



Sambhav

Day 66

Question 1: Discuss how the atmosphere is divided into layers based on temperature, and the significance of each layer for human life on earth? (150 Words)

Question 2: What is temperature inversion? Discuss the factors controlling the temperature distribution of air at any place. (250 Words)

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Approach / Explanation / Answer

Answer 1

Approach

- Introduce the composition of the atmosphere.
- Discuss how the atmosphere is divided into layers based on temperature.
- Conclude suitably.

Introduction

- The atmosphere is composed of gases, water vapour and dust particles. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.

Body

The atmosphere consists of different layers with varying density and temperature. Density is highest near the surface of the earth and decreases with increasing altitude. Based on thermal properties the column of atmosphere is divided into five different layers. They are Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere.

- **Troposphere:** The troposphere is the lowermost layer of the atmosphere. Its average height is 13 km and extends roughly to a height of 8 km near the poles and about 18 km at the equator. Thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents. This layer contains dust particles and water vapour. All changes in climate and weather take place in this layer. The temperature in this layer decreases at

the rate of 1° C for every 165m of height. This is the most important layer for all biological activity.

- The zone separating the Troposphere from stratosphere is known as the tropopause. The air temperature at the tropopause is about minus 80° C over the equator and about minus 45°C over the poles. The temperature here is nearly constant, and hence, it is called the tropopause.
- **Stratosphere:** The stratosphere is found above the tropopause and extends up to a height of 50 km. One important feature of the stratosphere is that it contains the ozone layer. This layer absorbs ultra-violet radiation and shields life on the earth from intense, harmful form of energy.
- **Mesosphere:** The mesosphere lies above the stratosphere, which extends up to a height of 80 km. In this layer, once again, temperature starts decreasing with the increase in altitude and reaches up to minus 100° C at the height of 80 km.
 - The upper limit of mesosphere is known as the mesopause.
- **Ionosphere:** The ionosphere is located between 80 and 400 km above the mesopause. It contains electrically charged particles known as ions, and hence, it is known as ionosphere.
 - Radio waves transmitted from the earth are reflected back to the earth by this layer. Temperature here starts increasing with height.
- **Exosphere:** The uppermost layer of the atmosphere above the thermosphere is known as the exosphere. This is the highest layer but very little is known about it. Whatever contents are there, these are extremely rarefied in this layer, and it gradually merges with the outer space.

Conclusion

The atmosphere is divided into five main layers based on temperature, each of them have unique characteristics and functions, which are crucial for the survival of life on Earth. The troposphere, stratosphere, mesosphere, thermosphere, and exosphere each play a vital role in maintaining the conditions necessary for life on our planet.

Answer 2

Approach

- Introduce briefly about the temperature inversion.
- Discuss the factors controlling the temperature distribution of air at any place.
- Conclude suitably.

Introduction

Normally, temperature decreases with increase in elevation. It is called normal lapse rate. At times, the

situations are reversed, and the normal lapse rate is inverted. It is called Inversion of temperature. Inversion is usually of short duration but quite common, nonetheless. A long winter night with clear skies and still air is ideal situation for inversion. The heat of the day is radiated off during the night, and by early morning hours, the earth is cooler than the air above. Over polar areas, temperature inversion is normal throughout the year.

Body

The interaction of insolation with the atmosphere and the earth's surface creates heat which is measured in terms of temperature.

Factors Controlling Temperature Distribution: The temperature of air at any place is influenced by (i) the latitude of the place; (ii) the altitude of the place; (iii) distance from the sea, the air-mass circulation; (iv) the presence of warm and cold ocean currents; (v) local aspects.

- **The latitude:** The temperature of a place depends on the insolation received. It has been explained earlier that the insolation varies according to the latitude hence the temperature also varies accordingly.
- **The altitude:** The atmosphere is indirectly heated by terrestrial radiation from below. Therefore, the places near the sea-level record higher temperature than the places situated at higher elevations.
 - In other words, the temperature generally decreases with increasing height. The rate of decrease of temperature with height is termed as the normal lapse rate. It is 6.5°C per 1,000 m.
- **Distance from the sea:** Another factor that influences the temperature is the location of a place with respect to the sea. Compared to land, the sea gets heated slowly and loses heat slowly. Land heats up and cools down quickly. Therefore, the variation in temperature over the sea is less compared to land. The places situated near the sea come under the moderating influence of the sea and land breezes which moderate the temperature.
- **Air-mass and Ocean currents:** Like the land and sea breezes, the passage of air masses also affects the temperature. The places, which come under the influence of warm airmasses experience higher temperature and the places that come under the influence of cold air-masses experience low temperature. Similarly, the places located on the coast where the warm ocean currents flow record higher temperature than the places located on the coast where the cold currents flow.
- **Local Aspects:** The local factors like lakes, large rivers (like Ganga, Brahmaputra, etc.) and localized dense forests or grooves in the temperature of the local area. E.g., the presence of these factors leads to a modification in temperature in the local areas by creating a distinctive micro-climate.

Conclusion

The temperature distribution of air at any place is controlled by a complex interplay of factors such as latitude, altitude, land and water, ocean currents, air masses, cloud cover, urbanization and seasons, together they create a unique temperature condition for every place on Earth.

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