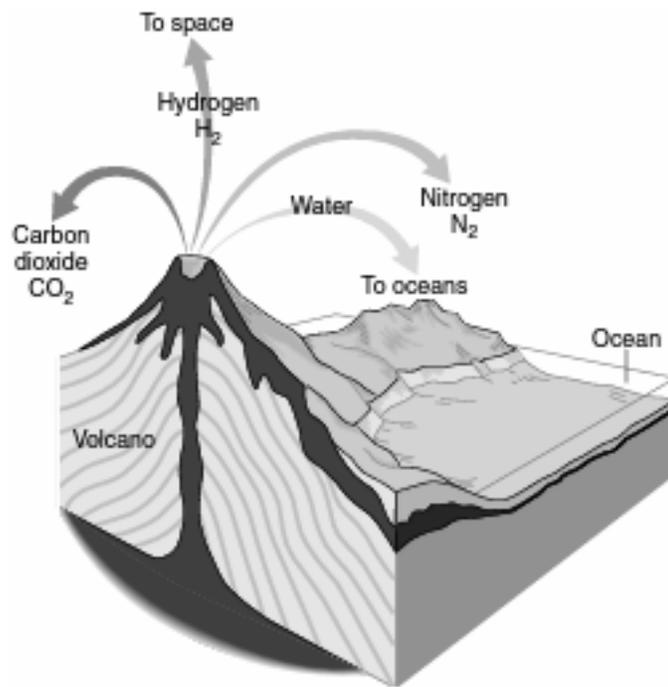


Earth's Early Atmosphere:

In thinking about Earth's history, it is important to consider both how life developed and how Earth's atmosphere might have formed. Earth's atmosphere is nearly as old as the planet itself. When magma comes to the surface, pressure is reduced and bubbles of hot gas escape into the atmosphere. This process is known as **outgassing**. Gases collected from erupting volcanoes are about 80 percent water vapor, 10 percent carbon dioxide, and 10 percent other gases including nitrogen. The world's oceans originated from water vapor vented during volcanic eruptions. The water vapor condensed and fell as precipitation. Carbon dioxide and other gases remained as Earth's atmosphere. Objects in space that are much smaller than Earth, such as our moon, do not have enough gravity to prevent gases from escaping into space. However, Earth has been able to hold onto its atmosphere and oceans.

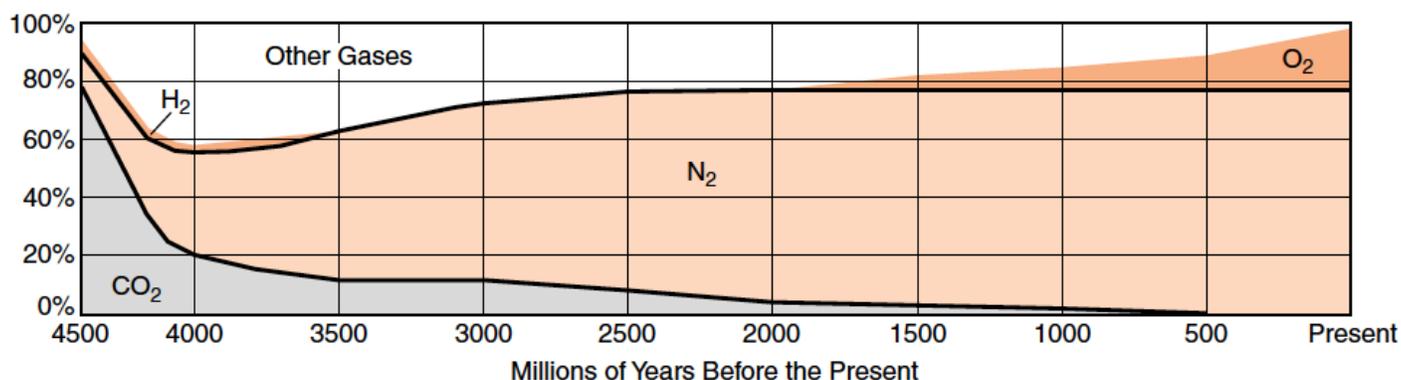
**How Organisms Influenced Earth's Atmosphere:**

The history of life and the evolution of the atmosphere are tightly coupled. Earth's earliest life-forms were primitive bacteria that thrived in an atmosphere that had no oxygen. Chemical evidence of these earliest life-forms has been found in rocks 3.5 billion years old. That is only 1 billion years after Earth formed.

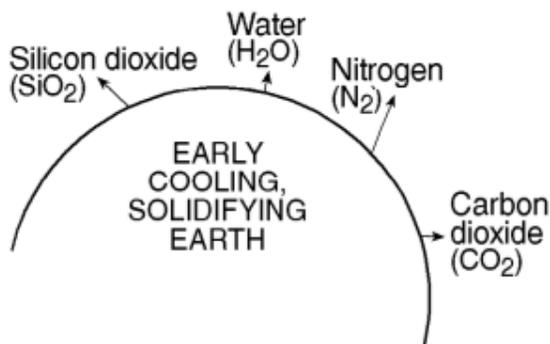
The distance between Earth and the sun has played an important part in Earth's development. Consequently, Earth has moderate (not too hot or too cold) temperatures. Ocean water protected

early life-forms from destructive solar radiation. Early plantlike life-forms in the oceans began to use the energy of sunlight to make food through photosynthesis. During photosynthesis, oxygen is produced as a waste product.

In fact, as oxygen built up in the atmosphere, the original life-forms could no longer live at the surface. Their descendants now occupy the deep oceans and subsurface environments where there is little free oxygen. As the atmosphere changed, other organisms, such as animals including humans, evolved that thrived in an environment of abundant oxygen. Oxygen also supports the ozone layer in the upper atmosphere that protects land dwellers from short-wave ultraviolet radiation. Today's atmosphere is in a dynamic balance sustained by plants that produce oxygen and animals that consume it.



The diagram below shows four different chemical materials escaping from the interior of early Earth.



Which material contributed *least* to the early composition of the atmosphere?

- A) CO₂ B) SiO₂ C) H₂O D) N₂

Analysis – Please *annotate* where you found the answer!

1.) What is outgassing?

2.) How did Earth's oceans originate?

3.) Why does the Moon not have an atmosphere?

4.) What were Earth's first life-forms and where did they live? Why did they live there?

5.) What gas did organisms add to the atmosphere? How did they add it?
