet with a strong greenhouse effect, whose surface temperature averages 480°C (900°F) is

|  |  |
| --- | --- |
| a. | Earth. |
| b. | Venus. |
| c. | Mars. |
| d. | Pluto. |

ANSWER: B

21. The earth's atmosphere is divided into layers based on the vertical profile of

|  |  |
| --- | --- |
| a. | air pressure. |
| b. | air temperature. |
| c. | air density. |
| d. | wind speed. |

ANSWER: B

22. Carbon dioxide is a naturally-occurring component of the atmosphere.

|  |  |
| --- | --- |
| a. | true |
| b. | false |

ANSWER: A

23. Almost all of the earth's weather occurs in the

|  |  |
| --- | --- |
| a. | exosphere. |
| b. | stratosphere. |
| c. | mesosphere. |
| d. | thermosphere. |
| e. | troposphere. |

ANSWER: E

24. The most abundant gas in the stratosphere is

|  |  |
| --- | --- |
| a. | oxygen (O2). |
| b. | nitrogen (N2). |
| c. | carbon dioxide (CO2). |
| d. | ozone (O3). |
| e. | chlorofluorocarbons (CFCs). |

ANSWER: B

25. The atmospheric layer in which we live is called the

|  |  |
| --- | --- |
| a. | troposphere. |
| b. | stratosphere. |
| c. | thermosphere. |
| d. | ionosphere. |
| e. | exosphere. |

ANSWER: A

26. The temperature of the tropopause

|  |  |
| --- | --- |
| a. | is close to the temperature at the earth's surface. |
| b. | is much colder than the temperature at the earth's surface. |
| c. | has never been measured. |
| d. | is much warmer than the temperature at the earth's surface. |
| e. | is nearly the same as the sun's temperature. |

ANSWER: B

27. In a temperature inversion

|  |  |
| --- | --- |
| a. | air temperature increases with increasing height. |
| b. | air temperature decreases with increasing height. |
| c. | air temperature remains constant with increasing height. |
| d. | it is warmer at night than during the day. |

ANSWER: A

28. The rate at which temperature decreases with increasing altitude is known as the

|  |  |
| --- | --- |
| a. | temperature slope. |
| b. | lapse rate. |
| c. | sounding. |
| d. | thermocline. |

ANSWER: B

29. Most of the ionosphere is found in what atmospheric layer?

|  |  |
| --- | --- |
| a. | troposphere |
| b. | stratosphere |
| c. | mesosphere |
| d. | thermosphere |

ANSWER: D

30. The gas that absorbs most of the harmful ultraviolet radiation in the stratosphere is

|  |  |
| --- | --- |
| a. | water vapor. |
| b. | nitrous oxide. |
| c. | carbon dioxide. |
| d. | ozone. |
| e. | chlorofluorocarbons. |

ANSWER: D

31. Which latitude belt best describes the middle latitudes?

|  |  |
| --- | --- |
| a. | 20° to 80° |
| b. | 10° to 35° |
| c. | 20° to 35° |
| d. | 40° to 70° |
| e. | 30° to 50° |

ANSWER: E

32. The word "weather" is defined as

|  |  |
| --- | --- |
| a. | the average of the weather elements. |
| b. | the climate of a region. |
| c. | the condition of the atmosphere at a particular time and place. |
| d. | any type of falling precipitation. |

ANSWER: C

33. The wind direction is

|  |  |
| --- | --- |
| a. | the direction from which the wind is blowing. |
| b. | the direction to which the wind is blowing. |
| c. | always directly from high toward low pressure. |
| d. | always directly from low toward high pressure. |

ANSWER: A

34. Meteorology is the study of

|  |  |
| --- | --- |
| a. | landforms. |
| b. | the oceans. |
| c. | the atmosphere. |
| d. | outer space. |
| e. | extraterrestrial meteoroids that enter the atmosphere. |

ANSWER: C

35. Middle latitude storms are also known as

|  |  |
| --- | --- |
| a. | anticyclones. |
| b. | hurricanes. |
| c. | extratropical cyclones. |
| d. | tornadoes. |

ANSWER: C

36. At night, when the weather is extremely cold and dry,

|  |  |
| --- | --- |
| a. | atmospheric pressure increases with increasing altitude. |
| b. | atmospheric pressure remains constant with increasing altitude. |
| c. | atmospheric pressure decreases with increasing altitude. |
| d. | atmospheric pressure first increases, then decreases with increasing altitude. |

ANSWER: C

37. In the middle latitudes of the Northern Hemisphere, surface winds tend to blow \_\_\_\_ and \_\_\_\_ around an area of surface low pressure.

|  |  |
| --- | --- |
| a. | clockwise; inward |
| b. | clockwise; outward |
| c. | counterclockwise; inward |
| d. | counterclockwise; outward |

ANSWER: C

38. The difference in altitude (i.e., the thickness) is greatest in the layer bounded by

|  |  |
| --- | --- |
| a. | 1 mb and 10 mb. |
| b. | 101 mb and 110 mb. |
| c. | 1001 mb and 1010 mb. |
| d. | impossible to determine |

ANSWER: A

39. On a weather map, sharp changes in temperature, humidity, and wind direction are marked by

|  |  |
| --- | --- |
| a. | a front. |
| b. | an anticyclone. |
| c. | a ridge. |
| d. | blowing dust. |

ANSWER: A

40. Which of the following is MOST likely associated with fair weather?

|  |  |
| --- | --- |
| a. | high pressure area |
| b. | low pressure area |
| c. | a cold front |
| d. | a warm front |

ANSWER: A

41. Which relates to weather rather than climate?

|  |  |
| --- | --- |
| a. | The average temperature for the month of January is 28°F. |
| b. | The lowest temperature ever recorded in Frozenlake, Minnesota is -57°F. |
| c. | The foggiest month of the year is December. |
| d. | I like the warm, humid summers. |
| e. | Outside it is cloudy and snowing. |

ANSWER: E

42. In an average year, more people die from \_\_\_\_ than from any other natural disaster.

|  |  |
| --- | --- |
| a. | lightning |
| b. | earthquakes |
| c. | tornadoes |
| d. | flash floods and flooding |
| e. | droughts |

ANSWER: D

43. At the 500 mb level, the amount of oxygen inhaled in a single breath is \_\_\_\_ of that inhaled at sea-level.

|  |  |
| --- | --- |
| a. | about the same |
| b. | about one-quarter |
| c. | about one-half |
| d. | about three-quarters |

ANSWER: C

44. The ozone hole is an actual hole in the atmosphere, a region of complete vacuum.

|  |  |
| --- | --- |
| a. | true |
| b. | false |

ANSWER: B

45. Ozone in the stratosphere

|  |  |
| --- | --- |
| a. | is a health hazard for people with respiratory illnesses. |
| b. | protects life from harmful ultraviolet radiation. |
| c. | is one of the main ingredients of photochemical smog. |
| d. | b and c |

ANSWER: B

46. If you were to take a breath of pure oxygen, from a tank, you'd be getting about \_\_\_\_ the amount of oxygen you'd get by taking a normal breath of our atmosphere.

|  |  |
| --- | --- |
| a. | one-fifth |
| b. | half |
| c. | twice |
| d. | three times |
| e. | five times |

ANSWER: E

47. Standing at the top of a tall mountain, a breath of air would contain a lot fewer molecules than a breath of air taken at sea level. But the proportion of oxygen in the two breaths of air, relative to the other constituents, would remain the same.

|  |  |
| --- | --- |
| a. | true |
| b. | false |

ANSWER: A

48. There is a lot of mixing and overturning of air in which of the following atmospheric layers?

|  |  |
| --- | --- |
| a. | stratosphere |
| b. | troposphere |
| c. | mesosphere |

ANSWER: B

49. As a radiosonde balloon ascends through the atmosphere, the balloon

|  |  |
| --- | --- |
| a. | contracts. |
| b. | expands. |
| c. | maintains a constant pressure. |

ANSWER: B

50. Atmospheric storm systems can be

|  |  |
| --- | --- |
| a. | only a few meters wide. |
| b. | about a kilometer wide. |
| c. | several hundred kilometers wide. |
| d. | all of the above |

ANSWER: D

**Essay Exam Questions**

1. Compare and contrast the Earth’s atmosphere with the atmospheres of two other planets.

2. Describe the various types of storms found in the earth's atmosphere. Can you find any correlation between storm size and storm duration? What factors might determine a storm's severity?

3. What instruments are used in meteorology? What role did the discovery of instruments play in the emergence of the science of meteorology?

4. Briefly describe some of the historical events that helped meteorology progress as a natural science from Aristotle to the present day.

5. Under what circumstances might a person breathe stratospheric air? How often is it likely to happen in a student's lifetime?

6. What causes air pressure? Why does air pressure decrease with increasing altitude?

7. Describe some of the processes that release and remove carbon dioxide from the atmosphere. Is there any evidence that suggests that these processes are not in balance?

8. There is currently concern that the amount of ozone in the stratosphere may be decreasing. Why would a decrease in ozone concentration be important? Describe some of the effects that a decrease in ozone concentration might have.

9. If the air temperature at the surface (0 feet) is 60°F, what would be the approximate air temperature at an altitude of 10,000 feet, assuming an average atmospheric lapse rate of 3.6°F per 1000 feet?

10. Draw a diagram showing how air temperature normally changes with height. Begin at the ground and end in the upper thermosphere. Be sure to label the four main layers. Give one important characteristic of each layer. Where on your diagram would the top of Mt. Everest, the ozone layer, and the ionosphere be found?

11. What are the principal gaseous components of the earth's atmosphere? Where do scientists believe these gases came from?

12. Why is there very little water vapor above the tropopause?

13. What information might you find on a surface weather map that is not readily apparent on a satellite photograph? What information could a satellite photograph provide that a surface chart could not?

14. Explain briefly why it is possible to transmit AM radio waves over larger distances at night than during the day.

15. Describe the relationship between gravity and weight.