Name: _____ **Date:** _____

Answer Key: Sifting Through the Sands of Time: Geologic Deep Dive for Grade 10

Piece together the puzzle of Earth's history by synthesizing isotopic data, index fossils, and stratigraphy to reconstruct lost worlds.

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1. An igneous intrusion cuts through several layers of sedimentary rock, which in turn contains inclusions of a nearby granite. According to the Principle of Cross-Cutting Relationships and the Principle of Inclusions, which of the following is the most accurate sequence of events?

Answer: B) The granite is the oldest feature, followed by the sedimentary rock, and finally the intrusion.

Since the sedimentary rock contains granite inclusions, the granite must have existed and been eroded first. Because the intrusion cuts through the sedimentary layers, it must be the youngest event.

2. A geologist finds a layer of volcanic ash that contains Zircon crystals with a Parent-to-Daughter ratio of 25% Uranium-235 to 75% Lead-207. Given that the half-life of U-235 is 704 million years, the rock is approximately _____ million years old.

Answer: C) 1,408

A 25% parent/75% daughter ratio indicates that two half-lives have passed (100% -> 50% -> 25%). Two half-lives of 704 million years equals 1,408 million years.

3. The 'Great Oxygenation Event,' evidenced by Banded Iron Formations (BIFs), occurred primarily due to the metabolic activities of anaerobic heterotrophs during the Archean Eon.

Answer: B) False

The Great Oxygenation Event was caused by cyanobacteria, which are photoautotrophs that produce oxygen as a byproduct of photosynthesis, not anaerobic heterotrophs.

4. Which set of characteristics would make a fossil the most effective 'Index Fossil' for correlating strata across different continents?

Answer: B) Wide geographic range and short evolutionary lifespan.

Effective index fossils must be widespread (to correlate distant areas) and exist for a short geologic duration (to provide a precise timestamp).

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5. The transition from the Paleozoic Era to the Mesozoic Era is marked by the 'Great Dying' or the _____ Extinction, which eliminated roughly 96% of marine species.

Answer: C) Permian-Triassic

The Permian-Triassic extinction is the most severe extinction event in Earth's history, defining the boundary between the Paleozoic and Mesozoic eras.

6. A disconformity represents a period of tectonic tilting and uplift followed by the deposition of horizontal strata on top of the angled layers.

Answer: B) False

This describes an angular unconformity. A disconformity is an erosional break between parallel layers of sedimentary rock.

7. How does the discovery of Glossopteris flora fossils across Antarctica, India, and South America provide evidence for plate tectonics?

Answer: C) It supports the existence of the supercontinent Gondwana and subsequent continental drift.

The heavy, non-buoyant seeds of Glossopteris could not have crossed oceans, implying these landmasses were once joined as part of Gondwana.

8. The principle of _____ states that in an undisturbed sequence of rocks, each layer is older than the one above it and younger than the one below it.

Answer: B) Superposition

Superposition is the fundamental principle of relative dating used to determine the chronological order of sedimentary layers.

9. Which of the following geochemical signatures in the rock record would most likely indicate a massive bolide (asteroid) impact?

Answer: A) Anomalously high concentrations of Iridium.

Iridium is rare in Earth's crust but abundant in asteroids. Spikes in Iridium (like the K-Pg boundary) are key markers for impact events.

10. Carbon-14 dating is an effective method for determining the age of Tyrannosaurus rex fossils from the Late Cretaceous.

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Answer: B) False

Carbon-14 has a short half-life (approx. 5,730 years) and is only useful for dating organic material up to about 50,000 years old. Dinosaur fossils are millions of years old.