1. Use examples from lecture or text to help explain (a) the concepts and (b) the processes of adaptation. (c) Explain at least three reasons why adaptations are not ‘perfect.’

2. What is life? Your answer should include (a) the properties listed in the text (and lecture) and (b) a careful analysis of the criteria for detecting life on Mars. (c) Explain the strengths & weakness of each of the criteria and specify what level of biological organization these criteria can be applied to. Apply these properties & criteria to (i) real viruses (ii) computer viruses, (iii) human fetuses, and (iv) the earth.

3. Summarize the Endosymbiotic Theory for the origin of eukaryotes. Use facts & examples to help describe some of the patterns that are consistent with this hypothesis.

4. What is a species? Your answer should include a careful analysis of the alternative species concepts and their strengths & weaknesses, illustrated with examples. What concept is most often used to comply with the US Endangered Species Act?

5. Describe the life cycle of the cellular slime mold Dictyostelium and explain why it serves as a model for questions about the evolution of multicellularity and cooperation.

6. Explain why the Reptiles are not a monophyletic group.

7. Explain the principle of negative feedback regulation. Use examples from lecture or text to illustrate how this works in the realms of (a) mammal homeothermy, (b) endocrine regulation of blood glucose, (c) posture and the knee-jerk reflex, and (d) population regulation via density dependent demographics.

8. Describe the Nonspecific Defense Mechanisms and Specific Immune Responses that a human would put up against a bacteria that entered the body on a splinter. Explain the roles of (a) Helper (CD4) T cells, (b) Cytotoxic (CD8) T cells, and (c) B cells. Briefly compare and contrast primary and secondary responses.

9. What is sexual selection? Give an example from lecture or text of sexual selection on a signal (or secondary sexual characteristic) by some non-human animal, and explain what the discriminating signal receiver gets (at least hypothetically) in return for the costs of being
choosy. Briefly summarize the famous t-shirt sniffing experiment presented in lecture and explain the hypothetical interpretation of the results.

10. What are the component demographic processes that combine to determine population growth rate? What kinds of ecological processes influence these demographic processes. What is exponential (or geometric) population growth and what conditions should lead to this kind of growth? What is the logistic model and what additional ecological and demographic processes does it incorporate. What general characteristic tends to make logistic population growth chaotic?

11. What is the Lotka-Volterra competition model and what additional ecological and demographic processes does it incorporate? What, in general, tends to lead to coexistence rather than competitive exclusion in competitive interactions? Illustrate with an example from lecture or the text.