Lesson 3 Test Bank – Earth's Atmosphere

Multiple Choice Questions

1. What are the two most abundant permanent gases in the atmosphere?
   1. Nitrogen and oxygen
   2. Carbon dioxide and oxygen
   3. Ozone and nitrogen
   4. Methane and carbon dioxide

Correct Answer: A

1. What percentage of the atmosphere is composed of nitrogen and oxygen?
   1. 50%
   2. 60%
   3. 78%
   4. 99%

Correct Answer: D

1. Free \_\_\_\_ is a product of plant photosynthesis.
   1. methane
   2. carbon dioxide
   3. oxygen
   4. nitrogen

Correct Answer: C

1. Variable gases include all the following EXCEPT:
   1. Methane
   2. Carbon dioxide
   3. Oxygen
   4. Water vapor

Correct Answer: C

1. The concentration of carbon dioxide in the atmosphere
   1. is generally higher during the winter.
   2. has increased in the last 100 years
   3. is a greenhouse gas
   4. all the above

Correct Answer: D

1. Greenhouse gases
   1. are good absorbers of solar (shortwave) radiation.
   2. are good absorbers of longwave radiation emitted by the Earth.
   3. absorb shortwave and longwave radiation equally well.
   4. absorb neither shortwave or longwave radiation.

Correct Answer: B

1. Atmospheric pressure is greatest at:
   1. 50 km above the surface
   2. Sea level
   3. 10 km altitude
   4. The stratosphere

Correct Answer: B

1. As altitude increases, atmospheric density:
   1. Increases
   2. Stays the same
   3. Decreases
   4. Fluctuates randomly

Correct Answer: C

1. Heat transfer by circulation of a fluid is called
2. radiation
3. convection
4. latent heat
5. conduction

Correct Answer: B

1. What causes air pressure to decrease with altitude?
   1. Increasing temperature
   2. Reduced gravity
   3. Fewer gas molecules higher up
   4. Expansion of oxygen

Correct Answer: C

1. The layer of the atmosphere closest to the surface is the:
2. Troposphere
3. Stratosphere
4. Mesosphere
5. Thermosphere

Correct Answer: A

1. Which layer contains most of the mass of the atmosphere?
   1. Mesosphere
   2. Thermosphere
   3. Troposphere
   4. Exosphere

Correct Answer: C

1. Which of the following describes the homosphere?
   1. Found above 100 km
   2. Has stratified gases
   3. Uniformly mixed gases
   4. Contains only ozone

Correct Answer: C

1. Which layer has temperatures that increase with height due to solar radiation absorption?
   1. Troposphere
   2. Stratosphere
   3. Mesosphere
   4. Exosphere

Correct Answer: B

1. Which atmospheric layer is directly responsible for weather patterns?
   1. Stratosphere
   2. Troposphere
   3. Thermosphere
   4. Mesosphere

Correct Answer: B

1. Which layer of the atmosphere contains the ozone layer?
   1. Troposphere
   2. Stratosphere
   3. Mesosphere
   4. Thermosphere

Correct Answer: B

1. What are chlorofluorocarbons (CFCs) mainly used for?
   1. Fertilizers
   2. Propellants and refrigerants
   3. Rocket fuel
   4. Solar panels

Correct Answer: B

1. Which molecule is primarily responsible for ozone depletion?
   1. Methane
   2. Carbon dioxide
   3. Nitrogen
   4. Chlorine

Correct Answer: D

1. Which of the following gases has increased most due to human activities?
   1. Oxygen
   2. Nitrogen
   3. Carbon dioxide
   4. Argon

Correct Answer: C

1. Which gas plays the largest role in the natural greenhouse effect?
   1. Ozone
   2. Methane
   3. Carbon dioxide
   4. Nitrogen

Correct Answer: C

1. What happens to UV rays in the ozone layer?
   1. Reflected to space
   2. Absorbed and converted to heat
   3. Converted into visible light
   4. Trapped and scattered

Correct Answer: B

1. Which atmospheric layer exhibits the most significant UV absorption?
   1. Troposphere
   2. Stratosphere
   3. Thermosphere
   4. Mesosphere

Correct Answer: B

1. What is a common human health impact of ozone depletion?
   1. Bronchitis
   2. Hearing loss
   3. Skin cancer
   4. Diabetes

Correct Answer: C

1. The temperature at the tropopause is approximately:
   1. 20°C
   2. 0°C
   3. -57°C
   4. 40°C

Correct Answer: C

1. Why is the thermosphere not considered "hot" in the usual sense?
   1. Heat is not present
   2. Air is too thin for heat to transfer effectively
   3. UV radiation is blocked
   4. It has no molecules

Correct Answer: B

1. What happens to temperature in the mesosphere?
   1. Stays the same
   2. Increases with altitude
   3. Decreases with altitude
   4. Fluctuates randomly

Correct Answer: C

1. Temperatures tend to \_\_\_\_\_\_ through much of the stratosphere.
   1. increase with an increase in elevation
   2. decrease with and increase in elevation
   3. stay the same with an increase in elevation
   4. None of the above

Correct Answer: A

1. What is the environmental lapse rate?
   1. The lapse rate at the poles
   2. A theoretical average rate
   3. The actual observed rate at a location
   4. The rate in the ozone layer

Correct Answer: C

1. Clouds are good absorbers of
   1. insolation
   2. longwave radiation emitted by the earth
   3. UV light
   4. none of the above

Correct Answer: B

1. The greatest heat absorption in the atmosphere occurs due to:
   1. Direct radiation
   2. Solar reflection
   3. Greenhouse gases trapping longwave radiation
   4. Sound waves

Correct Answer: C

1. Which term describes the process of warm air sitting above cold air in the troposphere?
   1. Greenhouse effect
   2. Ozone depletion
   3. Temperature inversion
   4. Convection

Correct Answer: C

1. How does deforestation affect atmospheric CO₂ levels?
   1. Decreases them
   2. Increases them
   3. Has no effect
   4. Converts it to oxygen

Correct Answer: B

1. What is the role of the Clean Air Act?
   1. To ban fossil fuels
   2. To fund weather research
   3. To regulate air pollutants
   4. To promote mining safety

Correct Answer: C

1. How do aerosols affect climate?
   1. They block carbon
   2. They reflect sunlight
   3. They increase ocean acidity
   4. They generate ozone

Correct Answer: B

1. The EPA uses which index to report air quality?
   1. Clean Air Score
   2. UV Risk Index
   3. Air Quality Index
   4. Pollution Value Indicator

Correct Answer: C

1. Which process increases atmospheric methane?
   1. Mining
   2. Urban construction
   3. Livestock farming
   4. Photosynthesis

Correct Answer: C

1. The ozone hole is most severe over:
   1. North America
   2. Africa
   3. Antarctica
   4. Europe

Correct Answer: C

1. What is the main function of the ionosphere?
   1. Cloud formation
   2. Ozone production
   3. Reflects radio waves
   4. Supports jet streams

Correct Answer: C

1. Which of the following is considered a "permanent gas"?
   1. Carbon dioxide
   2. Methane
   3. Ozone
   4. None of the above

Correct Answer: D

1. What are the average temperatures in the mesopause?
   1. 50°C
   2. -10°C
   3. -90°C
   4. 0°C

Correct Answer: C

1. What does the term “temperature gradient” refer to?
   1. Change in pressure
   2. Change in ozone concentration
   3. Change in temperature with altitude
   4. Change in density

Correct Answer: C

1. Particulates
   1. serve as condensation nuclei.
   2. can cause atmospheric cooling.
   3. can cause atmospheric warming
   4. can do all the above.

Correct Answer: D

1. Most of the ozone found in the atmosphere is found in the
   1. troposphere.
   2. stratosphere.
   3. mesosphere.
   4. thermosphere.

Correct Answer: B

1. Where is ozone most concentrated?
   1. Near the ground
   2. Lower mesosphere
   3. Middle stratosphere
   4. Upper thermosphere

Correct Answer: C

1. An inversion
   1. is where temperatures increase with increasing altitude.
   2. is where temperatures decrease with increasing altitude.
   3. is where temperatures stay the same with increasing altitude.
   4. is where temperatures increase with decreasing altitude.

Correct Answer: A

1. What chemical reaction leads to acid rain?
   1. Methane + ozone
   2. CO2 + UV light
   3. SO2/NOx + water
   4. Argon + oxygen

Correct Answer: C

1. What causes the temperature inversion in the stratosphere?
   1. Presence of nitrogen
   2. Solar flares
   3. Absorption of UV radiation by ozone
   4. Jet streams

Correct Answer: C

1. The troposphere

A. usually exhibits an increase in temperature with an increase in altitude.

B. has a normal lapse rate of 1C.

C. is primarily heated by solar radiation.

D. is primarily heated by energy emitted by the earth.

Correct Answer: D

Written Response Questions

1. Explain why the troposphere contains most of the atmospheric mass.

Correct Answer: Gravity compresses air molecules near the surface, making the troposphere the densest layer.

1. Define homosphere and heterosphere.

Correct Answer: Homosphere: Sphere that lies between the surface and heterosphere where gases are uniformly mixed. Heterosphere: Outermost "sphere" of the atmosphere where gases are distributed into distinct layers.

1. List the "permanent (constant)" gases and variable gases.

Correct Answer: "Permanent (constant)" gases include nitrogen, oxygen, and argon. Variable Gases

Are those present in small and variable amounts. These include carbon dioxide, methane, ozone, water vapor, and particulates among others.

1. Which greenhouse gas is more effective at heating the atmosphere, carbon dioxide or methane?

Correct Answer: Methane

1. Which gas filters UV light in the stratosphere, carbon dioxide, ozone, or methane?

Correct Answer: Ozone.

1. Briefly describe how temperature changes from the surface up to the mesosphere.

Correct Answer: Troposphere: temperature decreases with an increase in elevation. Tropopause: no change in temperature with an increase in elevation. Stratosphere: temperature increases with an increase in elevation. Stratopause: no change in temperature with an increase in elevation.

1. Define the normal and environmental lapse rate of temperature.

Correct Answer: The normal lapse rate of temperature is the average decrease in temperature with an increase in elevation. The environmental lapse rate is the decrease in temperature with an increase in elevation at any given time.

1. Why is ozone both beneficial and harmful depending on its location? (Evaluating)

Correct Answer: In the stratosphere, it blocks UV rays; at ground level, it’s a pollutant harmful to health.

1. Explain how human activities contribute to ozone layer depletion. (Understanding)

Correct Answer: CFCs release chlorine that breaks down ozone molecules in the stratosphere.

1. What happens to air temperature as one moves upward through the stratosphere?

Correct Answer: Generally increases.

1. Define "temperature inversion" and what are its effects?

Correct Answer: A temperature inversion is a situation in which air temperature increases with increasing elevation. Inversions can occur under the right conditions in the troposphere. The stratosphere is noted for its inversion. A layer of warm air traps cooler air beneath, leading to smog and stagnant air.

1. Describe the "functional layers" of the atmosphere and explain what do they do?

Correct Answer: The ionosphere absorbs cosmic rays, gamma rays, X-rays, and shorter wavelengths of ultraviolet radiation. The ozonosphere absorbs 97% of the Sun's ultraviolet light that can be harmful to life on earth.

1. How do atmospheric pollutants affect visibility?

Correct Answer: Particulates scatter light, reducing clarity especially in scenic areas.

1. Describe one natural and one human-made source of air pollution.

Correct Answer: Natural—volcanic eruptions; human-made—car emissions.

1. Why is the thermosphere hot but not "hot" in the human sense?

Correct Answer: High temperatures due to energy absorption, but sparse molecules mean little heat transfer.

1. How does ozone form in the stratosphere?

Correct Answer: UV radiation splits O₂ into atoms, which then form ozone (O₃).

1. What role do polar stratospheric clouds play in ozone depletion?

Correct Answer: They enable reactions that convert stable chlorine into ozone-destroying forms.

1. How does methane contribute to global warming?

Correct Answer: Methane is a potent greenhouse gas that traps heat in the atmosphere.

1. What are some consequences of acid rain on ecosystems?

Correct Answer: Damages aquatic life, forests, and soils; erodes buildings.

1. List the four atmospheric layers in order from Earth's surface and give one trait of each.

Correct Answer: Troposphere (weather), Stratosphere (ozone), Mesosphere (coldest), Thermosphere (absorbs solar radiation).

1. Evaluate the success of the Clean Air Act based on health outcomes.

Correct Answer: It reduced deaths, improved air quality, and delivered economic benefits.

1. What impact do particulates have on the atmosphere?

Correct Answer: Particulates can reflect incoming shortwave and cause atmospheric cooling. They are also good absorbers of terrestrial earth radiation which would cause atmospheric warming. Particulates serve as condensation nuclei.

1. How do humans contribute to global warming?

Correct Answer: Fossil fuel burning (e.g., emissions from transportation and energy generation), deforestation, cattle farming and rice production to name a few.

1. Explain why temperatures increase with height through the stratosphere.

Correct Answer: Because ozone absorbs incoming solar radiation. The top of the stratosphere is hotter because its closer to the source of shortwave radiation. An ever diminishing amount of shortwave radiation as it passes through the stratosphere causes the temperature to decrease toward the bottom.

1. Describe how clouds impact climate.

Correct Answer: Clouds can reflect solar radiation off the top of the cloud causing atmospheric cooling. They are good absorbers of terrestrial earth radiation which would cause atmospheric warming. The role of clouds in climate change is one of the most vexing problems to climate scientists.

1. Describe how acid rain forms.

Correct Answer: Sulfur dioxide and nitrogen oxides react with water in the atmosphere to form acids.

1. How does the Clean Air Act address air pollution?

Correct Answer: It sets standards for emissions, reducing pollutants from industrial and vehicle sources.

1. Describe the role of water vapor in weather and climate.

Correct Answer: Water vapor influences humidity, precipitation, and acts as a greenhouse gas.

1. Why is the mesosphere the coldest atmospheric layer?

Correct Answer: It lacks ozone and absorbs little solar radiation.

1. Compare and contrast conduction, convection, and radiation.

Correct Answer: Conduction is the heat transfer via molecular collisions. Convection is heat transfer by circulation. Radiation is heat transfer via electromagnetic radiation.

**Acknowledgment**: Some questions in this test bank are reproduced from Introduction to Physical Geography by M. Ritter, licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License (CC BY-NC-SA 4.0).