Advanced Cosmological Concepts

Cosmology · Answer Key · 12 Questions

1. Which specific spectroscopic phenomenon occurs when light from distant galaxies is shifted toward the red end of the spectrum due to the expansion of the universe?

A) Doppler Effect
B) Cosmological Redshift
C) Gravitational Lensing
D) Synchrotron Radiation

2. What is the current estimated age of the universe according to data from the Planck satellite mission?

A) 11.8 billion years
B) 13.8 billion years
C) 15.2 billion years
D) 17.4 billion years

3. Which fundamental force is responsible for the large-scale structure formation of the universe by pulling matter into filaments and voids?

A) Strong Nuclear Force
B) Electromagnetic Force
C) Gravity
D) Weak Nuclear Force

4. What is the primary constituent of the universe by mass-energy density, according to the Lambda-CDM model?

A) Baryonic matter
B) Dark energy
C) Dark matter
D) Neutrinos

5. In the context of stellar evolution, what is the 'Chandrasekhar limit' approximately equal to in terms of solar masses?

A) 1.44
B) 2.25
C) 3.00
D) 0.75

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6. The cosmic microwave background radiation (CMB) corresponds to a blackbody temperature of approximately how many Kelvin?

A) 0.5 K
B) 2.7 K
C) 5.2 K
D) 10.0 K

7. Which planetary body in our solar system has the highest density, exceeding 5.4 g/cm³?

A) Earth
B) Mercury
C) Venus
D) Mars

8. What describes the 'Big Freeze' or 'Heat Death' scenario of the universe's ultimate fate?

A) Rapid collapse into a singularity
B) Expansion resulting in a cold, featureless void
C) Conversion of all matter into black holes
D) Thermal equilibrium via proton decay

9. What is the name of the region surrounding a black hole beyond which nothing, not even light, can escape?

A) Accretion disk
B) Event horizon
C) Ergosphere
D) Singularity

10. Which galaxy cluster is the closest major neighbor to the Local Group, located approximately 50 million light-years away?

A) Coma Cluster
B) Virgo Cluster
C) Perseus Cluster
D) Hercules Cluster

11. What is the term for the hypothetical particles that are believed to make up the majority of non-baryonic dark matter?

A) WIMPs
B) Quarks
C) Leptons
D) Tachyons

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12. Which element is most abundant in the universe by mass, excluding the products of stellar nucleosynthesis?

A) Helium

B) Hydrogen

C) Oxygen

D) Carbon

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