

### Extraterrestrial Life: Problem Set #3

Due, in class, Thursday February 28th

- 1) Outline the key properties that seem to be common to all life on Earth. Explain why the existence of these shared features supports the idea that all life on Earth arose from a common ancestor.
- 2) Suppose that life is discovered on Mars. Explain how we might be able to determine whether it shares a common ancestor with life on Earth. How would the prospects for making such a determination be affected if all that is found on Mars are fossils of life that died out hundreds of millions of years ago?
- 3) Suppose that (hypothetically, since I can't think how this could ever happen) **all** life on Earth were suddenly to die out. Describe how the atmosphere on the now-lifeless Earth would change. For how long would evidence of past human civilization persist (i.e. if an alien civilization were to visit the Earth thousands, millions, or hundreds of millions of years later, how easily could they determine that an intelligent species had once existed there?).
- 4) Describe what is meant by extremophiles. Why are extremophiles considered to be important in guiding the search for extraterrestrial life.
- 5) Suppose that a small asteroid or comet – like the one that struck an uninhabited area of Siberia in the early 20<sup>th</sup> century – were to hit the Earth next year. What is the probability that it would wipe out a major city? [hint: to do this you need to estimate the fraction of the Earth's surface that is covered by cities. There is no single right answer, so be very careful to state your assumptions clearly.]