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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. Earth's first atmosphere (approximately 4.6 billion years ago) was most likely composed of \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | nitrogen and oxygen | |  | b. | hydrogen and helium | |  | c. | carbon dioxide and nitrogen | |  | d. | oxygen and carbon dioxide |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2. The primary source of water vapor and carbon dioxide for Earth’s early atmosphere was most likely \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | photosynthesis | |  | b. | ozone reactions | |  | c. | outgassing | |  | d. | nitrogen chemical reactions |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3. The most abundant gases in Earth's present day atmosphere (by volume) are \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | carbon dioxide and nitrogen | |  | b. | oxygen and water vapor | |  | c. | nitrogen and oxygen | |  | d. | oxygen and helium |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 4. Near Earth’s surface, \_\_\_\_ occupies about 78% and \_\_\_\_ about 21% of the total volume of dry air.   |  |  |  | | --- | --- | --- | |  | a. | nitrogen; oxygen | |  | b. | hydrogen; oxygen | |  | c. | oxygen; hydrogen | |  | d. | nitrogen; water vapor |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 5. Atmospheric concentrations of \_\_\_\_ can vary significantly depending on time and location.   |  |  |  | | --- | --- | --- | |  | a. | hydrogen | |  | b. | water vapor | |  | c. | helium | |  | d. | argon |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. The only substance found naturally in the lower atmosphere that can exist as a solid, a liquid, and a gas is \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | carbon dioxide | |  | b. | water | |  | c. | methane | |  | d. | ozone |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7. Which chemical process is an example of condensation?   |  |  |  | | --- | --- | --- | |  | a. | water vapor formation | |  | b. | cloud droplet formation | |  | c. | photosynthesis | |  | d. | ice formation |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 8. The greenhouse effect is directly enhanced by \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | photosynthesis | |  | b. | energy absorption by atmospheric water vapor particles | |  | c. | chemical weathering | |  | d. | carbon dioxide dissolution in the oceans |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 9. Carbon dioxide is removed from the atmosphere through the process of \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | fuel combustion | |  | b. | respiration | |  | c. | volcanic activity | |  | d. | photosynthesis |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 10. Average atmospheric CO2 concentrations have \_\_\_\_ over the past 100 years.   |  |  |  | | --- | --- | --- | |  | a. | slightly decreased | |  | b. | remained constant | |  | c. | significantly decreased | |  | d. | increased |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 11. Which gas in the upper atmosphere shields Earth’s surface from the sun’s harmful ultraviolet rays?   |  |  |  | | --- | --- | --- | |  | a. | nitrogen | |  | b. | methane | |  | c. | ozone | |  | d. | chlorofluorocarbons |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 12. Tiny solid or liquid particles of various compositions that are suspended in the atmosphere are called \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | aerosols | |  | b. | carcinogens | |  | c. | greenhouse gases | |  | d. | chlorofluorocarbons |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 13. The "ozone hole" is observed above \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | the equator | |  | b. | Australia | |  | c. | Antarctica | |  | d. | Asia |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 14. In sunlight, nitrogen dioxide reacts with hydrocarbons and other gases to produce \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | weather elements | |  | b. | surface ozone | |  | c. | the ionosphere | |  | d. | pollution |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 15. The vertical profile of \_\_\_\_ is variable in each layer of Earth’s atmosphere.   |  |  |  | | --- | --- | --- | |  | a. | air temperature | |  | b. | air pressure | |  | c. | altitude | |  | d. | air density |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 16. In a temperature inversion, air temperature \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | increases with increasing height | |  | b. | decreases with increasing height | |  | c. | increases with decreasing height | |  | d. | remains constant with increasing height |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 17. A radiosonde \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | measures particulate matter in the atmosphere | |  | b. | monitors surface weather conditions in remote areas | |  | c. | measures the vertical distribution of atmospheric temperature, pressure, and humidity | |  | d. | uses radio waves to determine the height of the ionosphere |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 18. All of the weather we are familiar with on Earth occurs in the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | exosphere | |  | b. | stratosphere | |  | c. | mesosphere | |  | d. | troposphere |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 19. Jet streams are found within the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | thermosphere | |  | b. | tropopause | |  | c. | stratopause | |  | d. | exosphere |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 20. Which gas is responsible for the temperature inversion in the stratosphere?   |  |  |  | | --- | --- | --- | |  | a. | carbon dioxide | |  | b. | nitrogen | |  | c. | ozone | |  | d. | argon |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 21. Air density is greatest in the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | heterosphere | |  | b. | thermosphere | |  | c. | ionosphere | |  | d. | homosphere |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 22. The thermosphere is where charged particles from the sun interact with air molecules to produce \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | ozone | |  | b. | auroras | |  | c. | radio waves | |  | d. | humidity |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 23. The exosphere is \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | where jet streams are found | |  | b. | the ozone layer | |  | c. | the upper limit of our atmosphere | |  | d. | where air density is greatest |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 24. What is a region in the atmosphere where air temperature remains constant with height?   |  |  |  | | --- | --- | --- | |  | a. | temperature inversion | |  | b. | jet stream | |  | c. | isothermal zone | |  | d. | hypoxic zone |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 25. The majority of atmospheric ozone (about 97%) is found in the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | thermosphere | |  | b. | mesosphere | |  | c. | stratosphere | |  | d. | exosphere |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 26. What is the weather element that involves the horizontal movement of air?   |  |  |  | | --- | --- | --- | |  | a. | air temperature | |  | b. | air pressure | |  | c. | wind | |  | d. | humidity |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 27. The word "weather" is defined as\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | the frequency of precipitation or other events | |  | b. | any type of falling precipitation | |  | c. | the condition of the atmosphere at any particular time and place | |  | d. | the general climate of a region |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 28. The term “meteorology” goes back to the Greek philosopher Aristotle, who, about 340 B.C., wrote a book called \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | *Weather and Climate* | |  | b. | *Meteorologica* | |  | c. | *Extraordinary Weather* | |  | d. | *Meteorology Today* |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 29. A tropical storm system with winds in excess of 74 mi/hr in the eastern Pacific is called a(n) \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | anticyclone | |  | b. | tornado | |  | c. | extratropical cyclone | |  | d. | hurricane |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 30. Middle-latitude cyclonic storm systems are also known as \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | anticyclones | |  | b. | hurricanes | |  | c. | extratropical cyclones | |  | d. | tornadoes |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 31. A towering cloud, or cluster of clouds, accompanied by thunder, lightning, strong gusty winds, and heavy rain is called a(n) \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | hurricane | |  | b. | cyclone | |  | c. | thunderstorm | |  | d. | tornado |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 32. 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 | |

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| 33. Many common sayings about the weather, such as “red sky at morning, sailor take warning; red sky at night, sailor’s delight” are rooted in \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | careful observations | |  | b. | forming a hypothesis | |  | c. | careful experimentation | |  | d. | posing a question |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 34. Areas of high atmospheric pressure are also known as \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | hurricanes | |  | b. | anticyclones | |  | c. | troughs | |  | d. | tornadoes |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 35. The letters H and L on a surface weather map refer to regions of high and low \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | temperature | |  | b. | winds | |  | c. | pressure | |  | d. | latitude |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 36. What pattern is most likely associated with clear skies and fair weather?   |  |  |  | | --- | --- | --- | |  | a. | high pressure regions | |  | b. | low pressure regions | |  | c. | a cold front | |  | d. | a warm front |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 37. Clouds often form in \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | 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 | |

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| 38. Extratropical cyclones are found \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | inside the tropics | |  | b. | outside the tropics | |  | c. | at the equator | |  | d. | both inside and outside the tropics |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 39. You are facing north and the wind is blowing in your face. This wind would be called a(n) \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | south wind | |  | b. | east wind | |  | c. | north wind | |  | d. | southerly wind |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 40. Lines of latitude on a map represent the distance \_\_\_\_ from the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | east or west; prime meridian | |  | b. | north or south; equator | |  | c. | north or south; prime meridian | |  | d. | east or west; equator |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 41. Molecular oxygen (O2) in Earth’s early atmosphere probably originated from the splitting of water vapor (H2O) into hydrogen and oxygen.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 42. Methane (CH4), nitrous oxide (N2O), and chlorofluorocarbons (CFCs) are greenhouse gases.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| 43. The air pressure at the summit of Mount Everest is higher than the air pressure at sea level.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| 44. On a cloudless day, the tropopause is easily visible with the naked eye.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 45. Weather and climate have become so much a part of our lives that the first thing many of us do in the morning is listen to the local weather forecast. For this reason, many radio and television newscasts require that the weathercaster be certified by the American Meteorological Society (AMS).   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

|  |
| --- |
| **Instructions:** Choose one answer from each pair of selections. |

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| --- | --- | --- |
| 46. Chlorofluorocarbons (CFCs) cause destruction to ozone through the release of SULFURIC ACID | CHLORINE.   |  |  | | --- | --- | | *ANSWER:* | CHLORINE | |

|  |  |  |
| --- | --- | --- |
| 47. A cyclonic storm system in the Northern Hemisphere has winds spinning CLOCKWISE | COUNTERCLOCKWISE about its center.   |  |  | | --- | --- | | *ANSWER:* | TROPICAL | |

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| --- | --- | --- |
| 48. The burning of coal and oil can release SULFUR | NITROGEN gases into the atmosphere that may transform into acid rain.   |  |  | | --- | --- | | *ANSWER:* | SULFUR | |

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| 49. Air density is greatest in the UPPER | LOWER atmosphere.   |  |  | | --- | --- | | *ANSWER:* | LOWER | |

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| --- | --- | --- |
| 50. Sea level pressure is determined by the WEIGHT | HEIGHT of the atmosphere.   |  |  | | --- | --- | | *ANSWER:* | WEIGHT | |

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| --- | --- | --- |
| 51. Peak ozone (O3) concentrations are found in the stratosphere near 25 km altitude. Would you expect to find the highest molecular oxygen (O2) concentrations at HIGHER or LOWER altitude?   |  |  | | --- | --- | | *ANSWER:* | LOWER | |

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| --- | --- | --- |
| 52. Would you expect to find the strongest vertical air motions in the TROPOSPHERE or in the STRATOSPHERE?   |  |  | | --- | --- | | *ANSWER:* | TROPOSPHERE | |

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| --- | --- | --- |
| 53. Clear skies occur in high pressure regions where the air is RISING | SINKING.   |  |  | | --- | --- | | *ANSWER:* | SINKING | |

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| --- | --- | --- |
| 54. If the weather forecast predicts the arrival of a warm front to your area for the weekend, should you expect RAIN or CLEAR SKIES?   |  |  | | --- | --- | | *ANSWER:* | RAIN | |

|  |  |  |
| --- | --- | --- |
| 55. Would you expect wind speeds to DECREASE or INCREASE when a frontal system passes?   |  |  | | --- | --- | | *ANSWER:* | INCREASE | |

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| 56. Scientists pose hypotheses, or informed predictions about how our natural world will behave, using the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ method.   |  |  | | --- | --- | | *ANSWER:* | scientific | |

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| 57. Plant photosynthesis increased the concentration of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in Earth’s early atmosphere.   |  |  | | --- | --- | | *ANSWER:* | oxygen | |

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| 58. Earth’s atmospheric pressure always \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with increasing height.   |  |  | | --- | --- | | *ANSWER:* | decreases | |

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| 59. The basis for dividing Earth's atmosphere into layers is the change of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with altitude.   |  |  | | --- | --- | | *ANSWER:* | temperature | |

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| 60. Meteorologists use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radar to observe the winds and precipitation intensities associated with severe thunderstorms.   |  |  | | --- | --- | | *ANSWER:* | Doppler | |

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| 61. Explain how ozone (O3) can play both a beneficial and a detrimental role in the earth's atmosphere.   |  |  | | --- | --- | | *ANSWER:* | At Earth’s surface, ozone (O3) is the primary ingredient of photochemical smog, which irritates the eyes and throat and damages vegetation. But the majority of atmospheric ozone (about 97 percent) is found in the upper atmosphere (stratosphere) where it is formed naturally, as oxygen atoms combine with oxygen molecules. Here, the concentration of ozone averages less than 0.002 percent by volume. This small quantity is important, however, because it shields plants, animals, and humans from the sun’s harmful ultraviolet rays. It is ironic that ozone, which damages plant life in a polluted environment, provides a natural protective shield in the upper atmosphere so that plants on the surface may survive. | |

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| 62. Describe how deforestation affects the concentration of CO2 in the earth’s atmosphere.   |  |  | | --- | --- | | *ANSWER:* | The removal of CO2 from the atmosphere takes place during photosynthesis, as plants consume CO2  to produce green matter. Deforestation increases CO2 in the atmosphere as timber is cut. If forests are burned or left to rot, it then releases CO2 directly into the air, perhaps accounting for about 10 percent of the observed increase. | |

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| 63. Explain why oxygen-breathing equipment would be needed in mesospheric air even though it contains the same composition of gases that is found at the earth’s surface.   |  |  | | --- | --- | | *ANSWER:* | The air in the mesosphere is extremely thin and the atmospheric pressure is quite low. Even though the percentage of nitrogen and oxygen in the mesosphere is about the same as it is at Earth’s surface, a breath of mesospheric air contains far fewer oxygen molecules than a breath of tropospheric air. At this level, without proper oxygen-breathing equipment, the brain would soon become oxygen-starved—a condition known as hypoxia—and suffocation would result. | |

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| 64. What is the difference between weather and climate?   |  |  | | --- | --- | | *ANSWER:* | Weather is the condition of the atmosphere at any particular time and place. Weather is always changing and is comprised of the elements of air temperature, air pressure, humidity, clouds, precipitation, visibility, and wind. The climate of a particular region would be its “average weather”. Climate represents the accumulation of daily and seasonal weather events over a long period of time. | |

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| 65. Explain the differences in air motion within a low pressure system and a high pressure system.   |  |  | | --- | --- | | *ANSWER:* | Horizontal pressure differences create a force that starts the air moving from higher pressure toward lower pressure. Because of the earth’s rotation, the winds are deflected from their path toward the right in the Northern Hemisphere. This deflection causes the winds to blow clockwise and outward from the center of the highs, and counterclockwise and inward toward the center of the lows. As the surface air spins into the low, it flows together and is forced upward, like toothpaste squeezed out of an upward-pointing tube. The rising air cools, and the water vapor in the air condenses into clouds. In regions of high pressure, skies are generally clear. As the surface air flows outward away from the center of a high, air sinking from above must replace the laterally spreading surface air. Since sinking air does not usually produce clouds, we find generally clear skies and fair weather associated with the regions of high atmospheric pressure. | |

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| ​*Match the atmospheric term with the appropriate description.*   |  |  | | --- | --- | | a. | ​The air is extremely thin and the atmospheric pressure is quite low. The percentage of nitrogen and oxygen in this layer is about the same as it is at Earth’s surface, but contains far fewer oxygen molecules. | | b. | ​In this layer, collisions between gas molecules and atoms are so infrequent that fast-moving lighter molecules can actually escape Earth’s gravitational pull, and shoot off into space. | | c. | ​This layer is well stirred and contains all of the weather that we are familiar with on Earth and where temperature decreases with height. | | d. | ​In this layer, oxygen molecules (O2) absorb energetic solar rays making it the warmest part of the atmosphere. This is also the location where the bulk of the ionosphere lies. | | e. | In this layer, air temperature begins to increase with height producing a temperature inversion, which reduces the amount of vertical motion. This is also the layer in which the ozone layer lies. | |

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| 66. ​troposphere   |  |  | | --- | --- | | *ANSWER:* | c | |

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| 67. ​stratosphere   |  |  | | --- | --- | | *ANSWER:* | e | |

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| 68. ​mesosphere   |  |  | | --- | --- | | *ANSWER:* | a | |

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| 69. ​thermosphere   |  |  | | --- | --- | | *ANSWER:* | d | |

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| 70. ​exosphere   |  |  | | --- | --- | | *ANSWER:* | b | |