Glencoe Science

Biology

Interactive Classroom

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Mc Graw Hill Glencoe

Chapter 14 The History of Life

EXIT

Click on a lesson name to select.

14.1 Fossil Evidence of Change

Land Environments

- Earth formed about 4.6 billion years ago.
- Gravity pulled the densest elements to the center of the planet.
- After about 500 million years, a solid crust formed on the surface.

14.1 Fossil Evidence of Change

Atmosphere

- The gases that likely made up the atmosphere are those that were expelled by volcanoes.
  - Water vapor (H_2O)
  - Carbon dioxide (CO_2)
  - Sulfur dioxide (SO_2)
  - Carbon monoxide (CO)
  - Hydrogen sulfide (H_2S)
  - Hydrogen cyanide (HCN)
  - Nitrogen (N_2)
  - Hydrogen (H_2)

14.1 Fossil Evidence of Change

Clues in Rocks

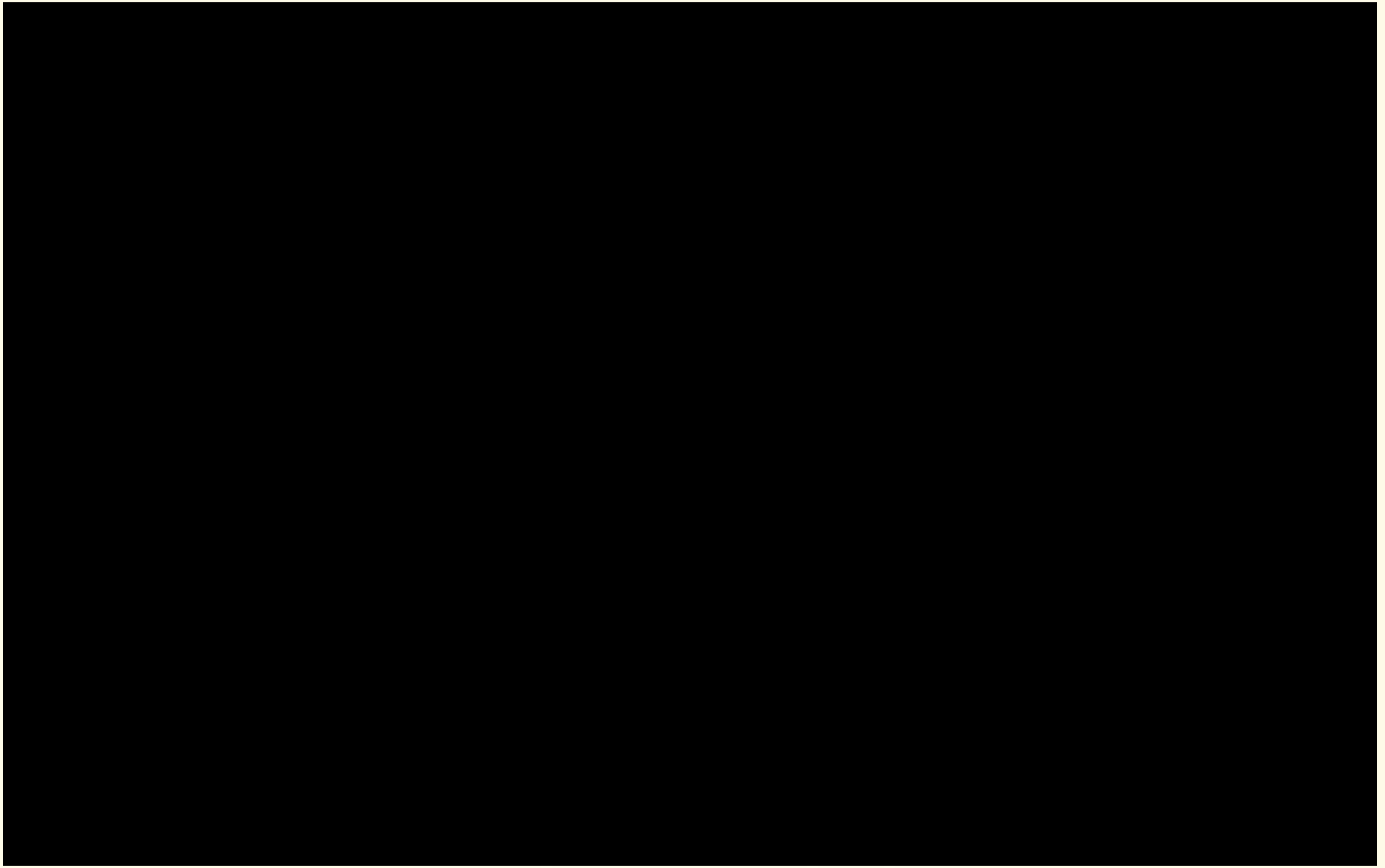
- A fossil is any preserved evidence of an organism.
- Most organisms decompose before they have a chance to become fossilized.

14.1 Fossil Evidence of Change

Categories of Fossil Types

Category	Trace fossil	Molds and casts	Replacement	Petrified or permineralized	Amber	Original material
Example						
Formation	A trace fossil is any indirect evidence left by an organism. Footprints, burrows, and fossilized feces are trace fossils.	A mold is an impression of an organism. A cast is a mold filled with sediment.	The original material of an organism is replaced with mineral crystals that can leave detailed replicas of hard or soft parts.	Empty pore spaces are filled in by minerals, such as in petrified wood.	Preserved tree sap traps an entire organism. The sap hardens into amber and preserves the trapped organism.	Mummification or freezing preserves original organisms.

Concepts In Motion



14.1 Fossil Evidence of Change

Fossil Formation

- Nearly all fossils are formed in sedimentary rock.
- The sediments build up until they cover the organism's remains.
- Minerals replace the organic matter or fill the empty pore spaces of the organism.

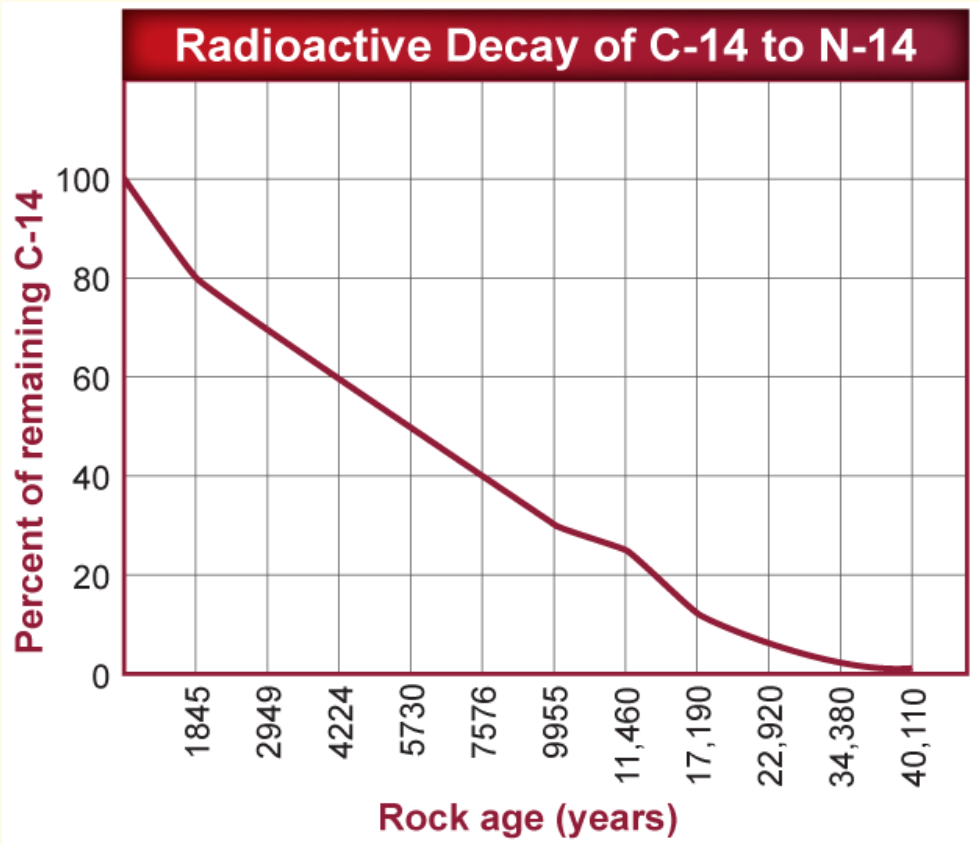
14.1 Fossil Evidence of Change

Dating fossils

- Relative dating is a method used to determine the age of rocks by comparing them with those in other layers.

14.1 Fossil Evidence of Change

Radiometric Dating



- Uses the decay of radioactive isotopes to measure the age of a rock
- Radioactive isotopes that can be used for radiometric dating are found only in igneous or metamorphic rocks.

14.1 Fossil Evidence of Change

The Geologic Time Scale

- The geological time scale is a model that expresses the major geological and biological events in Earth's history.
- The geologic time scale is divided into the Precambrian time and the Phanerozoic eon.
- Eras of the Phanerozoic eon include the Paleozoic, Mesozoic, and Cenozoic eras.
- Each era is divided into one or more periods.

14.1 Fossil Evidence of Change

Precambrian

- Nearly 90 percent of Earth's entire history, stretching from the formation of Earth to the beginning of the Paleozoic era about 542 million years ago
- Autotrophic prokaryotes enriched the atmosphere with oxygen.

14.1 Fossil Evidence of Change

The Paleozoic Era

- The ancestors of most major animal groups diversified in what scientists call the Cambrian explosion. 
- Life in the oceans continued to evolve at the end of the Cambrian period.
- Fish, land plants, and insects appeared during the Ordovician and Silurian periods.
- The first tetrapods emerged in the Devonian.

14.1 Fossil Evidence of Change

- A mass extinction ended the Paleozoic era at the end of the Permian period.
- Between 60 and 75 percent of the species alive went extinct.

14.1 Fossil Evidence of Change

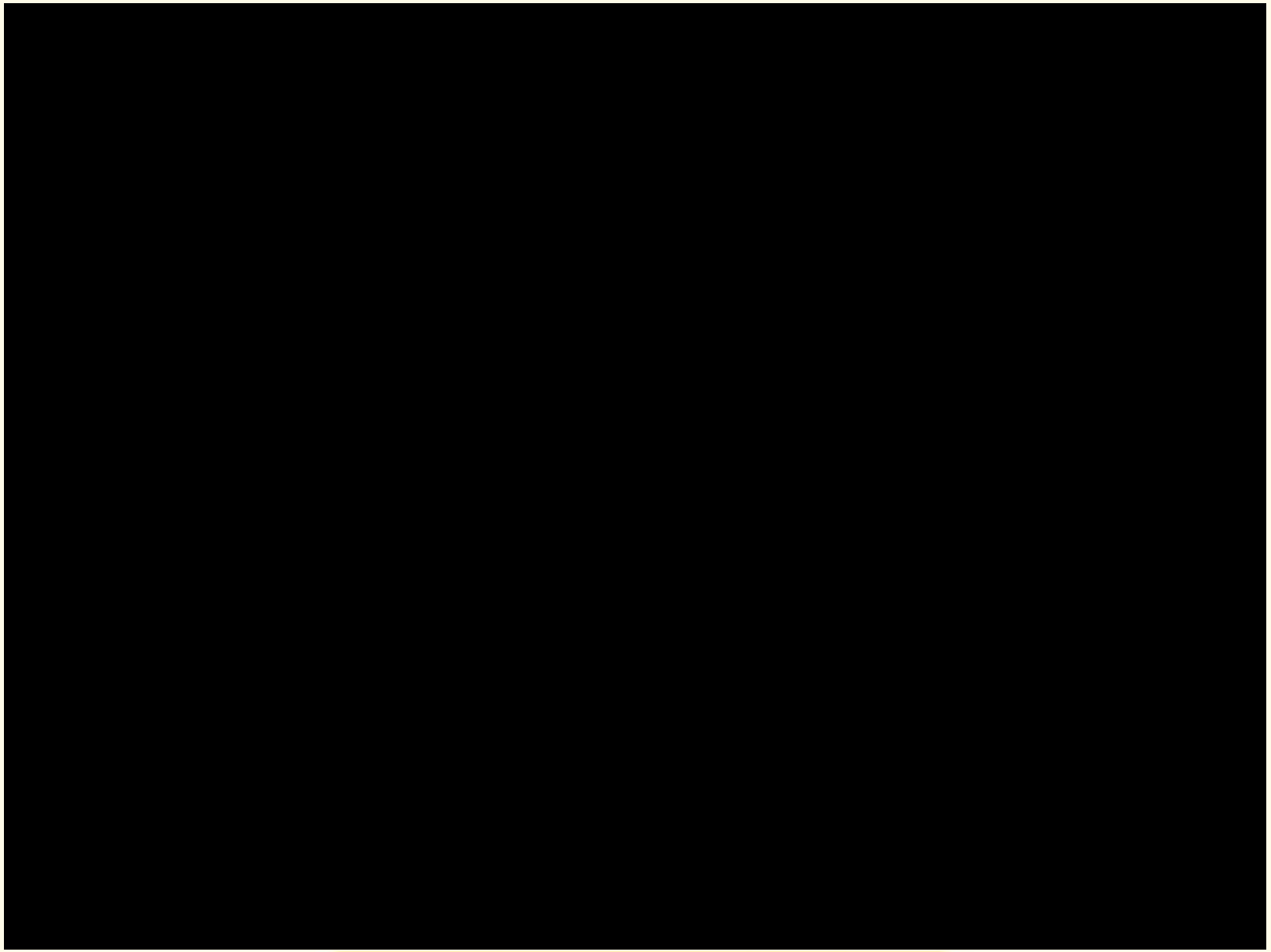
The Mesozoic Era

- Mammals and dinosaurs first appeared late in the Triassic period, and flowering plants evolved from nonflowering plants.
- Birds evolved from a group of predatory dinosaurs in the middle of the Jurassic period.
- About 65 million years ago, a meteorite struck Earth.

14.1 Fossil Evidence of Change

- Plate tectonics describes the movement of several large plates that make up the surface of Earth.
- These plates, some of which contain continents, move atop a partially molten layer of rock underneath them.

Concepts In Motion



14.1 Fossil Evidence of Change

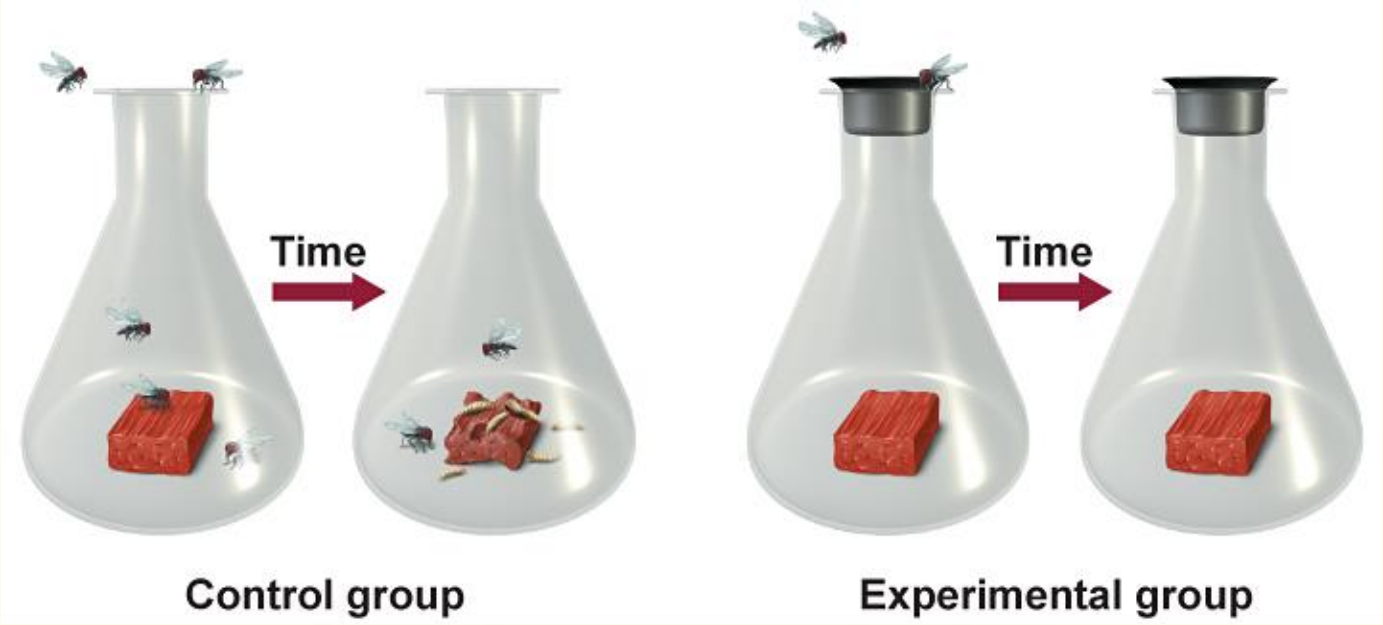
The Cenozoic Era

- Mammals became the dominant land animals.
- After the mass extinction at the end of the Mesozoic era, mammals of all kinds began to diversify.

14.2 The Origin of Life

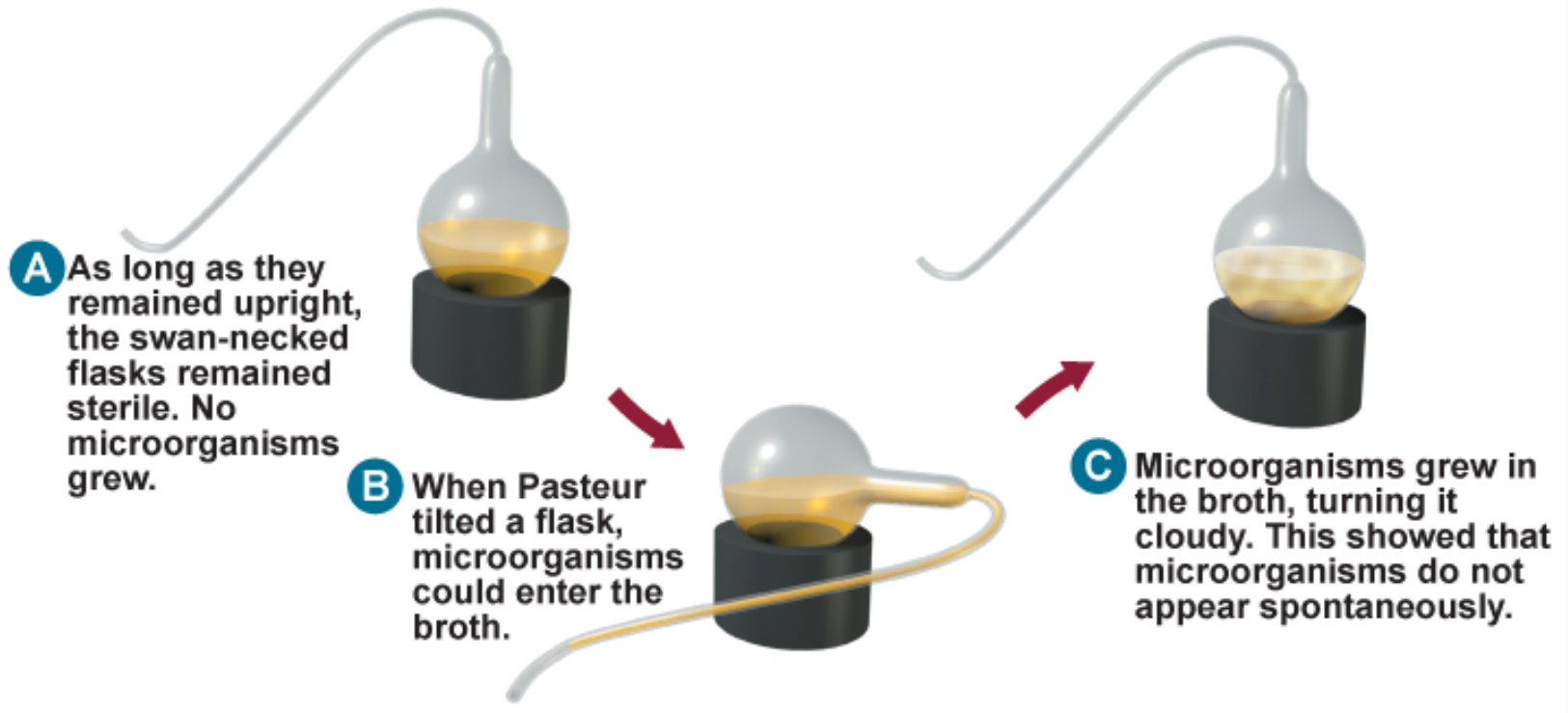
Origins: Early Ideas

- Spontaneous generation is the idea that life arises from nonlife.
- Francesco Redi, an Italian scientist, tested the idea that flies arose spontaneously from rotting meat.



14.2 The Origin of Life

- The theory of biogenesis states that only living organisms can produce other living organisms.
- Louis Pasteur designed an experiment to show that biogenesis was true even for microorganisms.



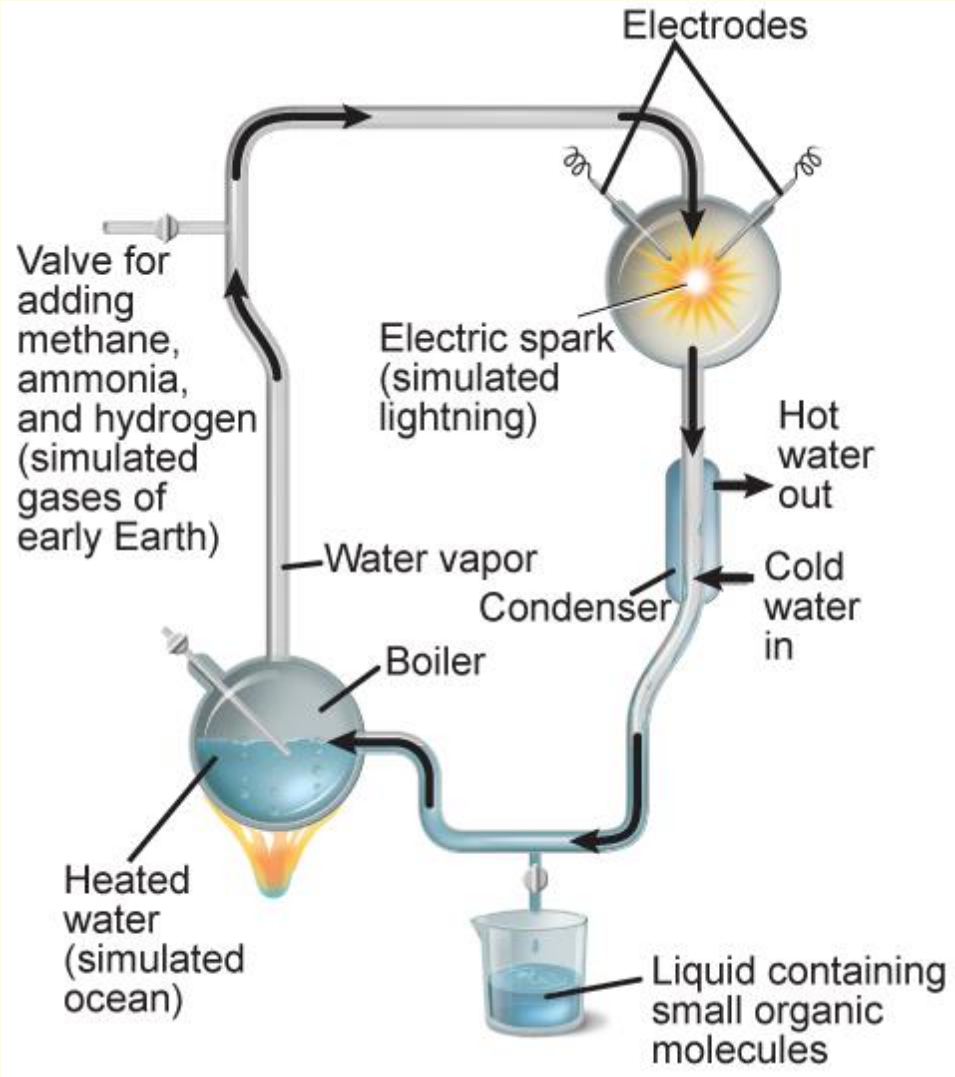
14.2 The Origin of Life

Origins: Modern Ideas

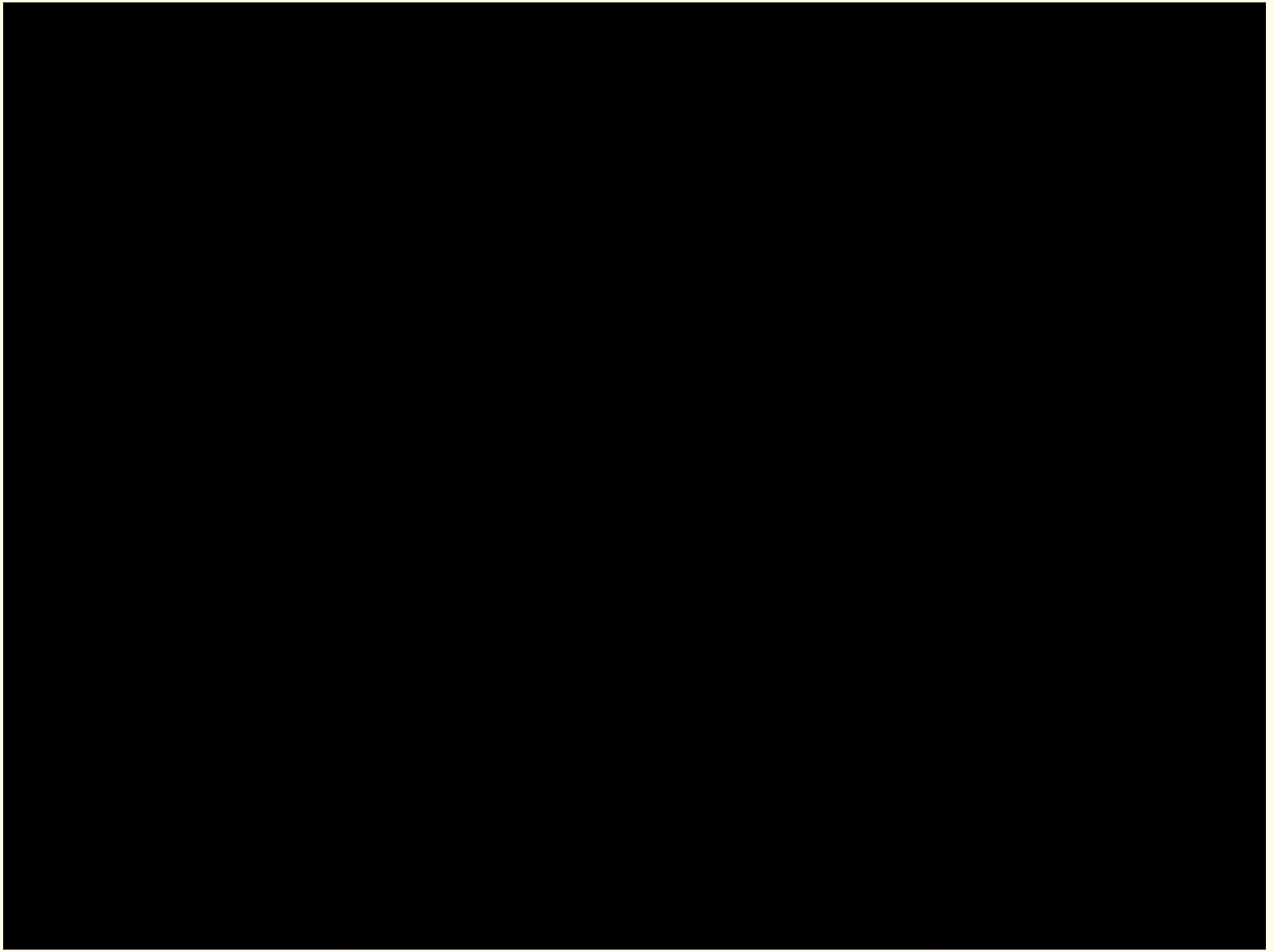
- Simple organic molecule formation
  - The primordial soup hypothesis was an early hypothesis about the origin of life.
  - Organic molecules could have been synthesized from simple reactions.
  - UV light from the Sun and electric discharge in lightning might have been the primary energy sources.

14.2 The Origin of Life

- Stanley Miller and Harold Urey were the first to show that simple organic molecules could be made from inorganic compounds.
- Later, scientists found that hydrogen cyanide could be formed from even simpler molecules in simulated early Earth environments.



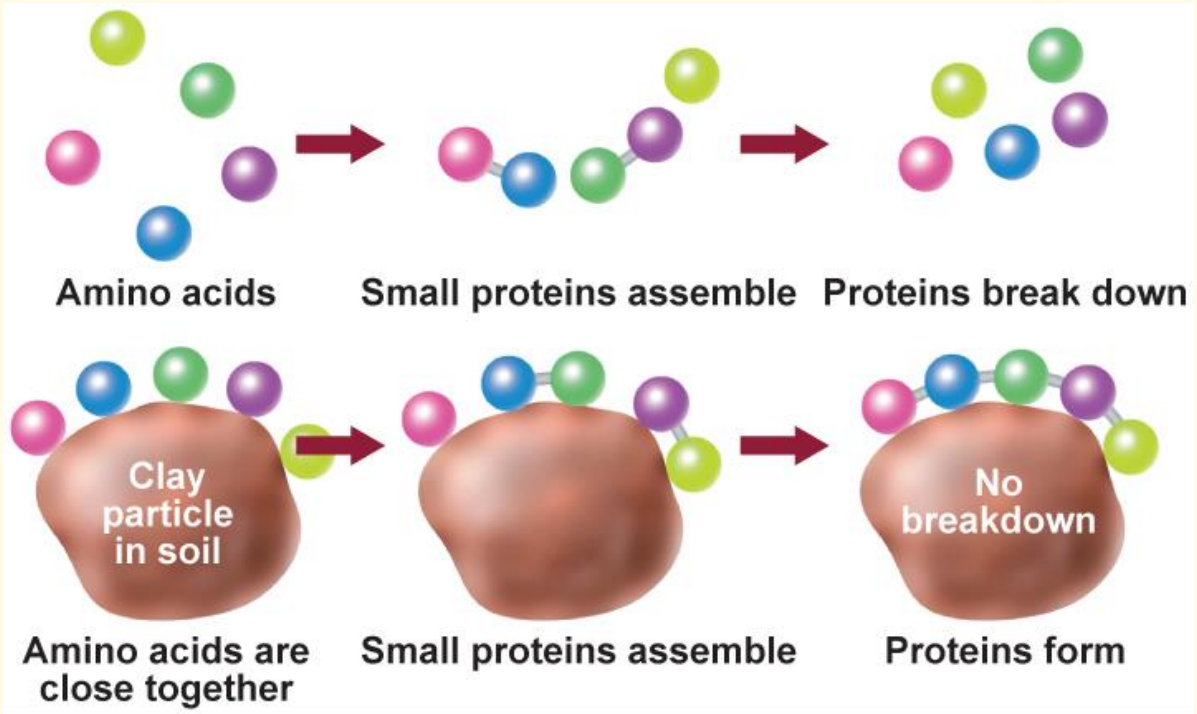
Concepts In Motion



14.2 The Origin of Life

Making Proteins

- Life requires proteins.
- One possible mechanism for the formation of proteins would be if amino acids were bound to a clay particle.



14.2 The Origin of Life

Genetic Code

- Some RNA sequences appear to have changed very little through time.
- Many biologists consider RNA to have been life's first coding system.
- Other researchers have proposed that clay crystals could have provided an initial template for RNA replication.

14.2 The Origin of Life

Cellular Evolution

- Scientists hypothesize that the first cells were prokaryotes.
- Many scientists think that modern prokaryotes called archaea are the closest relatives of Earth's first cells.

14.2 The Origin of Life

Photosynthesizing Prokaryotes

- Archaea are autotrophic.
- They do not obtain their energy from the Sun.
- Archaea also do not need or produce oxygen.

14.2 The Origin of Life

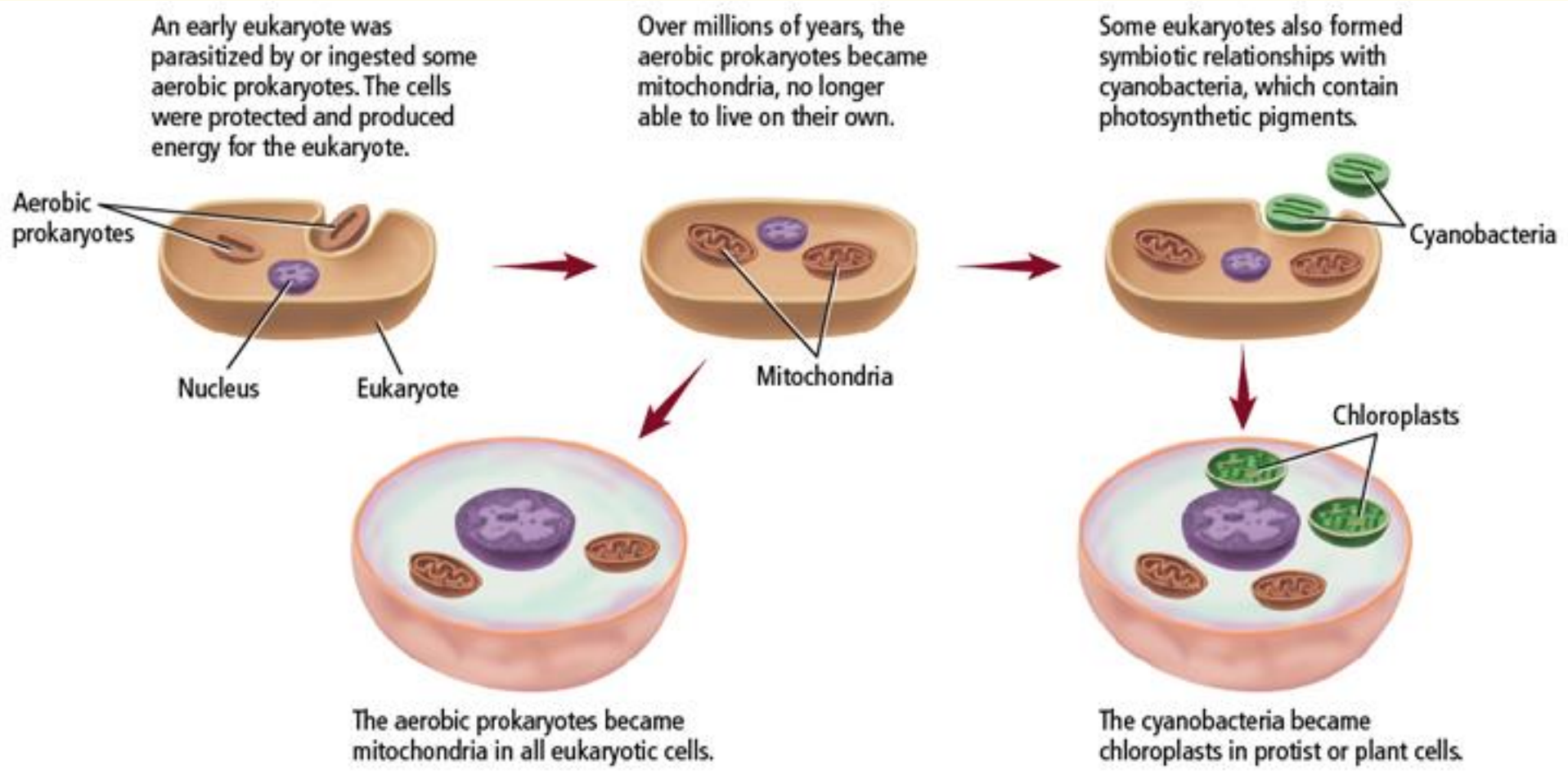
- Many scientists think that photosynthesizing prokaryotes evolved not long after the archaea.
- Prokaryotes, called cyanobacteria, have been found in rocks as old as 3.5 billion years.

14.2 The Origin of Life

The Endosymbiont Theory

- The ancestors of eukaryotic cells lived in association with prokaryotic cells.
- The relationship between the cells became mutually beneficial, and the prokaryotic symbionts became organelles in eukaryotic cells.
- This theory explains the origin of chloroplasts and mitochondria.

14.2 The Origin of Life



Chapter Resource Menu

Click on a hyperlink to view the corresponding lesson.

Chapter Diagnostic Questions

CheckPoint

Which is an example of the theory of spontaneous generation?

A. Tadpoles become frogs.

B. A starfish can grow from a severed arm.

C. Damp hay and corn create mice.

D. From a tiny acorn, an oak can grow.

Chapter Diagnostic Questions

CheckPoint

What gas do scientists think was absent from Earth's early atmosphere?

A. sulfur

B. nitrogen

C. oxygen

D. water vapor

Chapter Diagnostic Questions

CheckPoint

In which period did the first land vertebrates appear?

A. Cambrian

B. Devonian

C. Triassic

D. Mesozoic

14.1 Formative Questions

CheckPoint

In which type of rock do paleontologists search for fossils?

A. igneous

B. metamorphic

C. sedimentary

D. volcanic

14.1 Formative Questions

CheckPoint

Which dating method determines the age of rocks by comparing them to rocks in other layers?

A. absolute dating

B. geological dating

C. relative dating

D. sedimentary dating

14.1 Formative Questions

CheckPoint

Which geological change during the Mesozoic era had the greatest effect in shaping the course of evolution?

A. plate tectonics

B. extensive glaciation

C. increased volcanic activity

D. meteorite impact

14.2 Formative Questions

CheckPoint

At one time people believed that mold growing on a piece of cheese was created by the cheese. This is the idea of _____.

A. biogenesis

B. transgenesis

C. primordial generation

D. spontaneous generation

14.2 Formative Questions

CheckPoint

According to the endosymbiont theory, what may have happened to a prokaryotic cell that entered a host cell?

A. It was digested by the host cell.

B. It became an organelle in the host cell.

C. It became a harmful parasite in the host cell.

D. It was removed from the host cell by exocytosis.

14.2 Formative Questions

CheckPoint

An ancient prokaryote containing photosynthetic pigments that was engulfed by a host cell may have become a _____.

A. chloroplast

B. lysosome

C. centriole

D. ribosome

Chapter Assessment Questions

CheckPoint

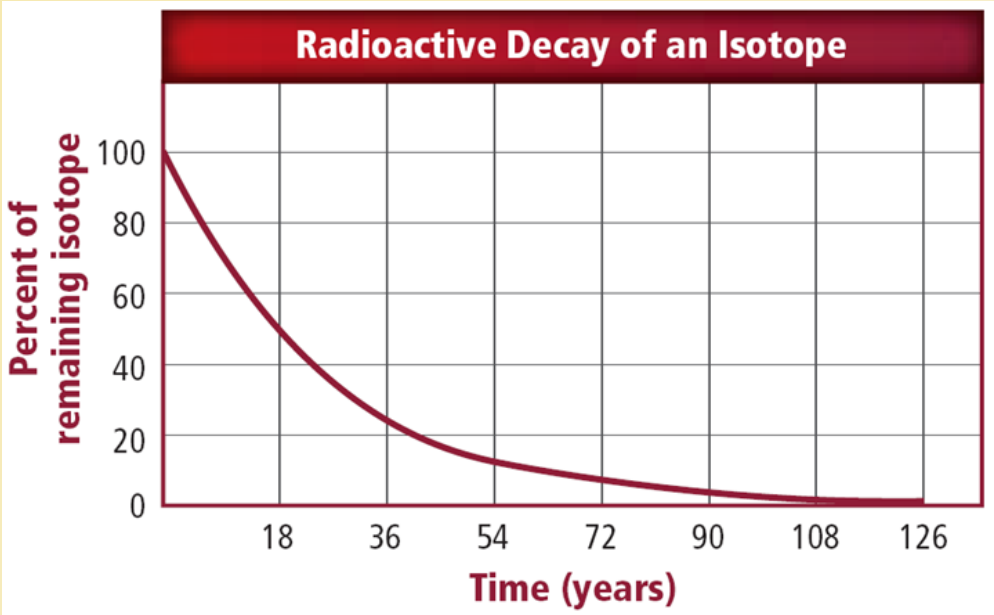
Which is the half-life of the radioactive isotope shown in the graph?

A. 18 years

B. 36 years

C. 54 years

D. 72 years



Chapter Assessment Questions

CheckPoint

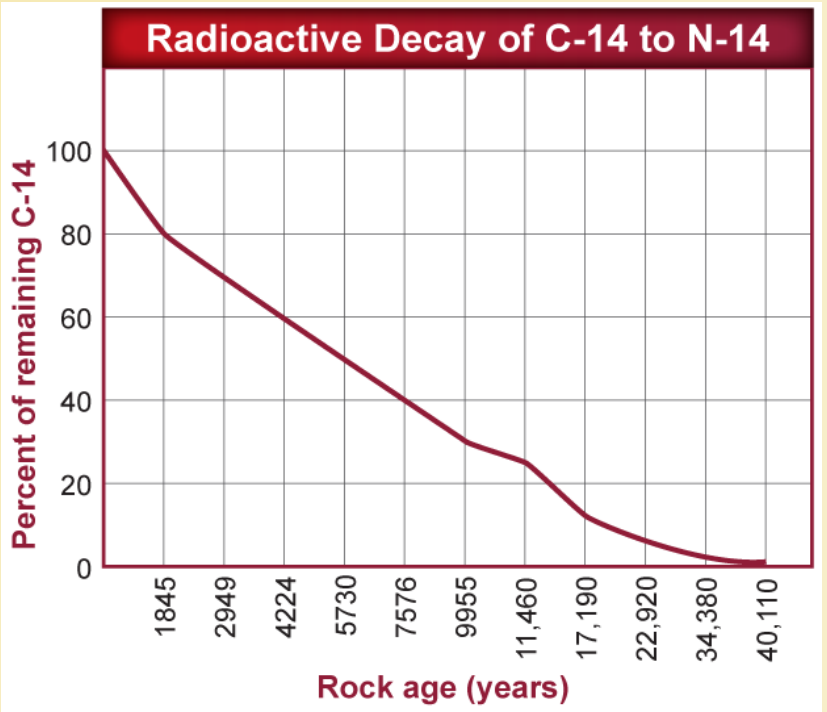
Study the graph. Determine the age of a rock if it contained 40% C-14.

A. 2,857.5 years

B. 7,576 years

C. 11,460 years

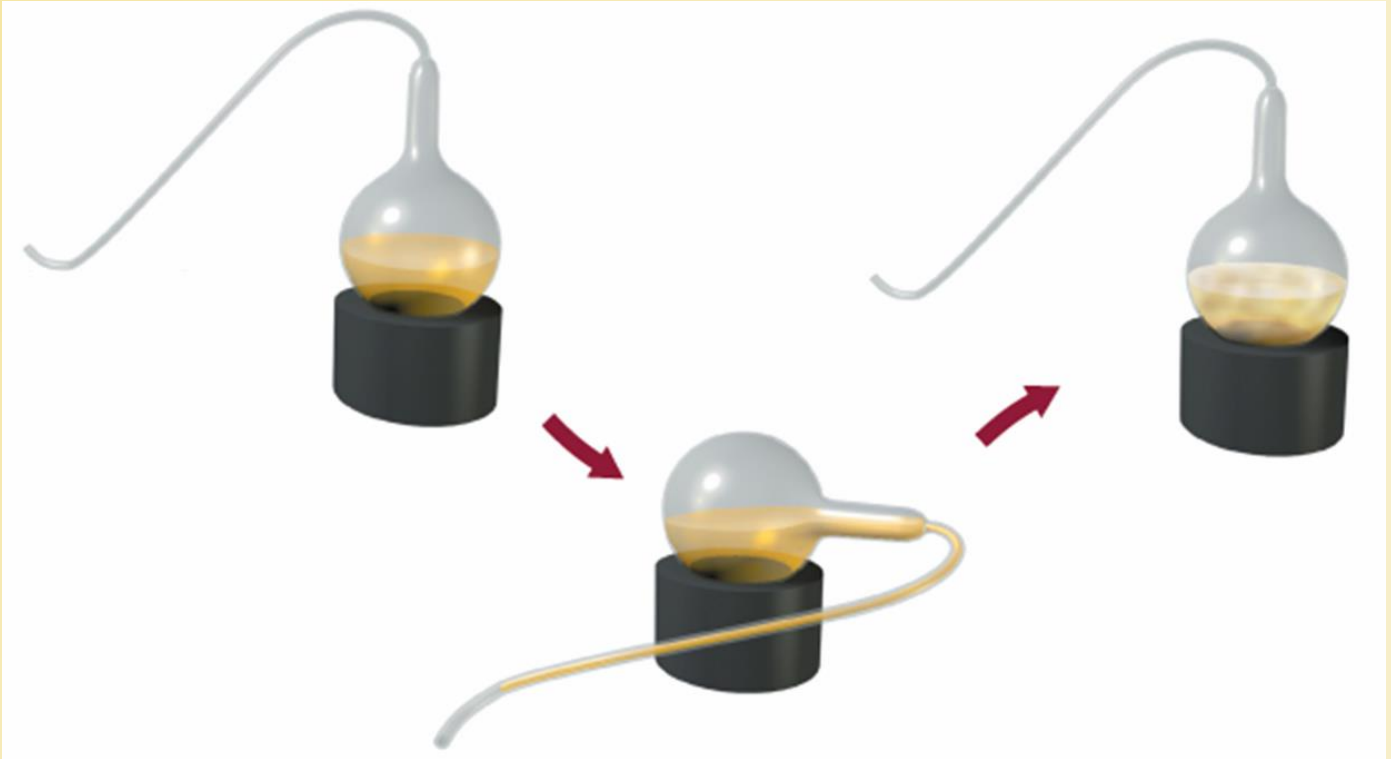
D. 5,730 years



Chapter Assessment Questions

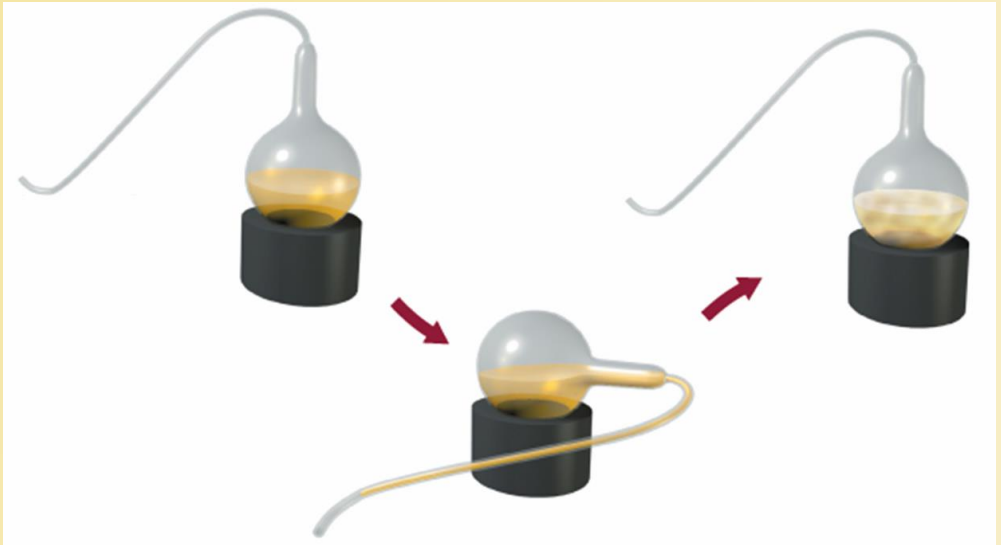
CheckPoint

Use the illustration to infer what Pasteur's experiment showed?



Chapter Assessment Questions

CheckPoint



A. Tilted bottles often spill.

B. Microorganisms do not grow in flasks.

C. Sterile liquids cannot spoil.

D. Microorganisms can enter the tilted flask.

Standardized Test Practice

CheckPoint

Which factor made it unlikely that life existed on Earth 4 billion years ago?

A. absence of oxygen

B. absence of food

C. intense heat

D. intense sunlight

Standardized Test Practice

CheckPoint

For which fossil might a paleontologist most likely use carbon-14 to determine its age?

A. fossilized microbes in volcanic rock

B. dinosaur footprints found in sedimentary rock

C. marine fossils found in a deep sedimentary layer

D. a woolly mammoth frozen in a glacier since the last Ice Age

Standardized Test Practice

CheckPoint

Beryllium-10 (Be-10) has a half life of about 1.5 million years. If a sample is analyzed and determined to contain ¼ of the original Be-10, what is the age of the sample?

A. 750,000 years

B. 3 million years

C. 4.5 million years

D. 6 million years

Standardized Test Practice

CheckPoint

Which provides the best evidence that a meteorite struck the earth 65 million years ago?

A. a large crater that was found

B. a layer containing high levels of iridium

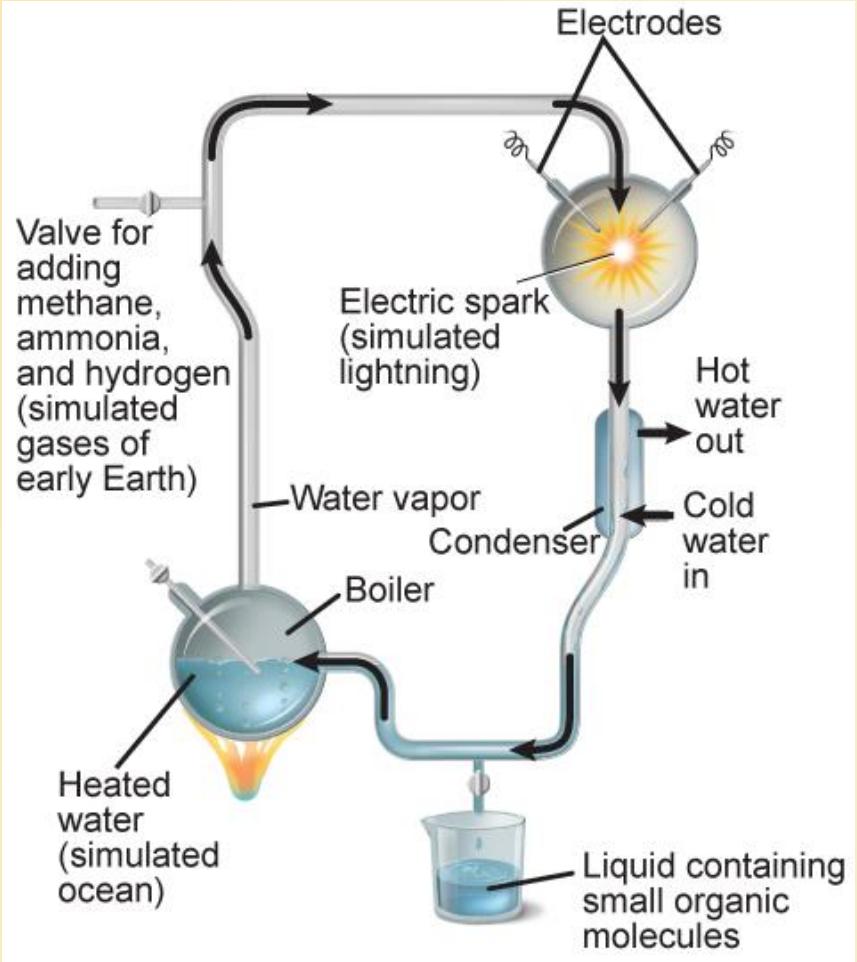
C. the sudden appearance of mammals

D. the sudden disappearance of dinosaurs

Standardized Test Practice

CheckPoint

In this experiment using water and the gases to simulate Earth's early atmosphere, which was *not* one of the final products?



Standardized Test Practice

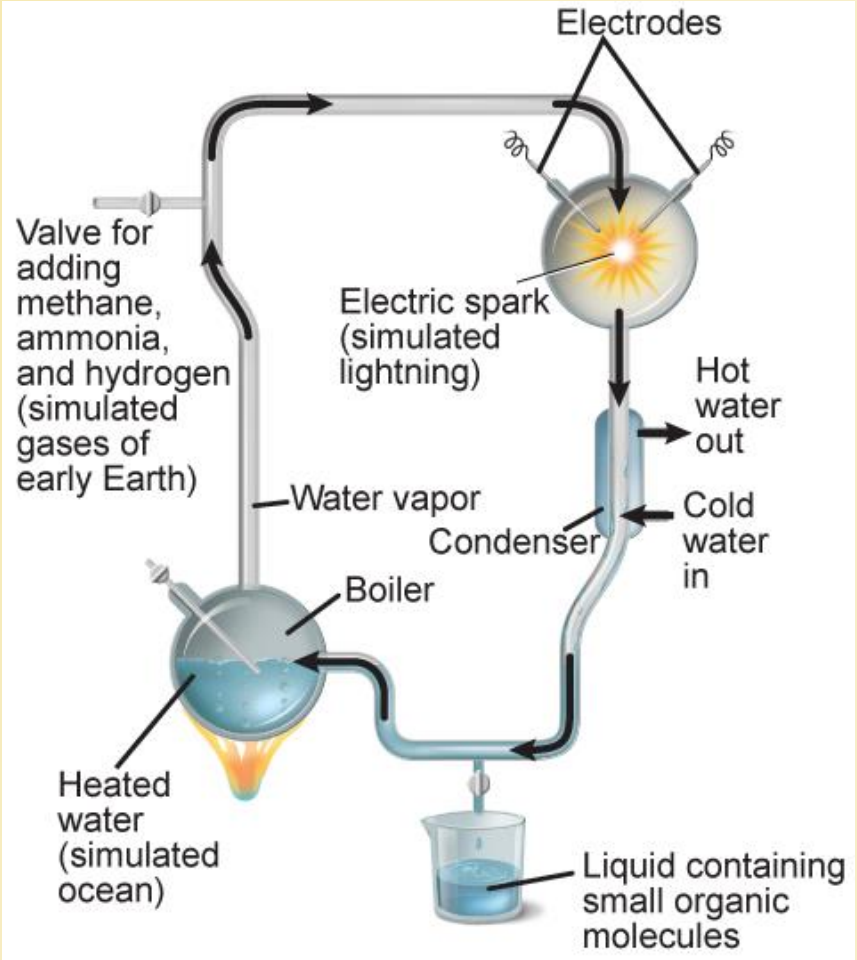
CheckPoint

A. amino acids

B. nucleotides

C. RNA molecules

D. sugar molecules



Standardized Test Practice

CheckPoint

Why do scientists believe that archea are the closest relatives to Earth's first cells?

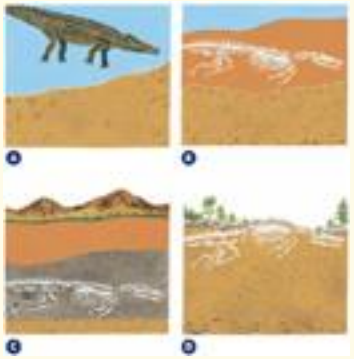
A. They are eukaryotes.

B. They contain DNA.

C. They carry out photosynthesis.

D. They live in extreme environments.

Glencoe Biology Transparencies



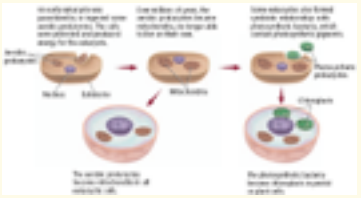
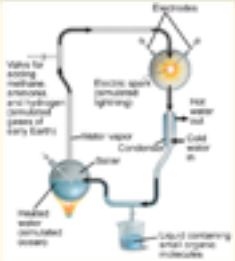
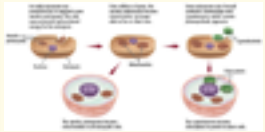


Image Bank


Categories of Fossil Types


Radioactive Decay of C-14 to N-14
Rock age (years)





Vocabulary

Section 1

- fossil
- paleontologist
- relative dating
- law of superposition
- radiometric dating
- half-life
- geologic time scale
- era
- period
- Cambrian explosion
- K-T boundary
- plate tectonics

Vocabulary

Section 2

- spontaneous generation
- theory of biogenesis
- endosymbiont theory

Animation

Concepts In Motion

- Visualizing Geologic Time
- Continental Drift
- Miller-Urey Experiment