

# STUDY GUIDE FOR EXAM I

CH 3420: Environmental Chemistry, Plymouth State University

## General Tips:

1. Review the "Suggested Homework" from the syllabus:
  - Ch1: 5, 33, 34, 36, 40, 44, 46, 47, 51
  - Ch2: 1, 2, 8
  - Ch4: 1, 2, 4, 5, 6, 9, 10, 11, 24, 36, 37, 40, 42, 50, 52
  - Ch5: 3, 4, 5, 6, 8, 9, 11, 12, 14, 22, 24, 26, 30, 35, 50
  - Ch6: 4, 6, 13, 14, 18, 22, 23, 24, 28, 40, 41, 44, 45
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 graphs, charts, etc. presented.
4. Review the labs we have done, including relevant reactions and how to do the calculations.

## Study Concepts Checklist

1. Be familiar with the various reservoirs of the environment: hydrosphere, geosphere, atmosphere, biosphere, anthrosphere
2. Be familiar with the carbon, nitrogen, phosphorus, and sulfur cycles
3. Know the various layers of the atmosphere, their approximate locations, and what is unique about each.
4. Be able to explain the composition and temperature changes of the atmosphere with increased altitude and change of layer
5. Understand the importance of hydroxyl radical in atmospheric processes including how it is formed
6. Know the following about radicals: what they are, why they are "bad", the three general steps of a radical reaction
7. Know the following about reactions: how to add the individual steps to determine the overall reaction, how to identify catalysts and intermediates, how to identify an oxidation or reduction product
8. Know the following about light: the relationship between energy, wavelength, and frequency; how to calculate the wavelength of light needed for a specific reaction, given the energy (enthalpy) of the reaction; the regions of light (e.g. visible, IR); the solar spectrum and how it changes as it passes through the atmosphere
9. Know the difference between a primary and secondary pollutant
10. Know the five major primary air pollutants and the major source(s) of each
11. Understand the causes and consequences of "acid rain"
12. Know the following about carbon monoxide: how it is produced, typical levels in air pollution of rush hour traffic and cigarette smoke, various health effects, control methods
13. Know the following about sulfur oxides [ $\text{SO}_x$ ]: how it is produced, important atmospheric reactions, its contribution to acid rain, effects on humans and the environment, control methods
14. Know the following about nitrogen oxides [ $\text{NO}_x$ ]: important forms found in atmosphere and source of each, photochemical cycle involving ozone, human health effects, contribution to acid rain, control methods

15. Know the following about hydrocarbons: their role and fate in the production of smog
16. Know the difference between industrial and photochemical smog
17. Know the following about photochemical smog: generally how it is formed, its precursors, its characteristic compounds and generally how they are formed, the role of light and radicals, the specific reaction(s) that produce ozone and how its concentration builds up
18. Understand the Chapman cycle for stratospheric ozone, the generic reaction for its catalytic destruction, and the naturally occurring catalysts
19. Understand the causes and consequences of ozone layer destruction, particularly the role of CFC's and stratospheric ice clouds. Know how the problem of the hole in the ozone layer was discovered and mitigated
20. Understand the legal aspects of air pollution control in the U.S., including the Clean Air Act, air quality standards, and mitigation technologies
21. Understand the quantum mechanical relationship between light and matter, including how to calculate the energy / wavelength / frequency of light. Understand how this relationship enables scientists to measure the concentrations of various gases.
22. Understand the general principles of remote sensing and in situ detection.
23. Know the paths and viewing geometries used in remote sensing of the atmosphere
24. Know the general types (e.g. UV, IR) of light used to detect various atmospheric gases