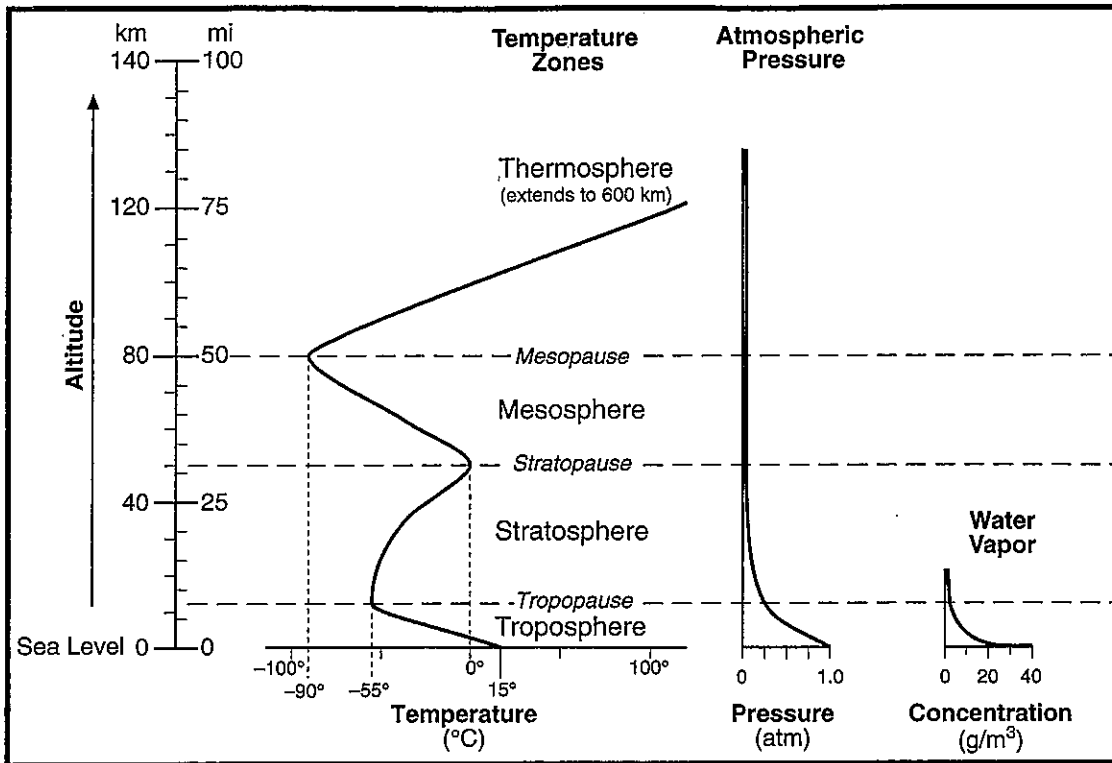


## Selected Properties of Earth's Atmosphere



### Overview:

Every mountain climber knows that as one ascends a mountain, atmospheric conditions quickly change. This chart covers three properties that change as altitude increases: temperature, atmospheric pressure, and water vapor. As altitude increases, there is less air, producing less air pressure. The amount of water vapor also decreases with altitude. Temperature is different; it reverses itself more than once. These temperature changes are the reason why the atmosphere is assigned different layers.

### The Chart:

**Altitude Scale** – On the left is the Altitude scale in kilometers (km) and miles (mi). Each interval (line) on the kilometer scale represents 10 km, and each line on the mile scale represents 5 mi. The Sea Level 0 line is the Earth's surface, being at the bottom of the atmosphere. All horizontal lines on this altitude scale are meant to be extended to the right, crossing all three graphs, just as the dash lines do.

**Temperature Zones graph** – The Temperature Zones graph shows the four different layers into which the atmosphere is divided. The suffix “pause” indicates the transition of one layer to the next. The first layer, which we live in, is the troposphere. In this layer, as the altitude increases, the temperature decreases. At top of the troposphere (the tropopause), the temperature is shown to be  $-55^{\circ}\text{C}$ . Passing through the tropopause, one enters the next layer, the stratosphere. The dash line shows that this occurs approximately at the 12 km or 7 mi level. In the stratosphere, the temperature reverses and warms up to  $0^{\circ}\text{C}$  at the stratopause. Once again, the temperature reverses and becomes colder in the mesosphere. In the mesosphere, the coldest temperature is found, shown on the graph to be  $-90^{\circ}\text{C}$ . In the thermosphere, the temperature continually increases and reaches very high temperatures.

*Atmospheric Pressure graph* – The pressure graph shows that pressure continually decreases as altitude increases. This makes sense because the higher one goes, the fewer air molecules are present, producing less pressure. The *x*-axis shows that, at sea level, the air pressure is equal to one atmosphere.

*Water Vapor graph* – The water vapor chart shows that almost all the water vapor of the atmosphere is found in the troposphere and that the amount decreases to zero in the stratosphere. Because almost all the water vapor is located in the troposphere, just about all the weather is confined to this layer.

***Additional Information:***

- Ozone, which absorbs UV rays, is located mostly in the stratosphere. This is what causes the temperature of this layer to increase.
- Almost all of the air of the atmosphere is located within the troposphere.
- Mt. Everest, the highest mountain on our planet, is still located in the troposphere. At the top of Mt. Everest, there is very little oxygen.
- Outer space is generally agreed to begin at 100 km or 62 miles, being in the thermosphere.
- The aurora borealis (northern lights) are the interaction of the Sun's solar wind particles and the molecules of the upper atmosphere. This light show usually occurs around 80 to 120 km in the atmosphere. This height is in the thermosphere.
- The composition of the atmosphere can be found in the Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere section, see page 42.
- Air pressure at sea level is equal to 14.7 pounds per square inch.

## Set 1 — Selected Properties of Earth's Atmosphere

1. An air temperature of 95°C most often exists in which layer of the atmosphere?

- (1) troposphere
- (2) stratosphere
- (3) mesosphere
- (4) thermosphere

1 \_\_\_\_\_

2. Most of the water vapor in the atmosphere is found in the

- (1) mesosphere
- (2) thermosphere
- (3) troposphere
- (4) stratosphere

2 \_\_\_\_\_

3. Ozone is concentrated in Earth's atmosphere at an altitude of 20 to 35 kilometers. Which atmospheric layer contains the greatest concentration of ozone?

- (1) mesosphere
- (2) thermosphere
- (3) troposphere
- (4) stratosphere

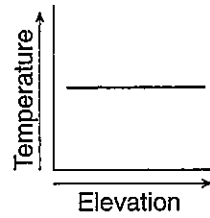
3 \_\_\_\_\_

4. As a weather balloon released from the surface of Earth rises through the troposphere, the instruments it carries will usually indicate that

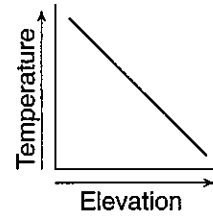
- (1) temperature increases, but atmospheric pressure and concentration of water vapor decrease
- (2) temperature decreases, but atmospheric pressure and concentration of water vapor increase
- (3) temperature, atmospheric pressure, and concentration of water vapor decrease
- (4) temperature, atmospheric pressure, and concentration of water vapor increase

4 \_\_\_\_\_

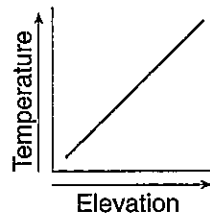
5. Which graph best shows the general effect that differences in elevation above sea level have on the average annual temperature within the troposphere?



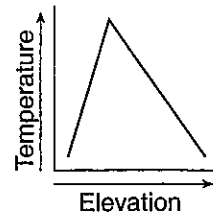
(1)



(3)



(2)



(4)

5 \_\_\_\_\_

6. At an altitude of 95 miles above Earth's surface, nearly 100% of the incoming energy from the Sun can be detected. At 55 miles above Earth's surface, most incoming x-ray radiation and some incoming ultraviolet radiation can no longer be detected. This missing radiation was most likely

- (1) absorbed in the thermosphere
- (2) absorbed in the mesosphere
- (3) reflected by the stratosphere
- (4) reflected by the troposphere

6 \_\_\_\_\_

7. The movement of volcanic ash occurred at an altitude of 1.5 kilometers. State the name of the layer of Earth's atmosphere in which the ash cloud traveled.

\_\_\_\_\_

**Set 2 — Selected Properties of Earth's Atmosphere**

8. Which layer of Earth's atmosphere contains very little water vapor, has an atmospheric pressure of 0.25 atmosphere, and has an air temperature that increases with altitude?

- (1) troposphere      (2) stratosphere      (3) mesosphere      (4) thermosphere      8 \_\_\_\_\_

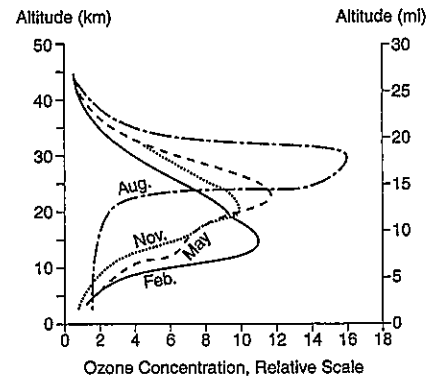
9. Which spheres are zones of Earth's atmosphere?

- (1) lithosphere, hydrosphere, and troposphere  
 (2) stratosphere, mesosphere, and thermosphere  
 (3) asthenosphere, lithosphere, and hydrosphere  
 (4) hydrosphere, troposphere, and stratosphere

9 \_\_\_\_\_

10. The graph shows the average concentration of ozone in Earth's atmosphere over Arizona during 4 months of the year. Which layer of Earth's atmosphere contains the greatest concentration of ozone?

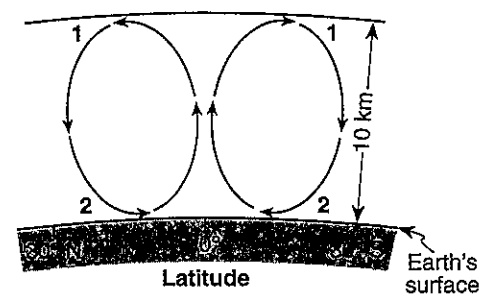
- (1) troposphere  
 (2) stratosphere  
 (3) mesosphere  
 (4) thermosphere



10 \_\_\_\_\_

11. The cross section shows the general movement of air within a portion of Earth's atmosphere located between 30° N and 30° S latitude. Numbers 1 and 2 represent different locations in the atmosphere. Which temperature zone layer of Earth's atmosphere is shown in the cross section?

- (1) troposphere      (3) mesosphere  
 (2) stratosphere      (4) thermosphere



(Not drawn to scale)

11 \_\_\_\_\_

12. A mountain climber climbs to the summit of a 7 km mountain and then returns to his campsite located at the base of the mountain. Explain what happens to the temperature and pressure as he ascends to the summit and returns to his campsite.

Temperature — \_\_\_\_\_  
 Pressure — \_\_\_\_\_