

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

## Why is Orbit Elliptical? 9th Grade Orbital Mechanics Quiz

High schoolers analyze Kepler's Second Law, the barycenter of the Earth-Moon system, and the geometric consequences of axial precession on long-term climate cycles.

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**1. Regarding Kepler's Second Law (Law of Equal Areas), how does Earth's orbital velocity change throughout the year?**

- A. Velocity is constant regardless of orbital position.
- B. Velocity increases at aphelion when Earth is furthest from the Sun.
- C. Velocity increases at perihelion when Earth is closest to the Sun.
- D. Velocity is determined solely by the Moon's phase.

**2. The 'Barycenter' of the Earth-Moon system is located exactly at the geometric center of planet Earth.**

- A. True
- B. False

**3. The slow 'wobble' of Earth's axis, which takes approximately 26,000 years to complete a cycle, is known as \_\_\_\_.**

- A. Nutation
- B. Precession
- C. Obliquity
- D. Eccentricity

**4. What is the primary cause of the 'Precession of the Equinoxes'?**

- A. The expansion of the universe.
- B. The magnetic reversal of Earth's poles.
- C. The gravitational pull of the Sun and Moon on Earth's equatorial bulge.
- D. The impact of solar winds on the ionosphere.

**5. Milankovitch cycles involve long-term changes in Earth's \_\_\_\_\_, affecting the shape of its orbit and long-term climate.**

- A. Eccentricity
- B. Albedo
- C. Insolation
- D. Luminosity

**6. The sidereal day (the time it takes Earth to rotate 360 degrees relative to stars) is shorter than the solar day.**

- A. True
- B. False

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**7. Which term describes the slight 'nodding' or oscillation in the Earth's axis of rotation, superimposed over precession?**

- A. Coriolis tension
- B. Apogee
- C. Nutation
- D. Syzygy

**8. In the context of the Earth-Moon-Sun system, a 'Syzygy' refers to the \_\_\_\_\_ of three celestial bodies in a gravitational system.**

- A. Equidistant spacing
- B. Linear alignment
- C. Inverse rotation
- D. Angular momentum

**9. Earth is at its closest point to the Sun (perihelion) during the Northern Hemisphere's summer month of July.**

- A. True
- B. False

**10. How would Earth's seasons be affected if the axial tilt were increased from 23.5 degrees to 45 degrees?**

- A. Seasons would become much less extreme.
- B. There would be no change in seasonal variation.
- C. Seasons would become significantly more extreme.
- D. The Earth would stop revolving around the Sun.