Some notes and thoughts for exam one

In this course one of my primary goals, besides presenting how ecology works in aquatic environments, is to foster synthetic ability in my students. That is to develop the ability to take two "seemingly" unrelated ideas, concepts or facts (e.g., interspecific competition and lake basin geomorphology), put them together, and see nature in a new light. Yes, how ecology works in lakes, streams and marine systems is important, that's why we work through all those studies and examine graphs of dependent and independent variables. It is absolutely necessary to cover all the descriptive things like zonation in lakes, basin formation, annual turnover patterns, and P/R changes along the course of a stream to a river, and how competition operates in a variety of case studies. Many ecology courses simply end there. I am trying to step past that. Facts and description are just that and it doesn't take a rocket-scientist to memorize things. But the simple memorization of facts isn't what science is about, yes it must be done, but it's only the first step. For example, as I mentioned in class, we might anticipate that competition among phytoplankton or zooplankton could operate in somewhat different fashion in a dimictic lake versus a polymictic lake when nutrient availability is considered. I realize that many of you have not experienced a course with such aims before, and that the link between such ideas and concepts might be clear to few of you. Hence, I'm putting together this blurb as an aid.

We began this course by constructing a simple graphical model of a lake ecosystem/community. The model contained, among other things, interspecific interactions within (e.g., competition) and between (e.g., predation) trophic levels, all linked via the flow of energy and cycling of nutrients in a variable environment. The purpose of this exercise was to first provide a framework for the course--what kind of mechanisms like competition, and processes like nutrient movements and storage, are found in aquatic environments. Further, how do such mechanisms and processes impact the coexistence of species, shape species phenotypes, and help us understand how nature works. The second purpose was to illustrate the sheer complexity of the world we live in and to develop approaches for understanding that complexity. Above all I want you to realize that simply because an experiment implicated some mechanism in promoting species coexistence (e.g., character displacement), that the story does not end there. Forces like disturbance can simply rewrite the rules and change outcomes altogether. For example, Hutchinson offered us his elegant 1:1.3 ratio but we rarely see it in nature. Why? It could simply be wrong, or Hutchinson could be right but things like disturbance might impact competitive interactions such that the ratio is not visible or the environment may change so fast that species do not partition resources in such a fashion. You see, ecology is not limited to simple facts like "the knee bone is connected to the leg bone".

As we worked through the introductory material and section on competition I tried to develop several lines of thought. First, why is coexistence among some
species not possible while others coexist readily in the long-term? Next, what factors subvert the previous statement--here is where the synthesis business I'm talking about begins to come into play. That is, coexistence among species which generally cannot coexist is possible given variation in some other factor. As an example, recall from General Ecology Gause's classic experiments with Paramecium and Didinium where migration was capable of altering the normal outcome. A primary emphasis in the section on competition is the various categories of ways species might coexist despite strong competition. Here, we explored ecological-time things like habitat, resource, and temporal partitioning, strategies like the "fugitive" species, and the way species might "pack" into some system (e.g., limits on species similarity as species enter a system). Of course partitioning of the environment is one way species ameliorate or reduce the intensity of competition. We also invoked processes as they occur in evolutionary time and observed things like character displacement and speciation.

Some of the more powerful studies we examined observed two or more species in allopatric and then sympatric situations. This provides us with information about, among other things, how species utilize resources in both the absence and presence of competitive interactions. The difference between these two situations is often very telling.

Be creative in answering exam questions. You always have the opportunity to explain an answer and what matters to me is that your thoughts make sense, not necessarily that you picked the right answer. Wrong answers with interesting angles of thought become correct answers--but the thinking must be there. Rely on your experience and what you have heard in class.