

## Atmospheric Properties Short Study Guide

### Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

- \_\_\_\_\_ 1. Earth's atmosphere contains more \_\_\_\_\_ than any other substance.  
a. hydrogen and nitrogen                      c. nitrogen and oxygen  
b. helium and oxygen                            d. carbon and nitrogen
- \_\_\_\_\_ 2. When the temperature in the atmosphere reaches the \_\_\_\_\_, condensation occurs.  
a. flash point                                      c. evaporation point  
b. dew point                                        d. inversion point
- \_\_\_\_\_ 3. \_\_\_\_\_ can act as a lid or trap, thus worsening air-pollution problems.  
a. Temperature inversions                      c. Lifted condensation levels  
b. Relative humidity                            d. Convection currents
- \_\_\_\_\_ 4. An air mass that has high \_\_\_\_\_ resists rising.  
a. moisture                                        c. stability  
b. density    d. heat
- \_\_\_\_\_ 5. Condensation nuclei are particles of atmospheric dust around which \_\_\_\_\_.  
a. ozone collects                                c. evaporation occurs  
b. cloud droplets form                            d. winds form
- \_\_\_\_\_ 6. In orographic lifting, clouds form when moist winds \_\_\_\_\_.  
a. flow over the sea                              c. encounter mountains  
b. become drier                                    d. warm up the ground
- \_\_\_\_\_ 7. Cloud droplets collide to form larger droplets in a process called \_\_\_\_\_.  
a. coalescence                                    c. condensation  
b. convection                                      d. composition
- \_\_\_\_\_ 8. What is the constant movement of water between the atmosphere and Earth's surface?  
a. precipitation cycle                            c. cloud cycle  
b. water cycle                                      d. atmosphere cycle

### Matching

Match each item with the correct statement below.

- |               |                 |
|---------------|-----------------|
| a. exosphere  | d. stratosphere |
| b. ionosphere | e. thermosphere |
| c. mesosphere | f. troposphere  |
- \_\_\_\_\_ 9. The layer between the stratosphere and thermosphere
- \_\_\_\_\_ 10. The layer in which most pollution occurs
- \_\_\_\_\_ 11. The atmosphere's outermost layer
- \_\_\_\_\_ 12. Layer within the thermosphere filled with electrically charged particles
- \_\_\_\_\_ 13. Air temperatures in this layer can reach higher than 1000° C

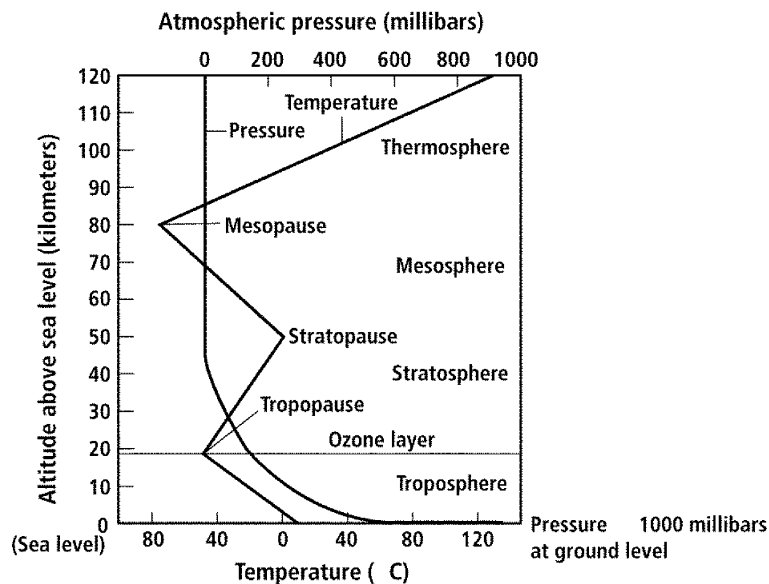
**Short Answer**

14. An electric heater that runs along the base of one wall heats a large room with a high ceiling. What method of energy transfer allows the room to be heated from bottom to top? Compare this to energy transfer in the upper levels of the troposphere.
15. What is a temperature inversion? Describe the relationship between temperature and pressure in a temperature inversion.
16. Describe the formation of clouds.
17. Why are cirrus clouds made of ice crystals?

Compare and contrast each pair of related terms or phrases.

18. heat, temperature
19. conduction, convection
20. Compare and contrast cumulus and cirrus clouds.
21. What is moving air called? Why does air move in the atmosphere?
22. A temperature inversion hangs over a city area. Is the formation of a towering cumulonimbus cloud likely? Explain your answer.

Use the graph to answer the following questions.



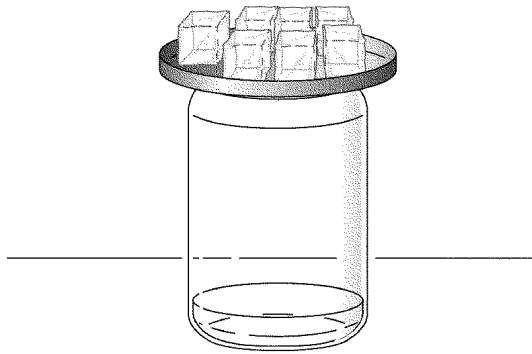
23. Describe the temperature changes that take place in each layer of the atmosphere.

**Problem**

A group of students decided to make a simple model of the atmosphere. To create their model, they used a clean glass jar, hot water, and a tray of ice cubes.

The students poured hot water into the jar to a level of about 4 cm. They then filled a small metal tray with ice cubes and placed it over the jar's opening, as shown in the illustration below.

Within a few seconds, the students observed white ribbons of mist forming in the center of the jar. Soon a larger white, misty area had formed inside the jar between the surface of the water and the jar's opening.



24. How does the temperature of the air in the model atmosphere vary with height? Explain your answer.
25. How might the results have been different if the tray and ice had not been placed over the opening of the jar?
26. How might the results have been different if students had put cold water in the bottom of the jar instead of hot water?
27. Based on your knowledge of cloud formation, compare the model with the formation of clouds in Earth's atmosphere.
28. Describe how you would change the design of the model to create a continuous water cycle. Explain how water would cycle through the new model.

## Atmospheric Properties Short Study Guide Answer Section

### MULTIPLE CHOICE

1. C
2. B
3. A
4. C
5. B
6. C
7. A
8. B

### MATCHING

9. C
10. F
11. A
12. B
13. E

### SHORT ANSWER

14. Through convection, currents of warm air rise toward the ceiling, cool, then sink toward the floor where they are heated and rise again. In the same way, convection currents in the atmosphere cause warm air at Earth's surface to rise high above the ground where it expands and cools. Then it sinks back to the surface where it is warmed, and the process continues.
15. Generally, temperature and pressure in the troposphere decrease with height. But this relationship is reversed in a temperature inversion. A temperature inversion can occur when the lower layers of the atmosphere lose heat to Earth's surface. As a result, the lower layers of air become cooler than the air above them, creating an inversion.
16. Clouds form when warm, moist air rises, expands, and cools. As the air reaches its dew point, water vapor in the air condenses around condensation nuclei into cloud droplets. A collection of millions of cloud droplets forms a visible cloud.
17. Cirrus clouds form high in the troposphere where temperatures are well below freezing. Thus, they are made of ice crystals.
18. Both are related to energy. Heat is the transfer of energy that occurs because of a difference in temperature. Temperature is the measurement of how rapidly or slowly molecules move around.
19. Both are ways in which energy is transferred. Conduction is energy transfer by the collision of molecules. Convection is energy transfer by the flow of a heated substance, such as water or air.
20. Cumulus clouds are puffy and white. Cirrus clouds are wispy, indistinct clouds made up of ice crystals. Cumulus clouds form lower in the atmosphere than cirrus clouds do.

21. Moving air is called wind. Air moves in response to density imbalances created by the unequal heating and cooling of Earth's surface. These imbalances create areas of high and low pressure. Air moves from areas of higher pressure or density to areas of lower pressure or density.
22. No; the inversion would block rising air, so towering clouds would not form.
23. Temperature decreases with altitude in the troposphere. In the stratosphere, temperature begins to increase with altitude. In the mesosphere, temperature begins to decrease again. Then between the mesosphere and thermosphere, temperature starts to increase with altitude.

## PROBLEM

24. It decreases with height. The air at the bottom of the jar is warmed by the water. The air at the top is cooled by the ice.
25. Possible response: The warm air would rise and escape, so water vapor would not have condensed and droplets of water would not have formed.
26. An area of mist would not have formed because there would have been no warm, moist air rising in the jar.
27. The hot water at the bottom of the jar represents liquid water on the surface of Earth that has been heated by the Sun's radiation, causing it to evaporate. It then rises in the atmosphere. The atmospheric layer nearest Earth's surface cools with altitude, as does the air in the jar as a result of the ice cubes at the top. Just as rising air cools and condenses in the atmosphere, the rising moist air cooled and condensed in the jar. The mist that formed in the jar is similar to cloud droplets that form in the atmosphere.
28. Answers will vary. Students might suggest adding a heat source under the water supply to keep the water heated. Then water would continuously warm up, evaporate, rise, condense, and fall as rain or drop down the sides of the jar.