

Name: _____ Date: _____

Answer Key: Stardust & Strata: 10th Grade Deep Time Paradox Quiz

Sophomores analyze isotopic decay curves, faunal succession, and tectonic anomalies to synthesize a coherent model of Earth's bio-geologic evolution.

1. A geologist identifies a layer of volcanic ash containing Zircon crystals with a U-235 to Pb-207 ratio suggesting three half-lives have passed. If the half-life of U-235 is ~704 million years, what is the best estimate for the age of the underlying sedimentary strata?

Answer: B) Minimum of 2.1 billion years

Three half-lives of U-235 (704 million years x 3) equals 2.112 billion years. According to the Principle of Superposition, the underlying strata must be older than the ash layer.

2. The use of _____ (taxa like Conodonts or Graptolites) allows geologists to correlate strata across distant basins because these organisms were widespread, abundant, and existed for a short chronostratigraphic duration.

Answer: B) Index fossils

Index fossils are the primary tool for biostratigraphy, providing a narrow window of geological time to synchronize disparate rock units.

3. The Great Oxygenation Event (GOE), roughly 2.4 billion years ago, is primarily evidenced by the appearance of Banded Iron Formations (BIFs) in the geologic record.

Answer: A) True

BIFs formed when dissolved iron in the oceans reacted with newly produced photosynthetic oxygen, precipitating as iron oxide layers.

4. Which of these scenarios best illustrates the application of Smith's Principle of Faunal Succession in a high-resolution stratigraphic study?

Answer: B) Assuming that the same species of Brachiopods at two sites indicates contemporaneous deposition

Faunal succession posits that fossil organisms succeed one another in a definite and determinable order, allowing for temporal correlation between distant locations.

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5. The _____ represents an erosional gap in the rock record where Cambrian sedimentary rocks sit directly atop billion-year-old metamorphic rock, signifying a massive loss of geologic information.

Answer: B) Great Unconformity

The Great Unconformity is a global phenomenon where much of Earth's mid-history is missing due to extensive erosion prior to the Cambrian explosion.

6. Steno's Law of Original Horizontality suggests that if rock layers are found tilted at steep angles, they must have been moved by tectonic forces after their initial deposition.

Answer: A) True

Sediments are deposited in flat layers due to gravity; any deviation from this horizontal state indicates subsequent crustal deformation.

7. Why is Carbon-14 dating ineffective for determining the age of a Stromatolite fossil from the Archean Eon?

Answer: B) The half-life of Carbon-14 is too short (approx 5,730 years).

Carbon-14 dating is only accurate for organic materials younger than approximately 50,000 years due to its rapid decay rate.

8. In taphonomy, the process of _____ involves the cellular-level replacement of organic structures by silica or pyrite, preserving minute anatomical details of the organism.

Answer: A) Permineralization

Permineralization occurs when mineral-rich groundwater permeates the pores of organic tissue, turning the original biological structure into stone.

9. The presence of *Glossopteris* flora across South America, Africa, India, and Antarctica is used as primary evidence for the theory of continental drift and the existence of Gondwana.

Answer: A) True

The distribution of this specific seed fern across unconnected southern continents suggests these landmasses were once part of a single supercontinent.

10. An analysis of stable oxygen isotopes (O-18/O-16) in Foraminifera shells from deep-sea sediment cores is used by paleoclimatologists to synthesize what type of data?

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Answer: A) Changes in global ice volume and ocean temperature

The ratio of oxygen isotopes in calcium carbonate shells is a proxy for the amount of water locked in glaciers; higher O-18 levels in shells generally indicate colder global periods.