Title *Advanced Chemistry in Creation, 2nd Edition*
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| **Science Credits** | 1 |
| **Lab Credits**[1] | 1 |
| **Honors Designation**[2] | Yes |
| **Science Type** | Physical |

This laboratory-based advanced chemistry course is designed to be taken after the student has completed algebra 2 and *Discovering Design with Chemistry*. If the student takes both courses, he or she will cover the entire AP chemistry syllabus. You cannot call it an AP course, however, unless you have your specific implementation of the course approved by the College Board.

The book begins with a review of dimensional analysis and includes unit conversions that are more challenging than those found in *Discovering Design with Chemistry*. It reviews stoichiometry as well, and it also discusses adding chemical equations together. It then covers the Bohr model of the atom in considerable detail, requiring the student to calculate the wavelengths of light emitted and absorbed by single-electron atoms. A discussion of the four quantum numbers follows so that the student understands where atomic orbitals come from.

Molecular orbital theory is then discussed, and the student learns how to determine the hybridization found in molecular orbitals. That is then related to the three-dimensional shape of the molecule, including the “rule-breaking” shapes like octahedral and trigonal bipyramidal. This leads to a discussion of complex ions in aqueous solution.

The kinetic theory of matter is then reviewed, and intermolecular forces are discussed. This leads to a detailed discussion of the phases of matter, phase diagrams, cohesion versus adhesion, surface tension, and phase diagrams. Concentrating on the solid phase, crystal structure is then discussed.

The concept of concentration is then reviewed, and the student learns how to covert between concentration units like g/mL and molarity. Solubility curves are then discussed, as is the effect of solute on a phase diagram. Separation techniques are covered, as are colloids. Solubility equilibria are then discussed, and the student learns how to relate the equilibrium constant and the change in Gibbs Free Energy. The common ion effect is also covered.

The book then turns to a discussion of acid/base equilibria and the definition of pH, which leads to the concept of buffer solutions. When the common ion effect is applied to pH, some of the problems require the technique of successive approximations, so that is also covered. Finally, other equilibrium situations are discussed.

A detailed discussion of electrochemistry follows. The student learns how to use the Nernst equation to calculate the emf of Galvanic cells, and the student also learns the details of electrolytic cells and Faraday’s law of electrolysis. The student is then taught how to balance redox reactions in acidic and basic solutions as well as how to determine the spontaneity of a redox reaction using reduction potentials. After a review of basic chemical kinetics, the book covers first- and second-order rate equations as well as collision theory and how to relate the mechanism of a chemical reaction to the rate law.

The book then provides an introduction to organic chemistry, first covering alkanes, alkenes, and alkynes, concentrating on how to name them. Aromatic compounds, petroleum, and polymers are also discussed. A survey of the major functional groups (alcohols, ethers, aldehydes and ketones, carboxylic acids, esters, and amine groups) follows. Carbohydrates and hydrolysis are also discussed.

A discussion of nuclear chemistry is next, starting with a detailed discussion of binding energy, the nuclear force, and nuclear stability. The student then learns the various modes of radioactive decay, the kinetics of radioactive decay, and the dangers of radiation. The student is then taught about radiometric dating, other uses of radioactivity, and nuclear reactions (including fission and fusion).

The book finishes with a long review, designed to remind the student of what has been covered in both *Discovering Design with Chemistry* and this book. There are 25 experiments in the course, comprising approximately 28 hours of laboratory instruction.

[1]To qualify as a lab credit, all of the experiments must be performed. Those experiments must be fully documented in a laboratory notebook, as discussed in the introduction to the text.

[2]To qualify as an honors credit, all modules must be completed, the tests must be taken closed book, and all experiments must be performed. Those experiments must be fully documented in a laboratory notebook, as discussed in the introduction to the text. In addition, a grade of B or higher must be earned following the pedagogy in the answer key.