

TEST #2
Dec 1, 2021

1. How was Earth's atmosphere formed? What natural mechanisms threaten it? What protects it? What would happen if atmosphere was depleted?
2. DNA is one of the fundamental building blocks of every single biological organism here on Earth.
 - a) What does DNA stand for?
 - b) What nucleic bases does DNA incorporate, and how do they pair together?
 - c) How are genetic "words" formed into a "sentence"?
 - d) What is the difference between coding and non-coding DNA?
 - e) What are mutations? The mutations of which "letter" in a genetic word are *least* likely to be lethal and why?
3. What is the likelihood of a non-carbon-based life in the Universe? Why?
4. Radioactive decay is at the forefront of determining ages on Earth and beyond.
 - a) What is radioactive decay?
 - b) What three types of radioactive decay do we know? Choose one of the three and explain it.
 - c) What is half-life?
 - d) How much of the parent isotope is left after 10 half-lives?
5. Briefly explain the nebular theory and how it explains the difference between rocky and gaseous planets.
6. The habitable zone is one of the prime targets when searching for life on planets orbiting other stars.
 - a) Define the habitable zone.
 - b) What physical considerations determine the inner and the outer boundaries of the habitable zone? At what distance from the Sun are these boundaries? Focus only on the extreme boundaries.
 - c) The Sun was 80% as luminous as it is today about 4 billion years ago. Estimate the inner and outer boundaries of the habitable zone then.

- d) The Sun will be about 130% as luminous as it is today in about 4 billion years. Estimate what the inner and outer boundaries of the habitable zone will be in that case.
- e) Based on those numbers, draw the evolution of the habitable zone through time and estimate when will Earth stop being habitable.

Hint: think about how the amount of light depends on the luminosity of the Sun.