CHEMISTRY 14A
COURSE ORGANIZATION & SYLLABUS

DESCRIPTION: This course provides a strong chemistry foundation. We review physical and chemical principles. We then go on to atomic structure based on quantum mechanics, and study atomic properties, trends in the periodic table, and chemical bonding in molecules and coordination compounds with an emphasis on structure and shape. The course concludes with the structure and properties of inorganic, organic, and biological acids, bases, and salts. Biological and environmental examples are used to illustrate the central role chemistry plays in the world around us. Prerequisites are high school chemistry and 3½ years of high school mathematics. Math at the level of Math 3A/31A is a corequisite. Chem 14A counts toward GE requirement "Foundations of Scientific Inquiry" as 4.0 units. Group activities, online interaction, collaborative support, interaction, learning, and developing problem solving skills, are emphasized in my courses.

LECTURES: MWF 10 am to 12 noon in CS24

INSTRUCTOR: Dr. Laurence Lavelle, 3048A Young Hall, Chemistry & Biochemistry, UCLA

OFFICE HOURS: W & F 12-1pm, 3048A YH. Questions will also be answered after each lecture.
Course related information is available at https://lavelle.chem.ucla.edu/.
Your questions can also be posted any day, any time to the Chemistry Community Forum created, developed, and maintained by Dr. Laurence Lavelle at https://lavelle.chem.ucla.edu/forum/.
All technical problems must be sent to voh@chem.ucla.edu.

TA (TEACHING ASSISTANTS) AND UA (UNDERGRADUATE ASSISTANTS): To be announced.

TA Discussion Sections: Attend only your TA discussion section you are enrolled in.

TA office hours and UA peer learning sessions: When schedules are finalized week 1 they will be posted on-line. You may go to any and all TA office hours and UA peer learning sessions.
Attend as many as possible. These are great for small group and one-on-one assistance.

COURSE SUPPORT:	Class lectures (Yes) Discussion sections (Yes)
Online materials (Yes)	Online Forum and Q&A database 24/7 (Yes)
Teaching Assistants (Yes)	Undergraduate Assistants (Yes)
Many office hours every week	**Many peer learning sessions every week**
Many exam review sessions	**Q&A online discussion on Chemistry Community 24/7**
Many Workshops	**Many Step-Up Sessions**

TEXTBOOK: Chemical Principles The Quest for Insight, 7th Ed., by Peter Atkins, Loretta Jones, and Leroy Laverman. The 7th edition textbook and solutions manual are available as one low-cost bundled package at the UCLA bookstore. The same textbook bundle is used in Chem 14B.

All required and recommended written course materials that impose a monetary cost upon the students in the Department of Chemistry & Biochemistry have been approved by a departmental Written Course Materials Committee. A list of approved materials for the course is available https://ccle.ucla.edu/course/view/chemistry-approvedmaterials. No-cost alternatives to the purchase of these materials are available in the library.

READING & HOMEWORK: Read the assigned chapters. Working through problems will facilitate your learning the course material and will also develop your problem solving skills. All homework problems listed in the syllabus below come from the textbook.

Homework is handed in each week to your TA in discussion section. *It is your responsibility to do the assigned homework in order to master the material covered.* **Do at least 20 hours of independent study per week**, and the more problems you do, the more you will learn.

TESTS & EXAMS: Two 50 minute tests in discussion section.
One 2-hour midterm.
One 3-hour final.
All Tests and Exams are closed book.

All material is directly related to class notes and the readings and homework problems. The best preparation for all of these is to be able to independently work through the assigned homework problems. See Test and Exam schedule online. Uncollected work is kept by your TA until the end of the quarter and after the final exam it is recycled.

Homework problems will be included in exams.

All tests and exams are closed book and must be written in **pen**. **No make-up exams** will be given. **No one** will be permitted to take the final exam either earlier or later than the scheduled time, and no one can receive a passing grade for the course without taking the final exam. There are no regrades.

Only non-programmable, non-graphing calculators are allowed.

Phones are not allowed in the classroom during lectures or exams. Students involved in academic dishonesty will receive a zero on the test or exam and will be referred to the Dean of Students.

COMPUTER SELF-STUDY: The online Audio-Visual Focus-Topics are highly recommended.

GRADING:

Weekly Homework (14 pts per week)	70 pts
Weekly Online Discussion (6 pts per week)	30 pts
Two Discussion Section Tests (2 x 50 minutes)	100 pts
Two Hour Midterm (120 minutes)	120 pts
Three Hour Final (180 minutes)	180 pts
Total	500 pts

For the homework, hand-in any 14 answers per week (1pt per answer) to your TA in discussion section. Select assigned homework problems from recently covered material. Make sure to clearly indicate textbook edition, chapter, and homework number. All homework problems listed in the syllabus below come from the textbook.

Each test and exam has a total score but is not assigned a grade. Only at the end of the class when the class average score (out of 500 points) is known are final grades assigned. This class does not use a curve. Group learning (Chemistry Community, Study Groups, Peer Learning, etc.) is encouraged. 50% or higher is required to pass with a C- or higher.

SYLLABUS

<u>Review</u> of Chemical & Physical Principles
(SI units; unit conversions; scientific notation; dimensional analysis; significant figures; accuracy versus precision; solutions; molarity and dilution calculations; determining mass percentage composition, and empirical and molecular formulas; conservation of mass and balancing chemical equations; limiting reactant calculations; determining real and theoretical yields in chemical reactions)

Reading all the Fundamentals sections in your textbook is highly recommended. The following are essential reading:

7th Edition: Fundamentals E, F, G, H, L1-2, M
Appendix 1B, 1C, 1D, 1E
Problems E 1, 3, 7, 9, 15, 17, 21, 23, 25, 27, 29; F 1, 3, 5, 9, 11, 13, 15, 17, 19, 23, 25; G 5, 7, 9, 11, 13, 17, 19, 21, 23, 25; H 1, 3, 5, 7, 11, 13, 15, 17, 19, 21; L 1, 3, 5, 7, 35, 39; M 1, 3, 5, 7, 9, 11, 15, 19

6th Edition: Fundamentals E, F, G, H, L1-2, M
Appendix 1B, 1C, 1D, 1E
Problems E 1, 3, 7, 9, 15, 17, 21, 23, 25, 27, 29; F 1, 3, 5, 9, 11, 13, 15, 17, 19, 23, 25; G 5, 7, 9, 11, 13, 17, 19, 21, 23, 25; H 1, 3, 5, 7, 11, 13, 15, 17, 19, 21; L 1, 3, 5, 7, 35, 39; M 1, 3, 5, 7, 9, 11, 15, 19

The Quantum World
(wave and photon properties of light; Einstein equation; photoelectric effect; Bohr frequency condition; atomic and molecular spectra (electronic transitions); wave and particle properties of electrons, protons, etc.; DeBroglie equation; Heisenberg's indeterminacy equation; wave functions and s-, p-, and d-orbitals; quantum numbers; H-atom; many-electron atoms; electron configurations of atoms and ions; atomic radius, ionic radius, ionization energy, electron affinity and their trends in the periodic table)

7th Edition: Focus 1 (Omit 1C & Table 1D.1)
Problems 1A: 3, 5, 7, 9, 11, 15; 1B: 3, 5, 7, 9, 15, 19, 21, 23, 25, 27; 1D: 1, 11, 13, 15, 17, 19, 21, 23, 25; 1E: 1, 5, 7, 9, 11, 13, 15 (omit d), 17 (omit d), 21(omit c), 23, 25; 1F: 1, 3, 5, 7, 19, 21; and 1.3, 1.13, 1.27, 1.31

6th Edition: Ch 1
Problems 3, 5, 7, 9, 11, 13, 15, 21, 23, 25, 27, 33, 37, 39, 41, 43, 55, 57, 59, 65, 67, 69
Ch 2 (Omit Table 2.1)
Problems 1, 13, 17, 19, 21, 23, 25, 27, 29, 31, 33, 37, 39, 41, 43, 45(omit d), 47, 51, 53, 55, 57, 59, 61, 63, 67, 71, 75, 77, 81, 85, 93

Chemical Bonds
(ionic and covalent bonds; Lewis structures of inorganic, organic, and biological compounds; resonance structures; formal charge; Lewis acids and bases; coordinate covalent bonds; octet rule exceptions; ionic versus covalent bonds; polarisability of anions, polarizing power of cations and their periodic trends; electronegativity; dipole moments; bond lengths, strengths and dissociation energies; intermolecular interactions (forces) and hydrogen bonding)

7th Edition: Focus 2A-D (Omit 2A.4)
Problems 2A: 1, 3(omit c), 5, 9(omit c&d), 11(omit c&d), 13, 15(omit e), 17(omit b), 19(omit c), 21, 23; 2B: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23; 2C: 1, 3, 5, 7, 9, 11, 15, 17; 2D: 1, 3, 5, 7, 9, 11, 13, 19; and 2.1, 2.7, 2.11, 2.25

Focus 3F.4 and 3F.5
Problems 3F: 1, 3, 5, 11, 13, 15, 19

6th Edition: Ch 3 (Omit 3.4)
Problems 5, 9(a,b), 11(a,b), 13, 19(omit c), 21, 23, 25, 27, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 93, 95, 97, 99, 101, 103, 117, 119, 121, 123

Ch 6.4-6.5
Problems 1, 3, 5, 9, 11, 19, 99

Molecular Shape and Structure
(determining molecular shape & polarity using VSEPR; predicting bond angles; polar and non-polar properties and intermolecular interactions (forces); sigma & pi bonds and their role in structure and shape in organic and biological molecules; hybridization (sp, sp^2 sp^3, dsp^3, d^2sp^3) and apply this bonding model to inorganic, organic, and biological compounds (molecules, cations, and anions))

7th Edition: Focus 2E-F
Problems 2E: 1, 3, 5, 7, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29; 2F: 1, 3, 5, 7, 9, 13, 15, 17; and 2.45, 2.59, 2.61, 2.63

6th Edition: Ch 4.1-4.7
Problems 1, 3, 5, 7, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 41, 43, 45, 73, 75, 81, 85, 91, 95, 109, 111

Coordination Compounds and their Biological Importance
(naming, oxidation states, shape and structures of coordination compounds; biological functions and examples (e.g., hemoglobin, chemotherapy drugs))

7th Edition: Focus 9C.1 and 9C.2
Problems 9C: 1, 3, 5, 7, 9

6th Edition: Ch 17.5-17.6
Problems 29, 31, 33, 35, 37

Acid and Base Structures and Properties
(structure and properties of inorganic, organic, and biological acids and bases; amphoteric compounds; Bronsted and Lewis acids and bases; conjugate acids and bases; polyprotic acids and bases; pH scale; pH calculations involving strong acids and bases; cations, anions, and salts that are acidic or basic; environmental and biological examples (e.g., air pollution and acid rain, carbon dioxide and blood pH))

7th Edition: Fundamentals J
Problems 1, 7, 9, 11, 13, 17, 23

Focus 6A.1-6A.3; 6B.1; 6C.3-6C.4; 6D.3; 6E.1; Box 6E.1
Problems 6A: 1, 3, 5, 7, 9, 11, 13, 15, 17; 6B: 1, 3, 5, 7, 9; 6C: 17, 19, 21; 6D: 11; and 6.5, 6.13, 6.21

6th Edition: Fundamentals J
Problems 1, 7, 9, 11, 15, 19

Ch 12.1-12.3; 12.5; 12.9-12.10; 12.13-12.14; Box 12.1
Problems 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 25, 27, 31, 49, 51, 53, 65, 119, 127

Study hard and enjoy your time at UCLA.