

Earth's Deep Clock

Use rock layers and isotopes to determine relative and numerical ages.

SC.7.E.6.3 "Identify current methods for measuring the age of Earth and its parts, including the law of superposition and radioactive dating."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each sentence that explains a method scientists use to determine age. Circle the words that show whether the method gives a relative age or a numerical age.

Reading Earth's Record

- ① Scientists estimate Earth's age by measuring rocks, minerals, and materials that formed early in the solar system. The oldest known Earth minerals are about 4.4 billion years old, while many meteorites formed about 4.56 billion years ago. These clues, along with lunar samples, support an Earth age of about 4.54 billion years. Scientists do not simply choose the oldest rock they find. Earth's surface changes as rocks melt, erode, and are buried, so researchers compare evidence from several kinds of samples.
- ② One relative method is the law of superposition. In an undisturbed stack of sedimentary layers, a lower layer was deposited before a layer above it. This method places layers in order, but it does not give their ages in years. Scientists first check whether folding, faulting, or overturning has changed the stack. Fossils can help match layers at different places, yet superposition still describes relative age, older or younger, rather than a numerical date.
- ③ Radioactive dating gives numerical ages. Some atoms in a mineral are radioactive parent isotopes that change into daughter isotopes at a predictable rate. After molten rock cools and its minerals crystallize, the amounts of parent and daughter isotopes can act like a clock. By measuring both amounts and using a known half-life, scientists calculate when the mineral formed. A date from an igneous layer can also limit the age of nearby sedimentary layers. Scientists compare dates with layer order to spot results that do not fit.

2 ANSWER WITH EVIDENCE Use the passage

- 1 According to the law of superposition, which layer is older in an undisturbed stack of sedimentary rock, a lower layer or a layer above it?

- 2 Why can the law of superposition not give a rock layer's exact age in years?

- 3 What two isotope amounts do scientists measure when they use radioactive dating?

- 4 In an undisturbed rock stack, an igneous layer lies above a sedimentary layer. If the igneous layer is dated, what does that date tell scientists about the sedimentary layer?

3 YOUR TURN Your own words

A road cut has three flat, undisturbed sedimentary layers. A thin igneous ash layer lies between the middle and upper layers, and radioactive dating shows that the ash is 28 million years old. Write exactly three sentences that explain the relative order of the layers, the numerical age, and what the ash date tells you about the layers above and below it.

PART 1 • READ AND MARK

Underline each sentence that explains a method scientists use to determine age. Circle the words that show whether the method gives a relative age or a numerical age. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	According to the law of superposition, which layer is older in an undisturbed stack of sedimentary rock, a lower layer or a layer above it?	The lower layer is older because it was deposited first.
2	Why can the law of superposition not give a rock layer's exact age in years?	It shows only the relative order of layers, older or younger, not a numerical age.
3	What two isotope amounts do scientists measure when they use radioactive dating?	They measure the amounts of parent isotopes and daughter isotopes in a mineral.
4	In an undisturbed rock stack, an igneous layer lies above a sedimentary layer. If the igneous layer is dated, what does that date tell scientists about the sedimentary layer?	The sedimentary layer was deposited before the igneous layer formed, so it is older than the dated igneous layer.

PART 3 • YOUR TURN (SAMPLE ANSWER)

The bottom sedimentary layer is oldest, the middle layer is younger than the bottom but older than the ash, and the upper layer is youngest. Radioactive dating gives the ash layer a numerical age of 28 million years. The bottom and middle layers were deposited before 28 million years ago, while the upper layer was deposited after that time.

Accept equivalent wording that distinguishes relative age from numerical age. For the open response, accept a correct layer sequence and the conclusion that layers below the ash are older than 28 million years and the layer above is younger.