

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Answer Key: Stellar Strata: A 11th Grade Galactic Geocaching Mission

Decode isotopic signatures and faunal succession patterns to reconstruct paleoenvironments as if you were an exogeologist analyzing a newly discovered planet.

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**1. Which isotopic ratio in the shells of Foraminifera is primarily used by paleoclimatologists to determine ancient sea-surface temperatures and ice volume?**

**Answer:** B) Oxygen-18 to Oxygen-16

Oxygen-18 is heavier and precipitates more easily in cold conditions; the ratio of O-18 to O-16 in calcium carbonate shells serves as a proxy for global temperature and glaciation levels.

**2. The 'Great Oxygenation Event,' evidenced by Banded Iron Formations (BIFs) in the rock record, was primarily driven by the metabolic waste of anaerobic heterotrophs.**

**Answer:** B) False

False. The Great Oxygenation Event was driven by cyanobacteria, which are photoautotrophs that produced oxygen through photosynthesis, not anaerobic heterotrophs.

**3. In the context of biostratigraphy, a(n) \_\_\_\_\_ fossil is a species that was geographically widespread but existed for a very short geological duration, making it ideal for correlating rock layers.**

**Answer:** C) Index

Index fossils (like certain ammonites or conodonts) are essential tools for relative dating because they identify specific, narrow windows of geologic time across different global locations.

**4. When observing an unconformity where horizontal sedimentary strata overlie tilted or folded sedimentary rocks, a geologist is looking at a(n):**

**Answer:** C) Angular unconformity

An angular unconformity indicates a period of tectonic uplift, tilting/folding, and erosion before new sediment was deposited, representing a significant gap in the geologic record.

**5. The principle of \_\_\_\_\_ states that in an undisturbed sequence of rocks, the fossils at the bottom are older than the fossils near the top, reflecting the evolution of life through time.**

**Answer:** B) Faunal succession

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William Smith's Principle of Faunal Succession recognizes that fossil organisms succeed one another in a definite and determinable order, allowing for the chronological organization of strata.

**6. The boundary between the Cretaceous and Paleogene periods is chemically marked worldwide by a thin layer of iridium, an element rare on Earth's surface but common in asteroids.**

**Answer:** A) True

True. The iridium anomaly at the K-Pg boundary provides strong evidence for a massive bolide impact that contributed to the mass extinction event 66 million years ago.

**7. Which of these lagerstätten (extraordinary fossil sites) is most famous for preserving soft-bodied organisms from the Cambrian Explosion, such as Opabinia and Hallucigenia?**

**Answer:** A) The Burgess Shale, Canada

The Burgess Shale is critical for understanding the rapid diversification of animal body plans during the Cambrian period, preserving anatomy that rarely fossilizes.

**8. If a sample contains only 12.5% of its original Parent isotope after undergoing radioactive decay, how many \_\_\_\_\_ have passed?**

**Answer:** C) Three half-lives

After one half-life, 50% remains; after two, 25% remains; and after three, 12.5% remains (0.5 to the power of 3).

**9. Stromatolites are trace fossils representing the activity of ancient burrowing trilobites during the Devonian Period.**

**Answer:** B) False

False. Stromatolites are layered structures formed by the trapping and binding of sediment by microbial mats, primarily cyanobacteria, dating back billions of years.

**10. The 'Hadean' is distinct from other divisions of the geologic time scale because it is primarily defined by:**

**Answer:** C) The lack of any rock record from Earth's initial formation

The Hadean Eon represents the earliest stage of Earth's history (4.6 to 4.0 billion years ago) for which no crustal rock record has survived, though some zircon crystals from this time exist.