Warm-Up | Geologic Time

Lesson Question

How is the geologic time scale used to show Earth's history?

Lesson Goals

Explain why the geologic time scale is used to show Earth's history.

Distinguish the units of the geologic time scale.

Explain how Earth has evolved over geologic time.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

era	one of three long and distinct divisions of geologic time
evolve	to develop gradually over time, often from a simple to more complex form
fossil record	a record of life on Earth based on the examination of organisms' remains
geologic time scale	a scale used to describe the timing of events in Earth's long history
index fossil	a fossil of a known geologic age used to determine the relative age of a rock layer
period	a length or portion of an era

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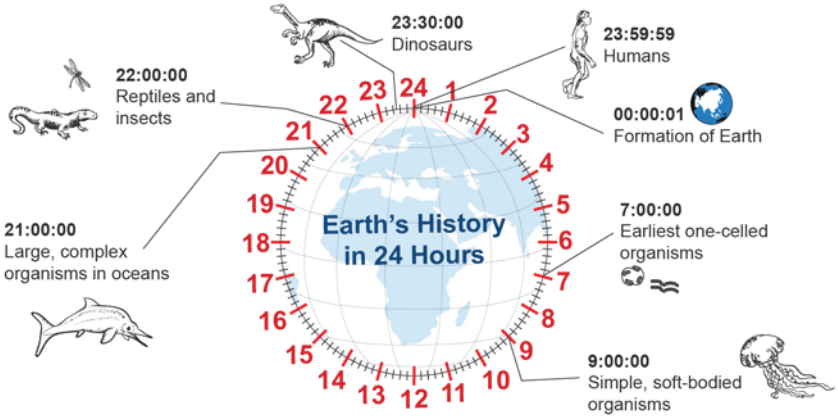
Earth's Geologic History



- Reptiles and insects did not appear until 10 p.m.
- Dinosaurs, which lived hundreds of millions of years ago, did not appear until 11 p.m.
- Now look where humans fall on this clock—humans didn't arrive on the scene until close to 12 a.m.

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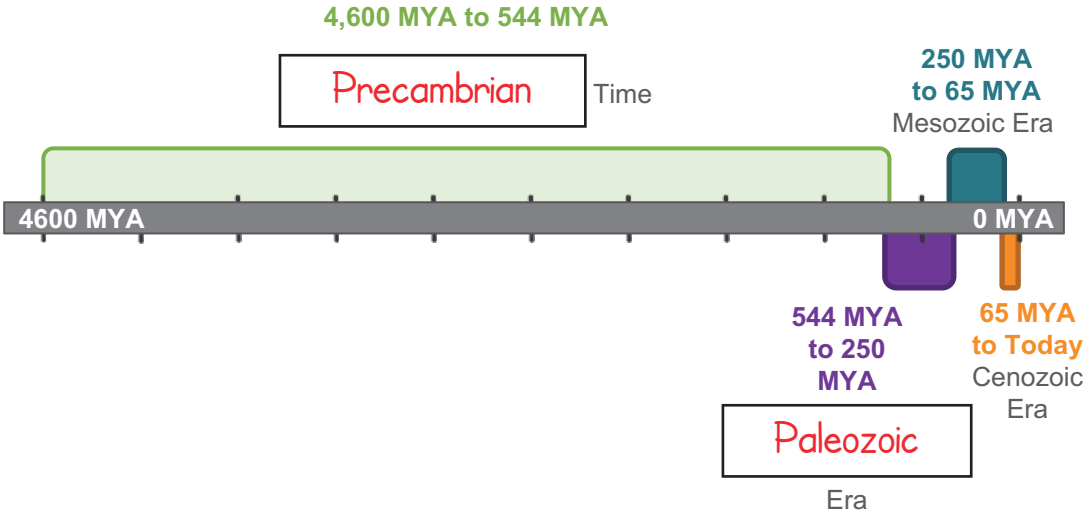
Geologic Time Scale

The **geologic time scale** is used to describe the [timing] of events in Earth's long history.

- Created by scientists who studied [rock] layers and **index fossils**

The **fossil record** helps geologists determine when one [length] of geologic time ended and when the [next] one began.

Geologic Time Scale



Paleozoic Era

After Precambrian time, geologic time is divided into **eras** and [periods].

The first is the Paleozoic era, which spanned from [544] million years ago to [250] million years ago.

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Mesozoic Era

The Mesozoic era follows the Paleozoic era.

- Lasted from 250 million years ago until 65 million years ago
- Included Triassic, Jurassic, and Cretaceous periods
- Was the time when most well-known dinosaurs lived
- Included the first birds and flowering plants

Cenozoic Era

The current era is the Cenozoic era.

- Began about 65 million years ago
- Divided into Paleogene, Neogene, and Quaternary periods
- Saw the emergence of mammals, including humans

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Age of Earth

Scientific evidence suggests that Earth formed around 4.6 billion years ago.

- Scientists have used radioactive dating to date rocks and meteors.
- This helps them determine the approximate age of Earth.

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Formation of Earth

Scientific evidence suggests that Earth started as a ball of dust, rock, and ice.

- Materials were pulled together by [gravity].
- Energy from collisions increased [temperature], causing the materials to melt.
- Dense melted material sunk toward the center, forming Earth's core.
- Heat was lost to surrounding space, causing less dense material to harden and form the [crust] and mantle.
- Earth's gravity captured hydrogen and helium to form the first atmosphere.
    - The Sun released a strong burst of particles that blew away this atmosphere.

Formation of the Moon

The moon formed around the same time as Earth.

- Moon rocks help scientists determine the age of the moon.
- The moon formed from material on Earth.
    - Earth collided with a large object, throwing material into [orbit].
    - This material [combined] to form the moon.

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Precambrian Time: The Atmosphere

During Precambrian time, Earth's new atmosphere began to form.

- The early atmosphere contained carbon dioxide, water vapor, and nitrogen.
- Life on Earth today could not exist in this atmosphere.
- Gases were added to the atmosphere by volcanoes and collisions with comets.

Precambrian Time: Oceans and Continents

During Precambrian time, oceans and continents began to form.

- Due to high temperatures, water on Earth's surface evaporated.
- As Earth's surface cooled:
  - water condensed and collected to form oceans.
  - rock hardened to form continents.

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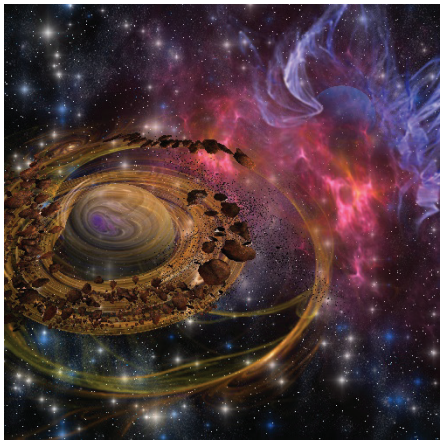
Life on Earth

Scientists do not know the exact date when life began on Earth.

- Fossils of single-celled organisms date back to about [3.5] billion years ago.
  - All other life forms **evolved** from these.
- Organisms began to [photosynthesize], which released oxygen into the air.
  - Some oxygen in the atmosphere formed ozone, blocking harmful ultraviolet (UV) rays from the Sun.

Heat in Earth's Formation

Heat during the formation of [Earth] came from three sources.



- Collision of materials

  First, heat was produced by the impact of [colliding] materials as gravity pulled materials together.

- Compaction of materials

  As the materials came together and Earth grew bigger, its gravitational field increased. As a result, Earth continued to attract more materials, as shown in this image. It became more [dense]. This process, known as compaction, also produced heat.

- Radioactive decay

  The third source of heat is radioactive decay.

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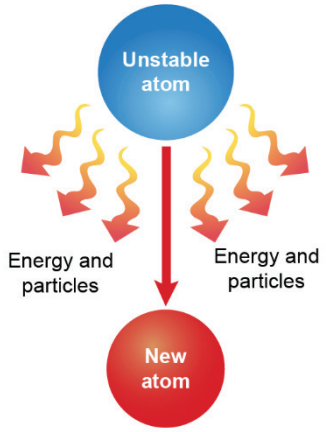
Radioactive Decay

Some atoms can undergo radioactive decay.

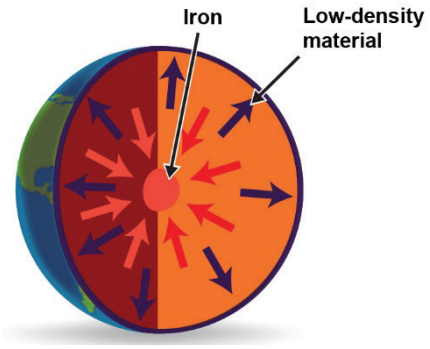
- [Stable] elements have a consistent number of smaller particles.
- Unstable, or radioactive, elements [lose] smaller particles.
  - This process is called radioactive [decay].



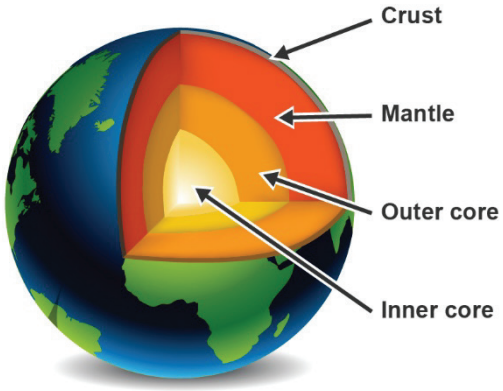
Formation of Layers

Heat allowed protoplanets, such as Earth, to form different [layers].

- Metals, such as iron, began to melt.
- High-density metals began to sink toward Earth's [core].
- Low-density materials rose toward Earth's surface.



- The heating, melting, sinking, [cooling], and rising processes helped form the different [layers].



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Summary | Geologic Time

Lesson Question

How is the geologic time scale used to show Earth's history?

Answer

(Sample answer) The fossil record helps geologists determine when one length of geologic time ended and when the next one began. The fossil record shows the different organisms that lived in and across the different eras and periods.

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Review: Key concepts

- The geologic time scale was developed by scientists using the fossil record.
- Geologic time is divided into eras and [periods].
- Precambrian time accounts for [88] percent of Earth's history.
- Earth and the moon formed about [4.6] billion years ago at the start of Precambrian time.
- As Precambrian time continued, conditions on Earth changed to allow life on Earth to begin.
- Life on Earth evolved with the changing [conditions].

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Use this space to write any questions or thoughts about this lesson.

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