

Name: _____ Date: _____

Dissect the Cosmic Scaffolding: An 11th Grade Astronomical Inquiry

Synthesize data on galactic chemical evolution and the accelerating expansion of the universe to map the fate of large-scale structures.

1. Which analytical method provides the most compelling evidence for the 'dark energy' driving the accelerated expansion of the universe, based on the observations of Type Ia Supernovae?

- A. Gravitational lensing of distant galaxies
- B. Measuring the luminosity distance vs. redshift of 'standard candles'
- C. The rotation curves of spiral galaxy outskirts
- D. The abundance of primordial helium in the interstellar medium

2. The _____ density of the universe determines its ultimate fate; if it is exactly equal to the critical density, the universe is 'flat' and will expand forever but at a decelerating rate (ignoring dark energy).

- A. Luminosity
- B. Baryonic
- C. Omega
- D. Standard

3. According to the hierarchical model of galaxy formation, massive elliptical galaxies are the result of multiple mergers between smaller spiral and irregular galaxies over billions of years.

- A. True
- B. False

4. The Great Attractor is a localized gravity anomaly in intergalactic space that is pulling our Local Group and the Laniakea Supercluster toward it. This phenomenon is an example of:

- A. Hubble Flow
- B. Peculiar Velocity
- C. Cosmic Inflation
- D. Stellar Parallax

5. Radio galaxies like Cygnus A are characterized by massive lobes of plasma emitted from their centers. These emissions are powered by _____ which convert gravitational potential energy into radiation.

- A. Main sequence fusion
- B. Supernova remnants
- C. Active Galactic Nuclei (AGN)
- D. Dark matter annihilation

6. The Epoch of Reionization refers to the period when the first stars and quasars emitted high-energy photons that ionized the neutral hydrogen gas filling the early universe.

- A. True

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B. False

7. If we observe a galaxy with a high abundance of 'metals' (elements heavier than Helium) in its interstellar medium, we can hypothesize that this galaxy:

- A. Is a primitive Population III structure
- B. Has undergone multiple generations of star formation and death
- C. Consists almost entirely of dark matter
- D. Formed before the Cosmic Microwave Background was emitted

8. The _____ horizon represents the maximum distance from which light could have traveled to reach an observer since the beginning of the universe, effectively limiting the observable universe.

- A. Event
- B. Schwarzschild
- C. Particle
- D. Chandrasekhar

9. What role does the 'Cold Dark Matter' (CDM) model play in the formation of the Cosmic Web?

- A. It provides the gravitational scaffolding that attracts baryonic gas to form galaxies
- B. Its repulsive force prevents galaxies from colliding
- C. It accounts for the high temperatures of the early universe
- D. It emits the CMB radiation observed by satellites

10. The Cosmological Principle assumes that on a sufficiently large scale, the universe is both homogeneous (looks the same in all locations) and isotropic (looks the same in all directions).

- A. True
- B. False