Exam I Study Guide **Chemistry BC2001x**

Suggestions and Hints on Studying, Problem Solving, and Taking Chemistry Examinations

STUDYING FOR EXAMINATIONS: EXAM I

1. Focus on the **basic operations**, and practice them in all different ways until you are fluent in:
(a) conversion of mass to moles and moles to mass for atoms, molecules, and formula units
(b) finding molar ratios from chemical formulas and from balanced reaction equations
(c) writing Lewis electron dot structures for covalent molecules and molecular ions
(d) Predicting the shapes and polarities of molecules

2. Do **memorize**:
(a) complete key *definitions* (not the exact wording, but a thorough, complete understanding)
(b) *units* of key quantities [for example, atomic weight (g/mole)]
(c) *names* and *symbols* of the common *elements* shown on the periodic table overview sheet
(d) *names* and *charges* of *cations* and *anions* listed on the inorganic nomenclature sheet
(e) rules for *naming* simple ionic and molecular compounds
(f) *fundamental* relationships and equations:
(1) conservation of *atoms* – used in balancing chemical reaction equations
(2) the general *structure* of the *periodic table* and the implications of its *arrangement*
(3) covalent bonds as shared electron pairs; lone pairs, the *octet rule*; 2 electrons for H; how the arrangement of electrons around each atom determines molecular geometry
(g) definitions and rules pertaining to significant figures and propagating uncertainties

3. Do **not** memorize:
(a) *numerical* values of N_A, atomic weights, and the like. Any numerical values that you need are always supplied on data sheets given out with the examination.
(b) the *periodic table*. You will always have a periodic table available to use in examinations.

4. You learn chemistry from four sources: lectures, textbook, problems, and laboratory.
(a) Lectures organize and clarify the material, stress what is considered important to learn and to understand, and try to motivate your interest in studying chemistry. Lectures differ from presentations in the textbook, deliberately. For example, you must learn chemical nomenclature, but this is not covered in lecture. Review and annotate your lecture notes.
(b) The required text is one organized presentation of the material. Use your text together with the lectures for explanations, examples, and reference material. Read actively, ask questions all the time, and use pencil and paper to check that you follow explanations in detail. Consult other textbooks freely for alternative explanations, which may be clearer.
(c) The ability to solve problems is the one and only test of understanding. Each assigned problem has a point, and is testing some particular skill. Make sure you know what that is. *If you can not work out a problem, you do not fully understand the material it is testing*. Seek help quickly if this happens; come to see me during office hours for clarification.
(d) Laboratory exercises teach you lab practice, illustrate concepts, show you some chemical reactions, and show how chemical calculations work in practice. Assessing uncertainty is a critical part of quantitative work.

The first examination will consist mostly but not entirely of problems involving quantitative calculations, of approximately the same kind as those in the text and those assigned to hand in, but easier than many. There will also be some short qualitative questions, e.g., on chemical structures, and/or properties of elements and compounds.

WORKING OUT PROBLEMS

1) A useful strategy in starting a problem is to *list what is given, what you know, what you seek*. Define symbols. Write units. If appropriate, write balanced chemical reaction equations or draw pictures to clarify what is happening. Then, using relevant relationships, reason your way to the end, step by step. Write each step explicitly, especially if substitution is involved.
2) Always use dimensional analysis: *write out all units*; carry units through equations; check that the answer has correct units. This is a quick, effective way to detect certain kinds of errors.
3) *Don't expect to see how to solve a problem right away, and don't expect to be able to reach the answer in one simple step*. Several steps of reasoning will almost always be required. Move forward, one step at a time. There may be several different ways to solve a problem.
4) *Thinking out a problem backwards is often very useful*. Ask what you must know to be one step from the desired result; then ask what you must know to get that information, and so on, until you reach a set of data that you do know and relationships that get you to the answer.
5) It is not sensible to do extensive numerical calculations before thinking the whole problem through. It is easier to work with symbols and keep track of the relations among quantities algebraically than it is to work with long chains of numbers. *Do calculations at the end.*
6) After solving a problem, look carefully at the calculated result. *Make sure it is reasonable* – in sign, in magnitude, in dimensions. Many computational errors (for example, accidentally pushing a wrong key on a calculator) can be found this way. *Double check all calculations.*

TAKING EXAMINATIONS

1) **NEVER EVER** stay up late the night before an examination. You must be able to think clearly and quickly during examinations, not merely repeat masses of memorized material. Always get a good night's sleep. Be on time, and arrive relaxed and ready.
2) The in-term examinations will last from *9:00 to 10:25 exactly*. If you arrive late, you will *not* be given extra time to complete the examination.
3) Read quickly through the *entire* examination first *before* you start working. You may answer the questions in any order, so work selectively – *do the question you know best first*.
4) Read each question twice through before answering. Think before you start writing anything. Understanding correctly what a question asks is key to solving that problem. You should understand the situation qualitatively, know what is happening, before doing any calculations.
5) Budget your time wisely. The examination lasts 85 minutes. If the total credit is 150 points, for example, then don't spend very much longer than 12 to 15 minutes on a 25 point question.
6) Set up problems clearly – *partial credit is given* <u>if</u> I can understand your work. Define symbols used. Write out any general equations relevant to the problem. You must SHOW all your work, both the reasoning and the calculations, to receive credit for it.
7) Try each question. You should be able to get at least some partial credit.
8) Units and significant figures matter – unless both are specified completely and accurately, final answers are not completely correct.
9) BRING A WORKING CALCULATOR. Get it ready the night before, and don't forget it.
10) You are only entitled to take a make-up examination for one of the following three reasons:
    (a) serious illness, requiring a visit to the health service or bed rest;
    (b) a death in the family or some equally serious personal emergency;
    (c) conflict with a religious observance, *which must be made known **in advance***.

Absence from an examination for any other reason will result in an unalterable grade of zero.

If a serious health problem or an emergency situation arises such that you must miss an examination, leave a message for Professor Chapman by telephone (854-2098) or by e-mail (schapman@barnard.edu) as soon as possible, in advance if you can. If I have not heard from you within 24 hours of the exam, I will assume you have dropped the course.