

OpenStax Astronomy, Ch.30: WS Problems (Apr-2021)

Review Questions

1. What is the Copernican principle? Make a list of scientific discoveries that confirm it.
2. Where in the solar system (and beyond) have scientists found evidence of organic molecules?
3. What is a biomarker? Give some possible examples of biomarkers we might look for beyond the solar system.
4. Why are Mars and Europa the top targets for the study of astrobiology?
5. Why is traveling between the stars (by creatures like us) difficult?
6. What is the “cosmic haystack problem”? List as many of its components as you can think of.
7. What is a habitable zone?
8. Why is the simultaneous detection of methane and oxygen in an atmosphere a good indication of the existence of a biosphere on that planet?
9. What are two characteristic properties of life that distinguish it from nonliving things?
10. What are the three requirements that scientists believe an environment needs to supply life with in order to be considered habitable?
11. Can you name five environmental conditions that, in their extremes, microbial life been challenged by and has learned to survive on Earth?
12. Would a human have been possible during the first generation of stars that formed right after the Big Bang? Why or why not?
13. What are some answers to the Fermi paradox? Can you think of some that are not discussed in this chapter?
14. Why is there so little evidence of Earth’s earliest history and therefore the period when life first began on our planet?
15. Why was the development of photosynthesis a major milestone in the evolution of life?
16. Does all life on Earth require sunshine?
17. Why is life unlikely to be found on the surface of Mars today?
18. In this chapter, we identify these characteristic properties of life: life extracts energy from its environment, and has a means of encoding and replicating information in order to make faithful copies of itself. Does this definition fully capture what we think of as “life”? How might our definition be biased by our terrestrial environment?
19. Given that no sunlight can penetrate Europa’s ice shell, what would be the type of energy that could make some form of euroman life possible?
20. Why is Saturn’s moon Enceladus such an exciting place to send a mission?
21. In addition to an atmosphere dominated by nitrogen, how else is Saturn’s moon Titan similar to Earth?
22. How can a planet’s atmosphere affect the width of the habitable zone in its planetary system?



23. The light a planet receives from the Sun (per square meter of planet surface) decreases with the square of the distance from the Sun. So a planet that is twice as far from the Sun as Earth receives $(1/2)^2 = 0.25$ times (25%) as much light and a planet that is three times as far from the Sun receives $(1/3)^2 = 0.11$ times (11%) as much light. How much light is received by the moons of Jupiter and Saturn (compared to Earth), worlds which orbit 5.2 and 9.5 times farther from the Sun than Earth?