

Cosmology: A Teenager's Guide to the Universe

Cosmology · Answer Key · 15 Questions

1. What is the approximate ratio of visible baryonic matter (like stars and gas) to dark matter in the universe, according to current cosmological models?

- A) 1:1
- B) 1:5**
- C) 1:10
- D) 1:20

2. The Cosmic Microwave Background (CMB) radiation is a remnant of which epoch in the universe's history?

- A) The Big Bang singularity
- B) Inflationary epoch
- C) Recombination (when atoms formed)**
- D) The formation of the first stars

3. What fundamental force is most responsible for the large-scale structure of the universe, such as galaxy clusters and filaments?

- A) Electromagnetism
- B) Strong nuclear force
- C) Weak nuclear force
- D) Gravity**

4. Which observational phenomenon provides the strongest evidence for the existence of dark energy?

- A) The redshift of distant galaxies
- B) The observed acceleration of the universe's expansion**
- C) The formation of gravitational lenses
- D) The abundance of light elements created during Big Bang nucleosynthesis

5. The 'Cosmic Horizon' in cosmology refers to the boundary beyond which light has not yet had time to reach us since the Big Bang. What does this imply about our observable universe?

- A) It is infinite
- B) It is constantly shrinking
- C) It is finite and expanding**
- D) It is static

6. What are the primary constituents of the 'cosmic web', the largest known structure in the universe?

- A) Black holes and nebulae
- B) Galaxies, dark matter, and intergalactic gas**
- C) Neutron stars and pulsars
- D) Supernovae and quasars

7. The fine-tuning problem in cosmology refers to the observation that certain fundamental constants of the universe seem to be precisely set to allow for life. Which of the following is an example of such a constant?

- A) The speed of light
- B) The Planck constant
- C) The cosmological constant (related to dark energy)**
- D) The gravitational constant

8. What is the approximate age of the universe, as determined by current cosmological measurements?

- A) 6 billion years
- B) 9.3 billion years
- C) 13.8 billion years**
- D) 20 billion years

9. The concept of 'Inflation' in cosmology is a hypothetical period of rapid expansion of the universe that occurred shortly after the Big Bang. What problem does it primarily help to solve?

- A) The overabundance of dark matter
- B) The origin of magnetic fields
- C) The horizon and flatness problems**
- D) The creation of heavier elements

10. The redshift of light from distant galaxies, observed by Edwin Hubble, is interpreted as evidence for what cosmological phenomenon?

- A) The universe is contracting
- B) The universe is expanding**
- C) Galaxies are moving randomly
- D) Galaxies are colliding

11. What is the 'Big Bang Nucleosynthesis' responsible for creating in the early universe?

- A) All elements heavier than iron
- B) Primarily hydrogen and helium, with trace amounts of lithium**
- C) Complex organic molecules
- D) The first stars and galaxies

12. What do cosmologists mean by the term 'dark energy'?

- A) A form of matter that emits no light
- B) An unknown form of energy causing the accelerated expansion of the universe**
- C) The absence of light in intergalactic space
- D) The theoretical boundary of the observable universe

13. The Planck satellite measured the Cosmic Microwave Background radiation with unprecedented accuracy. What key aspect of the CMB did it refine our understanding of?

- A) The precise location of black holes
- B) The initial temperature fluctuations that seeded cosmic structure**
- C) The composition of dark matter
- D) The rotation of the Milky Way galaxy

14. According to the Lambda-CDM model, the dominant component of the universe's total energy density is:

- A) Baryonic matter
- B) Dark matter
- C) Dark energy**
- D) Radiation

15. What theoretical concept proposes that our universe might be one of many, potentially with different physical laws and constants?

- A) The Big Crunch
- B) The Steady State theory
- C) The Multiverse hypothesis**
- D) The Oscillating Universe