

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

## Lambda-CDM & The Great Attractor: 12th Grade Cosmology Quiz

Calculate cosmic expansion rates and analyze galactic motion across 10 high-level questions covering mass-to-light ratios and baryonic acoustic oscillations.

---

**1. The 'Great Attractor' is a gravity anomaly in intergalactic space that reveals the motion of the Laniakea Supercluster. What is the primary method used to determine the mass of such structures when visible matter is insufficient?**

- A. Stellar parallax measurements
- B. Analysis of peculiar velocities
- C. Calculating the Chandrasekhar limit
- D. Measuring the sunyaev-zel'dovich effect

**2. According to the Cosmological Principle, the universe is both homogeneous and isotropic when viewed on a sufficiently large scale.**

- A. True
- B. False

**3. The Tully-Fisher relation is a critical 'standard candle' tool that establishes a correlation between a spiral galaxy's luminosity and its \_\_\_\_\_.**

- A. Rotational velocity
- B. Metallicity
- C. Surface brightness
- D. Central black hole mass

**4. Which of the following describes the 'Recombination' epoch approximately 380,000 years after the Big Bang?**

- A. The fusion of hydrogen into helium in stellar cores
- B. The moment dark energy became the dominant force
- C. Electrons and protons forming neutral hydrogen atoms
- D. The collision of the Milky Way and Andromeda galaxies

**5. If the density parameter ( $\Omega$ ) of the universe is exactly equal to 1, what is the predicted geometric shape of the universe in the Friedmann-Lemaître-Robertson-Walker (FLRW) metric?**

- A. Spherical (Closed)
- B. Hyperbolic (Open)
- C. Euclidean (Flat)
- D. Toroidal (Donut-shaped)

**6. Quasars are powered by the accretion disks of supermassive black holes. They are most commonly found in the center of galaxies undergoing \_\_\_\_\_.**

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

- A. Adiabatic cooling
- B. Gravitational collapse
- C. Tidal disruption events
- D. Mergers or interactions

**7. Dark energy is a force that acts to slow down the expansion of the universe over time due to gravitational tension.**

- A. True
- B. False

**8. Which piece of evidence suggests that the centers of most large galaxies contain supermassive black holes, even if they aren't currently active?**

- A. High orbital velocities of stars near the galactic core
- B. The presence of cosmic strings in the halo
- C. The lack of heavy elements in the galactic bulge
- D. The detection of neutrinos from the Oort cloud

**9. The 'Lyman-alpha forest' observed in the spectra of distant quasars provides data regarding the distribution of \_\_\_\_\_ in the intergalactic medium.**

- A. Neutral hydrogen clouds
- B. Ionized iron isotopes
- C. Degenerate neutron matter
- D. Primary dark matter particles

**10. The 'Heat Death' of the universe is a theoretical end-state where entropy reaches a maximum and no more work can be extracted from energy transfers.**

- A. True
- B. False