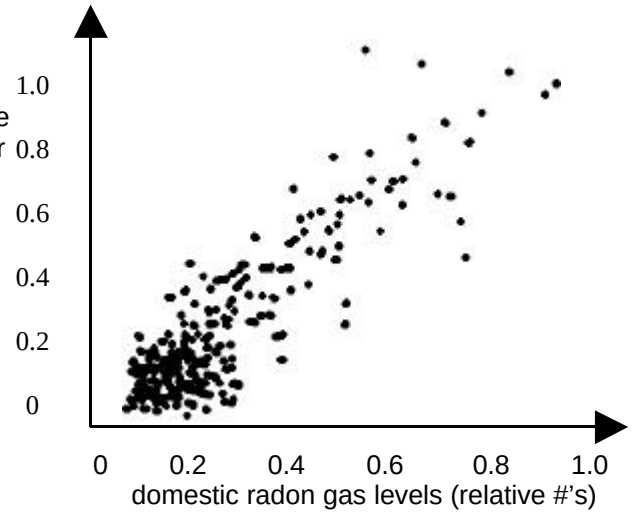
I. Short Answer Questions (4-9 points each)

SAQ #1. Please state and briefly explain the three major objectives of this course (listed on page two of the syllabus).

state and explain objective 1 - (3 pts)
state and explain objective 2 - (3 pts)
state and explain objective 3 - (3 pts)

SAQ #2. Radon gas is a radioactive natural byproduct of the decay of uranium oxide found in granitic rocks that often underlie, if not comprise, home foundations in Pennsylvania. Thus as uranium decays, radon gas is released into the soil and then leaks into and accumulates in poorly ventilated basements. Since radon is also radioactive, it is by definition a potential cancinogen.



In the figure at right appears a typical relationship one might find between basement radon gas levels and the lung cancer rate of longtime homeowners in PA. What is your response to the newspaper reporter who said that "**this graph shows that radon gas caused these cancers"**?

Please BRIEFLY explain (in 2-3 sentences) - How **valid** is this conclusion? 5 pts.

SAQ #3. Please **list** the principal strengths and weaknesses of **controlled laboratory experiments** to understand ecological phenomena.

strengths weaknesses:

5 pts.

SAQ #4. Please **list** the principal strengths and weaknesses of **controlled field experiments** to understand ecological phenomena.

strengths weaknesses:

5 pts.

SAQ #5. Please briefly explain the key differences between Inductive and Deductive reasoning in the scientific method. In addition, **please use a figure** to illustrate your explanation.

6 pts.

SAQ #6. Why it is a **misconception** to assert that "good science and scientists are totally objective"? Please list 3 totally different ways that subjectivity enters and is of value to productive scientific endeavor.

1 – 2 – 3 – 6 pts.

SAQ #7. According to analyses in Costanza et al (1997), the "ecosystem services" of the natural world are greatly undervalued. What are some of the major services, and what is the total approximate annual value of all of these services combined?

6 pts.

SAQ #8. This question will assess your understanding of ecological energy flow (please refer to the figure on the previous page [Stiling 21.1]). For each question, please write down the correct number or numbers from the figure. Where appropriate, express the answer as a sum, product, quotient, etc., but you do not need to use a calculator to solve any equations.

(a). Net primary productivity (which is defined as gross productivity minus metabolic expenditure) for this ecosystem is numerically equal to what?

2 pts

(b). Gross primary productivity for this ecosystem is numerically equal to what?

2 pts

(c). The ecological efficiency of net primary productivity for this ecosystem is numerically equal to what?

2 pts

(d). The ecological efficiency of "spiders" for this ecosystem is numerically equal to what?

2 pts

SAQ #9. Take a close look at the box for "bacteria" which is the primary category of decomposers in this ecosystem. What is their ecological efficiency, and what do you notice that is extremely unusual or perhaps inexplicable about this number?

6 pts.

Please examine the figure on the previous page that shows the ecosystem of a pitcher plant from West Malaysia [Stiling 20.2], and then answer the questions on this page.

SAQ #10. How might the problem of spatial scale pose a challenge to the accuracy and usefullness of THIS ecosystem model compared with others such as the salt march on a previous page? Please briefly speculate.

5 pts.

SAQ #11. How might the problem of temporal or time scale pose a challenge to the accuracy and usefullness of THIS ecosystem model compared with others such as the salt march on a previous page? Please briefly speculate.

5 pts.

SAQ #12. How might the problem of taxonomic scale (i.e. how one defines the identities of the numbered circles) pose a challenge to the accuracy and usefullness of THIS ecosystem model compared with others such as the salt march on a previous page? Please briefly speculate.

4 pts.

I. Longer Answer Questions (10 points each).

LAQ #1. This question will assess your understanding of the coriolis effect. Please use any combination of diagrams and sentences to explain why the Gulf Stream flows clockwise in the northern hemisphere (i.e. even a ship piloted by the least competent of Captains has a good chance of sailing from Spain to the Caribbean, then up what is now called the North American coast, and then back to Europe). (hint: remember that ocean currents are driven by wind currents…)

10 pts.

LAQ #2. Why is there a distinct **dry season** in December-February in tropical regions centered at about 10^o North latitude? Please use a clear diagram or set of diagrams. (hint: during June-Aug the dry season occurs at 10^o South latitude...)

10 pts.

LAQ #3. Please diagram and label the two basic "functional characteristics", i.e. energy flow and biogeochemical cycling, of an ecosystem. In addition to your diagram, please also write somewhere on the page what are the basic differences between the paths of energy and biogeochemicals in an ecosystem, i.e. highlight the unique differences between them. (Please OMIT OMNIVORES for simplicity)

functional characteristic 1: energy flow - (5 pts)

functional characteristic 2: biogeochemical cycling - (5 pts)

LAQ #4. Data from a census of tree species include 40 trees of species A, 30 of species B, and 10 each of species 3, 4 and 5 (note that the total number of species is 5 and the total of individuals is 100). The equation for the Shannon Diversity Index, H',

$$H' = -\sum_{i}^{S} p_i * \ln(p_i)$$

(for which p_i is the proportion of data from the ith species, and S is the total number of species)

...what is the diversity of species present? Please set up the problem, i.e. write out the equation for diversity, but you need not solve it numerically. (4 pts)

….Please briefly explain what is the main **advantage** of using a diversity index, such as H', to estimate biodiversity rather than simply using the number of species censused? (3 pts)

….Please briefly explain one major **disadvantage** of using a diversity index, such as H', to estimate biodiversity? (3 pts)

LAQ #5. Please state what are the two principal objectives of individual ecology.

state objective 1 - (3 pts)

state objective 2 - (3 pts)

How can the study of individual ecology contribute to an understanding of the ecosystem level concept of bioaccumulation, such as of DDT as illustrated in the figure at right (Stiling 22.Box 1). What exactly can individual ecology contribute to an understanding of bioaccumulation? (4 pts)