College of Chemistry

■ Bachelor of Science

Program Educational Objectives

We foster personnel with basic and extensive chemistry knowledge necessary for:(i) the pursuit of universal principles in the natural world as well as unknown substances and unknown phenomena; (ii) the creation of functional substances and materials development; (iii) the solution of environmental problems and energy problems; and (iv) the elucidation of life phenomena at the molecular level. Based on this, we aim to develop students with flexible ways of thinking backed by the aforementioned knowledge and understanding who are able to play vigorously active roles internationally.

Graduate Profile	A person who has thoroughly acquired diverse fundamental expertise in chemistry, is capable of independently identifying problems and devising methods for their solution, possesses a proactive research ability that leads to the discovery of new truths and the creation of value, and furthermore, applies the outcomes of research to contribute to social development and to addressing issues related to the environment, resources, and energy.
Career Paths after Graduation / Completion	Approximately 90% of graduates go on to pursue graduate studies. Furthermore, after graduation or completion of graduate school, they are widely active both in Japan and abroad in the following fields: – Companies and Organizations: Chemistry and Rubber, Electrical Equipment and Metals, Paper and Textiles, Energy, Food and Pharmaceuticals, Information and Communications, Services, Finance and Insurance, Transportation, Machinery and Automobiles – School Teachers: Public and Private Junior and Senior High Schools – Educational and Research Institutions: National Universities, National Research Institutes, Overseas Universities, Local Governments and Independent Administrative Agencies, etc.

Diploma Policy

We grant diplomas for Bachelor of Science to persons who have acquired the knowledge and skills (that is, Generic Competences) required based on the educational purpose for undergraduate students of the University of Tsukuba and the knowledge and skills (that is, Specialized Competences) required based on the human resorce development objectives of the college . In their learning outcomes, they will acquired the following the knowledge and skills (that is, Specialized Competences) required based on the educational purpose of our school and college.

Knowledge and Skills (Specialized Competences)	1. Knowledge and understanding of basic chemistry	Ability to correctly understand and apply concepts and theories related to basic chemistry
	2. Knowledge and understanding of, and ability to apply, inorganic and analytical chemistry	Knowledge in the fields of inorganic and analytical chemistry, ability to analyze chemical phenomena qualitatively and quantitatively, and ability to correctly understand the physical properties and molecular structure of inorganic compounds
	3. Knowledge, understanding, and application of the fields of thermodynamics and statistical	Knowledge in the fields of thermodynamics and statistical mechanics, and the ability to express chemical phenomena and concepts mathematically and physically
	4. Knowledge and understanding of the fields of quantum chemistry and spectroscopy and the ability to apply	Knowledge in the fields of quantum chemistry and spectroscopy, ability to describe chemical bonding patterns quantum mechanically, and ability to understand molecular structures correctly from spectroscopic information
	5. Knowledge and understanding of the field of organic chemistry and the ability to apply them	Ability to acquire knowledge in the field of organic chemistry, understand chemical reaction mechanisms, and apply such knowledge and understanding to organic synthesis
	6. Knowledge and understanding of the field of biochemistry and the ability to apply them	Ability to acquire knowledge in the field of biological chemistry and apply the laws and concepts of chemistry to the biological domain
	7. Ability to carry out chemical experiments	Ability to understand the principles and operations of chemical experiments and to correctly analyze and discuss the results
	8. Ability to understand and express chemical English	Ability to correctly read, express, and discuss in English the contents of English texts related to chemical research

Guidelines for Assessing Learning Outcomes	In the syllabus, the correspondence between courses and the competences set forth in the degree conferment policy, together with evaluation criteria and grading methods, are clearly indicated. In lectures, the acquisition of competences is assessed through quizzes and feedback, reports, and presentations. In practical training, evaluation is conducted through reports, attitudes toward experiments, and participation in questions and answers. Furthermore, the acquisition of the knowledge and skills (competences) specified in the degree conferment policy is assessed by multiple faculty members through the review of graduation research presentations.

Curriculum Policy

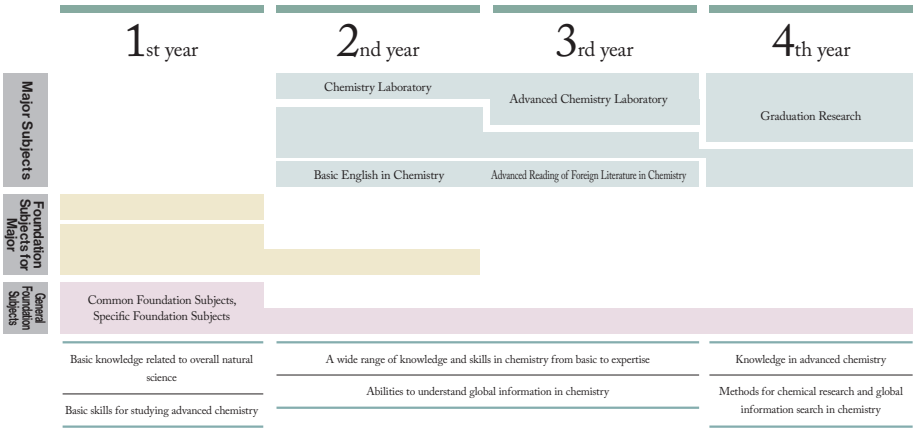
Curriculum Design Framework	**Correspondence between the knowledge and skills (that is, Specialized Competences) and course names.** – Knowledge and understanding of basic chemistry：Chemistry 1,2,3, Introduction to Chemistry – Knowledge and understanding of, and ability to apply, inorganic and analytical chemistry：Inorganic Chemistry I,II, Analytical Chemistry, Chemistry of Inorganic Elements – Knowledge, understanding, and application of the fields of thermodynamics and statistical：Physical Chemistry I,IV – Knowledge and understanding of the fields of quantum chemistry and spectroscopy and the ability to apply：Physical Chemitry II,III,IV – Knowledge and understanding of the field of organic chemistry and the ability to apply them：Organic Chemistry I,II,III,IV – Knowledge and understanding of the field of biochemistry and the ability to apply them：Biochemistry, Bioorganic Chemistry – Ability to carry out chemical experiments：Chemistry Laboratory, Chemistry Laboratory II, Advanced Chemitry Lavolatory in Inorganic and Analytical Chemistry, Advanced Chemitry Lavolatory in Organic Chemistry, Advanced Chemitry Lavolatory in Physical Chemistry – Ability to understand and express chemical English：Basic English in Chemistry, English in Advanced Chemistry We organize and implement curricula based on the following policies for programs that allow students to acquire learning outcomes related to Bachelor of Science. **General policy** We organize and implement a curriculum that allows students to move from basic knowledge to specialized knowledge so as to foster a chemistry specialty over four years. We offer class subjects with a central focus on lectures and experiments. We also provide seminar subjects that allow students to proactively engage in learning activities and a Graduation Project and Thesis for fostering comprehensive abilities related to chemistry. **Course sequence policy** – During the first year, we offer education with a central focus on lectures so that students acquire basic knowledge related to overall natural science and basic knowledge for learning specialized chemistry. – During the second year and the third year, in order for students to acquire extensive chemistry knowledge and techniques from the basic level to the specialized level, we offer practical training sessions and seminars according to systematic lectures and the progression of lectures in specialized chemistry. Moreover, in order to acquire abilities for reaching international chemical information, we provide lectures related to chemistry English. – During the fourth year, in order for students to learn knowledge about advanced chemistry and learn methods for uncovering relevant information concerning chemistry research and international chemistry information for inquiries into the truth, students engage in the Graduation Research and Thesis. **Implementation policy** – We offer well-balanced lectures for Basic Chemistry and Advanced Chemistry so that the level of chemistry increases sequentially according to the year. In order to acquire experimental methods for understanding natural phenomena, we implement practical training sessions. – In order for students to obtain the research methods that allow them to elucidate the truth about nature and unknown phenomena, we have a graduation project and thesis. – We offer chemistry lectures in English so students obtain English proficiency, which is internationally necessary in the field of chemistry.

Teaching and Learning Methods

Characteristics

In order to obtain deeper understanding of what is learned in lectures, students take specialized Advanced Chemistry Laboratory courses in their third year, where focus is placed not only on theory but also on acquisition of experimental methods.

Educational Plan



Subjects in College of Chemistry

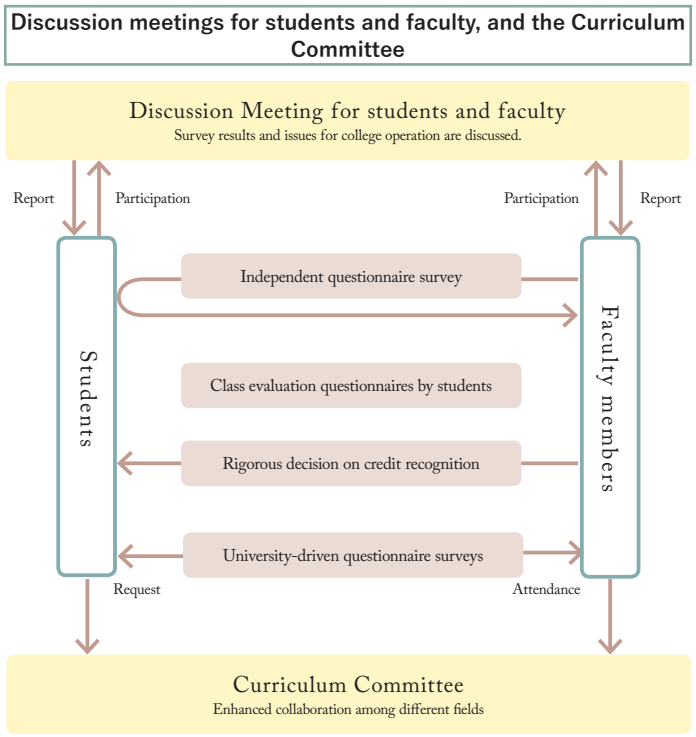
1st year	2nd year	3rd year	4th year
Introduction to Chemistry	Inorganic Chemistry I	Inorganic Chemistry II	Graduation Research
Chemistry 1	Analytical Chemistry	Chemistry of Inorganic Elements	Advanced Lecture in Inorganic Analytical Chemistry
Chemistry 2	Physical Chemistry I・II	Nuclear Chemistry	Advanced Lecture in Physical Chemistry
Chemistry 3	Organic Chemistry I・II	Organic Molecular Structure Analysis	Advanced Lecture in Organic Chemistry
Basic Chemistry Seminar	Biochemistry	Physical Chemistry III・IV	Advanced Lecture in Biomolecular Chemistry
	Basic English in Chemistry	Organic Chemistry III・IV	
	Chemistry Laboratory	Seminar in Physical Chemistry	
	Chemistry Laboratory II	Advanced Chemistry Laboratory I・II	
	Inorganic Material Chemistry	Advanced Reading of English in Advanced Chemistry	
	Applied Analytical Chemistry		
Common Foundation Subjects	**Common Foundation Subjects**	Computational Chemistry	Bioorganic Chemistry
Multidisciplinary Subjects, English	Multidisciplinary Subjects		
Information Literacy	Physical Education		
Physical Education			

Admission Policy

Desired Student Profile	Personnel with sufficient academic abilities related to chemistry and basic academic skills in the associated fields who are motivated to pursue universal principles in the natural world and seeking new substances and unknown phenomena are desired.	
Student Evaluation and Selection	Individual Achievement Test First Round	Gemeral academic ability, along with advanced understanding, reasoning, and application skills essential for chemistry, are evaluated.
	Individual Achievement Test Second Round	General academic ability, along with chemistry-related understanding, reasoning, application skills, interest, motivation, and expression, are evaluated.
	Entrance Examination by School Recommendation	Evaluation covers excellent high school performance, interest in chemistry, clear purpose, and motivation for study.
	Entrance Examination for International Science Olympiad Participants	Applicants who have taken part in the International Chemistry Olympiad, or have attained notable results in representative selection examinations, are assessed in terms of their eagerness to learn with well-defined objectives and their commitment to systematic study.
	Entrance Examination for IB Students	Evaluation covers curiosity for natural sciences, international perspective, chemistry fundamentals, and motivation to learn
	Entrance Examination for Foreign School Students	Evaluation covers cooperativeness, interest in chemistry, and the language and academic skills needed to study chemistry in Japanese.
	Transfer examination	Evaluation covers basic academic ability, interest in chemistry, logical reasoning, thinking, and application skills.

Learning Support Framework

Academic Support	In the Department of Chemistry, two class advisors are assigned to each academic year, and a diverse support system is in place to help students study effectively, including assistance with course registration, learning skills, and time management.
Opportunities for Peer Interaction	In the first year, a 'First-Year Seminar' is offered, and in the second year, a 'Fundamentals of Chemistry Seminar' is provided. By creating opportunities for students to interact with one another, these courses aim to enhance their motivation to learn.
Opportunities for Student–Faculty Interaction	Class meetings are organized twice annually to create opportunities for candid dialogue between teachers and students, with the aim of enhancing students' motivation to learn.



Approaches to Assuring and Enhancing Educational Quality

To guarantee educational quality, the Curriculum Committee examines the appropriateness of the curriculum through reviews based on the results of learning outcome assessments and continuously improves educational activities. Class meetings are held twice a year to exchange opinions for quality enhancement, drawing on the results of student-initiated course evaluation surveys. These outcomes are published annually in report form. Course instructors also make use of university-compiled evaluations to improve teaching effectiveness. Moreover, the Curriculum Committee, based on these surveys and related input, regularly reviews and revises educational content and inter-course coordination.