# Do NOT rely on this as your only preparation for the Chem 101 final.

This is an ***INCOMPLETE*** list of hints and topics for the Chem 101 final. You are responsible for ALL of the material we discussed in lecture, discussion, lab, and in the chapters assigned from the textbook.

These are a list of common mistakes and misconceptions that we have encountered during the semester, and we have collected them so that you are aware of the kinds of mistakes you have been making.

- Review the old hour exams and use them to fine tune your studying. Don't waste time studying things you already know and understand – use that time to hit the topics that you are struggling with.
- Don't avoid topics you aren't comfortable with – that's the entire point of studying. These are the things that you should focus your studying on. If you don't understand something, ask someone for help! If you don't understand it after they explain it to you, ask them to do it again! You may feel embarrassed, but it's much better to actually know what's going on then to pretend like you do just so you don't look silly.
- If your math skills are weak, now is the time to fix that. If you can't do the math ***efficiently***, you will struggle on the final exam. Practice makes perfect, especially with math, so work on those unit conversions, making sure that everything cancels out correctly.
- Look over the lab reports and on-line homework problems! You spent a lot of time working on them, and coincidentally, a lot of the hour exam questions are similar to what you've seen on your lab reports and on-line homework. You had to do a lot of explaining in the labs, and you can be sure that there will be explanation questions on the final.
- Understand ***WHAT*** you are doing and ***WHY*** you are doing it! Don't just memorize how to do the hour exam problems! I will guarantee that you won't see those questions again! You will see some questions that are similar to them, and you will see new questions that you haven't seen before! If all you know how to do is follow a bunch of steps, then you are going to have a long 3 hour exam period. You need to understand why you are doing each calculation (How are you going to use the results of that calculation to get to the answer? Just because you can calculate something doesn't mean that you should!).
- Many of the problems (*e.g.* stoichiometry) have common threads and concepts. You are doing the same steps in many of the problems. The setup may be different, you may be calculating different things, but you are doing the same sort of procedure. Use this to your advantage!

Assorted common mistakes (so now that you know about them, don't make these mistakes!):

- Learn the polyatomic ions! This includes names, formulas, and charges. You have probably forgotten some of them, so brush up on this before the exam.
- Learn to use the unit conversions correctly! Remember that if the unit conversion is given to you like this: 1000 m = 1 km, then you can use it either as $\frac{1000\,\text{m}}{1\,\text{km}}$ or $\frac{1\,\text{km}}{1000\,\text{m}}$.

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- Actually take the time to make sure that everything really does cancel out. Don't assume that you've set it up correctly. Don't just go through the motions. Write everything out, and make sure that everything cancels out correctly (that you have km on top *and* km on bottom). Some of you have rushed through this and put km on top and another km on top and just assumed that they canceled out, and you will lose a lot of points on the final because of this.
- Know the **most basic** definitions of the various quantities we calculated! (concentration, molar mass, % composition, etc.) You may find that starting with these basic definitions can help guide you through problems you're having trouble getting started on.
- Think about what you are doing! Take a few moments and mentally plan out how you will attack a problem. Be very explicit in your steps – know exactly what you have to do and exactly what you need to know in order to calculate something.
- Review the rules on how to name ionic and covalent compounds. Remember that only covalent compounds use the prefixes to say how many of a particular element are present!
- Completely understand the concept of a mole – it is a unit of counting individual objects, atoms, or molecules.
- Stoichiometry **must** be done in ***moles***!
- Know when it is appropriate to use the stoichiometric coefficients in the balanced reaction and when to ignore them. Remember that an individual coefficient is meaningless in the balanced reaction! The balanced reaction has NOTHING to do with how much of something you start with! YOU ALWAYS USE THE STOICHIOMETRIC COEFFICIENTS IN ***PAIRS*** WHEN GOING FROM MOLES OF ONE THING TO MOLES OF SOMETHING ELSE!
- Learn how to use the solubility rules and identify spectator ions correctly!
- ***You ALWAYS look for a limiting reactant unless you are certain that the other reactants are in excess!***
- All of the periodic trends we discussed depend on two factors: (1) the number of protons in the nucleus and (2) the location of the electrons. Understand how these two affect ionization energy and atomic size of neutral atoms, isoelectronic series, as well as sets of ions of the same element.
- Make sure your Lewis structures satisfy the octet rule for ALL atoms (with the exception of H and third-row elements and lower if needed). Always check the octet rule for the center atom and make sure that you have correctly accounted for all of the valence electrons!
- Learn the names of the molecular shapes and how to determine whether a molecule is polar or not!
- All molecules have London dispersion forces. Only polar molecules can have dipole-dipole forces. Only molecules where H is DIRECTLY BONDED to N, O, or F can have hydrogen bonding. Only ionic compounds can exhibit ionic forces. If a molecule is nonpolar, it CANNOT have any of the other intermolecular forces (only LDF)!

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***Incomplete*** topic list from this semester:

- Atoms, molecules, ions, compounds
- Dalton's atomic theory, elements, isotopes
- Atomic number, mass number, protons, neutrons, electrons
- Charges of common ions, metals/nonmetals
- Naming compounds (ionic : metal-nonmetal, covalent : nonmetal only)
- Moles, molar mass, Avogadro's number
- Percent compositions, empirical and molecular formulas
- Gases: kinetic molecular theory, ideal gas law, deriving the other gas laws from the ideal gas law, explaining the gas property relationships using ideas from KMT, real gas behavior
- Balancing reactions, drawing pictures to represent reactions, standard form of a balanced reaction, solubility rules, predicting products of reactions, molecular / complete ionic / net ionic equations, spectator ions
- Concentrations / molarity, dilution, making solutions
- Stoichiometry (including solution and gas stoichiometry), limiting reactants, conservation of mass
- Energy (exo/endothermic)
- Atomic structure and theory, including contributions of Dalton, Thomson, Rutherford, and Bohr
- Quantum theory, quantized energy, ground and excited states, electrons as particles and waves
- Orbitals : principal energy levels, shapes and types
- Electron configurations (full and shorthand), filling orders, unpaired electrons
- Periodic trends and properties: reactivity (noble gases), atomic and ionic radius, ionization energy, electronegativity
- Bonding: ionic, covalent (polar and nonpolar), effect of electronegativity on bonding
- Localized electron model and Lewis structures, valence electrons in bonding, resonance structures
- Electron geometry, molecular shape, polar/nonpolar molecules
- Intermolecular forces: London dispersion, dipole-dipole, hydrogen bonding, ionic; determine which has stronger intermolecular forces (especially London dispersion)
- Boiling/freezing/melting point, solubility → how intermolecular forces affect these