

Due Thursday March 12, 2009.

(Please hand in **before** class on Thursday, otherwise it will be docked points).

When answering questions in this or any college class, attempt to avoid simply repeating the question in your answer. All you have to do is *answer the question*. Please write clearly so that we can read your answers. Thank you!

1. (0.5 pts.) The first life forms in the Hadean or early Archean (before ca. 3.8 billion years ago) were most likely very tiny, unicellular organisms functioning as (please circle one)
 - A. psychrotrophs
 - B. heterotrophs
 - C. chemoautotrophs**
 - D. denitrifying bacteria
 - E. photoautotrophic metazoans

2. (1.5 pt.) Explain your answer to #1 above. WHY do we think the first organisms functioned in this way? Specifically, how does the Phylogenetic Tree of All Life inform us of the earliest kinds of life? Finally, explain in 1-2 sentences why this analysis makes sense in terms of Darwinian evolutionary theory.

The organisms with the DEEPEST phylogenetic roots in the tree of all life are those that perform chemoautotrophy, so it makes sense to argue that this was the earliest metabolic style. Darwinistic Theory suggests that the earliest organisms ought to have been “primitive” and have simple metabolic styles, and also that they were generalists.

3. (1.5 pts.) Explain in detail how radioactive age determinations from meteorites and Moon rocks can be used to infer the age of the Earth (*use the space below*).

All of the oldest ages of rocks from the Moon and meteorites tend to converge toward an age of ~4.5 billion years. The oldest components of all, found in the most primitive meteorites, converge at the same age, 4.56 Ga. This is considered the time of the first solidification of matter out of the cloud of gas and dust that formed the Sun and planets.

4. (1.5 pts.) The establishment of a habitable world like the Earth occurred because of an interplay of many different factors. Several of these include the formation and stabilization of the crust, condensation of the hydrosphere and establishment of the atmosphere. Briefly explain (in short, concise paragraph that does NOT repeat the question posed here) two or more process(es) by which the terrestrial planets (i.e. inner “rocky” planets) may have formed their initial atmospheres.

There are really three important ways a planet can acquire an atmosphere, I am interested in you having explored at least 2 ways planets do this.

a. Degassing from differentiation of the planet into different layers (core, mantle and crust) based on density differences. The densest stuff (metals) sank to the center to make the core, lighter materials (silicates) floated up to form the crust. The lightest of all, gases and liquids went into making the atmosphere and hydrosphere, respectively.

b. Cometary and meteor bombardment may have brought gases from the colder parts of the solar system to the Earth and added to the formation of the atmosphere.

c. Capture of gases from the solar system cloud of gas and dust by the gravity of a planet could pull gases into the atmosphere from the surrounding space.

d. Implantation of gases by solar wind may have added material to the accumulating atmosphere.

I give credit to any permutation of the above scenarios

