

## CHEMISTRY

### Natural and Applied Sciences Division

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### Chemistry A.A. Degree

Chemistry is the study of the properties, composition and transformations of all material substances. It is often called the "central science" since it draws from mathematics and physics and forms a necessary background to the study of the earth sciences and all the biological disciplines, including the various medical professions. A chemistry major is considered excellent preparation for medical school.

As pure scientists, chemists seek to understand ever more complex substances in greater detail. As applied scientists, chemists contribute to the creation and development of thousands of the products that support our complex society. Chemistry is a profoundly experimental science and much of a student's time will be spent in the laboratory.

A chemistry major usually transfers to a four-year institution to complete a bachelor's degree. Many also go on to earn Masters or Ph.D.s, since advanced degrees generally lead to more rewarding careers. Cabrillo's chemistry program is articulated with those of the UC and CSU systems and includes the standard courses needed to complete the first two years of the major.

Verification of prerequisites will be required. Prerequisites for courses in this department are computer enforced. Students should be sure their records have been entered into the Cabrillo computer system before attempting to enroll.

#### Learning Outcomes

The Cabrillo College Core Competencies (with an emphasis in the study of Chemistry):

1. Communication: Reading, Writing, Listening, Speaking and/or Conversing
2. Critical Thinking and Information Competency: Analysis, Computation, Research, Problem Solving
3. Global Awareness: An appreciation of Scientific Processes, Global Systems and Civics, and Artistic Variety
4. Personal Responsibility and Professional Development: Self-Management and Self-Awareness, Social and Physical Wellness, Workplace Skills

#### Model Program for Chemistry

These Associate Degrees require 60 units appropriate to your educational goal, to include general education and at least 30 units in a major. Courses should be selected to meet the lower-division major preparation requirements at your intended transfer university - these specific requirements can be found at [www.assist.org](http://www.assist.org) for 4-year public institutions in California. Please see a counselor for advisement to ensure you are taking the best possible courses given your goal.

The department presents the following suggested Model Programs for this major. The courses listed below may or may not be appropriate depending on your specific goal. Please see a counselor for advisement for transfer to any 4-year institution.

A.A. General Education		30 Units
Core Courses (20-24 Units)		Units
CHEM 1A	General Chemistry I .....	5
CHEM 1B	General Chemistry II .....	5
CHEM 5	+ Quantitative Analysis .....	4
CHEM 12A	Organic Chemistry I .....	3
CHEM 12AL	Organic Chemistry Laboratory I.....	2
CHEM 12B	Organic Chemistry II .....	3
CHEM 12BL	Organic Chemistry Laboratory II .....	2
Foreign Language*	.....	8 - 12
MATH 5A	Analytic Geometry and Calculus I.....	5
MATH 5B	Analytic Geometry and Calculus II.....	5
MATH 5C	Analytic Geometry and Calculus III.....	5
MATH 6	Introduction to Linear Algebra .....	3
MATH 7	Introduction to Differential Equations.....	3
PHYS 4A	Physics for Scientists and Engineers I .....	5
PHYS 4B	++ Physics for Scientists and Engineers II .....	5
PHYS 4C	+++ Physics for Scientists and Engineers III.....	5
PHYS 4D	++++ Modern Physics.....	3
<b>Electives:</b>		<b>Units</b>
(Any Course Number 1-99).....		6 - 10
<b>Total Units</b>		<b>60</b>

\*The student should consult the *Catalog* of the intended transfer institution concerning the necessity or appropriateness of these courses.  
+Spring, odd years only; ++Fall only; +++Spring only; ++++Fall, even years only

### Chemistry A.S. Degree

A.S. General Education		21 Units
Core Courses (39 Units)		Units
CHEM 1A	General Chemistry I .....	5
CHEM 1B	General Chemistry II .....	5
CHEM 5	+ Quantitative Analysis .....	4
CHEM 12A	Organic Chemistry I .....	3
CHEM 12AL	Organic Chemistry Laboratory I.....	2
CHEM 12B	Organic Chemistry II .....	3
CHEM 12BL	Organic Chemistry Laboratory II .....	2
Foreign Language*	.....	8 - 12
MATH 5A	Analytic Geometry and Calculus I.....	5
MATH 5B	Analytic Geometry and Calculus II.....	5
MATH 5C	Analytic Geometry and Calculus III.....	5
MATH 6	Introduction to Linear Algebra .....	3
MATH 7	Introduction to Differential Equations.....	3
PHYS 4A	Physics for Scientists and Engineers I .....	5
PHYS 4B	++ Physics for Scientists and Engineers II .....	5
PHYS 4C	+++ Physics for Scientists and Engineers III.....	5
PHYS 4D	++++ Modern Physics.....	3
<b>Total Units</b>		<b>60</b>

\*The student should consult the *Catalog* of the intended transfer institution concerning the necessity or appropriateness of these courses.  
+Spring, odd years only; ++Fall only; +++Spring only; ++++Fall, even years only.

## Chemistry Courses

### CHEM 1A General Chemistry I

5 units; 3 hours Lecture, 6 hours Laboratory

Prerequisite: CHEM 2 or CHEM 3 and CHEM 3L or equivalent, or high school chemistry with grade of "B" or better and MATH 152 or equivalent.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers general chemical principles including structure of matter, chemical equations and bonding, gases, solutions, periodic law, acids and bases, and chemical equilibrium.

*Transfer Credit:* Transfers to CSU; UC. C-ID: CHEM 110. CHEM 1A + CHEM 1B = C-ID 120S

### CHEM 1B General Chemistry II

5 units; 3 hours Lecture, 6 hours Laboratory

Prerequisite: CHEM 1A.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers general chemical principles including organic chemistry, chemical kinetics, equilibrium, acid/base chemistry, thermochemistry, thermodynamics, electrochemistry, structure, properties of transition metals, and nuclear chemistry.

*Transfer Credit:* Transfers to CSU; UC. C-ID: CHEM 1A + CHEM 1B = C-ID 120S

### CHEM 3 Introductory Inorganic Chemistry

3 units; 3 hours Lecture

Prerequisite: MATH 152.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers fundamental principles of inorganic chemistry. Lecture topics include chemical calculations, classification of matter, the atomic and kinetic theories of matter and the mole concept. CHEM 3L is an additional requirement in preparation for CHEM 1A at Cabrillo. May be offered in a Distance-Learning Format.

*Transfer Credit:* Transfers to CSU; UC, with conditions: No credit if taken after CHEM 1A. CHEM 3 + 3L = C-ID CHEM 101

### CHEM 3L Introductory Inorganic Chemistry Laboratory

1 unit; 3 hours Laboratory

Prerequisite: MATH 152.

Hybrid Requisite: Completion of or concurrent enrollment in CHEM 3.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Presents an introduction to small scale laboratory techniques and the properties of matter, chemical reactions, solubility, gas laws, and acid-base.

*Transfer Credit:* Transfers to CSU; UC, with conditions: No credit if taken after CHEM 1A. CHEM 3 + 3L = C-ID CHEM 101.

### CHEM 5 Quantitative Analysis

4 units; 2 hours Lecture, 6 hours Laboratory

Prerequisite: CHEM 1B.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Presents quantitative chemical determinations using classical (gravimetric, volumetric) and instrumental (electrochemical, spectrochemical, polarimetric, chromatographic) methods; data obtained from these experiments will then be analyzed utilizing statistical methods. Designed for any scientific discipline that requires the knowledge and skills necessary to perform quantitative chemical determinations. Spring semester odd years only.

*Transfer Credit:* Transfers to CSU; UC.

### CHEM 10 Concepts of Chemistry

4 units; 3 hours Lecture, 3 hours Laboratory

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100; Eligibility for MATH 154.

Repeatability: May be taken a total of 1 time.

Presents an introduction to atoms, molecules, reactions, nomenclature and energy, including the chemical concepts most useful for understanding contemporary life--food, water, materials, nuclear reactions, and the modern chemical industry and its impact on our environment.

*Transfer Credit:* Transfers to CSU; UC, with conditions: No credit for CHEM 10 if taken after CHEM 1A.

### CHEM 12A Organic Chemistry I

3 units; 3 hours Lecture

Prerequisite: CHEM 1B.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Presents the lecture portion of the first semester of the year-long organic chemistry course designed for chemistry majors and pre-professional medical and biology majors. Covers stereochemistry, mechanisms, reactions and spectroscopic studies of aliphatic compounds. Students enrolled in the Honors Transfer Program may count this course towards the Honors Scholar designation with an Honors Contract.

*Transfer Credit:* Transfers to CSU; UC. CHEM 12A + AL = C-ID CHEM 150. CHEM 12A+ CHEM 12AL + CHEM 12B + CHEM 12BL = C-ID CHEM 160S

### CHEM 12AL Organic Chemistry Laboratory I

2 units; 6 hours Laboratory

Prerequisite: CHEM 1B.

Hybrid Requisite: Completion of or concurrent enrollment in CHEM 12A.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Presents an introduction to microscale laboratory and instrumental techniques covering isolation, synthesis and identification of many classes of organic compounds. Students enrolled in the Honors Transfer Program may count this course towards the Honors Scholar designation with an Honors Contract.

*Transfer Credit:* Transfers to CSU; UC. CHEM 12A + AL = C-ID CHEM 150. CHEM 12A+ CHEM 12AL + CHEM 12B + CHEM 12BL = C-ID CHEM 160S

**CHEM 12B      Organic Chemistry II**

3 units; 3 hours Lecture

Prerequisite: CHEM 12A.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers mechanisms, synthesis and spectroscopy of aliphatic and aromatic alcohols, amines, carbonyl and carboxyl compounds, carbohydrates and proteins. Students enrolled in the Honors Transfer Program may count this course towards the Honors Scholar designation with an Honors Contract.

*Transfer Credit:* Transfers to CSU; UC. CHEM 12A + AL + B + BL = C-ID CHEM 160S.

**CHEM 12BL      Organic Chemistry Laboratory II**

2 units; 6 hours Laboratory

Prerequisite: CHEM 12AL.

Hybrid Requisite: Completion of or concurrent enrollment in CHEM 12B.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Presents multi-step synthesis and identification of unknown mixtures including chemical, physical and spectroscopic studies of aliphatic and aromatic alcohols, aldehydes, ketones, acids and other classes of organic compounds. Includes GC and IR. Students enrolled in the Honors Transfer Program may count this course towards the Honors Scholar designation with an Honors Contract.

*Transfer Credit:* Transfers to CSU; UC. CHEM 12A + AL + B + BL = C-ID CHEM 160S.

**CHEM 30A      Inorganic Chemistry for Health Occupations**

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: MATH 152 or MATH 152A and MATH 152B or MATH 142 or MATH 142A and MATH 142B.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers chemical concepts such as atomic structure, acids and bases, salts, buffers, electrolyte systems and nuclear chemistry. Appropriate for students interested in physiology and paramedical fields.

*Transfer Credit:* Transfers to CSU.

**CHEM 30B      Introductory Organic Chemistry and Biochemistry for Health Occupations**

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: CHEM 30A or CHEM 2 or CHEM 3 and CHEM 3L or high school chemistry.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Presents a survey of the major classes of organic and biochemical compounds as they relate to the chemistry of life processes. Designed for students preparing for the Dental Hygiene program or a four-year nursing degree.

*Transfer Credit:* Transfers to CSU.

**CHEM 32      Chemistry for the Allied Health Major**

5 units; 3 hours Lecture, 6 hours Laboratory

Prerequisite: MATH 152 or MATH 152A and MATH 152B or MATH 142 or MATH 142A and MATH 142B.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Presents a one semester survey of general and organic chemistry as preparation for careers in the allied health sciences. It is not appropriate for premed, dental or veterinary students nor is it intended for allied health students requiring two semesters of chemistry.

*Transfer Credit:* Transfers to CSU. CHEM 32 is a one-semester alternative that satisfies the CHEM 30A/CHEM 30B two semester sequence required for students transferring to some 4-year Nursing Programs - please see a counselor or check [www.assist.org](http://www.assist.org) for more information. CHEM 32 also satisfies the Prerequisite requirement for BIO 5 and BIO 6.