Name: _____ **Date:** _____

Answer Key: Feeling the Heat: Lithospheric Stress & Magmatic Evolution Quiz for 11th Grade

Junior geologists synthesize complex data on isostasy, rheology, and seismic tomography to predict tectonic shifts during this rigorous summative assessment.

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1. Which specific seismic observation provides the most definitive evidence for the presence of a liquid outer core and a solid inner core?

Answer: B) The termination of S-waves at the mantle-core boundary and P-wave refraction into the inner core.

S-waves cannot travel through liquids (outer core), while P-waves refract and change velocity, indicating density changes between the liquid outer and solid inner core.

2. The _____ process occurs when a slab of oceanic crust sinks into the mantle, pulling the rest of the plate behind it due to negative buoyancy.

Answer: C) Slab Pull

Slab pull is considered the primary driving force of plate motion, occurring at subduction zones where cold, dense lithosphere sinks into the asthenosphere.

3. Deep-focus earthquakes (depths >300km) are primarily associated with transform plate boundaries like the North Anatolian Fault.

Answer: B) False

Deep-focus earthquakes occur only in subduction zones (Benioff zones) where rigid crust is forced deep into the mantle; transform boundaries host shallow-focus quakes.

4. Consider the formation of the Japanese Archipelago. Which petrological process best explains the generation of its calc-alkaline magmas?

Answer: B) Flux melting caused by the dehydration of a subducting oceanic slab.

As the subducting slab undergoes metamorphism, it releases volatiles (water), lowering the melting point of the overlying mantle wedge (flux melting).

5. If an earthquake's P-waves arrive at 10:00:00 AM and S-waves arrive at 10:04:30 AM, the total _____-_____ interval is used to calculate the distance to the epicenter.

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Answer: C) S-P Lag

The S-P lag time is directly proportional to the distance from the station to the earthquake epicenter, based on the known velocities of both wave types.

6. The Wadati-Benioff zone is a planar zone of seismicity corresponding to the down-going slab in a subduction zone.

Answer: A) True

This zone documents the path of the lithospheric plate as it descends into the mantle, producing earthquakes at varying depths.

7. Why does the East Pacific Rise exhibit a much smoother, broader profile compared to the rugged, steep topography of the Mid-Atlantic Ridge?

Answer: B) Faster spreading rates lead to higher heat flow and a more plastic response in the crust.

High spreading rates (East Pacific Rise) result in warmer, less dense lithosphere that doesn't subside as quickly, creating a broad rise rather than a deep rift valley.

8. A _____ volcano, such as Mauna Loa, is characterized by low-viscosity basaltic lava flows and a wide, gently sloping profile.

Answer: C) Shield

Shield volcanoes are built by successive flows of fluid basaltic lava, which can travel long distances before cooling, creating a wide, low-profile structure.

9. Which of the following would likely occur if the asthenosphere were to become completely solid and rigid?

Answer: B) Plate tectonics would cease as the lithosphere could no longer move over a ductile layer.

The asthenosphere's semi-fluid (ductile) nature is what allows the overlying lithospheric plates to slide; without this mobility, tectonic processes would stop.

10. Paleomagnetism supports the theory of seafloor spreading because magnetic stripes on the ocean floor are asymmetrical relative to the mid-ocean ridge.

Answer: B) False

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The magnetic anomalies (stripes) are symmetrical on either side of the ridge, proving that new crust is being created equally in both directions.