

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

## Dissect Galactic Dynamics and Lamda-CDM: 12th Grade Advanced Astrophysics Quiz

Synthesize complex data regarding the Tully-Fisher relation, nucleosynthesis ratios, and dark matter halos to evaluate the current Friedmann-Lemaître-Robertson-Walker model.

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**1. The 'Great Attractor' is a gravitational anomaly in intergalactic space that suggests the presence of a massive concentration of mass. Which structure is the Milky Way currently being drawn toward as part of this localized flow?**

- A. The Shapley Supercluster
- B. The Boötes Void
- C. The Andromeda Nebula
- D. The Sombrero Galaxy

**2. In a 'Flat' Universe model where the density parameter ( $\Omega$ ) equals 1, the expansion rate of the universe will eventually decelerate to a complete stop at  $t = \text{infinity}$ , assuming dark energy is treated as a cosmological constant.**

- A. True
- B. False

**3. The empirical relationship used to calculate the distance to spiral galaxies by correlating their intrinsic luminosity with their rotational velocity (spectral line width) is known as the \_\_\_\_\_ relation.**

- A. Faber-Jackson
- B. Hertzsprung-Russell
- C. Tully-Fisher
- D. Saha-Equation

**4. Which specific observation provides the most robust evidence for the existence of Dark Matter within galaxy clusters, specifically by observing the warping of spacetime around massive foreground objects?**

- A. Parallax shifting
- B. Weak and strong gravitational lensing
- C. Type Ia Supernova light curves
- D. Synchrotron radiation from pulsars

**5. The Cosmological Principle asserts that on sufficiently large scales, the universe is both isotropic (looks the same in all directions) and homogeneous (looks the same from all locations).**

- A. True
- B. False

**6. During the Era of Nucleosynthesis, the ratio of Hydrogen to Helium (by mass) was approximately \_\_\_\_\_%, providing a 'fossil' record of the early universe's temperature and density.**

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- A. 50/50
- B. 90/10
- C. 75/25
- D. 99/1

**7. Elliptical galaxies are generally thought to be 'red and dead.' What is the primary reason these galaxies have very little active star formation compared to late-type spirals?**

- A. They lack supermassive black holes at their centers
- B. They contain mostly cold, molecular hydrogen gas
- C. They have exhausted their reservoir of cool interstellar gas
- D. Their high rotational speeds prevent gravitational collapse

**8. The 'Epoch of \_\_\_\_\_' refers to the time when the first stars and quasars emitted UV radiation that ionized the neutral hydrogen gas filling the intergalactic medium.**

- A. Recombination
- B. Reionization
- C. Decoupling
- D. Inflation

**9. The 'Big Rip' scenario is a theoretical end-state of the universe where the strength of dark energy increases over time (phantom energy), eventually overcoming all physical forces.**

- A. True
- B. False

**10. Quasars are extremely luminous active galactic nuclei (AGN). What mechanism releases the massive amounts of energy observed from these distant objects?**

- A. The simultaneous supernova explosion of billions of stars
- B. Gravitational energy released by matter in an accretion disk
- C. The collision of two galaxies of equal mass
- D. Nuclear fusion occurring in the intergalactic medium