Atmosphere

The atmosphere is the envelope of gases that surrounds the Earth and is held in place by gravity. It extends from the Earth's surface into space and plays a crucial role in sustaining life by regulating temperature, enabling weather systems, and protecting living organisms from harmful solar radiation.

Composition of the atmosphere

The atmosphere is primarily composed of nitrogen (78.08%) and oxygen (20.95%), both of which are essential for life. Other components include argon (0.93%), carbon dioxide (0.04%) and water vapor which varies between 0 to 4% depending on location and conditions. Trace gases such as neon, helium, methane and hydrogen are also present in very small

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amounts. Each gas has a specific role— oxygen supports respiration, nitrogen provides atmospheric stability, carbon dioxide is crucial for photosynthesis and heat retention, while water vapor drives the water cycle and weather patterns.

Importance of the atmosphere

The atmosphere is essential for maintaining life on Earth. It provides oxygen for breathing and carbon dioxide for plant life. The ozone layer within the stratosphere filters out harmful ultraviolet (UV) radiation from the sun. The atmosphere also helps in regulating the Earth's temperature through the greenhouse effect, ensuring that the planet remains warm enough to support life. It allows weather and climate systems to function and plays a vital role in the hydrological cycle, enabling the formation of clouds and precipitation. Moreover, it protects Earth by burning up meteoroids before they can reach

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the surface. The ionosphere, part of the upper atmosphere, reflects radio waves, aiding long-distance communication.

Layers of the atmosphere

The atmosphere is divided into five major layers based on temperature variation and altitude. Each layer has its own distinct characteristics and plays a specific role in Earth's climate, weather and protection.

I. Troposphere

The troposphere is the lowest layer of the atmosphere and is closest to the Earth's surface. It extends up to around 12 kilometers on average, though it is thicker at the equator and thinner at the poles. This layer contains about 75% of the atmospheric mass and almost all the ~~atmospheric mass~~ water vapor, clouds and dust particles. As a result, all weather phenomena such as clouds, rain, storms and winds occurs in the

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troposphere. In this layer, temperature decreases with altitude, typically at a rate of about 6.5°C per kilometer. The upper boundary of the troposphere is known as the ~~troposphere~~ tropopause, which acts as a transition zone to the next layer.

II. Stratosphere

Above the troposphere lies the stratosphere, extanding from about 12 KM to 50 Km in altitude. Unlike the troposphere increases with altitude. This is due to the presence of the ozone layer, which absorbs harmful ultraviolet (UV) radiation from the sun and converts it into heat. The ozone layer is found roughly between 15 to 35 Km above Earth's surface and plays crucial role in protecting life by blocking UV rays. The stratosphere is relatively stable and free from turbulence which is why commercial jets often fly in the lower stratosphere to avoid weather disturbances. The boundary at the top

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is called the stratopause.

III. Mesosphere

The mesosphere extends from about 50 km to 80 km above the Earth. In this layer, temperature again decreases with altitude making it the coldest layer of the atmosphere with temperatures dropping as low as -90°C. The mesosphere plays an important protective role by burning up meteroids due to increased friction and resistance, preventing them from reaching the Earth's surface. Despite its importance, this layer is the least understood because it is difficult to study; it lies above the reach of aircraft and below the orbit of satellites. The upper boundary of this layer is known as the mesopause.

IV. Thermosphere

The thermosphere lies above the mesosphere and

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extends from about 80km to 700km. This layer experiences a sharp rise in temperatures reaching up to 2,000°C or more due to the absorption of high energy solar radiation by oxygen and nitrogen molecules. Despite the high temperature, it would not feel hot to humans because the air is extremely thin. The thermosphere also contains the ionosphere, a sub-region rich in ionized particles that reflects radio waves and enables long-distance communication. Additionally, auroras occur in this layer due to interactions between charged solar particles and Earth's magnetic field.

V. Exosphere

The exosphere is the outermost layer of the atmosphere, gradually merging with the vacuum of outer space. It starts around 700 Km above Earth and extends upto 10,000 Km. In this layer, atmospheric gases are extremely sparse and molecules like

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hydrogen and helium drift into space. There is no well-defined upper limit to the exosphere and it contains satellites orbiting the Earth. Because of the low density of particles, collisions between molecules are rare and it marks the transition from the Earth's atmosphere into space.

too lengthy for a 5 marks answer. shorten it abit.

attempt proper questions from past papers for better practice