



Origins of Life on Earth

SYI-3.E.1

Several hypotheses about the origin of life on Earth are supported with scientific evidence—

- a. Geological evidence provides support for models of the origin of life on Earth.
 - i. Earth formed approximately **4.6** billion years ago (bya). The environment was too hostile for life until **3.9** bya, and the earliest fossil evidence for life dates to **3.5** bya. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred.



Origins of Life on Earth

SYI-3.E.1

Several hypotheses about the origin of life on Earth are supported with scientific evidence—

- b. There are several models about the origin of life on Earth—
 - i. Primitive Earth provided inorganic precursors from which organic molecules could have been synthesized because of the presence of available free energy and the absence of a significant quantity of atmospheric oxygen (O_2).
 - ii. Organic molecules could have been transported to Earth by a meteorite or other celestial event.



Origins of Life on Earth

SYI-3.E.1

Several hypotheses about the origin of life on Earth are supported with scientific evidence—

- c. Chemical experiments have shown that it is possible to form complex organic molecules from inorganic molecules in the absence of life—
 - i. Organic molecules/monomers served as building blocks for the formation of more complex molecules, including amino acids and nucleotides.
 - ii. The joining of these monomers produced polymers with the ability to replicate, store, and transfer information.



Origins of Life on Earth

SYI-3.E.2

The RNA World Hypothesis proposes that RNA could have been the earliest genetic material.



Based on evidence, earth formed...

- A. 3.5 billion years ago
- B. 3.9 billion years ago
- C. 4.3 billion years ago
- D. 4.6 billion years ago

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Based on evidence, earth formed...

D. **4.6** billion years ago



Directly from the CED:

Earth formed approximately 4.6 billion years ago (bya). The environment was too hostile for life until **3.9** bya, and the earliest fossil evidence for life dates to **3.5** bya. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred.



Based on evidence, the earliest fossil evidence...

- A. 3.5 billion years ago
- B. 3.9 billion years ago
- C. 4.3 billion years ago
- D. 4.6 billion years ago

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Based on evidence, the earliest fossil evidence...

A. **3.5** billion years ago



Directly from the CED:

Earth formed approximately **4.6** billion years ago (bya). The environment was too hostile for life until **3.9** bya, and the earliest fossil evidence for life dates to **3.5** bya. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred.



Based on evidence, the Earth was too hostile for life until...

- A. 3.5 billion years ago
- B. 3.9 billion years ago
- C. 4.3 billion years ago
- D. 4.6 billion years ago

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Based on evidence, the Earth was too hostile for life until...

B. 3.9 billion years ago



Directly from the CED:

Earth formed approximately **4.6 billion years ago (bya)**. The environment was too hostile for life until **3.9 bya**, and the earliest fossil evidence for life dates to **3.5 bya**. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred.

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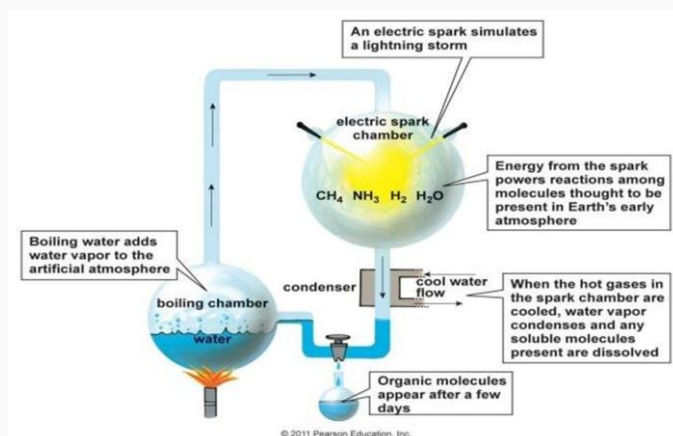


Describe Miller's experiment regarding abiotic synthesis of organic compounds.

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Miller created an environment with similar gases of primitive Earth. He heated up the water similar to how the sun heats the ocean. He used electric sparks to recreate lightning. Then condensed the vapor (made rain) and collected the sample. In the sample, he found monomers (amino acids, etc).



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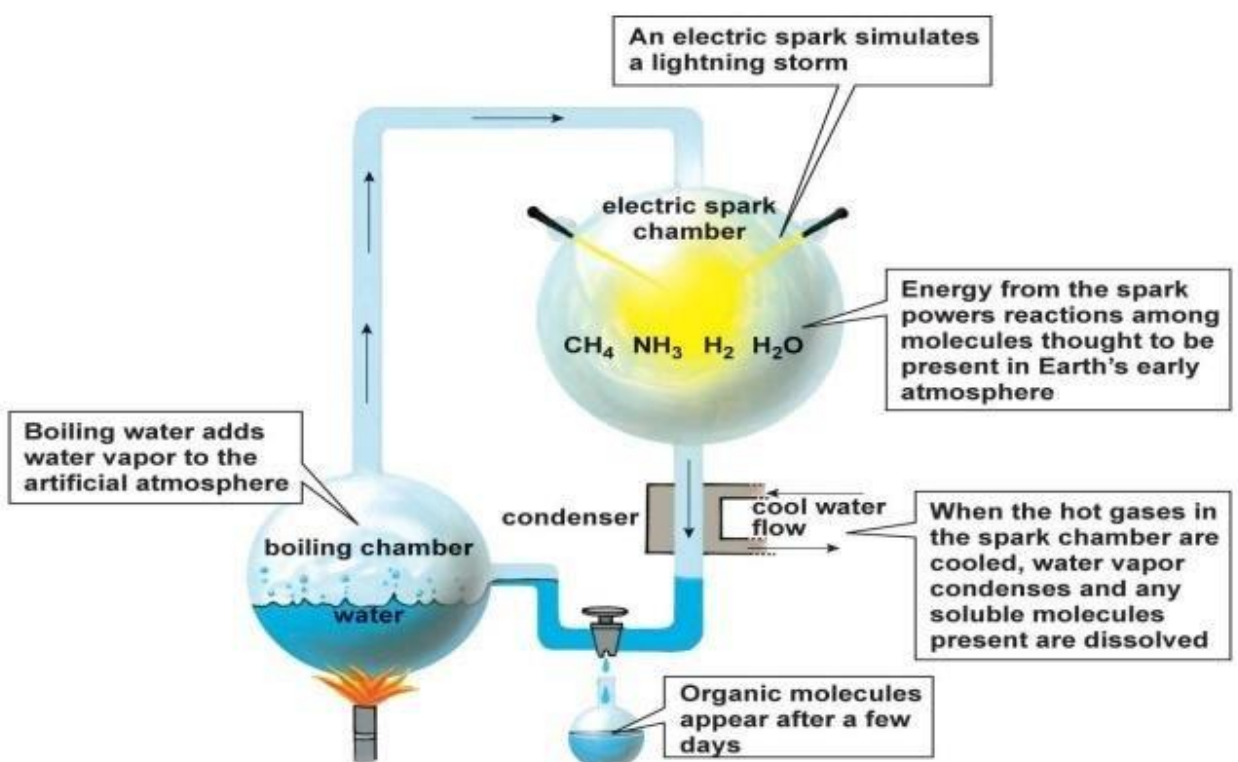
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Describe Miller's experiment regarding abiotic synthesis of organic compounds.



Miller created an environment with similar gases of primitive Earth. He heated up the water similar to how the sun heats the ocean. He used electric sparks to recreate lightning. Then condensed the vapor (made rain) and collected the sample. In the sample, he found monomers (amino acids, etc).

Describe Miller's experiment regarding abiotic synthesis of organic compounds.



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Which gas was not present in earth Earth's atmosphere?

- A. Ammonia**
- B. Hydrogen**
- C. Methane**
- D. Oxygen**

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Which gas was not present in earth Earth's atmosphere?

D. Oxygen



Oxygen (O_2) gas was not available in early Earth's atmosphere.

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Organic compounds could have come to Earth on meteorites.

- A. True**
- B. False**

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Organic compounds could have come to Earth on meteorites.

A. True



Directly from the CED:

**There are several models about the origin of life on Earth—
Organic molecules could have been transported to Earth by a meteorite or other celestial event.**



The first genetic material was...

- A. Carbohydrate**
- B. DNA**
- C. Protein**
- D. RNA**

The first genetic material was...

D. RNA



Ribozymes (ribonucleic acid enzymes) are RNA molecules that have the ability to catalyze specific biochemical reactions, including RNA splicing in gene expression, similar to the action of protein enzymes. The 1982 discovery of ribozymes demonstrated that RNA can be both genetic material (like DNA) and a biological catalyst (like protein enzymes), and contributed to the RNA world hypothesis, which suggests that RNA may have been important in the evolution of prebiotic self-replicating systems.

-Wikipedia

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Why was RNA thought to be the first genetic material?

Why was RNA thought to be the first genetic material?



It has the capability to self replicate.

It can be used as a template to make proteins.

It has enzymatic capabilities (ribozymes).



**The environment was too hostile
for life until...**

- A. 4.6 billion years ago**
- B. 3.9 billion years ago**
- C. 3.5 billion years ago**

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The environment was too hostile for life until...

B. 3.9 billion years ago



Directly from the CED:

Earth formed approximately **4.6 billion years ago (bya)**. The environment was too hostile for life until **3.9 bya**, and the earliest fossil evidence for life dates to **3.5 bya**. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred.



How old were the earliest fossils?

- A. 4.6 billion years ago**
- B. 3.9 billion years ago**
- C. 3.5 billion years ago**

How old were the earliest fossils?

c. 3.5 billion years ago



Directly from the CED:

Earth formed approximately **4.6** billion years ago (bya). The environment was too hostile for life until **3.9** bya, and the earliest fossil evidence for life dates to **3.5** bya. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred.



When was the earth first formed?

- A. 4.6 billion years ago**
- B. 3.9 billion years ago**
- C. 3.5 billion years ago**

When was the earth first formed?

A. 4.6 billion years ago



Directly from the CED:

Earth formed approximately 4.6 billion years ago (bya). The environment was too hostile for life until 3.9 bya, and the earliest fossil evidence for life dates to 3.5 bya. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred.

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Oxygen was found on primitive earth.

- A. True**
- B. False**

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Oxygen was found on primitive earth.

B. False



Oxygen (O_2) was not found in early Earth's atmosphere.



Which macromolecule is not made of monomers?

- A. Carbohydrates**
- B. Lipids**
- C. Nucleic Acids**
- D. Proteins**

Which macromolecule is not made of monomers?

B. Lipids



Lipids do not have a repeating structure.

Carbohydrates are made up of monosaccharides. Nucleic acids are made up of nucleotides.

Proteins are made up of amino acids.



What is the monomer for nucleic acids?

- A. Amino acids**
- B. Fatty acids**
- C. Monosaccharides**
- D. Nucleotides**

What is the monomer for nucleic acids?

D. Nucleotides



Nucleic Acids are made up of nucleotides. Nucleotides are composed of a phosphate group, pentose sugar, and a nitrogenous base.



What is the monomer for proteins?

- A. Amino acids**
- B. Fatty acids**
- C. Monosaccharides**
- D. Nucleotides**

What is the monomer for proteins?

A. Amino acids



Proteins are made up of amino acids. Amino acids are composed of an amino group, carboxyl group, a variable R group, and a hydrogen around a central carbon.



What was the first genetic material?

- A. DNA**
- B. Proteins**
- C. RNA**

What was the first genetic material?

C. RNA



The first genetic material is believed to be RNA as it was able to be a ribozyme to self-catalyze and a template.