

and laboratory courses. Among the techniques studied are purification of biological macromolecules, gene splicing, DNA sequencing, culturing of mammalian cells, hybridoma production, and plant cell culturing and cloning.

The Certificate Program can lead to potential careers in expanding fields, such as drug and hormone production in the pharmaceutical industry, monoclonal antibody production for medical diagnostics, crop improvement, industrial bioprocessing and medical research. The program also provides a background for further postgraduate studies in fields such as biochemistry, molecular biology and agricultural biotechnology. Some of the courses may also be used at California State University, Fresno as components of master's degree programs in biology, chemistry, plant science, and related departments.

Courses include: Molecular Biology (BIOL/CHEM 241A-B), Techniques in Protein Purification (BIOL/CHEM 242), Nucleic Acid Technology Lab (BIOL/CHEM 243), Cell Culture/Hybridoma Laboratory (BIOL/CHEM 244), Micropropagation (PLANT 102), and Seminar in Molecular Biology/Biotechnology (BIOL/CHEM 248).

COURSES

Chemistry (CHEM)

1A. General Chemistry (5)

CHEM 1A not open to students with credit in CHEM 1B. Students with credit in CHEM 3A receive only 1 unit of credit. Prerequisites: high school chemistry or CHEM 15R, and General Education area requirement (may be taken concurrently). Fundamental principles of chemistry, including the wave mechanical model of the atom, chemical bonding and structure, valence bond, VSEPR and molecular orbital theory; stoichiometry, thermochemistry, oxidation-reductions, and states of matter. G.E. Breadth B1. (3 lecture, 6 lab hours)* (CAN CHEM 2)

1B. General Chemistry and Qualitative Analysis (5)

Prerequisite: CHEM 1A or CHEM 4 with a grade of *C* or better. Acid-base theory; chemical kinetics; equilibrium (acid-base, hydrolysis, and solubility); thermodynamics, electrochemistry; selected topics in nuclear chemistry, coordination chemistry, and/or chemistry of selected groups. (3 lecture, 6 lab hours)* (CAN CHEM 4)

3A. Introductory General Chemistry (4)

No credit for CHEM 3A after 1A. High school chemistry or CHEM 15R recommended. Prerequisite: completion of the General Education B4 area requirement. For applied science and nonscience majors. Composition of matter and physical and chemical changes; fundamental laws and principles; atomic and molecular structure; acid-base theory, redox and equilibria; qualitative and quantitative theory and techniques. G.E. Breadth B1. (3 lecture, 3 lab hours)*

3B. Introductory Organic and Biochemistry (3)

No credit for CHEM 3B to students with credit in 1B. Primarily for students in health-oriented professions; not a substitute for CHEM 8. Prerequisite: CHEM 3A. Introduction to the basic concepts of organic and biochemistry. Structure and behavior of organic and biological compounds, metabolism, and regulation.

4. Introduction to Chemical Theory (3)

No credit for CHEM 4 after CHEM 1A. Not recommended for the health-oriented professions. Prerequisite: CHEM 3A. Beginning and intermediate development of the concepts of chemistry, including the laws and principles of atomic and molecular structure, stoichiometry, nomenclature, ionic equilibria, and energy relationships. *CHEM 3A and 4 are equivalent to CHEM 1A.* (Spring semester)

8. Elementary Organic Chemistry (3)

Not open to chemistry majors. Recommended for students requiring a one-semester course in the field. Prerequisite: CHEM 1A or 3A. Lectures, discussions, and demonstrations of fundamental principles; structure and chemical behavior of organic compounds.

10. Chemistry and Society (4)

Not open to students with credit in college chemistry; for nonscience majors. Prerequisite: completion of the General Education B4 area requirement. The significance of chemical principles in contemporary society; benefits and hazards relative to areas such as energy, health, diet, environment, and agriculture. G.E. Breadth B1. (3 lecture, 2 lab hours)* (Formerly CHEM 1)

15R. Preparation for Chemistry (2)

Prerequisite: one year of high school algebra. Recommended for students without high school chemistry who are interested in taking additional chemistry or science

courses. Basic principles and concepts of chemistry with an emphasis on problem solving. Preparation for CHEM 1A and CHEM 3A. *CR/NC* grading only. Not applicable to baccalaureate degree requirements. (Formerly CHEM AR)

102. Analytical Chemistry (5)

For chemistry majors; recommended for other science majors. Prerequisites: CHEM 1B (with a grade of *C* or better) and 128A. Students with credit in a similar lower-division quantitative analysis course will receive only one additional unit of credit. Introduction to principles and methods of analytical chemistry. (3 lecture, 6 lab hours)*

105. Quantitative Analysis Laboratory (4)

Not open to chemistry majors. Prerequisites: CHEM 1A or 3A. Laboratory study of principles and methods of applied quantitative analysis. (2 lecture, 6 lab hours)*

106. Analytical

Measurements Laboratory (4)

Prerequisites: CHEM 102 (with a grade of *C* or better), CHEM 110A and PHYS 4C, or permission of instructor. Principles and methods of analytical measurements of organic and inorganic substances by instrumental and non-instrumental techniques. (2 lecture, 6 lab hours) (Fall semester)*

108. Introductory Physical Chemistry (4)

Prerequisites: MATH 76 (MATH 77 strongly recommended), CHEM 8 or 128A and PHYS 2A, 2B (PHYS 4A, 4AL, 4B, 4BL, and 4C strongly recommended). Basic treatment of gas laws, thermodynamics, phase equilibria, properties of solutions, kinetics, and spectroscopy. (Fall semester)

109. Elementary Organic Chemistry Laboratory (3)

Not open to chemistry majors. Prerequisite: CHEM 8 or 128B or concurrently. Laboratory study of the carbon compounds with coordinating lectures. (1 lecture, 6 lab hours)* (Spring semester)

110A-B. Physical Chemistry (3-3)

Prerequisites: MATH 77; CHEM 1B, 8 or 128A; CHEM 110A requires PHYS 4B; CHEM 110B requires PHYS 4C or permission of instructor. Mathematical treatment of the laws of thermodynamics, reaction kinetics, elementary statistical and quantum mechanics, properties of solutions, kinetic theory of gases, crystal structure, molecular structure, and nuclear

* In all lab courses, the wearing of approved safety glasses is mandatory.