

Chapter 2: Habitable Worlds --

- 1) Question 2.8, page 76, from Gilmour and Sephton.
- 2) Provide clear, complete, yet concise explanations to explain how undersea hydrothermal vents provide a satisfactory source for the iron and, separately, for the oxygen involved in the formation of banded iron formations.
- 3) Clearly and completely present arguments regarding the truth (or not) of the following statements:
 - a) Europa is the only icy satellite in the Solar System to show signs of tidal heating.
 - b) Both diatomic oxygen (O_2) and ozone (O_3) have been detected spectroscopically on Europa.
 - c) The most abundant spectroscopically determined salt on Europa's surface is NaCl.
 - d) The concentration of salts in Europa's ice is fairly uniform across the globe.
 - e) 'Ball of string' ridges on Europa's surface are equivalent to subduction zones on Earth.
- 4) Clearly and completely present arguments regarding the truth (or not) of the following statements:
 - a) Solar type stars have been the focus of many Doppler spectroscopy searches for extrasolar planets because such stars have plenty of narrow spectral lines, good stability, and there are plenty of bright examples.
 - b) Most of the known exoplanets must have a composition in which the heavy elements constitute over half of their mass.
 - c) There is a strong correlation between eccentricity and semimajor axis of exoplanet orbits, whereby the larger the semimajor axis the smaller the eccentricity.
 - d) If Earth-mass planets in Earth-like orbits around solar-type stars are fairly common, they will be discovered when we have space telescopes that will be able to measure star positions with greater precision than presently possible.
 - e) Earth-mass planets can avoid speedy Type I migration carrying them into their star if they form sufficiently slowly.
- 5) A hypothetical Earth-like planet with a radius of 5000 km and an albedo, a , of 0.4 orbits a star with a mass 5 times that of the Sun. The total fraction of solar radiation absorbed by a planet is $(1 - a)$. The total energy incident on the planet is 1.7×10^{17} W.
 - a) Assuming the planet radiates all of the energy that it absorbs (i.e. it neither gains nor loses heat) determine its effective temperature. How does this temperature compare with the effective temperature of the Earth?
 - b) Explain how the recycling of carbon dioxide by active volcanism and plate tectonics on the planet might modify its surface temperature.
 - c) Why does it seem unlikely that complex Earth-type life might develop on this planet?