

Learning Objective: Earth Processes: Scales of Time and Space

NGSS Standard: (MS-ESS2.A) The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.

Objective:

Students will be able to:

1. Explain the significance of time scales.
2. Explain the significance of space scales.
3. Understand the role that units of measurement play in time scales.
4. Understand the role that units of measurement play in space scales.

Time Required: 85 minutes

Materials Needed:

- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Earth's Time and Space Scales handout (attached)
- Images for the Engage portion (attached)
- 2 - 6ft strands of yarn (one per group of students)
- Ziploc bags
- Tape or 10 paper clips per group

Teacher Preparation:

- Create Playlist 1, a 30 minute [playlist](#) in [Legends of Learning](#) with the following games found in the Earth Processes: Scales of Time and Space learning objective (in order):
 - *Time for Fun: Geologic Time and Scale*
 - *Flip and Learn: Earth Scale of Time and Space*
- Create Playlist 2, a 10 minute [playlist](#) in Legends of Learning with 5 [assessment questions](#) from the Earth Processes: Scales of Time and Space learning objective.
- Make copies of Earth's Time and Space Scales handout (1 per student).
- For each group:
 - Make copies (copies can be in black and white; color printing is not essential) of "Images for Engage" and cut out the globes for Pangea and the life cycle of a human. Place these in a ziploc bag (Pangea in one bag and life cycle of a human in a separate bag).
 - Cut two strands of yarn approximately 6 feet long. Place one strand of yarn in each of the ziploc bags.

Engage (10 minutes):

1. Pass out ziploc bags with materials to students and ask them to assemble two different timelines. One of Pangea and one of the life cycle of a human.
 - a. Students will use tape or paper clips to attach the images to the yarn to construct the timeline.
2. Remind the students that for Pangea, the time scale is in millions of years. Therefore, 225 is 225 million years.
3. The teacher will ask the students, "What differences and similarities do you notice about the two different time scales?"
 - a. ANSWER: The yarn distance is the same length for each of the time scales, but the amount of time that is being represented on each timeline is different. Different events are occurring in the separate time scales. Some events take

a small amount of time when compared to the age of the Earth.

4. The teacher will ask the students, "What do you notice about the units on the time scales?"
 - a. ANSWER: Pangea is in millions of years and the human life cycle is in years.
5. The teacher will say, "Today we are going to learn about scales of time and space that exist on Earth. Think about this demonstration during today's lesson as we will refer back to it at the end of class."

Explore (30 minutes):

1. Have your students [sign in to Legends of Learning and enter your teacher code](#).
2. [Launch](#) Playlist 1 to your students.
3. As students complete *Time for Fun: Geologic Time and Scale*, students should fill out the Earth's Time and Space Scales handout (**Part I ONLY**).
4. Assist students as needed during game play, pause playlist if you need to address content or questions to entire class.

Explain (20 minutes):

1. Review answers to Earth's Time and Space Scales handout.
2. Relate student knowledge to demonstration at the beginning of class.
 - a. Which time scale took the longest? (Pangea/earth's continents)
 - b. Which time scale was the shortest? (The human's life cycle)
 - c. What was significant about the length of the strand of yarn? (The size of the instrument being used to illustrate an event on Earth is relative to the units being used to communicate the event that is being measured)
 - d. What is the importance of Earth's time scales? (Some events occur quickly and may have negative consequences, such as a volcano erupting. Some events take millions of years, such as the geological processes that have shaped the Earth into a habitable planet.)
 - e. What is the importance of Earth's space scales? (These scales show the relative sizes of various objects in comparison to each other.)
 - f. Which is more important the size of the instrument being used to illustrate an event or the units of measurement? (The units of measurement. The units of measurement will indicate the rate of speed or indicate the size of an event or object.)

Elaborate (15 minutes):

1. Explain to students that although it appears that a day in your life, or life in general, is long, it is only a very, very small portion on Earth's geologic time scale.
2. This [short video](#) will further explain how different terms are used to explain the different events and/or different species that have occurred on/inhabited the Earth in a time scale.
3. Ask students to describe and explain what they are seeing in the video.
 - a. Answer: The Earth has time scales (that span many years) which indicate the events and/or organisms that lived during that era.
4. The teacher will have the students complete **Part II** on the Earth's Time and Space Scales handout.

Evaluate (10 minutes):

1. [Launch](#) Playlist 2 to your students. When they finish the assessment questions, any time left is freeplay.
2. [Analyze student results](#) to determine what concepts need to be a focus for reteaching.



Earth's Time and Space Scales

Name: _____

Directions: While playing the first game in Legends of Learning called *Time for Fun: Geologic Time Scale*, use what you learn to answer the questions below.

Part I

1. What is the smallest object in the simulation? (*human, dust, dust mite, quartz*)
2. Which is smaller, a *quartz geode* or a *raindrop*?
3. Why is the unit meters used to measure distances or the size of some objects?
 - A The unit meters can be used if the person who is measuring decides to use meters instead of millimeters or inches.
 - B The unit meters can be used to measure large objects and/or large distances.
 - C Both A and B are correct
 - D None of the above
4. Which of the following is known as the "age of the mammals"? (*Cenozoic, Mesozoic, Paleozoic, Proterozoic*)

5. Has oxygen been in the atmosphere since the beginning of geologic time? (*yes no*)

6. Explain your answer for question 5. _____

7. How long have humans inhabited the Earth?
(*61 million years ago, 2500 million years ago, 4000 million years ago, none of the above*)

8. How long is a millennium in years? (*100 years, 1000 years, 1 million years, none of the above*)

Part II

9. What is the significance of time/space scales? _____

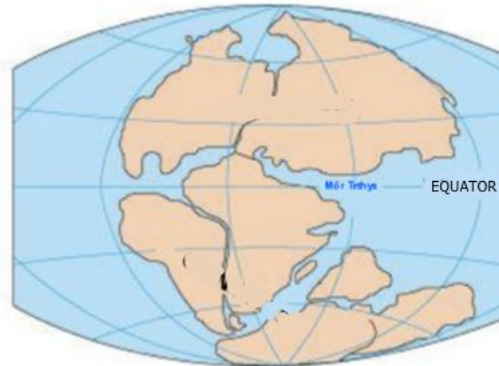
10. How are time and space scales different from each other, and how are space and time scales similar? _____

Images for Engage.

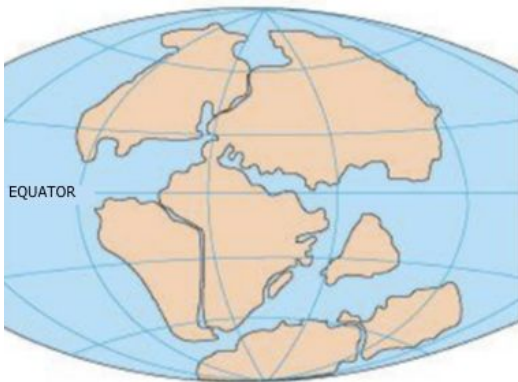
Each globe must be cut separately.



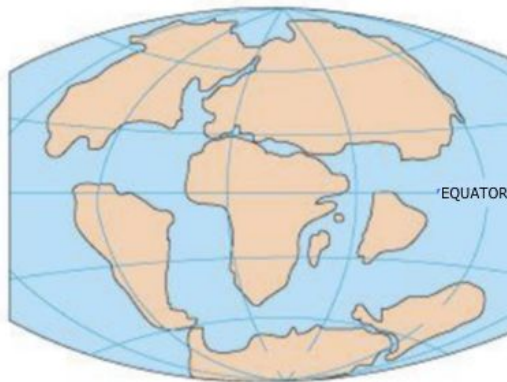
Permian **225m**



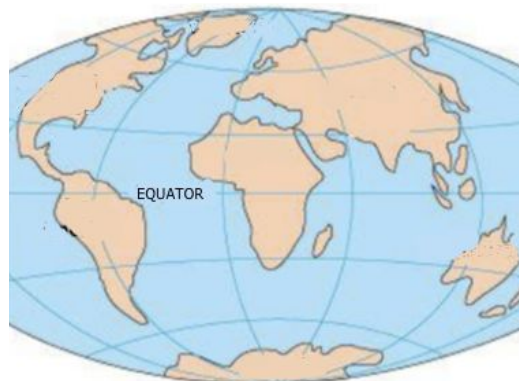
Triassic **200m**



Jurassic **150m**



Cretaceous **65m**



Present Day

Images for Engage (cont.).

Each milestone must be cut separately.

