

Astronomy 305: Life in the Universe
Homework 9: Chapter 9

Total points: 40

1. (5 pts) What is synchronous rotation, and why is it so common among the jovian moons (i.e., what causes it)?
2. (10 pts) [a] What is tidal heating? Briefly explain how it can arise and how it persists as a result of orbital resonances.
[b] How does tidal heating affect Io?
3. (10 pts) [a] What energy sources might be available to life on Europa? [b] Overall, what can we say about the likelihood and abundance of life on Europa?
4. (5 pts) Based on recent data, describe the general nature of Titan and discuss its prospects for life.
5. (2 pts) Which statement about synchronous rotation is true?
 - (a) It can develop only on moons that are born with slow rotation.
 - (b) It occurs commonly as a result of tidal forces exerted on moons by their parent planets.
 - (c) It can develop only on moons with liquid oceans.
6. (2 pts) Io is covered in volcanoes while Europa is covered in ice because
 - (a) Io is larger than Europa;
 - (b) Io receives much more sunlight than Europa;
 - (c) Io is subject to stronger tidal heating than Europa.
7. (2 pts) Which of the following is not an indication of liquid water beneath Europa's icy surface?
 - (a) the moon's changing magnetic field;
 - (b) the moon's average density;
 - (c) surface features that look like jumbled icebergs.
8. (2 pts) Photosynthesis is an unlikely source of energy for life in European seas primarily because
 - (a) the moon's ice cover is too thick;
 - (b) the sunlight at the distance of Jupiter is too weak;
 - (c) there is no soil on which plants could grow.
9. (2 pts) It's assumed that, even if Europa has life, the total amount of that life will be small. That is because
 - (a) Europa is only about as big as our own Moon, and consequently there's not much room for life;
 - (b) the ocean will be cold, slowing down metabolism;
 - (c) there are likely to be only limited sources of energy for life.