

Chemistry 11: Test 3 Review Sheet
(Atoms, the Periodic Table, and Chemical Bonds)
Chapters 7, 8, 9; Lectures from 10/12 to 11/7

Studying strategies:

- Do extra problems at the ends of the chapters. If you do not have access to the solution for a given problem, please come talk with me to check your work.
- Focus on your homework and lecture notes first, then look at the textbook.
- If a topic was not covered in homework or in lecture, you are not responsible for it!
- Focus on these topics:

Chapter 7: Thomson's and Rutherford's models of the atom, basic wave properties, emission and absorption of light by atoms, the Bohr model, and photons as chemical reagents (light is a particle!). Standing waves (number and shapes of nodes), de Broglie and Schrodinger's model of the electron, and wave functions (an electron is a standing wave!). The four quantum numbers, boundary surface diagrams (with radial and angular nodes), and radial distribution functions.

Chapter 8: Pauli exclusion principle, aufbau principle, Hund's rule, valence vs. core electrons, shielding and penetration, effective nuclear charge, relative energies of orbitals. Structure of the periodic table. Electronic structure of atoms and ions (orbital diagram, complete and abbreviated electron configurations), extra stability of filled and half-filled subshells (and how these lead to exceptions). Trends in atomic properties (atomic/ionic radii, ionization energies (1st, 2nd, ...), electron affinities), and the effect of Z_{eff} and n on these properties. Impact of atomic properties on the reactivity of metals.

Chapter 9: Ionic vs. covalent compounds, electronegativity (trend for atoms), lattice energy, varying bond polarities: ionic, polar covalent (partial charges), and non-polar covalent bonds. Lewis structures (duet/octet rules, reasonable connectivities, formal charges, valence expansion for 3rd period and below). Resonance: when required (due to symmetry), evaluating relative stability of different structures. Bond order, bond length, and bond energy; how to estimate ΔH_{rxn} from bond energies.

Instructions before starting the test:

1. Write your name in the space above and on the backs of the other pages.
2. This exam is closed-everything.
3. Your exam booklet should have **seven** pages total, with questions on pages 2-6, and reference data on p. 7. Check to see you have seven pages now. If you do not, ask for another copy of the exam.
4. You will need your own calculator for the test. It may be programmable, but chemical data and equations should not be stored in it.
5. To receive full credit for a mathematical problem, you must show the method by which you obtained the final answer, including dimensional analysis.
6. You have **60 minutes** to work on this exam. Do not start until you are instructed to.

What not to memorize (they will be provided on page 7 of the test booklet):

- (1) A periodic table listing electronegativities.
- (2) A table of bond energies
- (3) The information below:

$$r = 0.529 \text{ \AA} \left(\frac{n^2}{Z} \right) \quad E = -2.179 \times 10^{-18} \text{ J} \left(\frac{Z^2}{n^2} \right) \quad \Delta E = -2.179 \times 10^{-18} \text{ J} Z^2 \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

$$E = h\nu \quad c = \lambda\nu \quad L = n \frac{\lambda}{2} \quad \lambda = \frac{h}{m\nu} \quad r \sim \frac{n^2}{Z_{\text{eff}}} \quad IE \sim \frac{Z_{\text{eff}}^2}{n^2}$$

$$N_A = 6.022 \times 10^{23} \text{ particle mol}^{-1}$$

$$h = 6.626 \times 10^{-34} \text{ J s particle}^{-1}$$

$$c = 2.998 \times 10^8 \text{ m s}^{-1}$$

$$1 \text{ m} = 10^9 \text{ nm} = 10^{10} \text{ \AA}$$

Test-Taking Tips

- There will be a variety of question types: some multiple-choice, some one-word answers, some longer answers, and a few mathematical calculations—not as many as on the first two tests.
- Pace yourself. Try to make your effort on a given problem proportional to the number of points that it is worth.
- Read the problems carefully.
- If you can't figure out how to begin a problem after thinking about it for a couple of minutes, go on to the next problem.
- Please ask me if a question doesn't make sense.