

Module 11: Meteorology

Topic 1 Content: Formation of the Atmosphere Notes

Introduction

Formation of the Atmosphere

Introduction



The atmosphere is a thin layer of gases that formed shortly after the formation of Earth. Over geologic time, the composition of gases in the atmosphere has changed. In this interactivity, click on the events in the timeline to learn about the formation and evolution of Earth's atmosphere.



Unstable Early Atm... Condensation an... Photosynthesis Nitrogen

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Unstable Early Atmosphere

Formation of the Atmosphere

Unstable Early Atmosphere

Earth's earliest atmosphere was thinner than it is today. After the formation of Earth, there was a long period during which Earth's atmosphere was unstable. The early atmosphere of hydrogen and helium was soon replaced. The planet contained a large amount of volcanic activity. When volcanoes erupt, they produce large quantities of gas. This outgassing replaced the early atmosphere with gases like carbon dioxide and water vapor. These gases were held in place by the gravitational pull of Earth. Earth's early atmosphere contained no nitrogen and oxygen.



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Condensation and Precipitation

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Condensation and Precipitation

Over millions of years of cooling, water vapor formed clouds through the process of condensation. The large quantity of water vapor produced a lot of clouds. It is theorized that Earth experienced a long period of rain. The rain was so heavy that it filled the lowest points on Earth called basins. Once the basins were filled, Earth had oceans.

The diagram is a horizontal timeline with four stages represented by arrows pointing right. The first arrow is brown and labeled 'Unstable Early Atm...'. The second arrow is blue and labeled 'Condensation and Precipitation', with a callout box above it containing the text 'Condensation and Precipitation'. The third arrow is brown and labeled 'Synthesis'. The fourth arrow is teal and labeled 'Nitrogen'.

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Photosynthesis

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Photosynthesis



After the formation of the oceans, another long period of time occurred until the oceans stabilized. At some point during the oceans' formation, the first signs of life on the planet evolved. Cyanobacteria, or blue-green algae, began to produce oxygen through photosynthesis as early as 3.5 billion years ago. The process of photosynthesis removed carbon dioxide and produced significant amounts of oxygen for the atmosphere. The image shows stromatolites. Stromatolites are large fossilized colonies of cyanobacteria that can be as old as 3.5 billion years.



Unstable Early Atm... Condensation an... **Photosynthesis** Nitrogen

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Nitrogen

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Nitrogen

While photosynthesis can explain the amounts of oxygen in the atmosphere, it cannot explain the large amounts of nitrogen gas. It appears that the high percentage of nitrogen originated from two sources. First, early Earth was likely bombarded by comets and meteors. This would have brought large amounts of nitrogen to the planet. Also, nitrogen is a very common element in Earth. As Earth outgassed, smaller amounts of nitrogen were released. Since nitrogen is very stable and not impacted by solar radiation, the amount of nitrogen increased over geologic time.



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