

**Preview Sheet for Test 3**

## Chapters 8, 9, and 10

Lectures from 3/9 through 4/2; Problem Sets 6 and 7

The test will be on Thursday, April 9, in Olin-Rice **350**, starting at 8:30 a.m. You will have **2 hours and 30 min** to work on the exam.

(In my religious tradition, the day of your exam is known as Maundy Thursday, where “maundy” is a Middle English rendering of the Latin “mandatum” or command. This refers to Christ’s command to his apostles that they love one another. I will leave it to you to decide whether Test 3 constitutes an act of love or of something else.)

Studying Strategies:

- Focus on your lecture notes and homework first, then look at your textbook. (See the course web page for class overheads, homework keys, and Rob Rossi’s lecture notes)
- Do extra problems at the ends of the chapters.
- It is important to understand concepts from lecture not covered explicitly in the homework problems.
- If a topic was not covered in homework or in lecture, you are not responsible for it!
- You are not responsible for Rob’s coverage of alpha fractions (but we will pick this idea back up after we talk about the titration of dibasic species). However, you are responsible for the other topics Rob covered.

Test Format:

- About 80 points for math problems, and about 20 points for short answer questions.
- The following kinds of problems are fair game: calculations requiring more than one iteration, setting up and solving (or beginning to solve) a system of equations used in a systematic treatment of equilibrium, derivations of equations just like or similar to ones used in class. I know these problems can be time-consuming; this is why I am giving you 30 minutes more than you had for the first two tests.

Preview of Test Instructions:

1. Write your name in the space above and on the backs of the other pages.
2. Your exam booklet should have **eleven pages** total, with questions on Pages 2-8, formulas and constants on Page 9, a table of activity coefficients on Page 10, and a periodic table on Page 11. Check to see you have ten pages now. If you do not, ask for another copy of the exam.
3. You may use programmable calculators, but chemical data should not be stored in them.
4. You should always justify your answers in writing, unless you are explicitly told not to do so. You will be awarded credit only for clear, legible work.
5. You may always assume all activity coefficients are 1 unless you are explicitly told otherwise in a problem statement.
6. You may always use Harris’ shortcuts for computing equilibrium concentrations unless you are explicitly told otherwise in a problem statement.

7. You have **2 hours and 30 minutes** to work on this exam.

Note the formulas and constants you will be given on the exam:

$$\mu = \frac{1}{2} \sum_i C_i z_i^2 \quad A_j = [j] \gamma_j \quad \log \gamma_j = \frac{-0.51 z_j^2 \sqrt{\mu}}{1 + \frac{\alpha_j \sqrt{\mu}}{305}}$$

$$K_w = [\text{H}^+][\text{OH}^-] = K_a K_b = K_1 K_{b2} = K_2 K_{b1} = 1.0 \times 10^{-14} \quad \text{p}K_w = \text{pH} + \text{pOH} = 14.00$$

$$K_1 = \frac{[\text{H}^+][\text{HA}^-]}{[\text{H}_2\text{A}]} \quad K_2 = \frac{[\text{H}^+][\text{A}^{2-}]}{[\text{HA}^-]} \quad K_{b1} = \frac{[\text{HA}^-][\text{OH}^-]}{[\text{A}^{2-}]} \quad K_{b2} = \frac{[\text{H}_2\text{A}][\text{OH}^-]}{[\text{HA}^-]}$$

$$\text{pX} = -\log[\text{X}] \quad \text{pH} = \text{p}K_a + \log\left(\frac{[\text{A}^-]}{[\text{HA}]}\right) \quad [\text{H}^+] = \sqrt{\frac{K_1 K_2 [\text{HA}^-] + K_1 K_w}{[\text{HA}^-] + K_1}}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$N_A = 6.022 \times 10^{23} \text{ particle mol}^{-1} \quad 1 \text{ L} = 1000 \text{ mL} = 1000 \text{ cm}^3$$

$$1 \text{ ppm} = 1 \text{ in } 10^6 \quad 1 \text{ ppb} = 1 \text{ in } 10^9 \quad 1 \text{ ppt} = 1 \text{ in } 10^{12}$$