

Chp 8-Review Questions. Looking for Life beyond Earth

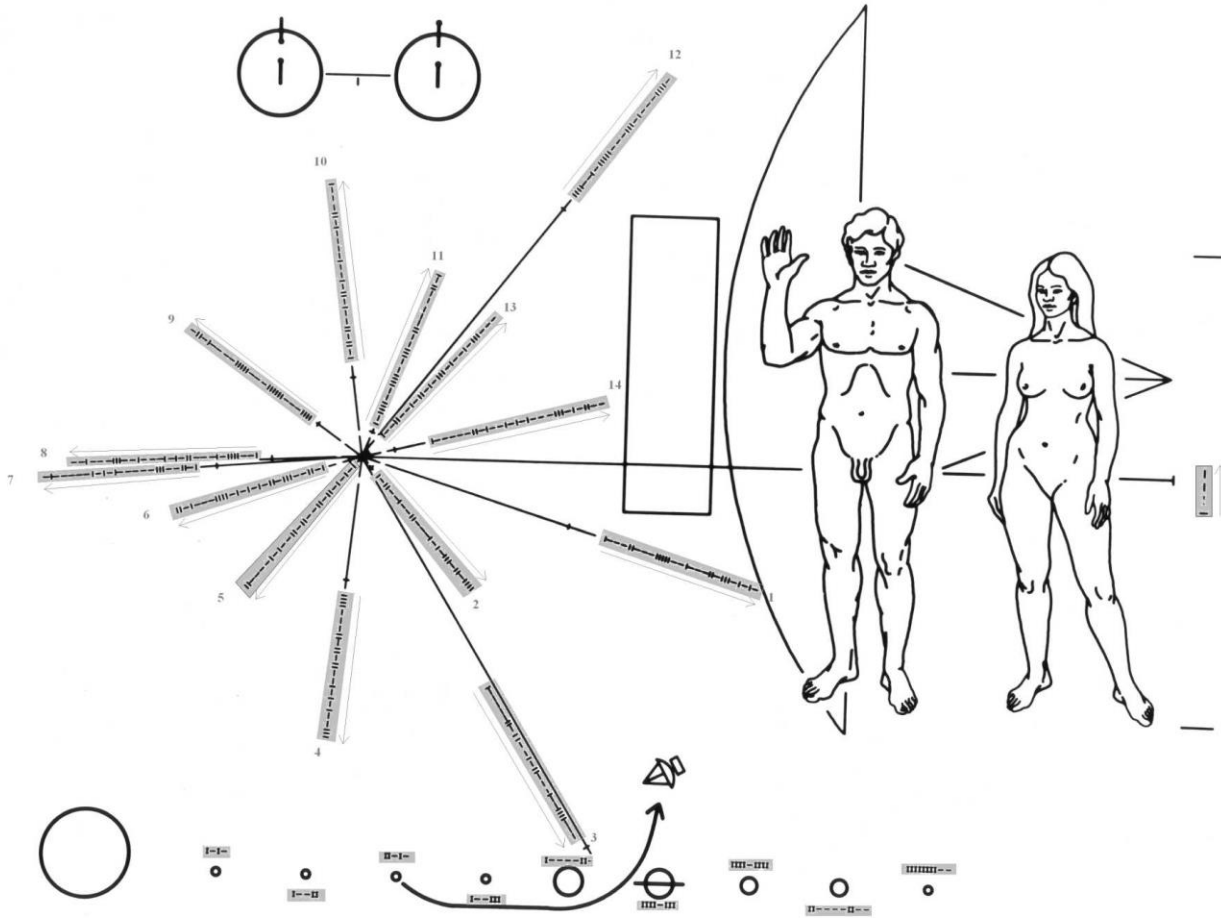
1. Why are extreme life-forms on Earth, such as those shown in the photograph that opens this chapter, of interest to astrobiologists?
2. What is meant by “life as we know it”? Why do astrobiologists suspect that extraterrestrial life is likely to be of this form?
3. How have astronomers discovered organic molecules in interstellar space? Does this discovery mean that life of some sort exists in the space between the stars?
4. Mercury and Venus are both considered unlikely places to find life. Suggest why this should be.
5. Many science-fiction stories and movies—including *The War of the Worlds*, *Invaders from Mars*, *Mars Attacks!*, and *Martians, Go Home*—involve invasions of Earth by intelligent beings from Mars. Why Mars rather than any of the other planets?
6. Describe how the Viking Landers looked for evidence of life on Mars.
7. Explain which variable in the Drake equation is the most difficult to estimate and suggest why this would be.
8. Suppose someone brought you a rock that he claimed was a Martian meteorite. What scientific tests would you recommend be done to test this claim?
9. Why are most searches for extraterrestrial intelligence made using radio telescopes? Why are most of these carried out at frequencies between  $10^3$  MHz and  $10^4$  MHz?
10. Explain why planet-hunting infrared telescopes need to be placed in space.

Chp 8-Discussion Questions. Looking for Life beyond Earth

1. Suppose someone told you that the Viking Landers failed to detect life on Mars simply because the tests were designed to detect terrestrial life-forms, not Martian life-forms. How would you respond?
2. Science-fiction television shows and movies often depict aliens as looking very much like humans. Discuss the likelihood that intelligent creatures from another world would have (a) a biochemistry similar to our own, (b) two legs and two arms, and (c) about the same dimensions as a human.
3. The late, great science-fiction editor John W. Campbell exhorted his authors to write stories about organisms that think as well as humans but not like humans. Discuss the possibility that an intelligent being from another world might be so alien in its thought processes that we could not communicate with it.
4. If a planet always kept the same face toward its star, just as the Moon always keeps the same face toward Earth, most of the planet’s surface would be uninhabitable. Discuss why.
5. How do you think our society would respond to the discovery of intelligent messages coming from a civilization on a planet orbiting another star? Explain your reasoning.
6. What do you think will set the limit on the lifetime of our technological civilization? Explain your reasoning.
7. The first of all Earth spacecraft to venture into interstellar space were *Pioneer 10* and *Pioneer 11*, which were launched in 1972 and 1973, respectively. Their missions took them past Jupiter and Saturn and eventually beyond the solar system. Both spacecraft carry a metal plaque with artwork (reproduced below) that shows where the spacecraft is from and what sort of creatures designed it. If an alien civilization were someday to find one of these spacecraft, which of the features on the plaque do you think would be easily understandable to them? Explain.

INVESTIGATING ASTRONOMY END-OF-CHAPTER QUESTIONS & EXERCISES

Middle left is position of the Sun relative to 14 reference stars (pulsars) and the center of the Galaxy  
Top left is Hydrogen emitting radiation at a wavelength of 21 cm  
Far right is the mathematical Binary equivalent of the decimal number 8



Original: <http://dctonhq.nasa.gov/IMAGES/LARGE/GPN-2008-001623.jpg>  
Annotation: <http://www.exploratorium.com>

Across bottom are planets of the solar system and their relative distances from the Sun (shown in binary code)

Chp 8-Collaborative Group Exercises. Looking for Life beyond Earth

1. Any living creatures in the subsurface ocean of Europa would have to survive without sunlight. Instead, they might obtain energy from Europa's inner heat. Search the Internet for information about "black smokers," which are associated with high-temperature vents at the bottom of Earth's oceans. What kind of life is found around black smokers? How do these life-forms differ from the more familiar organisms found in the upper levels of the ocean?
2. Like other popular media, the Internet is full of claims of the existence of "extraterrestrial intelligence," namely, UFO sightings and alien abductions. (a) Choose a Web site of this kind and analyze its content using the idea of Occam's razor, the principle that if there is more than one viable explanation for a phenomenon, one should choose the simplest explanation that fits all the observed facts.  
(b) Read what a skeptical Web site has to say about UFO sightings. A good example is the Web site of the Committee for the Scientific Investigation of Claims of the Paranormal, or CSICOP. After considering what you have read on both sides of the UFO debate, discuss your opinions about whether aliens really have landed on Earth.
3. Imagine that astronomers have discovered intelligent life in a nearby star system. Your group is submitting a proposal for who on Earth should speak for the planet and what 50-word message should be conveyed. Prepare a maximum one-page proposal that states (a) who should speak for Earth and why; (b) what this person should say in 50 words; and (c) why this message is the most important compared to other things that could be said.