AT621 Fall 2012

Review for Exam 2

1. Describe the "modes" of the atmospheric aerosol, including approximate size ranges and compositions.
2. Give estimates of the variation in particle lifetime with diameter, and describe the primary removal mechanisms in various size ranges.
3. Give examples of primary and secondary particles.
4. How does the ionic fraction of the aerosol change with location around the globe? What significance does this have?
5. Given data for the numbers of particles found in various size ranges, each of which spans a width ($Dp_i + \Delta Dp_i$), compute the number distribution function n(Dp) for the aerosol population. Explain what n(Dp) describes. How are the surface area and volume distributions computed from this information? Which particle classes contributed most to each?
6. What is a lognormal distribution?
7. Describe the four components of the visibility extinction coefficient, and give some examples of species that contribute to each term.
8. What is the Koschmieder equation? What assumptions does it contain?
9. Describe how one can compute the aerosol contributions to b_{ext} – what data are needed?
10. Describe the changes in b_{ext} as a hygroscopic aerosol is exposed to increasing RH.
11. Write the equation for Henry's law equilibrium. What does an "effective" Henry's law constant describe?
12. Write the electroneutrality equation for a system composed of ammonia gas, carbon dioxide, and water. Show how to solve for pH.
13. What is the role of liquid water in establishing gas-aqueous equilibrium?
14. What are the primary oxidants for SO_2? Discuss the pH dependence of each.
15. Describe what is meant by "open" and "closed" systems, and discuss the evolution of S(VI) in each type of simulation (give reasons why the behavior might be as you describe).
16. What is "acid deposition"? What are the primary acidifying species in the atmosphere?
17. What pH is defined as "acid deposition", and why?
18. What factors moderate whether a body of water will acidify?
19. What are the two types of smog? How are they different?
20. Explain the typical evolution of a photochemical smog event.

21. Explain the “ozone isopleth” plot
22. Explain the following formulae – what significance attaches to the coefficients α, β, γ, δ?

$$VOC(+h\nu, OH, NO_3, O_3) \rightarrow \alpha RO_2\bullet$$

$$RO_2\bullet + \beta NO \rightarrow \gamma NO_2 + \delta OH$$

23. Describe the basic photochemical cycle
24. What is the PSSR? (both its form and its physical meaning)
25. Describe the role of organic species in ozone/NOx chemistry (build from CO, CH4, to higher hydrocarbons)
26. Explain the fates of free radicals and of NOx under varying conditions
27. What controls ozone production vs. destruction vs. neutral conditions?