

Name: _____ Date: _____

Answer Key: Cosmic Forensics: High School Astrometry & Galactic Evolution Quiz

Examine Friedmann equations, quasar redshift distributions, and nucleosynthesis ratios to reconstruct the billion-year history of the observable universe.

1. Which piece of evidence suggests that galactic rotation curves do not follow the standard Keplerian decline, necessitating the existence of a non-baryonic matter halo?

Answer: B) Flatness of orbital velocities in external disk regions

Observed orbital velocities of gas and stars remain constant even at large radii from the galactic center, indicating that substantial 'dark' mass exists beyond the visible light profile.

2. The observation of ____, highly energetic active nuclei of distant young galaxies, provides evidence that the early universe was significantly more dense and chaotic than it is today.

Answer: A) Quasars

Quasars (Quasi-Stellar Radio Sources) are found at high redshifts, meaning they existed primarily in the early universe, serving as markers for galactic evolution stages.

3. The 'Great Attractor' is a massive gravitational anomaly in intergalactic space that suggests the motion of the Laniakea Supercluster is influenced by structures beyond our immediate observation.

Answer: A) True

The Great Attractor is a localized concentration of mass that exerts a gravitational pull on our galaxy and its neighbors, demonstrating large-scale structural dynamics.

4. What is the primary implication of the High-Z Supernova Search Team's discovery regarding the current expansion rate of the universe?

Answer: C) The expansion rate is accelerating, fueled by dark energy

Type Ia supernovae observations showed that distant galaxies are moving away faster than expected, leading to the conclusion that expansion is accelerating.

5. When analyzing the Cosmic Microwave Background (CMB), the degree of ____ in temperature fluctuations allows cosmologists to calculate the precise geometry of the universe.

Name: _____ **Date:** _____

Answer: C) Anisotropy

Anisotropies are small temperature variations in the CMB that represent the seeds of current large-scale structures like galaxy clusters.

6. How does the 'Bottom-Up' (hierarchical) model of galaxy formation differ from the 'Top-Down' model?

Answer: B) It posits that small protogalactic fragments merged to form larger systems

The hierarchical model is the widely accepted theory where small dark matter halos and gas clouds merged over time to create the large galaxies we see today.

7. The 'Heat Death' of the universe theory posits that the universe will continue to expand until it reaches a state of maximum entropy where no more work can be performed.

Answer: A) True

If expansion continues indefinitely, thermodynamic heat death occurs as the universe reaches a uniform temperature and all energy becomes unusable.

8. In the context of the cosmic distance ladder, why are Cepheid variables critical for determining the distance to relatively nearby galaxies like M31?

Answer: B) They exhibit a direct period-luminosity relationship

Henrietta Leavitt discovered that the period of a Cepheid's pulsation is directly related to its intrinsic brightness, allowing it to be used as a 'standard candle'.

9. According to Big Bang Nucleosynthesis, the ratio of ____ to hydrogen provides a strict constraint on the density of ordinary baryonic matter in the early universe.

Answer: B) Deuterium

Deuterium (a heavy isotope of hydrogen) is very sensitive to the density of protons and neutrons during the first few minutes of the universe.

10. The Sloane Digital Sky Survey (SDSS) mapping of the 'Great Wall' confirmed that galaxies are distributed uniformly and randomly throughout space at all scales.

Answer: B) False

The SDSS revealed that the universe is not uniform on local scales but instead forms a 'Cosmic Web' of filaments and immense voids.

Name: _____ **Date:** _____