

Biology/Geology 350
Invertebrate Paleontology: The History of Life on Earth
Exam Number One

Remember, this is only the essay portion of the test, and although you are to *prepare* answers to all questions provided, you will answer only one or perhaps two for the test. Which one or two you will not know until the time you take the test. Also, you may have a choice.

BACKGROUND: In lecture we constructed a sequence of arguments to gain explainability to the “Problem of Problems, *how can life become more complex and diverse with time when the 2nd law of thermodynamics says it is supposed to be running down?*” Unlike mythical truths where the only criteria for their truthfulness is, “It is so because it is said to be so” scientific hypotheses must explain both WHY and HOW? Neither of these is easy to do and for a long time they were “non-problems.” Biologists and paleontologists did not acknowledge they existed because they were insoluble. But it is probably true that more people in this country would agree with William Paley’s Watchmaker Argument than with scientific explanations of evolution. But “God did it” is not a scientific explanation, where a step by step description of how the phenomena comes about is required.

Today we have many more powerful tools available to us to solve the thermodynamic conundrum, and provide explainability for how life could arise from the disorder of the universe. The sequence of questions below follow the lines of evidence, arguments, and demonstrations we developed in class to explain the principles of the origin of life.

These questions deal with these issues.

Question One
NON-EQUILIBRIUM THERMODYNAMIC PRINCIPLES

This first question is primarily philosophical and works toward an understanding of the principles involved and understanding of some basic terms. Begin by stating the problem the 2nd Law of Thermodynamics presents to explanations of evolutionary systems. Then develop a quintessential discourse explaining the principles of non-equilibrium thermodynamics. Be sure to incorporate the following terms and concepts in addition to any other subjects you discuss.

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| <input type="checkbox"/> Closed System (with examples) | <input type="checkbox"/> Entropy | <input type="checkbox"/> Open System (with examples) |
| <input type="checkbox"/> Cybernetics | <input type="checkbox"/> Negative Feedback | <input type="checkbox"/> Positive Feedback |
| <input type="checkbox"/> Determinism | | <input type="checkbox"/> Stratified Stability |
| <input type="checkbox"/> Dissipative Structures (with exploration of their properties) | | |