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This list should help guide you in your preparation for the upcoming exam. Please feel free to come by my office (POST 606E) if you have questions about the material.

Important points and logistical details

✺ The exam will be given out on Monday, 17 Mar and is due by the end of class 2 weeks later (31 Mar)). This won't take that long to complete (normally I give people a week to turn this around, but the holiday and Break schedule interferes with that plan this time around) In any event, plan ahead to make sure you complete the assignment by the due time, because unlike homework I will not accept late exams.

✺ The exam will contain both quantitative and qualitative/descriptive sections, with emphasis on the latter.

✺ It should be quantitatively easier than most of the homework but perhaps more thought provoking.

✺ I will provide paper in the form of a test booklet attach more if you need to

✺ Try to be familiar with both concepts and the practical aspects of topics we have discussed in class. Sometimes the best way to answer a question is to think through the governing equations

> For example, if I ask you about which direction O_2 diffuses between anoxic sediments and the overlying oxic water, your best answer might be to write out Fick's Law (Flux= k(da/dx)) and to show using the equation that O_2 diffuses downward (the Flux will be negative) because the concentration gradient da/dx is negative with increasing depth (x).

✺ Try to be familiar with various diagrams we have discussed this semester. You may need to draw a diagram (such as seasonal O_2 depth profiles in lakes) to answer a question.

✺ Try to be familiar with material found in your reading and in the lecture notes through today. Focus on the concepts. We have seen many repeated "themes" during the semester thus far.

Some typical questions from previous years
1. Describe the role of marine aerosols, continental dust and pollutants in governing rain composition. How might the three components be distinguished chemically?

2. Explain the difference between a chelate and a normal complex (use a drawing if necessary)

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3. Explain how suspended particles can affect the composition of a natural water. How does pH affect the ability of a particle to alter the abundance of dissolved ions in solution?

Some specific topics to study (in no particular order)

1. Periodic properties of elements (1st ionization potential, electronegativity, size, relationships between an element and its neighbors in the periodic chart, relationships between periodic properties and the electronic structure of atoms).

2. Chemical equilibria and how they relate to dissolution of materials in H_2O (balancing chemical equations, writing equilibrium constant expressions, calculations using thermodynamic relationship between K_{eq}, ΔG, E_H and pe). Also, equilibria affecting the aqueous CO_2 system.

4. Calculations using residence times.

5. Lewis acids and lewis bases ions, ligands, complexation, and chelation

6. Chemical characteristics of rain, river water, lake water and estuaries, sources of major chemical constituents in each system, processes involved in their acquisition.

7. Physical processes that affect the geochemistry of waters and sediments in rivers, lakes and estuaries

8. Basic microbial processes (types of organisms and processes they engage in)

9. Properties of colloids/charged particles in aqueous environments, exchange of ions/ sorption with natural aqueous solutions.

10. Chemistry of photosynthesis and respiration (nutrients, Redfield ratio stoichiometry, natural biological processes and anthropogenic effects (e.g., nutrient loading) on photosynthesis and respiration in rivers, lakes and estuaries).

11. Redox, E_H (or pe) poising, typical half reactions involved in poising of E_H.

12. Common structures and nomenclature of organic molecules, reactivities of different classes of organic molecules.

13. Soil formation, weathering, soil water, soil contaminants

14. Groundwater, solute retardation, voc/nadl/dnapl

15. Organic and inorganic contaminants in the hydrosphere; toxicology basics