

Nested Boxes and Big Numbers: The Language of Deep Time

Learning target: I can use the units of the geologic time scale, the abbreviations Ga, Ma and ka, and the evidence words of this lesson to describe new situations correctly.

Vocabulary in action

About 30 min

Individual

MS-ESS1-4 · supports

MS-LS4-1 · supports

independent practice

writing

Name _____

Date _____

Period _____

Directions

Read the term box first. Every definition there is written in plain words; read each one twice. Then work through Parts A to D in order. In Part C you are given a situation and must name the term that fits and say why. Write complete sentences wherever a line is given. Use the term box; do not use the textbook.

You will need: This worksheet, Pencil, Calculator (optional for Part B)

geologic time scale

A model that divides Earth's whole 4.54-billion-year history into named stretches of time, built from the order of rock layers and the fossils in them, with some ages in years added from datable rocks.

eon

The largest unit of the time scale. There are four; three of them cover the first 4 billion years, and the one we live in, the Phanerozoic, covers the last 539 million years.

era

A division of an eon, hundreds of millions of years long. The Phanerozoic Eon has three: Paleozoic, Mesozoic and Cenozoic.

period

A division of an era, usually tens of millions of years long.

epoch

A division of a period, the smallest unit named on most charts. We live in the Holocene Epoch, which began about 11,700 years ago.

Ga, Ma, ka

Short labels for billions, millions and thousands of years (from annum, the Latin word for year). 2.5 Ga means 2.5 billion years; on a timeline it usually means that many years ago.

relative dating

Putting rocks, fossils or events in order (older, younger) without giving an age in years. Rock layers and fossils give relative ages.

absolute dating

Measuring an age in years from the steady change of certain atoms inside a mineral. Works on meteorites, moon rocks and some volcanic rocks, including ash layers.

mass extinction

The dying out of a large share of Earth's species within a geologically short time. Rock strata show it as many kinds of fossils stopping at one level. Five big ones mark boundaries on the time scale.

principle of lateral continuity

A sediment layer spreads out sideways as a sheet until it thins out or meets a barrier. So the same layer seen in two separate cliffs can be matched, joining their records.

stromatolite

A layered mound of rock built up by mats of microbes, including the cyanobacteria that first released oxygen. Fossil stromatolites are among the oldest signs of life.

ice age

A long stretch of cooler global climate with permanent ice at the poles. Earth is in one now, and has been for about 2.6 million years.

glacial period

A colder stretch inside an ice age, when ice sheets grow outward from the poles.

interglacial period

A warmer stretch inside an ice age, when ice sheets melt back and cover less land. We live in one that began about 11,700 years ago.

nebular hypothesis

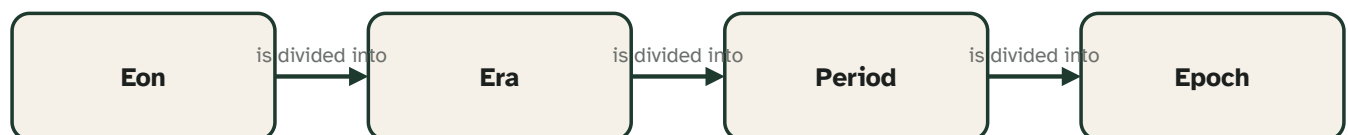
The explanation for how the solar system formed: a cloud of gas and dust shrank, spun into a disk, and clumped into the sun, the planets and leftover asteroids about 4.6 billion years ago.

giant impact hypothesis

The explanation for the moon: a body about the size of Mars struck the young Earth, and debris from both went into orbit and gathered into the moon about 4.5 billion years ago.

Part A: How the units nest

Units of the geologic time scale, longest to shortest



The units are nested like boxes inside boxes. Each arrow means 'is divided into'. Moving to the right, the boxes get shorter in time.

1. Write today's date on the geologic time scale, from the largest unit to the smallest. Word bank:

Cenozoic, Holocene, Phanerozoic, Quaternary. Eon: _____ Era: _____ Period: _____ Epoch: _____

2. Which is longer, an era or a period? Explain how the diagram tells you, using the word *divided* or *nested*.

3. A student says, 'Every period is the same length, like every hour is 60 minutes.' Use the definition of **mass extinction** to explain why periods are not all the same length.

Part B: Reading and converting the big numbers

4. Complete the table. (a) 2.5 Ga to Ma. (b) 66 Ma to ka. (c) 11.7 ka to years. (d) 539 Ma to Ga. (e) 300 ka to Ma. Write the multiplication or division you used in the Answer column.

Given	Convert to	Answer
a		
b		
c		
d		
e		

5. The label **66 Ma** can mean a *date* (66 million years ago) or a *length* (66 million years long). Write one sentence that uses it as a date and one that uses it as a length.

Part C: Which term fits? Name the term and give the reason

6. A geologist finds the same pale volcanic ash layer in two cliffs 60 km apart and concludes the two cliffs once shared one continuous layer.

7. A laboratory reports that the minerals in a sample of volcanic rock formed 201 million years ago.

8. In a stack of layers, nine kinds of shell fossils appear in every layer up to one thin line of rock; above the line only two of those kinds are found.

9. Ice sheets are growing outward from both poles and covering land that was bare a few thousand years earlier. Give the most specific term.

10. A scientist slices open a layered, cabbage-shaped mound of 3-billion-year-old rock and argues it was built by mats of microbes.

11. Moon rocks turn out to match the chemistry of Earth's mantle far better than they match the asteroids. Which explanation does this evidence support, and why?

Part D: Sorting the evidence words

12. Sort these five clues into the two columns: the lowest undisturbed layer is oldest; a volcanic ash layer whose minerals are dated in a lab; a meteorite's mineral clock; the same fossils appearing in the same order in two places; a layer that cuts across other layers is younger than them.

Gives order only (relative)	Gives an age in years (absolute)
Write each clue in one column	

13. Explain the difference between an **ice age**, a **glacial period** and an **interglacial period**. Use the word *inside* or *within* at least once. Then state which of the three we are living in today (more than one may apply) and give the starting date of each one you name.

Conversion ladder

Each step on the ladder is 1,000: 1 Ga = 1,000 Ma, 1 Ma = 1,000 ka, 1 ka = 1,000 years. To go down a step (Ga to Ma, Ma to ka, ka to years) multiply by 1,000, which moves the decimal point three places right. To go up a step, divide by 1,000, which moves it three places left. Check: 2.5 Ga is a very long time, so it should become a bigger number in Ma (2,500), not a smaller one.

Write the rules of a time scale for your own life

Invent a four-level time scale for one person's life, with your own names for the levels (for example 'ages', 'chapters', 'seasons', 'weeks'). Decide what kinds of events would mark the boundaries between units, then write two sentences explaining why your units, like the geologic time scale's, would not all be the same length. Finish by naming one thing about a human life that makes it easier to divide than Earth's history, and one thing that makes it harder.