**Critical Reading**

*Read these passages from the text and answer the questions that follow.*

**The First Cells**

How organic molecules such as RNA developed into cells is not known for certain. Scientists speculate that lipid membranes grew around the organic molecules. The membranes prevented the molecules from reacting with other molecules, so they did not form new compounds. In this way, the organic molecules persisted, and the first cells may have formed.

**LUCA**

No doubt there were many early cells of this type. However, scientists think that only one early cell or group of cells) eventually gave rise to all subsequent life on Earth. That one cell is called the Last **Universal Common Ancestor (LUCA).** It probably existed around 3.5 billion years ago. LUCA was one of the earliest prokaryotic cells. It would have lacked a nucleus and other membrane-bound organelles.

**Photosynthesis and Cellular Respiration**

The earliest cells were probably heterotrophs. Most likely they got their energy from other molecules in the organic “soup.” However, by about 3 billion years ago, a new way of obtaining energy evolved. This new way was photosynthesis. Through photosynthesis, organisms could use sunlight to make food from carbon dioxide and water. These organisms were the first autotrophs. They provided food for themselves and for other organisms that began to consume them. After photosynthesis evolved, oxygen started to accumulate in the atmosphere. This has been dubbed the “oxygen catastrophe.” Why? Oxygen was toxic to most early cells because they had evolved in its absence. As a result, many of them died out. The few that survived evolved a new way to take advantage of the oxygen. This second major innovation was cellular respiration. It allowed cells to use oxygen to obtain more energy from organic molecules.

Questions

1. Describe the first cells.
2. What was LUCA?
3. Why were the first cells heterotrophs?
4. How long did it take for photosynthesis to evolve?
5. What was the oxygen catastrophe?

*Read these passages from the text and answer the questions that follow.*

**Setting the Stage: The Late Precambrian**

The late Precambrian is the time from about 2 billion to half a billion years ago. During this long span of time, Earth experienced many dramatic geologic and climatic changes.

• Continents drifted. They collided to form a gigantic supercontinent and then broke up again and moved apart. Continental drift changed climates worldwide and caused intense volcanic activity.

• Carbon dioxide levels in the atmosphere rose and fell. This was due to volcanic activity and other factors. When the levels were high, they created a greenhouse effect. More heat was trapped on Earth’s surface, and the climate became warmer. When the levels were low, less heat was trapped and the planet cooled. Several times, cooling was severe enough to plunge Earth into an ice age. One ice age was so cold that snow and ice completely covered the planet.

**Life During the Late Precambrian**

The dramatic changes of the late Precambrian had a major impact on Earth’s life forms. Living things that could not adapt died out. They were replaced by organisms that evolved new adaptations. These adaptations included sexual reproduction, specialization of cells, and multicellularity.

• Sexual reproduction created much more variety among offspring. This increased the chances that at least some of them would survive when the environment changed. It also increased the speed at which evolution could occur.

• Some cells started to live together in colonies. In some colonies, cells started to specialize in doing different jobs. This made the cells more efficient as a colony than as individual cells.

• By 1 billion years ago, the first multicellular organisms had evolved. They may have developed from colonies of specialized cells. Their cells were so specialized they could no longer survive independently. However, together they were mighty. They formed an organism that was bigger, more efficient, and able to do much more than any single-celled organism ever could.

**The Precambrian Extinction**

At the close of the Precambrian 544 million years ago, a mass extinction occurred. In a mass extinction, many or even most species abruptly disappear from Earth. There have been five mass extinctions in Earth’s history. Many scientists think we are currently going through a sixth mass extinction. What caused the Precambrian mass extinction? A combination of climatic and geologic events was probably responsible. No matter what the cause, the extinction paved the way for a burst of new life during the following Paleozoic Era.

*Questions*

1. Name two major events of the late Precambrian.
2. Name three major adaptations for life during the late Precambrian.
3. Explain the major benefits of the evolution of sexual reproduction.
4. How did the first multicellular organisms evolve? What were the benefits of being multicellular?
5. What is a mass extinction?