Homework 1 (chapters 1-3):

1. Using Figure 2.31 on page 47 as a reference, determine the *percentage* increase in CO_2 concentrations in the atmosphere from 1960 to 1995.

2. List the main pathways of heat exchange for an organism.

3. Several species of Arctiid moths emit clicks when in the presence of bats. Bats, of course, locate their prey by sound. Several hypotheses exist as to the purpose of these clicks. Locate online (through the Dawes Library, OhioLink and the Ohiolink Electronic Journal Center) the following article:

   Arctiid moths and bat echolocation: broad-band clicks interfere with neural responses to auditory stimuli in the nuclei of the lateral lemniscus of the big brown bat.

   From the introduction, list 4 hypotheses for how the clicks may protect the moths. Then, read the last section "Relevance for bat/moth interactions" and determine which hypotheses are supported by the authors' work. You don't have to read the rest of the article.

4. Locate a distribution map for the paddlefish, *Polyodon spathula*, and determine which are the westernmost and easternmost states in its distribution. Incorporate a copy of the map.

5. A flight of 199 Canada Geese averaging 1m long approaches a Vestas V-80-2.0 MW wind turbine in Kansas. The birds are flying is a typical "V" formation. The wind is blowing *from* 172° at 15 m/s. The birds are flying at (towards) a bearing of 172° at an airspeed of 65 km/hr. Assuming the birds fly within the arc of the turbine blades:
   a. What is the chance that all of the birds will pass through the blades unscathed?
   b. How many birds would you expect to be struck?

Study questions (these might appear on a test; do not turn them in as part of your homework:

1. For each chemical, list the primary uses in organisms: C, N, O, P, K, S, Mg, Fe, Na, Cu.

2. Prepare a table comparing ammonia, urea, and uric acid in terms of the amount of water used in excretion, the toxicity, and the amount of energy used to synthesize each. Use ratings of low medium, and high.

3. Describe the ecological differences in a mouse's and a frog's approach to life.

4. Why is the electrical sense only found in aquatic organisms?

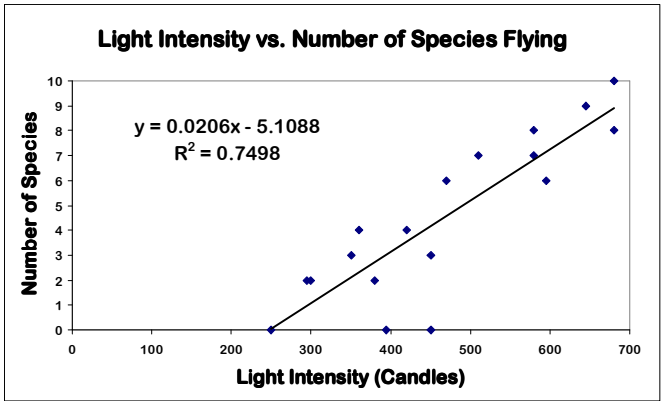
Homework 2 (chapters 3-6):

1. In 1995-1996, John Goold, a senior at Marietta College, set out to determine the diel periodicity of dragonfly activity. At a selected site in Washington County, Ohio, he observed the number of dragonfly species active under varying light and temperature conditions at various times of the day. Among his findings were the data in the table below. Take the data, and plot separate scattergrams for temperature vs. number of species flying and light intensity vs. number of species flying. Insert trendlines (and their equations) on the graphs. Answer the following questions:

   A. Which variable shows a stronger correlation with the number of species flying?
   B. How do you know this?
   C. Does correlation always imply causation? What about in this case?

Data from Goold, 1996, and a sample graph showing what I am looking for in question 1.

Temp (C)	Light int. (Footcandles)	# Species
13	380	2
14	420	4
17	470	6
18	350	3
19	300	2
21	360	4
23	295	2
23	580	7
23	595	6
24	450	3
24	580	8
28	680	10
29	680	8
31	510	7
31	645	9



2. List the habitats where animals would excrete urea, uric acid, and ammonia. For each of the three molecules, list at least 3 taxonomic groups that utilize them.

3. How does the kangaroo rat minimize water loss for cooling (be complete)? Where does a kangaroo rat get its water?

4. Distinguish between C_3 and C_4 photosynthesis.

5. Would terrestrial organisms be more or less likely to show temperature compensation in enzymes than aquatic organisms? Why?

6. What type of biome will develop under these conditions?

Annual Precipitation (mm)	Average Temperature (^{0}F)	Vegetation Type
1100	**60**	_____
2250	**77**	_____
1000	**32**	_____
1000	**50**	_____
500	**41**	_____
3500	**70**	_____
750	**68**	_____

7. Find this article on J-Stor:

Stefan, Heinz G., et al. "Simulation of dissolved oxygen profiles in a transparent, dimictic lake", *Limnology and Oceanography*. v. 40 issue 1, 1995, p. 105-118.

From figure 2, plot the temperature profile of the lake in mid-April, July 1, and October 1. Put the depth on the y-axis and the temperature on the x-axis as in Figure 8.13 in your textbook.

8. Why would a shallow, temperate-climate pond be more likely to become anoxic in late summer as opposed to early summer?

9. Find (or calculate) the average annual temperature and precipitation for Washington County, Ohio. According to this data, which biome should develop here according to Figure 5.9 in Ricklefs? Attach a copy of your data.

10. Examine the article at:

http://www.pnas.org/cgi/content/full/97/4/1630

A. Examine figures 1-6. For each, tell me how strong you think the correlation is, and on what basis.
B. In a paragraph, summarize the authors' conclusions.

Homework 3 (chapters 6 -10):

1. Fill in Table DA 1.1 by following Steps 1-6 in Module 1.

A. Time	B. Temp. °C	C. Dissolved oxygen (mg/L)	D. Dissolved oxygen at saturation (mg/L)	E. Departure from saturation (C-D)	F. Change in oxygen (mg/L/hr) (C_2-C_1)	G. Respiration (mg/L/hr)	H. Gas exchange rate (mg/L/hr)	I. Gas exchange rate * departure (E*H)	J. Gross primary production (mg/L/hr) (F+G+I)
16:00	30.8	7.52	7.45	0.07					
17:00	30.6	6.54	7.48	-0.94	-0.98	6.55	0.71	-0.67	4.9
18:00	29.9	5.41	7.57	-2.16	-1.13	6.14	0.70	-1.50	3.5
19:00	28.8	4.30	7.72			5.65	0.68		
20:00	27.6	2.69	7.89			5.24	0.66		
21:00	26.6	1.79	8.02			4.91	0.65		
22:00	25.8	1.43	8.13			4.67	0.64		
23:00	25.2	1.34	8.25			4.48	0.63		
0:00	24.6	1.30	8.32			4.34	0.62		
1:00	24.2	1.33	8.39			4.21	0.61		
2:00	23.8	1.37	8.45			4.11	0.61		
3:00	23.5	1.40	8.50			4.03	0.61		
4:00	23.3	1.41	8.50			3.98	0.60		
5:00	23.1	1.42	8.55			3.94	0.60		
6:00	22.9	1.45	8.59			3.88	0.60		
7:00	22.8	1.76	8.60			3.86	0.60		
8:00	22.8	2.37	8.62			3.86	0.60		
9:00	22.9	3.26	8.58			3.92	0.60		
10:00	23.6	5.55	8.48			4.19	0.61		
11:00	25.1	8.23	8.24			4.79	0.64		
12:00	27.0	10.03	7.97			5.39	0.67		
13:00	28.5	10.55	7.75			5.94	0.69		
14:00	29.6	9.85	7.61			6.18	0.70		
15:00	29.9	8.43	7.57			6.37	0.71		
16:00	29.9	7.49	7.58			6.27	0.70		

2. Graph dissolved oxygen vs. time (x axis). Indicate day and night times on the graph.

3. From 1:00 am to sunrise, dissolved oxygen concentrations in table DA1-1 are very low, why is this? At what time do you think sunrise occurred?

4. During the period of 1:00 am to sunrise, dissolved oxygen changes little, yet respiration is still occurring (column G). Considering the physical and biological processes at play, how is this possible?

5. Based on these values, at what times of the day is oxygen diffusing into or out of the water at the highest rates, and why?

6. Based on your answer, would you classify this stream as primarily autotrophic or heterotrophic, in other words, is P/R greater than or less than 1?

7. What do you think would have happened to patterns of productivity in the *Hydrilla* stream if the forest had been cleared but *Hydrilla* had not been introduced? Would production still increase?

8. Why do estuaries have such a high productivity rate as compared to open ocean, continental shelves, lakes, and streams?

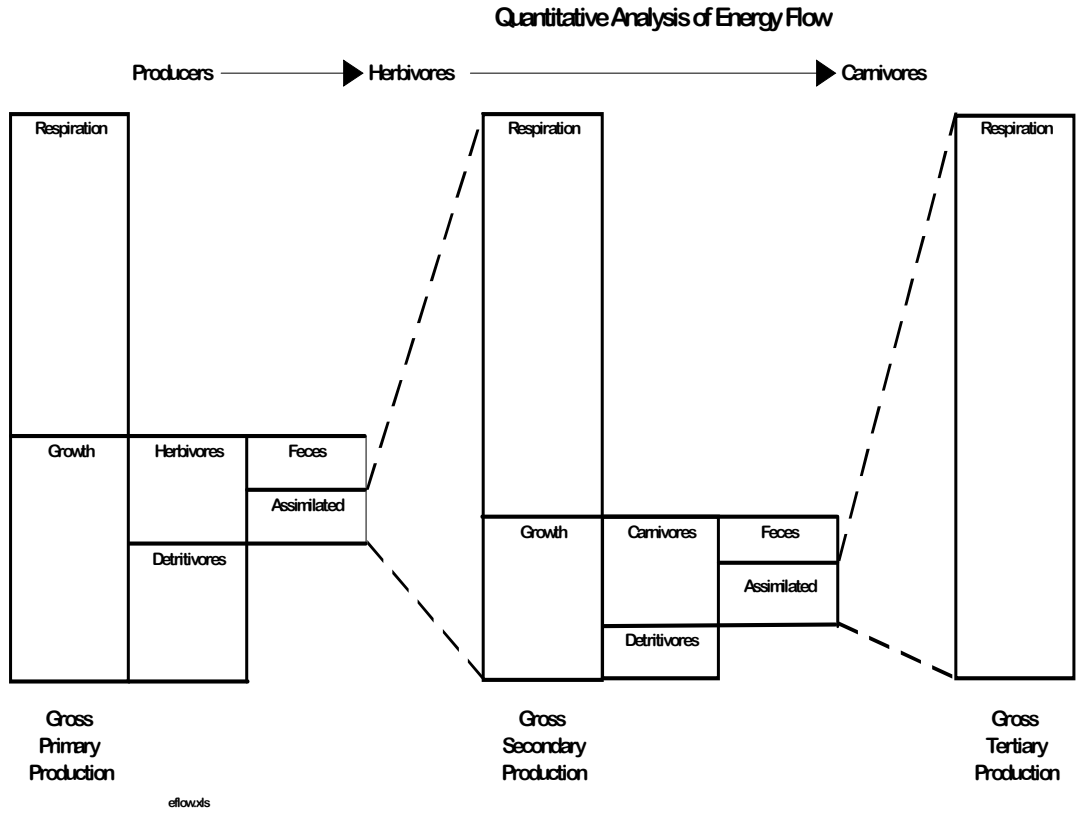
9. Fill in the blanks for the energy budget below. All energy values are in kilocalories.

	Producers	Herbivores	Carnivores
Energy available	**1,700,000 (sunlight)**		
Energy Fixed in Photosynthesis	**22,800**		
Energy Consumed		**3,250**	
Energy in Feces			
Energy Assimilated		**2,200**	**250**
Energy Respired	**10,560**	**1,690**	**250**
Energy used in Growth			
Gross Production			
Net Production			
Energy ultimately consumed by next trophic level	**3,250**	**383**	
Energy ultimately utilized by detritivores			

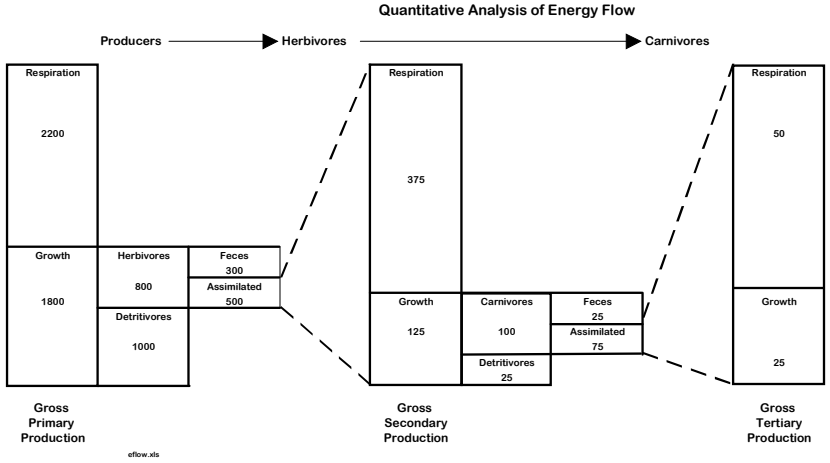
10. What percent of the energy fixed in photosynthesis was used in the <u>respiration</u> of each trophic level?

producers	_____ kcal	_____ %
herbivores	_____ kcal	_____ %
carnivores	_____ kcal	_____ %
detritivores	_____ kcal	_____ %
total	22,800 kcal	_____ %

11. Use the values from question 10 to complete the diagram below:



The sample chart below might help you in answering the question above:



12. Using the data in Table 6.1, prepare 3 graphs. Each of the graphs should have the number of trophic levels plotted on the x-axis, and one of the other 3 parameters on the y-axis. Each graph should have a regression line and equation. Which of the 3 parameters – net primary production, consumer ingestion, or ecological efficiency – is most closely tied to the number of trophic levels? Write a paragraph giving your answer, making clear why you chose the answer you did mathematically and why this answer makes sense biologically. Include the 3 graphs.

13. Find a *research* (as opposed to a news) paper dealing with the effect on photosynthesis of iron concentrations in the ocean. Read the paper and summarize the findings in a paragraph. Attach a copy of the paper to your homework.

Study questions:

14. Explain the difference in nutrient cycling between a tropical and a temperate forest.
15. Why are the open oceans often referred to as “deserts”?
17. Describe in words what happens to solar energy impinging on a plant.
18. Imagine a planet with an atmosphere that absorbs red, blue, and violet light. What color would the sky be? What color would the plants be? Why?
19. Which would have more accessory pigments: a plant living on the floor of a rain forest or one of the trees which gets full sun? Explain.
20. Create your own diagram to convey the same information as Odum’s flow diagrams shown on p. 127 in Ricklefs.
21. Why are the open oceans often referred to as “deserts”?
22. Describe in words what happens to the energy in food ingested by an animal.
23. A lake has yearly rainfall of 5,000,000 liters; streams bring in an additional 12,000,000 liters. Evaporation has been measured at 4,000,000 liters per year. The lake’s volume is 135,000,000 liters. The water level remains constant from year to year. What is the outflow through the stream draining the lake? What is the residence time of water in the lake?
24. Find this paper:

    Contrasting leaf development within the genus *Syzygium.* G Woodall, I Dodd and G Stewart.

After reading the paper, write a one paragraph summary of what the authors found. Write a second paragraph focusing on the possible role of anthocyanin in these plants.