Chapter 1
The Earth's Atmosphere

Multiple Choice Exam Questions

1. 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

2. Which of the following gases could be found in the atmosphere with a concentration greater than 1%?
   a. hydrogen (H)
   b. water vapor (H_2O)
   c. carbon dioxide (CO_2)
   d. ozone (O_3)

ANSWER: b

3. In a volume of air near the earth's surface, ___ occupies 78% and ___ nearly 21%.
   a. nitrogen, oxygen
   b. hydrogen, oxygen
   c. oxygen, hydrogen
   d. nitrogen, water vapor
   e. hydrogen, helium

ANSWER: a

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

ANSWER: a

5. The only substance near the earth's surface that is found naturally in the atmosphere as a solid, liquid, and a gas.
   a. carbon dioxide
   b. water
   c. molecular oxygen
   d. ozone
   e. methane

ANSWER: b

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. all of the above

ANSWER: a

7. The gas that shows the most variation in concentration from place to place and from time to time in the lower atmosphere.
   a. ozone (O_3)
   b. carbon dioxide (CO_2)
   c. water vapor (H_2O)
   d. methane (CH_4)
   e. argon (Ar)

ANSWER: c

8. The concentration of this gas in the atmosphere can range from about 0% to near 3 or 4%.
   a. oxygen (O_2)
   b. ozone (O_3)
   c. carbon dioxide (CO_2)
   d. water vapor (H_2O)

ANSWER: d

9. In the atmosphere, tiny solid or liquid suspended particles of various composition are called
   a. aerosols.
   b. carcinogens.
   c. greenhouse gases.
   d. fog.

ANSWER: a

10. Since the turn of this century, CO_2 in the atmosphere has
    a. disappeared entirely.
    b. been decreasing in concentration.
    c. remained at about the same concentration from year to year.
    d. been increasing in concentration.

ANSWER: d

11. The concentration of carbon dioxide (CO_2) in the atmosphere is relatively low compared to some of the other constituents. CO_2 is important none the less because
    a. it dissolves in water to form acid rain.
    b. it is a greenhouse gas.
    c. it is the main ingredient in photochemical smog.
    d. it is toxic.

ANSWER: b

12. This greenhouse gas is used as a refrigerant, a solvent, and during the manufacture of foam.
    a. water vapor (H_2O)
    b. carbon dioxide (CO_2)
    c. methane (CH_4)
    d. nitrous oxide (N_2O)
    e. chlorofluorocarbons (CFCs)

ANSWER: e

13. The most abundant greenhouse gas in the earth's atmosphere is
    a. carbon dioxide (CO_2).
    b. nitrous oxide (N_2O).
    c. water vapor (H_2O).
    d. methane (CH_4).
    e. chlorofluorocarbons (CFCs).

ANSWER: c

24. When chlorofluorocarbons are subjected to ultraviolet radiation, ozone-destroying ___ is released.
    a. chlorine
    b. nitrogen
    c. carbon dioxide
    d. carbon

e. water vapor

ANSWER: a

15. About 97% of the ____ in the atmosphere is found in the stratosphere where it absorbs the sun's ultraviolet rays.
a. water vapor
b. nitrous oxide
c. carbon dioxide
d. ozone
e. chlorofluorocarbons

ANSWER: d

16. What gas is produced naturally in the stratosphere and is also a primary component of photochemical smog in polluted air at the surface?
a. carbon dioxide
b. carbon monoxide
c. ozone
d. nitrogen dioxide
e. hydrocarbons

ANSWER: c

17. The so-called "ozone hole" is observed above
a. the equator.
b. the continent of Australia.
c. the continent of Antarctica.
d. the continent of Asia.

ANSWER: c

18. The earth's first atmosphere was composed primarily of
a. carbon dioxide and water vapor.
b. hydrogen and helium.
c. oxygen and water vapor.
d. argon and nitrogen.

ANSWER: b

19. The primary source of the oxygen in 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

20. This holds a planet's atmosphere close to its surface.
a. solar radiation
b. gravity
c. cloud cover
d. moisture
e. temperature

ANSWER: b

21. Much of Tibet lies at altitudes over 18,000 feet where the pressure is about 500 mb. At such altitudes, the Tibetans live above roughly
a. 10% of the air molecules in the atmosphere.
b. 25% of the air molecules in the atmosphere.
c. 50% of the air molecules in the atmosphere.
d. 75% of the air molecules in the atmosphere.

ANSWER: c

22. Which of the following weather elements <u>always</u> decreases as we climb upward in the atmosphere?
a. wind
b. temperature
c. pressure
d. moisture
e. all of the above

ANSWER: c

23. At jet aircraft cruising altitude (33,000 ft. or about 10 km) you are
a. near the top of the stratosphere.
b. near the top of the troposphere.
c. above the ozone layer.
d. in the ionosphere.

ANSWER: b

24. Almost all of the earth's weather occurs in the
    a. exosphere.
    b. stratosphere.
    c. mesosphere.
    d. thermosphere.
    e. troposphere.

ANSWER: e

25. The earth's atmosphere is divided into layers based on changes in the vertical profile of
    a. air temperature.
    b. air pressure.
    c. air density.
    d. wind speed.

ANSWER: a

26. 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

27. About 97% of all ozone in the atmosphere is found in the
    a. stratosphere.
    b. troposphere.
    c. exosphere.
    d. thermosphere.

ANSWER: a

28. 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.

ANSWER: b

29. A radiosonde
    a. is used to monitor surface weather conditions in remote areas.

b. uses radio waves to determine the height of the ionosphere.
c. is carried aloft by balloon and measures weather conditions above the ground.
d. measures water flow in stream beds during flash floods.

ANSWER: c

30. ___ has a major effect on radio communications.
a. Air pressure
b. The ozone layer
c. The ionosphere
d. Air density

ANSWER: c

31. The horizontal movement of air is the weather element
a. temperature.
b. pressure.
c. wind.
d. humidity.

ANSWER: c

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. Storms vary in size (diameter). Which list below arranges storms from largest to smallest?
a. hurricane, tornado, middle latitude cyclone, thunderstorm
b. hurricane, middle latitude cyclone, thunderstorm, tornado
c. middle latitude cyclone, tornado, hurricane, thunderstorm
d. middle latitude cyclone, hurricane, thunderstorm, tornado

ANSWER: d

35. A tropical storm system whose winds are in excess of 74 mi/hr is called a(n)
    a. anticyclone.
    b. tornado.
    c. extratropical cyclone.
    d. hurricane.

ANSWER: d

36. Middle latitude storms are also known as
    a. anticyclones.
    b. hurricanes.
    c. extratropical cyclones.
    d. tornadoes.

ANSWER: c

37. A towering cloud, or cluster of clouds, accompanied by thunder, lightning, and strong gusty winds.
    a. hurricane
    b. trough
    c. thunderstorm
    d. tornado

ANSWER: c

38. 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

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. Areas of high atmospheric pressure are also known as
a. hurricanes.
b. middle latitude cyclonic storms.
c. troughs.
d. tornadoes.
e. anticyclones.

ANSWER: e

41. The letters H and L on a surface weather map refer to high and low
a. temperature.
b. altitude.
c. pressure.
d. latitude.

ANSWER: c

42. 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

43. Clouds often form in the
a. rising air in the center of a low pressure area.
b. rising air in the center of a high pressure area.
c. sinking air in the center of a low pressure area.
d. sinking air in the center of a high pressure area.

ANSWER: a

44. The altitude of the troposphere over Honolulu, Hawaii is _____ the altitude of the troposphere over Fairbanks, Alaska.
a. lower than
b. higher than
c. the same as

ANSWER: b

45. Breathing nitrogen gas is _____ to your health.

a. a little harmful
b. harmful
c. very harmful
d. not harmful

ANSWER: d

46. When we exhale, our breath _____ greenhouse gases.
a. does not contain any
b. contains some
c. contains only

ANSWER: b

47. If you're looking for an ozone hole, your best bet would be to go to
a. Los Angeles
b. Denver
c. Chicago
d. the stratosphere

ANSWER: d

48. The atmosphere, which is composed mostly of gases, has _____ mass.
a. no
b. very little
c. a lot of

ANSWER: c

49. Which of the following cities is in the middle latitudes?
a. Quito, Ecuador
b. Panama City, Panama
c. Barrow, Alaska
d. Chicago, Illinois

ANSWER: d

50. Extratropical cyclones are found _____
a. inside the tropics
b. outside the tropics
c. both inside and outside the tropics
d. neither inside nor outside the tropics

ANSWER: b

True/False Exam Questions

1. On a cloudless day, the tropopause is easily visible with the naked eye. (ans: FALSE)

2. The concentrations of nitrogen, oxygen, and water vapor show very little variation in concentration from place to place and from time to time in the lower atmosphere. (ans: FALSE)

3. Most of the water vapor in the atmosphere is thought to have come from the earth's hot interior. (ans: TRUE)

4. Carbon dioxide concentrations have increased nearly 250% since the early 1800s. (ans: FALSE)

5. While carbon dioxide concentrations are increasing, the concentrations of other greenhouse gases such as methane are decreasing. (ans: FALSE)

6. While the atmosphere absorbs dangerous ultraviolet radiation, it is too thin to protect surface inhabitants from meteors and other solid objects coming from space. (ans: FALSE)

7. Chlorofluorocarbons (CFCs) play a role in stratospheric ozone destruction and are also greenhouse gases. (ans: TRUE)

8. The atmosphere's first oxygen is thought to have come from the splitting of water vapor molecules by solar radiation. (ans: TRUE)

9. Sea-level pressure is determined by both the amount of air in the atmosphere and the strength of the earth’s gravity. (ans: TRUE)

10. Air temperatures in the thermosphere are higher than at the ground because sunlight energy is absorbed and shared by relatively few atoms and molecules. (ans: TRUE)

Word Choice Exam Questions

1. 99% of the air in the atmosphere is found in a layer that is much THICKER than, much THINNER than, about the SAME thickness as the diameter of the earth. (circle one answer) (ans: THINNER)

2. Are the highest water vapor concentrations found in TROPICAL or POLAR regions? (circle one answer) (ans: TROPICAL)

3. It is the observed steady INCREASE DECREASE in OZONE CARBON DIOXIDE concentrations that has lead to concern over global warming. (choose one word from each pair). (ans: INCREASE, CARBON DIOXIDE)

4. There is currently concern about INCREASING DECREASING ozone concentrations in the troposphere and INCREASING DECREASING concentrations of ozone in the stratosphere. (choose one word from each pair). (ans: INCREASING, DECREASING)

5. Peak ozone (0_3) concentrations are found in the stratosphere near 25 km altitude. Would you expect to find the highest molecular oxygen (0_2) concentrations at HIGHER, LOWER, or the SAME altitude? (circle one answer) (ans: LOWER)

6. Sea level pressure is determined by the COMPOSITION WEIGHT THICKNESS of the atmosphere. (circle one answer) (ans: WEIGHT)

7. Would you expect to find the strongest vertical air motions in the TROPOSPHERE or in the STRATOSPHERE? (circle one answer) (ans: TROPOSPHERE)

8. AM radio waves are able to propagate a LONGER SHORTER distance at night than they do during the day because of WEAKENING STRENGTHENING of the lower D layer in the ionosphere. (choose one word from each pair) (ans: LONGER, WEAKENING)

9. Clear skies occurs in regions where the surface pressure is HIGH LOW and the air is RISING SINKING. (choose one word from each pair) (ans: HIGH, SINKING)

10. Vertical profiles of TEMPERATURE POLLUTION are measured by RADAR RADIOSONDE) (ans: TEMPERATURE, RADIOSONDE)

Short Answer Exam Questions

1. Without _____in the atmosphere we would only survive for a few minutes.
(ans: OXYGEN)

2. Because these atmospheric constituents absorb a portion of the earth's outgoing radiant energy, _____ play a significant role in the earth's heat-energy budget.
(ans: GREENHOUSE GASES)

3. The most abundant greenhouse gas in the earth's atmosphere is _____
(ans: WATER VAPOR)

4. The white clouds that form over active volcanoes indicate that they release large amounts of this common atmospheric constituent.
(ans: WATER VAPOR)

5. Outside an airplane at 30,000 feet altitude (about 10 km), the air temperature would be _____, the air pressure would be _____and the air density would be _____than(as) at sea level. (fill in each blank with HIGHER, LOWER, or the SAME)
(ans: LOWER, LOWER, LOWER)

6. 10. _____is defined as the mass of an object multiplied by the acceleration of gravity.
(ans: WEIGHT)

7. The basis for dividing the earth's atmosphere into layers is the change of _____ with altitude.
(ans: TEMPERATURE)

8. The word _____ refers to the "average weather" observed over a period of many years.
(ans: CLIMATE)

9. _____ has the ability to peer into severe thunderstorms and unveil their winds.
(ans: DOPPLER RADAR)

10. Air pressure _____ with increasing altitude in the atmosphere of Venus.
(ans: DECREASES)

Essay Exam Questions

1. Why does air pressure always decrease with increasing altitude?

2. What can infrared satellite images tell us about clouds?

3. Are the largest storms the most destructive ones? Why or why not?

4. What is the role of the ionosphere?

5. What is the difference between weather and climate?

6. What factors determine a storm's severity?

7. What information does a surface weather map provide about the weather?

8. Explain how ozone might be thought to have both a beneficial and a detrimental role in the earth's atmosphere.

9. Describe the various types of storms found in the earth's atmosphere. Can you find any correlation between storm size and storm duration?

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

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

12. What role does deforestation play in the current concern over global warming?

13. What causes air pressure? Is there air pressure on the moon?

14. 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?

15. There is currently concern that the amount of ozone in the stratosphere may be decreasing. Why would a decrease in ozone concentration be important?

16. 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?

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

18. Explain why the invention of the telegraph should have resulted in more accurate weather predictions.

19. What information might you find on a surface weather map that is not readily apparent on a satellite image?

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