STUDY GUIDE FOR EXAM 4

CH 3420: Environmental Chemistry, Plymouth State University

General Tips:

1. Review the "Suggested Homework" from the syllabus:
   - Ch 3: 5, 6, 7, 8, 10, 13, 15, 18, 20, 30, 32, 34, 38, 39, 44, 46
   - Ch 10: 2, 3, 8, 9, 10, 11, 12, 16, 17, 18, 24, 26, 34, 42, 44, 54, 56
   - Ch 11: 1, 2, 6, 8, 16, 22, 28, 40, 44, 46, 54, 56
   - Ch 12: 2, 4, 6, 8, 13, 17, 18, 19, 20, 24, 26, 32, 46
   - Ch 18: 29, 32, 48
2. Prepare your 3×5 notecard. Remember that you will be given constants but not equations. You may also wish to include general reaction schemes (see Study Concepts Checklist below).
3. Review the overheads in class and make sure you understand the various figures presented.
4. Review the labs we have done, including relevant reactions and how to do the calculations.

Study Concepts Checklist

For this exam, you should be able to:

1. Explain the differences between the modern, oxidizing atmosphere and the ancient, reducing atmosphere, including how the modern one developed and the balance of energy that occurred in the process.
2. Explain the difference between the spectrum of light the earth receives from the sun and the spectrum the earth emits.
3. Explain how some of the earth's emitted IR spectrum is absorbed by certain molecules in the atmosphere, including why some absorb and some do not.
4. Name four "greenhouse" gases and generally describe how their concentrations have changed over time
5. Describe the significant sources of the changes of three of the greenhouse gases
6. Describe a number of natural and anthropogenic processes, substances, etc. that contribute to the absorbed/emitted energy balance of the earth.
7. Explain one positive and one negative feedback loop for the increase of a greenhouse gas
8. Explain Radiative Forcing and use it to describe the potential for a process or substance to contribute or detract from global warming
9. Name and describe several sources of evidence for global climate change.
10. Interpret in detail data, graphs, and figures used as evidence for global climate change
11. Explain the role of isotope measurements in providing data on global climate change
12. Provide a cohesive and detailed argument for global climate change, including a variety of sources of data supporting that argument
13. Provide at least one argument against global climate change and provide/interpret data related to that argument
14. Explain several predicted effects of global climate change that are being and/or are expected to be observed
15. Explain the role of computer models in predicting global climate change and its effects, including the support for such models and their limitations
16. Provide a reasonable answer to the question "what is energy?", including different types and how it is measured
17. Utilize and convert between the variety of units used to measure energy
18. Explain in practical terms the three laws of thermodynamics

19. Name the three areas in which we need/use energy
20. Name a number of sources of energy
21. Name the four "consumers" of energy
22. Explain the "Master Equation" from Industrial Ecology, including the ramifications of the individual terms on our ability to address the "Energy Crisis"
23. Name and describe the three major fossil fuels used for energy, including their sources, benefits, and issues
24. Explain how energy is derived from chemical bonds
25. Calculate the energy of a reaction from bond strengths, including the energy available and amount of carbon dioxide produced per mass
26. Explain how energy is derived from and the forces in the nucleus involved in nuclear reactions
27. Interpret, write, and balance nuclear reactions
28. Name the three common radioactive "particles" and balance nuclear reactions using them
29. Calculate the energy produced in nuclear reactions, including energy per reaction and binding energy
30. Explain why, eventually, all elements will "become iron"
31. Define the terms fission, fusion, and fissionable material
32. Predict whether a given element will be involved in fission or fusion
33. Describe how a fusion chain reaction (e.g. that involving ^{235}U) occurs and can be controlled
34. Explain why uranium must be enriched in ^{235}U before it can be used to generate energy, and the two processes used for enrichment
35. Describe how a "breeder reactor" works and what the advantages and risks of using breeder reactors are
36. Name several issues of using nuclear energy, including the potential to solve them
37. Use the integrated rate law and equation for half-life for first-order reactions to calculate the amount of material remaining after a certain time or the amount of time/number of half-lives that have passed
38. Compare and contrast the dangers of the three times of common radiation in terms of penetrating and ionizing ability
39. Name several sources of natural and anthropogenic radiation contributing to our daily background dosage
40. Name and describe a number of renewable energy sources, including their potentials to supply our energy needs, their benefits, and their limitations
41. Calculate the maximum efficiency of a heat engine
42. Discuss the efficiency of various energy conversions
43. Describe how a fuel cell works and why it is more energy efficient than an internal combustion engine