Biology 612 Test 1 Fall 2002 Name_____

1. List 5 potential values of freshwater aquatic systems (5).
2. How did watershed management differ between protecting water yield in the South African Fynbos and protecting native salmon runs in the Pacific Northwest United States (6)?
3. Where would you expect particles that are slightly denser than water to collect in a lake where there are Langmuir circulation cells (a diagram of water circulation patterns may help you show this)(4)?
4. Draw a graph of the density of water as a function of temperature from 0 to 10 ^{o}C, label both axes (10).
5. The Great Lakes of North America have a much greater surface area than Lake Tanganyika or Lake Biakal. On the basis of that information, why would you expect the number of species to be greater in the Great Lakes than either Tanganyika or Biakal? Why do Tanganyika and Biakal have so much greater diversity and numbers of endemic species, and what ultimately leads to the differences between the lakes (10)?
6. List 3 reasons for halting species extinctions and explain why freshwater systems are particularly vulnerable to species extinctions (5).
7. Fisheries managers have regularly introduced species into habitats where they did not occur previously, why might this be a bad idea and list one intentionally introduced species that has shown that this is a bad idea (4).
8. Explain why rRNA analysis is particularly useful in distinguishing among bacterial species (4).
9. List three types of lakes formed by glacial action (6).
10. Why are oxbow lakes relatively short-lived in geological time (5)?
11. Draw a vertical profile of temperature versus depth for 11 m deep monomictic Pottawatomie State Lake # 2 in summer and in winter. Place temperature on the x axis with depth increasing from top to bottom of the graph. Where they form, label a metalimnion, hypolimnion, and epilimnion (10).
12. Order the following processes with respect to Reynolds number. Label the process associated with relatively higher Reynolds number with an "H", and the one with the lower Reynolds number with an "L" (7)?

Low inertia __L___	High inertia ____H_____
Molecular diffusion _____	Advective transport _____
Flow boundary layer _____	Open channel flow _____
Streamlining _____	Blunt shape _____
Turbulence _____	Laminar flow _____
High groundwater flow, high porosity _____	Low flow, low porosity _____
Swimming bacterium _____	Swimming fish _____
Quickly sinking particle _____	Slowly sinking particle _____

13. Match the term on the left with the corresponding letter on the right (1 point each,10 total).

Cyanobacteria _____	a. forensic medicine and paleolimnology
Diatom (Bacillarionphyceae)___	b. Plecoptera, Ephemeroptera, Trichoptera
Anurans_____	c. lures with glochidia
Cnidaria_____	d. nauplii
Rotifera_____	e. emergent, floating leaved, etc..
Unionid mussels_____	f. Phytomasigophora, Zoomastigophora, Ciliophora
Insecta_____	g. Hepatotoxins
Copepod_____	h. Hydra
Macrophytes_____	i. Bdelloid forms stable without sexual reproduction for about 10 mill years
Protozoa_____	j. Dinoflagellates
Dinophyceae_____	k. Chitrid fungal infections

14. How does hydrology cause ombrotrophic and minertrophic bogs to vary with regard to nutrient inputs (4)?
15. Draw a diagram of groundwater habitats and label the vadose zone, the water table, and a confined aquifer (10).

Biology 612 Limnology Fall 2002 Test 2 Name_____

1. Draw the carbon cycle as presented in class, labeling all pools and fluxes. (15)
2. Why would it be a bad idea to add iron sulfate to a lake to control eutrophication, even though the iron would immediately precipitate out the phosphate? (5)
3. Draw the nitrogen cycle as presented in class. Label all fluxes, with oxidized pools to the right, reduced to the left, anoxic fluxes on top, and oxic on the bottom. (15)
4. What happens to an obligate hyperthermic organism (thermophile) when it is put in cold water (specifically what would happen to the lipids, proteins, and rRNA's? (6)
5. Why does nutrient concentration in lake water return to about the same level it was at when it is diluted with distilled water by about half? (5)
6. What are three characteristics of aquatic habitats that explain the Paradox of the Plankton? (5)
7. If sewage had been dumped into Lake Washington for a few more years, it may not have reverted to an oligotrophic state upon cessation of sewage additions, why? (4)
8. Why does aluminum concentration peak in some streams in the northeastern United States during periods of snow melt? (4)
9. What basic property of organic contaminants leads to greater degree of bioaccumulation and biomagnification (a greater concentration factor)? (4)
10. Who is Rachel Carson, and what did she do? (4)
11. You conduct an experiment to measure photosynthesis. You know the initial O_2 concentration (I), the O_2 concentration after the incubation in bottles in the light (L), and the O_2 in bottles in the dark (D). Use the letters to complete the following equations to calculate rates. (6)
    Gross photosynthesis = ( ) ÷ Time
    Net photosynthesis = ( ) ÷ Time
    Respiration = ( ) ÷ Time
12. Give the equations for photosynthesis and respiration. (4)
13. Why is organic carbon metabolized by microorganisms using oxygen, then nitrate, then sulfate as electron acceptors? (4)
14. What happened to the Aral Sea and what are the health ramifications? (4)
15. Place the appropriate letter by the term (15)

Item	**Match**
Phosphatase _____	a. Monod equation
Low redox compound high redox environment _____	b. Grass carp
Low redox compound low redox environment _____	c. low potential energy
Survival in ephemeral habitat _____	d. high potential energy
Neuston _____	e. Michaelis-Menten equation
Iron pyrite _____	f. ultra-oligotrophic
Lake Trummen _____	g. cleave organic P
Macrophyte control _____	h. Nutrient runoff encourages cattails

Concentration versus growth _____	i. Water surface tension
Concentration versus uptake _____	j. 106:16:1
Deep groundwater _____	k. desiccation resistance
Everglades _____	l. FeS
Nutrient patches _____	m. Sediment dredging
Redfield ratio _____	n. zooplankton excretion
Anoxic hypolimnion _____	o. high internal loading

Exam 3 Fall 2002 Limnology Biol 612 Name_____

1. Match the items on the right with those on the left. (20)

Item	Match
Nostoc mutualism	a. fruit eating fishes
Spines	b. fish abundance
Amazon	c. copepod
Stock	d. moving toward chemicals
Azolla	e. interactions based on population density
Spirit Lake	f. consumes leaves
Fastest swimmer (relative)	g. using a resource before another can
Geotaxis	h. stopping a competitor from using a resource
Chemotaxis	i. complementary metabolism
Photophobic response	j. mouth size determines prey size
Trait-mediated interactions	k. midge
Density-mediated interactions	l. predation avoidance
Shredder	m. primary succession
Schistosomiasis	n. survival of fish from one size class to another
Exploitation competition	o. movement downward
Interference competition	p. moving away from light
Syntrophy	q. interactions based on evolved traits
Gape limited predator	r. trematode and a snail
Keystone species	s. disproportionately strong interactor
Recruitment	t. n-fixing symbiont stimulates rice production

2. List three potential problems with fish stocking programs. (6)
3. List 4 reasons to establish nutrient criteria in streams. (8)

4. Describe the trophic cascade as it may operate in a lake, and give an example of how it may operate in a stream. (10)
5. Describe the functions of primary, secondary and tertiary treatments in a sewage treatment plant, and mention the benefit of activated sludge. (10)

6. Describe some of the complex interactions between Cladophora/ epiphytes/ and grazers by filling out the table below, only give one example of how the requested interaction occurs. (10)

Interacting Species (effect of first species on second)	Observed interaction
Cladophora on epiphytes	Positive:
Epiphytes on Cladophora	Positive:
Grazer on epiphytes	Negative: grazer eats epiphytes
Epiphytes on grazer	Positive:
Grazer on Cladophora	Negative:
Cladophora on grazer	Positive:

7. What types of phenotypic plasticity did the two species of *Daphnia Daphnia pulicaria and Daphnia mendotae* that Randy Bernot talked about exhibit, and how were fish involved (10)?
8. Describe how resource ratio use rates can resolve part of the Paradox of the Plankton. (6)

9. How do filtering rate and prey ingestion rate change with prey density for a filter-feeding organism (10, a graph could work well here)?
10. Why are triploid grass carp required in some areas, and why may excessive numbers of grass carp lead to phytoplankton blooms (10)?

Final Biology 612 Fall 2002 Name_____

1. Diagram the carbon cycle as it was given in class (15)

2. Describe the River Continuum Concept in a forested-headland stream (the classic case) by filling in the following table with low, medium, and high for each row (18)

Attribute	Low order stream	Mid order stream	High order stream
Canopy cover			
Respiration			
periphyton photosynthesis			
Shredder abundance			
Fine Particulate material			
Discharge	Low	Medium	High
Fine filter feeders			

3. What is nutrient spiraling and how do discharge, temperature, and average depth affect it? (8)

4. You receive a call from a golf course with a large pond. They tell you they have the following problems: The lake was choked with macrophytes, so they added a bunch of grass carp. The macrophytes disappeared and massive phytoplankton blooms appeared. Low O_2 caused fish kills. The lake has fertilized grass up to the edge and a stream that feeds into it runs through fertilized grass before reaching it. What management recommendation do you give them to solve their water quality problems and in the process establish a catch and release fishery of trophy size bass? (10)
5. Why does redox give more information about nutrient cycling transformations than just O_2 concentrations? (5)
6. Describe the three worst environmental problems (your judgment) in freshwater systems, their causes and some cures (12)
7. What molecular/biochemical adaptations of protein, DNA/RNA, and lipids are required for life at very high temperatures? (6)

8. Describe the factors that are influenced by the physical properties indicated by Reynolds number in the following processes: water flow through fine versus coarse sediments,

filter feeding bacteria from an aquatic solution, and diffusion of nutrients away and toward a 2 mm thick layer of periphyton (12)

9. Why is it important to consider uptake and remineralization rather than nutrient concentration alone when investigating nutrients that limit primary production by phytoplankton? (6)

10. Describe the process of meander formation including zones of erosion and deposition (a drawing may help here, 8).