Name: _____ **Date:** _____

Answer Key: When the Heliocentric Model Hits the Fan: College Orbital Mechanics Quiz

Calculate orbital perturbations and analyze barycentric motion to understand why our celestial neighborhood isn't as stable as it looks in textbooks.

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1. The Milankovitch cycle known as 'precession' involves a 26,000-year wobble of Earth's axis. Which star will serve as the North Star in approximately 12,000 years due to this shift?

Answer: B) Vega

Axial precession changes the orientation of the rotational axis in space; while Polaris is the current North Star, the cycle will point the North Pole toward Vega in roughly 12,000 years.

2. The _____ is the common center of mass around which two or more bodies orbit, which for the Earth-Moon system lies about 1,700 km below Earth's surface.

Answer: C) Barycenter

The barycenter is the point in a system where the masses balance; because Earth is much more massive than the Moon, the center of mass remains inside Earth's radius.

3. True or False: The Earth is at its perihelion (closest approach to the Sun) during the Northern Hemisphere’s winter month of January.

Answer: A) True

Distance does not cause seasons; axial tilt does. Earth is actually closest to the sun in early January, despite it being winter in the Northern Hemisphere.

4. Which phenomenon provides direct physical evidence of Earth's rotation by demonstrating the change in the plane of a swinging weight over time?

Answer: C) Foucault's Pendulum

Foucault's Pendulum shows that as the Earth rotates beneath the pendulum, the plane of oscillation appears to rotate from the perspective of an observer on the surface.

5. A _____ day is the time it takes for Earth to rotate once relative to the distant stars, lasting approximately 23 hours and 56 minutes.

Name: _____ **Date:** _____

Answer: B) Sidereal

A sidereal day measures a 360-degree rotation. A solar day is longer because Earth must rotate slightly more than 360 degrees to realign with the Sun after moving in its orbit.

6. What is the primary cause of 'proxigean' spring tides, which result in exceptionally high water levels?

Answer: B) The Moon being at perigee during a New or Full Moon

Proxigean spring tides occur when the Moon is at its closest point to Earth (perigee) while also in the New or Full Moon phase (syzygy).

7. True or False: If the Earth's axial tilt (obliquity) were to decrease to 0 degrees, the planet would no longer experience distinct seasonal variations.

Answer: A) True

Without an axial tilt, the Sun's rays would consistently hit the same latitudes at the same angles year-round, eliminating the temperature cycles that define seasons.

8. In the context of the Earth-Moon-Sun system, what occurs at the L1 Lagrange point?

Answer: B) Gravitational forces and centrifugal force reach equilibrium

Lagrange points are positions in space where the gravitational pull of two large masses precisely equals the centrifugal force felt by a smaller object.

9. The variation in Earth's orbital path from a nearly perfect circle to a more elliptical shape is known as _____, and it operates on a roughly 100,000-year cycle.

Answer: C) Eccentricity

Eccentricity measures the departure of an orbit from circularity. It is one of the three Milankovitch cycles that impact long-term climate.

10. True or False: A total solar eclipse can be seen from the exact same geographic location on Earth approximately every 18 months.

Answer: B) False

While a total solar eclipse happens somewhere on Earth roughly every 18 months, the probability of one hitting the same specific spot is roughly once every 375 years.