

Astrobiology Frontiers: Biology in the Cosmos

Advanced Biology · Answer Key · 10 Questions

1. What is the primary factor limiting the habitability of planets within the traditional 'habitable zone' around stars?

- A) Atmospheric pressure fluctuations
- B) Stellar flare activity and radiation**
- C) The prevalence of silicate minerals
- D) The orbital eccentricity of the planet

2. Which extraterrestrial environment is currently considered the most promising candidate for harboring subsurface liquid water oceans and potentially extant life due to tidal heating?

- A) Titan (Saturn's moon)
- B) Io (Jupiter's moon)
- C) Europa (Jupiter's moon)**
- D) Enceladus (Saturn's moon)

3. The detection of phosphine (PH₃) in the atmosphere of Venus, while debated, was significant due to phosphine's association with which biological process on Earth?

- A) Photosynthesis
- B) Methanogenesis
- C) Nitrogen fixation
- D) Anaerobic respiration**

4. Panspermia, a hypothesis for the origin of life, suggests that life on Earth originated from organic compounds transported from:

- A) The Earth's primordial atmosphere
- B) Comets and asteroids**
- C) Deep-sea hydrothermal vents
- D) The Moon

5. The extremophile Archaea known as 'thermophiles' thrive in environments characterized by:

- A) Extremely high radiation levels
- B) High pressure and low temperature
- C) Extremely high temperatures**
- D) Anoxic conditions with high salinity

6. What is the primary challenge in directly observing signs of life on exoplanets, even with advanced telescopes?

- A) The vast distances and faintness of exoplanet atmospheres**
- B) The lack of suitable biosignatures to search for
- C) The technological limitations in detecting organic molecules
- D) The difficulty in distinguishing biological from geological processes

7. The presence of a robust magnetosphere around a planet is crucial for habitability primarily because it:

- A) Regulates planetary temperature
- B) Shields the surface from harmful solar winds and cosmic rays**
- C) Facilitates the formation of liquid water
- D) Drives atmospheric circulation patterns

8. Which element is considered essential for life as we know it and is a key component of organic molecules, making its presence on other celestial bodies a significant finding?

- A) Silicon
- B) Iron
- C) Carbon**
- D) Aluminum

9. The discovery of amino acids and nucleobases in meteorites, such as the Murchison meteorite, provides evidence for:

- A) Extraterrestrial intelligence
- B) The extraterrestrial origin of some of life's building blocks**
- C) The existence of microbial life on other planets
- D) Ancient Earth geological processes

10. What is the theoretical concept of a 'Roche zone' in astrobiology, referring to the region around a star where a planet could potentially retain a substantial atmosphere, even if it is tidally locked?

- A) The region where a planet's magnetic field is strongest
- B) The zone where liquid water can exist on the surface**
- C) The area influenced by stellar winds and radiation
- D) The region beyond the heliosphere