Name Period Date

SECTION 12.4

EARLY SINGLE-CELLED ORGANISMS

Reinforcement

KEY CONCEPT Single-celled organisms existed 3.8 billion years ago.

The first organisms on Earth were most likely prokaryotes, such as bacteria, that didn't need oxygen to survive. Once life began to thrive, Earth began to change. These single-celled organisms eventually began depositing minerals on the Earth's surface and adding oxygen to the atmosphere as a by-product of photosynthesis. Scientists have found evidence, through fossils, that photosynthetic life evolved more than 3.5 billion years ago. These fossils are remains of a group of marine **cyanobacteria**, which are bacteria that can carry out photosynthesis. Some cyanobacteria live in colonies and form stromatolites—domed, rocky structures made of layers of cyanobacteria and sediment. Communities of photosynthesizing cyanobacteria in stromatolites raised the oxygen levels in the atmosphere and ocean, which allowed the evolution of aerobic life forms, which need oxygen to live.

Endosymbiosis is a relationship in which one organism lives within the body of another and both benefit from the relationship. The theory of endosymbiosis proposes that the first eukaryotic cells arose from a large prokaryote engulfing a smaller prokaryote. Over many generations, the smaller prokaryote evolved as mitochondria or, if they were photosynthetic, chloroplasts. Unlike a prokaryote, a eukaryote has a nucleus and other membrane-bound organelles.

The fossil record shows that eukaryotic organisms had evolved by 1.5 billion years ago. Eukaryotic organisms were all aerobic. While the first eukaryotes were made of only one cell, later eukaryotes were multicellular—made of many cells.

1. Why is it reasonable to assume that the earliest life on Earth was anaerobic, not needing oxygen to survive?

2. How are cyanobacteria different from most bacteria?

3. The theory of endosymbiosis describes the probable evolution of what type of cell?

4. Mitochondria and chloroplasts both have their own DNA and ribosomes. How does this information support the theory of endosymbiosis?