Essential Question: What is the geologic time scale?

Vocabulary:
- **Geology**: the scientific study of the origin, history, and structure of Earth and the processes that shape it.
- **Geologic Time Scale**: The standard method used to divide Earth’s long natural history into manageable parts.

How Have Geologists Described the Rate of Geologic Change?

1. **Geology** is the scientific study of the origin, history, and structure of Earth and the processes that shape it.
   - a. Early geologists proposed different ideas to explain how Earth changes over time.

2. Changes Occur Suddenly: Catastrophism
   - a. **Catastrophism**: the principle that states that all geologic change occurs suddenly.
   - b. Supporters of catastrophism thought that Earth’s features, such as mountains and seas, formed during sudden events called catastrophes.

3. Changes Occur Gradually: Uniformitarianism
   - a. About 250 years ago, James Hutton established a principle that is now known as uniformitarianism.
   - b. **Uniformitarianism**: the idea that the same geologic processes that shape Earth today have been at work throughout Earth’s history.
   - c. The principle also states that the average rate of geologic change is slow and has remained relatively constant over time.
4. Changes Occur Both Catastrophically and Gradually
   a. Today, geologists realize that neither uniformitarianism nor catastrophism accounts for all geologic change.
   b. While most geologic change is gradual and uniform, catastrophes do cause some geologic change.
   c. Example: earthquakes, floods, volcanic eruptions, and asteroid
How do Geologists Use the Geologic Time Scale?

1. To divide Earth’s long geologic history
   a. The **geologic time scale** divides Earth’s geologic history into intervals of time defined by major events or changes on Earth.
   b. The largest unit of geologic time is an **eon**.
   c. Earth’s 4.6-billion-year history is divided into four eons: the Hadean, Archean, Proterozoic, and Phanerozoic.
   d. The Hadean, Archean, and Proterozoic eons together are called **Precambrian time**.
   e. Precambrian time makes up almost 90 percent of Earth’s history.
   f. Eons may be divided into smaller units of time called **eras**.
   g. The Phanerozoic Eon, the present eon, is divided into three eras: the Paleozoic, Mesozoic, and Cenozoic.
   h. Each era is subdivided into a number of **periods**.
   i. The periods of the Cenozoic, the present era, are further divided into **epochs**.

2. To mark major changes in the fossil record
   a. Some divisions are based entirely on the fossil record.
   b. At least five divisions of geologic time have ended in large mass extinction events.
      - The Cenozoic Era is only a tiny fraction of Earth’s geologic history.
What were some defining events of Precambrian time?

1. Precambrian time began with the formation of Earth about 4.6 billion years ago.

2. Massive supercontinents, the first oceans, and the early atmosphere formed during this time.

3. Toward the end of Precambrian time, much of Earth’s land surfaces were located near the poles and covered in ice.

What were some defining events of the Paleozoic Era?

1. The Paleozoic Era began about 540 million years ago. The supercontinent Pannotia was breaking up and the supercontinent Pangaea began forming.

2. Life diversified quickly and dramatically during the Cambrian Explosion, during which most major groups of organisms first evolved.

3. The era ended about 250 million years ago with a huge mass extinction event.

4. During the Cambrian Explosion, new species evolved rapidly in Earth’s shallow seas.
What were some defining events of the Mesozoic Era?

1. During the Mesozoic Era, which began about 250 million years ago, Pangaea began breaking up.

2. The Atlantic Ocean began to open up, the Mid-Atlantic Ridge formed, sea levels rose, and shallow seas covered much of the land.

3. Along the western edge of North America, tectonic activity began to fold Earth’s crust, forming mountains. The climate was likely warm, as periods of heavy volcanism added carbon dioxide to the atmosphere.

4. Life during the Mesozoic was dominated by dinosaurs. The few mammals were very small.

5. A mass extinction event about 65 million years ago marked the end of the era, and the end of dinosaurs.

What were some defining events of the Cenozoic Era?

1. The Cenozoic Era began about 65 million years ago with the Cretaceous mass extinction and continues to the present.

2. Greenland split apart from North America and Europe, and the continents assumed their current positions.

3. The Indian subcontinent collided with Eurasia to form the Himalayas. The collision of Africa and Europe resulted in the Alps.
4. The Cenozoic Era is divided into two periods: the Tertiary and the Quaternary. The latter stretches from about 2.6 million years ago to the present.

5. The Quaternary has been characterized by an ice age, with much of Europe, North America, and Asia having been covered in thick sheets of ice.

6. The evolution of modern humans occurred during the late Quaternary.

**Essential Question Review:**

- What is the geologic time scale?