Name: _____ **Date:** _____

Answer Key: Dissect Cosmic Ballistics: 11th Grade Earth-Space Orbital Quiz

Calculate orbital perturbations and analyze barycentric motion to determine how gravitational anomalies reshape planetary paths in this rigorous challenge.

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1. A planet's orbital eccentricity increases due to a passing massive body. According to Kepler’s Second Law, how does this change the planet's orbital velocity at perihelion compared to its original state?

Answer: B) The velocity at perihelion increases to conserve total angular momentum for the more elliptical path.

Kepler's Second Law dictates that as eccentricity increases, the perihelion distance decreases; for angular momentum to be conserved, the subterranean velocity must increase at this closer approach.

2. The slow, cyclical shift in the orientation of Earth's rotational axis, which completes a cycle approximately every 26,000 years and alters the timing of the equinoxes, is known as _____.

Answer: B) Axial Precession

Axial precession is the 'wobble' of Earth's axis caused by the torque exerted by the Moon and Sun, significantly impacting long-term climate cycles and celestial navigation.

3. Milankovitch cycles suggest that Earth’s glaciation periods are primarily triggered when high-latitude summer insolation is at a maximum.

Answer: B) False

Glaciation is actually triggered when high-latitude summer insolation is at a minimum, allowing winter snow to persist through the summer and accumulate into ice sheets.

4. If the Earth’s axial tilt (obliquity) were to increase from 23.5° to 28.5°, what would be the specific atmospheric result regarding the Tropics of Cancer and Capricorn?

Answer: C) The tropics would migrate further toward the poles, increasing the latitudinal range of the tropical zone.

The latitude of the tropics is directly determined by the angle of axial tilt; a higher tilt pushes the point of direct overhead sunlight further north and south respectively.

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5. In a three-body system, the specific points where a small mass can orbit in a constant pattern with two larger masses are called _____ points.

Answer: C) Lagrange

Lagrange points (L1 through L5) are equilibrium points where the gravitational pull of two large masses precisely equals the centripetal force required for a small object to move with them.

6. Amphidromic points are locations in the ocean where the tidal range is zero because of the canceling effects of the Coriolis force and basin geometry.

Answer: A) True

Amphidromic points act as nodes for tidal waves; while high tides rotate around these points, the water level at the point itself remains relatively constant.

7. The Saros cycle is a period of approximately 18 years used to predict eclipses. What underlying synchronization causes this cycle?

Answer: B) The harmonic resonance between the Moon's synodic, draconic, and anomalistic months.

The Saros cycle occurs because the Moon returns to the same phase (synodic), the same node (draconic), and the same distance from Earth (anomalistic) simultaneously.

8. The phenomenon where the Earth's rotation causes a moving object to veer off course, calculated by the formula $2v\omega \sin \phi$, is the _____.

Answer: B) Coriolis Frequency

The Coriolis effect/frequency is essential in 11th-grade physics to explain the rotation of weather systems and ocean currents in a non-inertial reference frame.

9. Analyze the impact of Tidal Locking. If the Earth were to become tidally locked with the Sun, what would be the most significant consequence for the Earth's atmosphere?

Answer: A) Atmospheric collapse on the dark side due to extreme radiative cooling and gas solidification.

In tidal locking, the side facing away from the star receives no heat; without a very efficient transport mechanism, the atmosphere can freeze onto the surface on the night side.

10. Syzygy refers to the straight-line configuration of three celestial bodies in a gravitational system, such as during a solar eclipse.

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Answer: A) True

Syzygy is the formal astronomical term for the alignment of three bodies, which is the requisite geometry for both eclipses and the maximum gravitational pull of spring tides.