

Zoe's Desert Rock Record Hunt

Grade 6

science

desert

Students will be able to analyze rock layers, fossils, and geologic evidence to explain Earth's history and the age of rock formations.

Name: _____

Date: _____

1. Zoe arrives at a desert canyon on her first morning. She spots three rock layers stacked on top of each other. True or False: The bottom rock layer is the oldest. Explain your answer in one sentence.

2. Zoe finds a special object — a flat, shiny fossil pressed into sandstone. Fill in the blank: A fossil found inside a rock layer gives scientists clues about _____ that lived during that time period.

3. Zoe studies four desert rock layers labeled A (top), B, C, and D (bottom). Layer D contains ocean-shell fossils. Layer A contains no fossils at all. What does this pattern tell Zoe about how this desert formed over time? Use the word 'superposition' in your answer.

4. Zoe discovers a unique item — a canyon wall where one rock layer is missing between layers C and E. A local geologist tells her this gap represents 10 million years of missing time. What is this gap in the rock record called, and what could have caused it?

5. Zoe compares two desert rock columns from sites 5 km apart. Both columns contain the same rare find — an index fossil of an ancient trilobite. Explain how this one shared fossil helps Zoe match the age of rock layers across both sites.

6. Zoe uncovers a hidden treasure — a volcanic ash layer sandwiched between two sediment layers in the canyon wall. The ash layer has been dated by scientists to 65 million years ago using radiometric dating. The sediment layer below it contains dinosaur fossils. The layer above it contains no dinosaur fossils. How does this evidence help Zoe build a timeline of Earth's history at this site? Use at least two science terms in your answer.

7. Zoe finds a secret item deep in a desert cave — a rock sample containing tiny crystals. A geologist tells her large crystals mean slow cooling and small crystals mean fast cooling. The sample has two zones: large crystals on the inside and tiny crystals on the outside edge. Zoe hypothesizes this rock formed when magma slowly cooled underground, then a piece was pushed to the surface and cooled quickly. Evaluate Zoe's hypothesis using evidence from the crystal sizes. Is her reasoning scientifically sound? Explain why or why not.

8. Zoe completes her desert mission. She has collected four pieces of evidence: (1) ocean-shell fossils in the lowest layer, (2) a trilobite index fossil matching a site 5 km away, (3) a volcanic ash layer dated to 65 million years ago, and (4) a porphyritic rock showing two cooling stages. Using ALL four pieces of evidence, write a scientific explanation of the geologic history of this desert site. Your explanation must move from oldest to most recent events. Use at least three science vocabulary terms.

Answer Key: Zoe's Desert Rock Record Hunt

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Before the worksheet, show students a photo of desert canyon walls with visible rock strata. Ask them which layer they think is oldest and why — this activates the superposition thinking Zoe uses in Q3 and Q5.

1. Zoe arrives at a desert canyon on her first morning. She spots three rock layers stacked on top of each other. True or False: The bottom rock layer is the oldest. Explain your answer in one sentence.

Answer: Working: The principle of superposition states that in undisturbed rock layers, older rocks form first and are buried beneath newer ones. The bottom layer was deposited first, so it is the oldest. Answer: TRUE — The bottom rock layer is the oldest because it formed before the layers above it were deposited.

2. Zoe finds a special object — a flat, shiny fossil pressed into sandstone. Fill in the blank: A fossil found inside a rock layer gives scientists clues about _____ that lived during that time period.

Answer: Working: Fossils are preserved remains or traces of organisms. Scientists use them to identify which living things existed when that rock layer was forming. Answer: Fill in the blank → 'organisms' (or 'plants and animals' or 'living things') — A fossil gives scientists clues about the ORGANISMS that lived during that time period.

3. Zoe studies four desert rock layers labeled A (top), B, C, and D (bottom). Layer D contains ocean-shell fossils. Layer A contains no fossils at all. What does this pattern tell Zoe about how this desert formed over time? Use the word 'superposition' in your answer.

Answer: Working: Using superposition, Layer D is oldest and Layer A is newest. Ocean shells in Layer D mean this area was once covered by a shallow sea. The absence of fossils in Layer A may mean it formed in dry desert conditions where few organisms were preserved. Answer: By superposition, Layer D formed first when the area was an ancient sea. Over millions of years the sea disappeared, and dry desert conditions replaced it. Layer A formed most recently, likely after the environment became a desert.

4. Zoe discovers a unique item — a canyon wall where one rock layer is missing between layers C and E. A local geologist tells her this gap represents 10 million years of missing time. What is this gap in the rock record called, and what could have caused it?

Answer: Working: A gap in the rock record where layers are missing or eroded is called an unconformity. Causes include erosion by wind or water removing rock before new layers formed, or a period when no sediment was deposited. Answer: The gap is called an UNCONFORMITY. It could have been caused by erosion — wind or water wore away the missing layer before new sediment was deposited on top.

5. Zoe compares two desert rock columns from sites 5 km apart. Both columns contain the same rare find — an index fossil of an ancient trilobite. Explain how this one shared fossil helps Zoe match the age of rock layers across both sites.

Answer: Working: Index fossils are from organisms that lived for a short, well-defined time period and were widespread geographically. If the same index fossil appears in two separate rock columns, those layers must have formed during the same time period. Answer: The trilobite is an index fossil. Because it lived during only a short time window, any rock layer containing it must have formed in that same window. Zoe can use this shared fossil to show that the matching layers at both sites are the same age — even though they are 5 km apart.

6. Zoe uncovers a hidden treasure — a volcanic ash layer sandwiched between two sediment layers in the canyon wall. The ash layer has been dated by scientists to 65 million years ago using radiometric dating. The sediment layer below it contains dinosaur fossils. The layer above it contains no dinosaur fossils. How does this evidence help Zoe build a timeline of Earth's history at this site? Use at least two science terms in your answer.

Answer: Working: The volcanic ash layer gives an absolute age of 65 million years using radiometric dating. By superposition, the dinosaur fossils below the ash are older than 65 million years. The absence of dinosaur fossils above the ash supports the idea that a major extinction event occurred around that time. This links the rock record to the end-Cretaceous mass extinction. Answer: The ash layer provides an ABSOLUTE AGE of 65 million years through RADIOMETRIC DATING. By SUPERPOSITION, the dinosaur fossils in the layer below are older than 65 million years. The sudden disappearance of dinosaur fossils above this layer supports evidence of a mass extinction event at that boundary. Zoe can use this ash layer as a time marker to build a detailed timeline of life and events at this site.

7. Zoe finds a secret item deep in a desert cave — a rock sample containing tiny crystals. A geologist tells her large crystals mean slow cooling and small crystals mean fast cooling. The sample has two zones: large crystals on the inside and tiny crystals on the outside edge. Zoe hypothesizes this rock formed when magma slowly cooled underground, then a piece was pushed to the surface and cooled quickly. Evaluate Zoe's hypothesis using evidence from the crystal sizes. Is her reasoning scientifically sound? Explain why or why not.

Answer: Working: Crystal size in igneous rocks is determined by cooling rate. Slow cooling underground (intrusive) allows large crystals to grow. Rapid cooling at or near the surface (extrusive) produces tiny crystals. The sample shows large crystals inside (slow cooling = intrusive phase) and tiny crystals at the outer edge (fast cooling = extrusive or surface-contact phase). This two-zone texture, called porphyritic texture, matches exactly what Zoe predicts. Answer: Zoe's hypothesis IS scientifically sound. The large crystals in the center are evidence of slow cooling deep underground. The tiny crystals at the outer edge are evidence of rapid cooling when part of the rock reached the surface or contacted cooler rock. This two-zone pattern — called PORPHYRITIC TEXTURE — supports her hypothesis that the rock experienced two different cooling rates at two different times in Earth's history.

8. Zoe completes her desert mission. She has collected four pieces of evidence: (1) ocean-shell fossils in the lowest layer, (2) a trilobite index fossil matching a site 5 km away, (3) a volcanic ash layer dated to 65 million years ago, and (4) a porphyritic rock showing two cooling stages. Using ALL four pieces of evidence, write a scientific explanation of the geologic history of this desert site. Your explanation must move from oldest to most recent events. Use at least three science vocabulary terms.

Answer: Working through the timeline from oldest to most recent: Event 1 — Ocean shells in the deepest layer (oldest by superposition) show this area was once a shallow sea where marine organisms lived. Event 2 — The trilobite index fossil correlates this sea-floor layer with a matching layer 5 km away, confirming the sea covered a wide region during the same time period. Event 3 — The volcanic ash layer dated by radiometric dating to 65 million years ago marks a dramatic event — a volcanic eruption — and corresponds to the mass extinction boundary where dinosaur fossils disappear. Event 4 — The porphyritic rock shows that after the ash event, magma intruded slowly underground, then part of it was forced to the surface and cooled rapidly, meaning volcanic activity continued to reshape this landscape. The desert surface we see today is the most recent result of millions of years of erosion, deposition, and tectonic activity. Answer: SCIENTIFIC EXPLANATION — The geologic history of Zoe's desert site begins hundreds of millions of years ago when this land was a shallow sea. SUPERPOSITION tells us the ocean-shell fossils in the deepest layer formed first. Over time, CORRELATION using the trilobite INDEX FOSSIL confirms this sea stretched at least 5 km wide. Approximately 65 million years ago, a massive volcanic eruption deposited the ash layer, which RADIOMETRIC DATING has precisely aged. This boundary also marks the extinction of dinosaurs in the rock record above it. After this event, magma intruded underground and later reached the surface, forming the PORPHYRITIC rock with its two crystal zones — proof of ongoing volcanic Earth processes. Finally, millions of years of wind and water erosion sculpted the desert canyon Zoe explored today. Zoe's mission is complete: she has

pieced together a 65-million-year story of an ancient sea, a mass extinction, volcanic reshaping, and the birth of a modern desert.