Section IV
Assessment #2
Grade Point Averages
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1. A brief description of the assessment and its use in the program

The assessment is Grade Point Averages. Grade point averages of 2.5 (out of a 4.0) or above is required of the candidates in three areas throughout their program: 1) overall, 2) in their science major, and 3) in their education courses. These three areas are monitored at three specific decisions points in their college program: 1) for admission to the teacher education program, 2) for admission to student teaching, 3) at the completion of their program for documentation to the State of New Hampshire that they have successfully fulfilled the requirements of the institution for graduation. A 4.0 is equivalent to an A, a 3.0 is equivalent to a B, a 2.0 is equivalent to a C, and a 1.0 is equivalent to a D.

Also included as part of this assessment is the NSTA Content Analysis tables to demonstrate alignment of the candidates' science content course requirements of the major that leads to New Hampshire state licensure.

2. A description of how this assessment specifically aligns with the standard

The Program of Study, Section I, Attachment C indicate the courses required for graduation in the content major. There is alignment of the courses (over 90%) with all of the NSTA content standards (Please see NSTA Content Analysis Tables at the end of this Assessment) with the exception of organic, physical chemistry and biochemistry that are not required for the Geology (Earth/Space) major.

This assessment meets NSTA Standard (1a), understanding the major concepts, principles, theories, laws, and interrelationships of the candidates field of licensure as recommended by the NSES. In addition to 1a, candidates in all five areas of licensure are required to conduct research (1d, 3a) and to use mathematics to process and report data and solve problems (1e). All candidates are required to take the History of Science course (2a, 2b). Every licensure area has courses that engage the students in socially important issues in science and technology, including environmental, personal, and community health issues (4a). All five areas have a community service piece in their program (7a) and all five areas must have a minimum of one Biology class and lab and all must take a full year of General Chemistry and lab, which provides candidates with the understanding of legal and ethical responsibilities, proper treatment of animals, and the maintenance and disposal of materials (9a). **(Please see NSTA Content Analysis tables to specifically address the NSTA standards alignment with the course requirements for majors at Keene State College at the end of this Assessment).**

The NSTA Content Analysis Tables for Secondary and Middle School indicate the alignment of the coursework required of the five science majors (plans of study)—Biology, Chemistry, Geology (Earth/Space), General Science, Chemistry/Physics (Physical Science). The alignment charts are included at the end of this assessment instead of in Section I, Attachment C, to show how the NSTA content standards align with the required courses for each of the Programs of Study .**(See Programs of Study for required courses for each of the above majors which includes a brief description of courses content where necessary).**

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3. A brief analysis of the data findings

All four candidates in their fields of licensure and related fields had GPA content averages over 2.5, as required by the Education program. All four candidates passed all of the required courses with a minimum of a C (2.0).

4. An interpretation of how that data provides evidence for meeting standards

Because the Keene State College science programs of study align with NSTA expectations according to the Content Analysis Tables, and because the four candidates received passing grades in the courses, then this assessment provides strong evidence of the candidates meeting Standard 1a, d, and e (Content—understand the knowledge and practices of contemporary science. They can interrelate and interpret important concepts, ideas, and applications in their fields of licensure; and can conduct scientific investigations). The two Biology majors had an overall GPA of 3.3 and 2.9, which includes supporting coursework. In their Biology major, one student had a 3.5 and the other a 3.0 average. The Chemistry major had a 3.5 average overall and in their Chemistry courses. The General Science student had a 3.0 overall in all of their science courses. Their strong academic achievement not only indicates their science content knowledge, but also their ability to do research (1d) and their understanding of the processes, tenets, and assumptions of multiple methods of inquiry leading to scientific knowledge (3a). Many of their courses, but especially the History of Science course that is required of all Secondary Science Education candidates, emphasizes the Nature of Science. This course stresses the historical and cultural development of science and the evolution of knowledge in all the fields of science (2a) and the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of know the world (2b). The research project that is required of all candidates must be a socially relevant problem (issue) that is related to science and technology, as well as processes used to analyze and make decisions on that problem (4a). The Biology candidates and the General Science candidates are all required to take Ecology and Evolution (BIO 252); the Chemistry candidates and the Physical Science candidates must take Quantitative Analysis and Lab (CHEM 251 & 255) and the Earth/Space candidate must take Environmental Geology (GEOL 315), all of which requires a service community project. This project requires the candidates to identify ways to relate science to the community, involve stakeholders, and use community resources to promote the learning of science (7a). Finally all of the candidates received a minimum of a C (2.0) in their Biology and Chemistry classes which provides evidence that the candidates understand of legal and ethical responsibilities, proper treatment of animals, and the maintenance and disposal of materials (9a).

Candidates GPA averages, which indicate accomplishments in their majors, are aligned with the NSTA standards as indicated in the NSTA Content Analysis tables for Secondary and Middle School that follow this assessment. The following disaggregated chart shows the percent alignment, all over 90%, of the required courses for the five majors with the NSTA Content Analysis standards:

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	Competencies	**Table I**	**Table II**	**Table III**	**Average Percentage**
All Science Teachers	5/5				**100%**
Biology		12/12	9/9	4/4	**100%**
Chemistry		13/13	14/14	4/4	**100%**
Earth/Space		12/12	10/10	3/4	**96%**

	Life Table I	**Life Table II**	**Physical Table I**	**Physical Table II**	**Earth/Space Table I**	**Earth/Space Table II**	**Interdisciplinary Table I**	**Interdisciplinary Table II**	**Average Percentage**
General Science	8/8	4/4	8/8	10/10	6/6	9/9	4/4	6/6	**100%**

	Chemistry Table I	**Chemistry Table II**	**Chemistry Table III**	**Physics Table I**	**Physics Table II**	**Physics Table III**	**Average Percentage**
Physical Science	13/13	14/14	4/4	11/11	11/11	4/4	**100%**

5. Assessment Documentation

5A: Assessment Tool/Description

The candidate is required to maintain a 2.5 (out of 4.0) grade point average in three areas: overall, in science content courses, and in education courses and pass all required courses for their program. This assessment demonstrates candidates GPAs for the science content courses.

The faculty members teaching the courses do not necessarily know which students in their classes are teacher candidates. The science education faulty member is responsible for recording and monitoring GPA data.

All of the courses listed are content courses for the major (see Plan of Study). Content analysis of courses is shown in the Content Analysis attachment to Section I.

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5B: Scoring Guide for the Assessment

Candidates must obtain a 2.5 average in their science content courses and in the related courses required of the major. An A = 4.0, an AB = 3.5, B = 3.0, BC = 2.5, a C = 2.0, a CD = 1.5, and a D = 1.0. All candidates must obtain a minimum of a 2.0 in each of the science courses and supporting courses for their majors.

5C: Candidate Data for the Assessment

As indicated in the Guidebook for Program Planners and Review Writers, only the 2005-2006 academic year data is required of Colleges that will be visited in Spring 2007. The data provided was collected from the four Student Teachers (program completers) in Spring 2006

Candidate #1 and #2 – Biology majors (Undergraduate, B.S.; Licensure Grades 7-12)

Course number	Course Title	Candidate #1	Candidate #2
BIO 151	Life: Diversity	A (4.0)	B (3.0)
BIO 152	Life: Diversity Lab	A (4.0)	A (4.0)
BIO 153	Life: Processes	A (4.0)	B (3.0)
BIO 154	Life: Processes Lab	A (4.0)	A (1.0)
BIO 251	Genetics	AB (3.5)	BC (2.5)
BIO 252	Ecology & Evolution	B (3.0)	B (3.0)
BIO 253 or BIO 232/233	Physiology of Plants and Animals or Human Anatomy and Physiology II & Lab	B (3.0)	AB (3.5)
BIO 254	Cell Biology`	B (3.0)	BC (2.5)
BIO 255 BIO 256 (Candidate #1) BIO 256 BIO 257 (Candidate #2)	Experimental Genetics Experimental Ecology & Evolution Experimental Ecology & Evolution Experimental Physiology	AB (3.5) B (3.0)	 B (3.0) AB (3.5)
BIO 315	General Microbiology	A (3.0)	BC (2.5)
BIO 415 (Candidate #1) BIO 334	Microbial Diversity Vertebrate Zoology	A (4.0)	 AB (3.5)

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Course number	Course Title	Candidate #1	Candidate #2
(Candidate #2)			
BIO 452/457 (Candidate #1) BIO 455/458 (Candidate #2)	Community and Ecosystem Ecology AND Research Methods: Ecology Comparative Animal Physiology AND Research Methods: Physiology	AB (3.5)	 B (3.0)
BIO 401	Biochemistry	AB (3.5)	B (3.0)
BIO 403	Experimental Biochemistry	A (4.0)	B (3.0)
BIO 405	Molecular Biology	AB (3.5)	AB (3.5)
BIO 495	Biology Seminar	A (4.0)	A (4.0)
CHEM 111	General Chemistry I	B (3.0)	C (2.0)
CHEM 115	General Chemistry I Laboratory	AB (4.0)	B (3.0)
CHEM 112	General Chemistry II	A (4.0)	B (3.0)
CHEM 116	General Chemistry II Laboratory	A (4.0)	AB (3.5)
GEOL 201	Introductory Physical Geology	AB (3.5)	B (3.0)
PHYS 210	History of Science	A (4.0)	A (4.0)
PHYS 141	College Physics I	B (3.0)	BC (2.5)
PHYS 142	College Physics II	B (3.0)	B (3.0)
MATH 151	Calculus I	B (3.0)	BC (2.5)
MATH 141	Introductory Statistics	AB (3.5)	B (3.0)
	Average GPA	**3.3**	**2.9**

Candidate #3 – Chemistry major (Undergraduate, B.A.; Licensure Grades 7-12)

Course number	Course Title	Candidate
CHEM 111	General Chemistry I	AB (3.5)
CHEM 115	General Chemistry I Laboratory	A (4.0)
CHEM 112	General Chemistry II	AB (3.5)
CHEM 116	General Chemistry II Laboratory	A (4.0)
CHEM 221	Organic Chemistry I	AB (3.5)
CHEM 225	Organic Chemistry I Lab	AB (3.5)
CHEM 222	Organic Chemistry II	AB (3.5)
CHEM 226	Organic Chemistry II Lab	AB (3.5)
CHEM 251	Quantitative Analysis	AB (3.5)

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Course number	Course Title	Candidate
CHEM 255	Quantitative Analysis Lab	A (4.0)
CHEM 341	Physical Chemistry I	AB (3.5)
CHEM 345	Physical Chemistry I Lab	A (4.0)
CHEM 342	Physical Chemistry II	AB (3.5)
CHEM 346	Physical Chemistry II Lab	A (4.0)
CHEM 363	Inorganic Chemistry	B (3.0)
CHEM 365	Inorganic Chemistry Lab	B (3.0)
CHEM 401	Biochemistry	A (4.0)
CHEM 403	Biochemistry Lab	AB (3.5)
CHEM 333	Medicinal Chemistry	AB (3.5)
CHEM 373	Polymer Chemistry	AB (3.5)
BIO 153	Life: Processes	C (2.0)
BIO 154	Life: Processes Lab	BC (2.5)
BIO 254	Cell Biology	BC (2.5)
GEOL 201	Introductory Physical Geology	B (3.0)
MATH 141	Introductory Statistics	A (4.0)
MATH 151	Calculus I	AB (3.5)
MATH 152	Calculus II	AB (3.5)
PHYS 210	History of Science	A (4.0)
PHYS 141	College Physics I	A (4.0)
PHYS 142	College Physics II	AB (3.5)
	Average GPA	**3.5**

Candidate #4 – General Science major (Undergraduate, B.A.; Licensure Grades 5-9)

Course number	Course Title	Candidate
BIO 151	Life: Diversity	AB (3.5)
BIO 152	Life: Diversity Lab	A (4.0)
BIO 153	Life: Processes	AB (3.5)
BIO 154	Life: Processes Lab	A (4.0
BIO 252	Ecology and Evolution	B (3.0)
BIO 230	Human Anatomy and Physiology I	BC (2.5)
BIO 231	Human Anatomy and Physiology I Lab	B (3.0)
BIO 251	Genetics	C (2.0)

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BIO 254	Cell Biology	B (3.0)
CHEM 111	General Chemistry I	B (3.0)
CHEM 115	General Chemistry I Laboratory	A (4.0)
CHEM 112	General Chemistry II	B (3.0)
CHEM 116	General Chemistry II Laboratory	A (4.0)
ASTR 101	Elementary Astronomy	B (3.0)
PHYS 201	Phenomenal Science	AB (3.5)
PHYS 210	History of Science	AB (3.5)
GEOL 201	Introductory Physical Geology	C (2.0)
GEOL 202	Historical Geology	BC (2.5)
MET 225	Meteorology	AB (3.5)
MATH 141	Introductory Statistics	B (3.0)
MATH 120	Applied Algebra & Trigonometry	AB (3.5)
	Average GPA	**3.0**
For NH certification students must specialize (9-12 credits) or minor (12-16 credits) in one of the following areas: Biology, Chemistry, or Geology		

NSTA Content Analysis Tables

Competency Requirements for All Science Teachers—Both Secondary (Biology, Chemistry, Earth/Space, Physical Science) and Middle School (General Science)

A: Competency	B: Required Courses	C: Advising Requirements
Multiple ways we organize our perceptions of the world and how systems organize the studies and knowledge of science.	Life science Bio 151/152 Life Processes (Bio, Chem., Physical, General Sci.) and 153/154 Life Diversity (Bio, Earth/Space) Physical science—All 5 areas of certification Chem. 111/115 General Chem. I and Lab Chem. 112/116 General Chem. II and Lab History of Science (Phys 210)—All 5 areas of certification	C or better in all science courses Transfer students must have equivalent introductory courses with a minimum grade of C
Nature of scientific evidence and the use of models for explanation.	Life science Bio 151/152 Life Processes (Bio, Chem., Physical, General Sci.) and 153/154 Life Diversity (Bio, Earth/Space) Physical science—All 5 areas of certification	C or better in all science courses Transfer students must have equivalent laboratory and coursework with a

A: Competency	B: Required Courses	C: Advising Requirements
	Chem. 111/115 General Chem. I and Lab Chem. 112/116 General Chem. II and Lab History of Science (Phys 210)—All 5 areas of certification	minimum grade of C
Measurement as a way of knowing and organizing observations of constancy and change.	Bio 152 Processes Lab (Bio, Chem., Physical, General Sci.) or Bio 154 Diversity Lab (Bio, Earth/Space) Chem. 115 and 116 General Chem. Lab I and II – All 5 areas of certification	C or better in all science courses Transfer students must have equivalent laboratory experience with a minimum grade of C
Evolution of natural systems and factors that result in evolution or equilibrium.	Bio 152 Processes Lab (Bio, Chem., Physical, General Sci.) or Bio 154 Diversity Lab (Bio, Earth/Space) Chem. 115 and 116 General Chem. Lab I and II – All 5 areas of certification	C or better in all science courses Transfer students must have introductory coursework with a minimum grade of C
Interrelationships of form, function, and behaviors in living and nonliving systems.	Bio 152 Processes Lab (Bio, Chem., Physical, General Sci.) or Bio 154 Diversity Lab (Bio, Earth/Space) Chem. 115 and 116 General Chem. Lab I and II – All 5 areas of certification	C or better in all science courses Transfer students must have equivalent introductory courses with a minimum grade of C

Science Content Requirement Analysis Tables I, II, III for Biology
1) B.S. In Biology for certification in New Hampshire

Table I: Biology

A. Core Competencies	B: Required Courses	C: Advising Requirements
Life processes in living systems including organization of matter and energy.	Bio 153/154 Life: Processes and Processes Lab Chem. 111/115 Gen Chem. I and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Similarities and differences among animals, plants, fungi, microorganisms, and viruses	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have

A. Core Competencies	B: Required Courses	C: Advising Requirements
		equivalent coursework and laboratory experience with a minimum grade of C
Principles and practices of biological classification	Bio 151/152 Life: Diversity and Diversity Lab 1	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Theory principles of biological evolution	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Ecological systems and relationships	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Population dynamics and population impacts	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
General concepts of genetics and heredity	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

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A. Core Competencies	B: Required Courses	C: Advising Requirements
Cells and multicellular systems	Bio 153/154 Life: Processes and Processes Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Behavior of organisms and social systems	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Regulation of biological systems including homeostatic mechanisms	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Fundamental processes of modeling and investigating in the biological sciences	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Applications of biology in environmental quality and in personal and community health	Bio 151/152 Life: Diversity and Diversity Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Table II: Biology

B. Advanced Competencies	B: Required Courses	C: Advising Requirements

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B. Advanced Competencies	B: Required Courses	C: Advising Requirements
Bioenergetics and major biochemical pathways	Bio 254 Cell Biology Bio 401 Biochemistry Bio 403 Experimental Biochemistry	Must be taken at Keene State College
Biochemical interactions of organisms and **their** environments	Bio 253 Physiology of Plants and Animals or Bio 232/233 Human Anatomy and Physiology II & Lab	Must be taken at Keene State College
Molecular genetics and heredity and mechanisms of genetic modification	Bio 251 Genetics	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Molecular basis for evolutionary theory ad classification	Bio 252 Ecology & Evolution	Must be taken at Keene State College
Causes, characteristics, and avoidance of viral, bacterial, and parasitic diseases	Bio 315 General Microbiology	Must be taken at Keene State College
Issues such as genetic modification, uses of biotechnology, cloning, and pollution from farming	Bio 251 Genetics	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Historical development and perspectives in biology including contributions of significant figures and underrepresented groups, and the evolution of theories in biology	Bio 151/152 Life: Diversity and Diversity Lab Bio 153/154 Life: Processes and Processes Lab Bio 495 Biology Seminar Phys 210 History of Science	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C Biology Seminar must be taken at Keene State College
How to design, conduct, and report research in biology	One of the following course pairs: Bio 451/457 Population Ecology AND Research Methods: Ecology	Must be taken at Keene State College

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
	Bio 452/457/Community and Ecosystem Ecology AND Research Methods: Ecology Bio 454/457 Ecological Physiology AND Research Methods: Ecology or Research Methods: Physiology Bio 455/458 Comparative Animal Physiology AND Research Methods: Physiology	
Applications of biology and biotechnology in society, business, industry, and health fields	Bio 151/152 Life: Diversity and Diversity Lab Bio 153/154 Life: Processes and Processes Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Table III: Biology

C. Supporting Competencies	B: Required Courses	C: Advising Requirements
Chemistry, including general chemistry and biochemistry with basic laboratory techniques.	Chem. 111/115 General Chem. And Lab Chem. 112/116 General Chem. And Lab Bio 401/403 Biochemistry and Experimental Biochemistry	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Physics including light, sound, optics, electricity, energy and order, magnetism, and thermodynamics.	Phys 141/142 College Physics I and II (includes labs)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Earth and space sciences including energy and geochemical cycles, climate, oceans, weather, natural resources, and changes in the Earth.	Geol 201 Introductory Physical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

C. Supporting Competencies	B: Required Courses	C: Advising Requirements
Mathematics, including probability and statistics	Math 141 Introductory Statistics Math 151 Calculus I	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Science Content Requirement Analysis Tables I, II, III for Chemistry
2) B. A. in Chemistry for certification in New Hampshire

Table I: Chemistry

A. Core Competencies	B: Required Courses	C: Advising Requirements
Fundamental structures of atoms and molecules	Chem. 111/115 General Chemistry I and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Basic principles of ionic, covalent, and metallic bonding	Chem. 112/116 General Chemistry II and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Physical and chemical properties and classification of elements including periodicity	Chem. 111/115 General Chemistry I and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Chemical kinetics and thermodynamics	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses

A. Core Competencies	B: Required Courses	C: Advising Requirements
		Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Principles of electrochemistry	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Mole concept, stoichiometry, and laws of composition	Chem. 111/115 General Chemistry I and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Transition elements and coordination compounds	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Acids and bases, oxidation-reduction chemistry, and solutions	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Fundamental biochemistry	Chem. 401/403 Biochemistry and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of

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A. Core Competencies	B: Required Courses	C: Advising Requirements
		C
Functional and polyfunctional group chemistry	Chem. 221/225 Organic Chemistry I and Lab Chem. 222/226 Organic Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Environmental and atmospheric chemistry	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Fundamental processes of investigating in chemistry	Chem. 255 Quantitative Analysis Lab Chem. 345/346 Physical Chemistry I and II\ Chem. 403 Biochemistry Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Applications of chemistry in personal and community health and environmental quality	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Table II: Chemistry

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
Molecular orbital theory, aromaticity, metallic and ionic structures, and correlation to properties of matter	Chem. 221/222 Organic Chemistry I and II Chem. 225/226 Organic Chemistry I and II Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a

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B. Advanced Competencies	B: Required Courses	C: Advising Requirements
		minimum grade of C
Superconductors and principles of metallurgy	Chem. 363/365 Inorganic Chemistry and Lab	Must be taken at Keene State College
Advanced concepts of chemical kinetics, and thermodynamics	Chem. 342/346 Physical Chemistry II and Lab	Must be taken at Keene State College
Lewis adducts and coordination compounds	Chem. 363/365 Inorganic Chemistry and Lab	Must be taken at Keene State College
Solutions, colloids, and colligative properties	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Major biological compounds and natural products	Chem. 401/403 Biochemistry and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Solvent system concepts including non-aqueous solvents	Chem. 221/225 Organic Chemistry I and Lab Chem. 222/225 Organic Chemistry II and Lab Chem. 363/365 Inorganic Chemistry and Lab	C or better in all science courses Organic Chemistry--Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C Inorganic Chemistry—Must be taken at Keene State College
Chemical reactivity and molecular structure including electronic and steric effects	Chem. 221/225 Organic Chemistry I and Lab Chem. 222/225 Organic Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Organic synthesis and organic reaction	Chem. 221/225 Organic Chemistry I and Lab	C or better in all science courses

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
mechanisms	Chem. 222/225 Organic Chemistry II and Lab	Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Energy flow through chemical systems	Chem. 342/346 Physical Chemistry II and Lab	Must be taken at Keene State College
Issues including such things as ground water pollution, disposal of plastics, and development of alternative fuels	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Historical development and perspectives in chemistry including contributions of significant figures and underrepresented groups, and the evolution of theories in chemistry	Chem. 111/115 General Chemistry I and Lab Chem. 112/116 General Chemistry II and Lab Phys 210 History of Science	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
How to design, conduct, and report research in chemistry	Chem. 251/255 Quantitative Analysis and Lab Chem. 363/365 Inorganic Chemistry and Lab	C or better in all science courses Organic Chemistry--Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C Inorganic Chemistry—Must be taken at Keene State College
Applications of chemistry and chemical technology in society, business, industry, and health fields	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

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Table III: Chemistry

C. Supporting Competencies	B: Required Courses	C: Advising Requirements
Biology with molecular biology, bioenergetics, and ecology	Bio 153/154 Processes and Lab Bio. 401/403 Biochemistry and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Earth science with geochemistry, geocycles, and energetics of earth systems	Geol 201 Introductory Physical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Physics w/energy, stellar evolution, waves, motions, forces, electricity, magnetism	Physics 141/142 College Physics I and II (Lab included)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Math w/statistics, differential equations and calculus	Math 141 Statistics Math 151/152 Calculus I and II	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Science Content Requirement Analysis Tables I, II, III for the Earth/Space Sciences
3) B.S. in Geology for Earth/Space certification in New Hampshire

Table I: Earth/Space science

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A. Core Competencies	B: Required Courses	C: Advising Requirements
Land, atmosphere & ocean systems	Geol 201 Introductory Physical Geology (includes lab) Geol 202 Historical Geology (includes Lab) Met 225 Meteorology Geol 206 Oceanography	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Properties, measurement, **and** classification of Earth materials	Geol 201 Introductory Physical Geology (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Changes in the Earth **including** land formation and erosion	Geol 201 Introductory Physical Geology (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Geochemical cycles **including** biotic and abiotic systems	Geol 202 Historical Geology (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Energy flow and transformation in Earth systems	Geol 202 Historical Geology (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Hydrological features of the Earth	Geol 210 The Hydrologic Cycle	C or better in all science courses Transfer students must have

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A. Core Competencies	B: Required Courses	C: Advising Requirements
		equivalent coursework and laboratory experience with a minimum grade of C
Atmosphere, weather, and climate	Met 225 Meteorology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Origin, evolution, and planetary behaviors of Earth	Geol 202 Historical Geology (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Origin, evolution, and properties of the universe	Astr 307 University Astronomy	Must be taken at Keene State College
Fundamental processes of investigating in the Earth and space sciences	Geol 201 Introductory Physical Geology (includes lab) Geol 202 Historical Geology (includes lab) Astr 307 University Astronomy	Astr 307 Must be taken at Keene State College Geol 201 and 202 – transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Sources and limits of natural resources	Geol 315 Environmental Geology (includes lab)	Must be taken at Keene State College
Applications to environmental quality and to personal and community health and welfare	Geol 315 Environmental Geology (includes lab)	Must be taken at Keene State College

Table II: Earth/Space Science

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B. Advanced Competencies	B: Required Courses	C: Advising Requirements
Gradual and catastrophic changes in the Earth	Geol 201 Introductory Physical Geology (includes lab) Geol 202 Historical Geology (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Oceans & relationship to atmosphere and climate	Geol 206 Oceanography Met 225 Meteorology Geol 210 Hydrologic Cycle	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Hydrological cycles **and** problems of distribution and use of water	Geol 210 Hydrologic Cycle	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Dating of **the** Earth and other objects in the universe	Geol 202 Historical Geology (includes lab) Geol 305 Paleontology (includes lab)	Geol 305 must be taken at Keene State College
Energy-matter structures and functions in the universe	Geol 201 Introductory Physical Geology (includes lab) Astr 307 University Astronomy	Astr 307 must be taken at Keene State College
Changes in the Earth and the evolution and distribution of living things	Geol 202 Historical Geology (includes lab) Geol 305 Paleontology (includes lab)	Geol 305 must be taken at Keene State College
Issues such as global climate change, mine subsidence, and channeling of waterways	Geol 315 Environmental Geology (includes lab)	Must be taken at Keene State College
Historical development and perspectives, including contributions of significant figures and underrepresented groups, and the evolution of theories in the Earth and space sciences.	Geol 201 Introductory Geology (includes lab) Geol 202 Physical Geology (includes lab) Astr 307 University Astronomy Phys 210 History of Science	Astr 307 and Phys 210 must be taken at Keene State College
How to design, conduct, and report research in the Earth and space sciences	Geol 303 Structural Geology (includes lab) Geol 315 Environmental Geology (includes lab)	Must be taken at Keene State College
Applications in society, business, industry, and	Geol 315 Environmental Geology (includes lab)	Must be taken at Keene State

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
health fields		College

Table III: Earth/Space Science

C. Supporting Competencies	B: Required Courses	C: Advising Requirements
Biology **including** evolution, ecology, population dynamics, and flow of energy and materials through Earth systems	Bio 151/152 Diversity and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Chemistry w/ inorganic and organic chemistry, physical chemistry, and biochemistry	Chem 111/115 General Chemistry I and lab Chem 112/116 General Chemistry II and lab Organic, physical chemistry and biochemistry are not required for this major	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Physics **including** electricity, forces and motion, energy, magnetism, thermodynamics, optics, and sound; as well as basic quantum theory	Phys 141 (or 241) College Physics I and lab (University Physics I and lab) Physics 142 (or 242) College Physics II and lab (University Physics II and lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Mathematics, including statistics and probability	Math 141 Introductory Statistics Math 152 Calculus II	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

General Science Middle School

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4) B.A. in General Science for Grades 5-9 certification in New Hampshire

Table I: Life Science Competency Requirements for All Teachers

A: Competency	B: Required Courses	C: Advising Requirements
LIFE SCIENCES		
Life Science standards for all areas on form	Bio 151/152 Life: Diversity and lab Bio 153/154 Life: Processes and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Features distinguishing living from nonliving systems.	Bio 153/154 Life: Processes and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Characteristics distinguishing plants, animals, and other living things.	Bio 151/152 Life: Diversity and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Multiple ways to order and classify living things.	Bio 151/152 Life: Diversity and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Ways organisms function and depend on their environments	Bio 151/152 Life: Diversity and lab Bio 252 Ecology and Evolution	Bio 252 must be taken at Keene State College
Ways organisms are interdependent.	Bio 151/152 Life: Diversity and lab Bio 252 Ecology and Evolution	Bio 252 must be taken at Keene State College

A: Competency	B: Required Courses	C: Advising Requirements
Reproductive patterns and life cycles of common organisms.	Bio 151/152 Life: Diversity and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Growth, change, and interactions of populations to form communities.	Bio 252 Ecology and Evolution	Bio 252 must be taken at Keene State College

Table II: Life Science Competency Requirements for Elementary Science Specialists and Middle Level Science Teachers

A: Competency	B: Required Courses	C: Advising Requirements
Factors governing the structures, functions, and behaviors of living systems.	Bio 153/154 Life: Processes and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Multiple systems of classification of organisms.	Bio 151/152 Life: Diversity and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Cycles of matter, and flow of energy, through living and nonliving pathways.	Bio 252 Ecology and Evolution	Must be taken at Keene State College
Natural selection, adaptation, diversity, and speciation.	Bio 252 Ecology and Evolution	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Structure, function, and reproduction of cells,	Bio 153/154 Life: Processes and lab	C or better in all science courses

A: Competency	B: Required Courses	C: Advising Requirements
including microorganisms.		Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Levels of organization from cells to biomes.	Bio 153/154 Life: Processes and lab Bio 252 Ecology and Evolution	Bio 252 must be taken at Keene State College
Reproduction and heredity, including human reproduction and contraception.	Bio 153/154 Life: Processes and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Behavior of living systems and the role of feedback in their regulation.	Bio 153/154 Life: Processes and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Hazards related to living things including allergies, poisons, disease, and aggression.	Bio 252 Ecology and Evolution	Must be taken at Keene State College

Table I: Physical Sciences Competency Requirements for All Teachers

A: Competency	B: Required Courses	C: Advising Requirements
Properties of matter such as mass, solubility, and density.	Chem 111/115 General Chemistry I and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Combinations of matter to form solutions, mixtures, and compounds with different	Chem 111/115 General Chemistry I and lab	C or better in all science courses

A: Competency	B: Required Courses	C: Advising Requirements
properties.		Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Variations in the physical and chemical states of matter and changes among states.	Chem 111/115 General Chemistry I and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Ordering and classification of matter and energy and their behaviors.	Chem 111/115 General Chemistry I and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Factors affecting the position, motion and behavior of objects.	Phys 201 Phenomenal Science	Must be taken at Keene State College
Properties of simple machines and tools, such as levers and screws.	Phys 201 Phenomenal Science	Must be taken at Keene State College
Properties of light, electricity, sound, and magnetism.	Phys 201 Phenomenal Science	Must be taken at Keene State College
Types of energy, energy sources, and simple transformations of energy.	Chem 112/116 General Chemistry II and lab Phys 201 Phenomenal Science	Phys 201 must be taken at Keene State College

Table II: Physical Sciences Competency Requirements for Elementary Science Specialists and Middle Level Science Teachers

A: Competency	B: Required Courses	C: Advising Requirements
Properties and applications of sound, light, magnetism, and electricity.	Phys 201 Phenomenal Science	Must be taken at Keene State College
Potential and kinetic energies and concepts of work.	Chem 111/115 General Chemistry I and lab Phys 201 Phenomenal Science	Phys 201 must be taken at Keene State College
Energy flow in physical and chemical systems,	Chem 111/115 General Chemistry I and lab	Phys 201 must be taken at Keene

A: Competency	B: Required Courses	C: Advising Requirements
including simple machines	Phys 201 Phenomenal Science	State College
States of matter and bonding in relation to molecular behavior and energy.	Chem 112/116 General Chemistry II and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Conservation of matter and energy.	Chem 112/116 General Chemistry II and lab Phys 201 Phenomenal Science	Phys 201 must be taken at Keene State College
Classifications of elements and compounds.	Chem 111/115 General Chemistry I and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Solvents (especially water) and solutions.	Chem 112/116 General Chemistry II and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Chemical nature of the earth and its living organisms.	Chem 111/115 General Chemistry I and lab Bio 153/154 Life: Processes and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Nature of radioactive substances.	Chem 111/115 General Chemistry I and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

A: Competency	B: Required Courses	C: Advising Requirements
Chemical, electrical and radiation hazards.	Chem 111/115 General Chemistry I and lab Chem 112/116 General Chemistry II and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Table I: Earth and Space Sciences Competency Requirements for All Teachers

A: Competency	B: Required Courses	C: Advising Requirements
Natural objects in the sky and why they change in position and appearance.	Astr 101 (or 307) Elementary Astronomy (or University Astronomy)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Causes of the seasons and seasonal changes.	Astr 101 (or 307) Elementary Astronomy (or University Astronomy)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Changes in the atmosphere resulting in weather and climate.	Met 225 Meteorology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Changes in the Earth creating and eroding landforms.	Geol 201 Introductory Physical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a

A: Competency	B: Required Courses	C: Advising Requirements
		minimum grade of C
Basic properties of rocks, minerals, water, air, and energy.	Geol 201 Introductory Physical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Differences between renewable and nonrenewable natural resources.	Bio 252 Ecology and Evolution	Must be taken at Keene State College

Table II: Earth and Space Sciences Competency Requirements for Elementary Science Specialists and Middle Level Science Teachers

A: Competency	B: Required Courses	C: Advising Requirements
Structures of objects and systems in space.	Astr 101 (or 307) Elementary Astronomy (or University Astronomy)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Earth's structure, evolution, history, and place in the solar system.	Geol 201 Introductory Physical Geology Astr 101 Elementary Astronomy	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Characteristics and importance of oceans, lakes, rivers, and the water cycle.	Met 225 Meteorology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Characteristics of the atmosphere including weather and climate.	Met 225 Meteorology	C or better in all science courses

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A: Competency	B: Required Courses	C: Advising Requirements
		Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Changes in the Earth caused by chemical, physical, and biological forces.	Geol 202 Historical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Causes and occurrences of hazards such as tornados, hurricanes, and earthquakes.	Geol 201 Introductory Physical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Characteristics and importance of cycles of matter such as oxygen, carbon, and nitrogen.	Geol 201 Introductory Physical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Characteristics of renewable and nonrenewable natural resources and implications for their use.	Bio 252 Ecology and Evolution	Must be taken at Keene State College
Interactions among populations, resources, and environments.	Bio 252 Ecology and Evolution	Must be taken at Keene State College

Table I: Interdisciplinary Perspectives Competency Requirements for All Teachers

A: Competency	B: Required Courses	C: Advising Requirements
Differences between science, as investigation, and technology as design.	Bio 151/152 Life: Diversity and lab Bio 153/154 Life: Processes and lab Chem 111/115 General Chemistry I and lab	Phys 201 must be taken at Keene State College

A: Competency	B: Required Courses	C: Advising Requirements
	Chem 112/116 General Chemistry II and lab Phys 201 Phenomenal Science	
Impact of science and technology on themselves and their community, and on personal and community health.	Bio 252 Ecology and Evolution Phys 201 Phenomenal Science Phys 210 History of Science	Phys 201 and 210 must be taken at Keene State College
How to use observation, experimentation, data collection, and inference to test ideas and construct concepts scientifically.	Bio 151/152 Life: Diversity and lab Bio 153/154 Life: Processes and lab Chem 111/115 General Chemistry I and lab Chem 112/116 General Chemistry II and lab Geol 202 Historical Geology (includes lab) Phys 201 Phenomenal Science	Phys 201 must be taken at Keene State College
How to use metric measurement and mathematics for estimating and calculating, collecting and transforming data, modeling, and presenting results.	Bio 151/152 Life: Diversity and lab Bio 153/154 Life: Processes and lab Chem 111/115 General Chemistry I and lab Chem 112/116 General Chemistry II and lab Phys 201 Phenomenal Science	Phys 201 must be taken at Keene State College

Table II: Interdisciplinary Perspectives Competency Requirements for Elementary Science Specialists and Middle Level Science Teachers

A: Competency	B: Required Courses	C: Advising Requirements
Interrelationships of pure and applied sciences, and technology.	Bio 151/152 Life: Diversity and lab Bio 153/154 Life: Processes and lab Chem 111/115 General Chemistry I and lab Chem 112/116 General Chemistry II and lab Phys 201 Phenomenal Science	Phys 201 must be taken at Keene State College
Applications of science to local and regional problems and the relationship of science to one's personal health, well-being, and safety.	Bio 252 Ecology and Evolution	Must be taken at Keene State College
Historical development and perspectives on science including contributions of underrepresented groups and the evolution of major ideas and theories.	Phys 210 History of Science	Must be taken at Keene State College
Applications of science to the investigation of	Bio 252 Ecology and Evolution	Must be taken at Keene State

A: Competency	B: Required Courses	C: Advising Requirements
individual and community problems.		College
Use of technological tools in science, including calculators and computers.	Bio 151/152 Life: Diversity and lab Bio 153/154 Life: Processes and lab Chem 111/115 General Chemistry I and lab Chem 112/116 General Chemistry II and lab Geol 202 Historical Geology Phys 201 Phenomenal Science	Phys 201 must be taken at Keene State College
Applications of basic statistics and statistical interpretation to the analysis of data.	Math 141 Introductory Statistics	

5) Physical Science New Hampshire certification
B.S. in Chemistry/Physics major for Physical Science certification in New Hampshire

Table I: Chemistry

A. Core Competencies	B: Required Courses	C: Advising Requirements
Fundamental structures of atoms and molecules	Chem. 111/115 General Chemistry I and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Basic principles of ionic, covalent, and metallic bonding	Chem. 112/116 General Chemistry II and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Physical and chemical properties and classification of elements including periodicity	Chem. 111/115 General Chemistry I and Lab	C or better in all science courses Transfer students must have

A. Core Competencies	B: Required Courses	C: Advising Requirements
		equivalent coursework and laboratory experience with a minimum grade of C
Chemical kinetics and thermodynamics	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Principles of electrochemistry	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Mole concept, stoichiometry, and laws of composition	Chem. 111/115 General Chemistry I and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Transition elements and coordination compounds	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Acids and bases, oxidation-reduction chemistry, and solutions	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

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A. Core Competencies	B: Required Courses	C: Advising Requirements
Fundamental biochemistry	Chem. 401/403 Biochemistry and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Functional and polyfunctional group chemistry	Chem. 221/225 Organic Chemistry I and Lab Chem. 222/226 Organic Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Environmental and atmospheric chemistry	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Fundamental processes of investigating in chemistry	Chem. 255 Quantitative Analysis Lab Chem. 345 or 346 Physical Chemistry I or II Chem. 403 Biochemistry Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Applications of chemistry in personal and community health and environmental quality	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Table II: Chemistry

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B. Advanced Competencies	B: Required Courses	C: Advising Requirements
Molecular orbital theory, aromaticity, metallic and ionic structures, and correlation to properties of matter	Chem. 221/222 Organic Chemistry I and II Chem. 225/226 Organic Chemistry I and II Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Superconductors and principles of metallurgy	Chem. 363/365 Inorganic Chemistry and Lab	Must be taken at Keene State College
Advanced concepts of chemical kinetics, and thermodynamics	Chem. 341 or 345 Physical Chemistry I or II and Lab	Must be taken at Keene State College
Lewis adducts and coordination compounds	Chem. 363/365 Inorganic Chemistry and Lab	Must be taken at Keene State College
Solutions, colloids, and colligative properties	Chem. 112/116 General Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Major biological compounds and natural products	Chem. 401/403 Biochemistry and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Solvent system concepts including non-aqueous solvents	Chem. 221/225 Organic Chemistry I and Lab Chem. 222/225 Organic Chemistry II and Lab Chem. 363/365 Inorganic Chemistry and Lab	C or better in all science courses Organic Chemistry--Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C Inorganic Chemistry—Must be taken at Keene State College
Chemical reactivity and molecular structure including electronic and steric effects	Chem. 221/225 Organic Chemistry I and Lab Chem. 222/225 Organic Chemistry II and Lab	C or better in all science courses

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
		Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Organic synthesis and organic reaction mechanisms	Chem. 221/225 Organic Chemistry I and Lab Chem. 222/225 Organic Chemistry II and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Energy flow through chemical systems	Chem. 341 or 345 Physical Chemistry I or II and Lab	Must be taken at Keene State College
Issues including such things as ground water pollution, disposal of plastics, and development of alternative fuels	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Historical development and perspectives in chemistry including contributions of significant figures and underrepresented groups, and the evolution of theories in chemistry	Chem. 111/115 General Chemistry I and Lab Chem. 112/116 General Chemistry II and Lab Phys 210 History of Science	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
How to design, conduct, and report research in chemistry	Chem. 251/255 Quantitative Analysis and Lab Chem. 363/365 Inorganic Chemistry and Lab	C or better in all science courses Organic Chemistry--Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C Inorganic Chemistry—Must be taken at Keene State College
Applications of chemistry and chemical	Chem. 251/255 Quantitative Analysis and Lab	C or better in all science courses

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
technology in society, business, industry, and health fields		Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

Table III: Chemistry

C. Supporting Competencies	B: Required Courses	C: Advising Requirements
Biology with molecular biology, bioenergetics, and ecology	Bio 153/154 Life: Processes and lab Bio. 401/403 Biochemistry and Lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Earth science with geochemistry, geocycles, and energetics of earth systems	Geol 201 Introductory Physical Geology	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Physics w/energy, stellar evolution, waves, motions, forces, electricity, magnetism	Physics 141/142 College Physics I and II (Lab included)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Math w/statistics, differential equations and calculus	Math 141 Statistics Math 151/152 Calculus I and II	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

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Table I: Physics

A. Core Competencies	B: Required Courses	C: Advising Requirements
Energy, work, and power	Phys 241 University Physics I (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Motion, major forces, and momentum	Phys 241 University Physics I (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Newtonian physics w/engineering applications	Phys 241 University Physics I (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Conservation mass, momentum, energy, and charge	Phys 241 University Physics I (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Physical properties of matter	Phys 241 University Physics I (includes lab) Chem 111/115 General Chemistry I and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Kinetic-molecular motion and atomic models	Phys 241 University Physics I (includes lab)	Phys 342 must be taken at Keene

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A. Core Competencies	B: Required Courses	C: Advising Requirements
	Phys 342 Modern Physics Chem 112/116 General Chemistry II and lab	State College
Radioactivity, nuclear reactors, fission, and fusion	Phys 241 University Physics I (includes lab) Phys 342 Modern Physics Chem 11 2/116 General Chemistry II and lab	Phys 342 must be taken at Keene State College
Wave theory, sound, light, the electromagnetic spectrum and optics	Phys 242 University of Physics II (includes lab) Phys 245 University of Physics III (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Electricity and magnetism	Phys 242 University of Physics II (includes lab) Phys 245 University of Physics III (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Fundamental processes of investigating in physics	Phys 241 University of Physics I (includes lab) Phys 242 University of Physics II (includes lab) Phys 245 University of Physics III (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Applications of physics in environmental quality and to personal and community health	Phys 342 Modern Physics Phys 210 History of Science	Both Phys 210 and Phys 342 must be taken at Keene State College

Table II: Physics

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
Thermodynamics and energy-matter relationships	Phys 242 University of Physics II (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
		minimum grade of C
Nuclear physics including matter-energy duality and reactivity	Phys 245 University of Physics II (includes lab) Phys 342 Modern Physics	Phys 342 must be taken at Keene State College
Angular rotation and momentum, centripetal forces, and vector analysis	Phys 241 University of Physics I (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Quantum mechanics, space-time relationships, and special relativity	Phys 245 University of Physics II (includes lab) Phys 342 Modern Physics	Phys 342 must be taken at Keene State College
Models of nuclear and subatomic structures and behavior	Phys 245 University of Physics II (includes lab) Phys 342 Modern Physics	Phys 342 must be taken at Keene State College
Light behavior, including wave-particle duality and models	Phys 245 University of Physics II (includes lab) Phys 342 Modern Physics	Phys 342 must be taken at Keene State College
Electrical phenomena including electric fields, vector analysis, energy, potential, capacitance, and inductance	Phys 241 University of Physics I (includes lab) Phys 242 University of Physics II (includes lab) Phys 245 University of Physics III (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Issues related to physics such as disposal of nuclear waste, light pollution, shielding communication systems and weapons development	Phys 342 Modern Physics Phys 210 History of Science	Both Phys 210 and Phys 342 must be taken at Keene State College
Historical development and cosmological perspectives in physics including contributions of significant figures and underrepresented groups, and evolution of theories in physics	Phys 210 History of Science	Must be taken at Keene State College
How to design, conduct, and report research in physics	Phys 241 University of Physics I (includes lab) Phys 242 University of Physics II (includes lab) Phys 245 University of Physics III (includes lab)	C or better in all science courses Transfer students must have equivalent coursework and

B. Advanced Competencies	B: Required Courses	C: Advising Requirements
		laboratory experience with a minimum grade of C
Applications of physics and engineering in society, business, industry, and health fields	Phys 210 History of Science	Must be taken at Keene State College

Table III: Physics

C. Supporting Competencies	B: Required Courses	C: Advising Requirements
Biology, including organization of life, bioenergetics, biomechanics, and cycles of matter	Bio 153/154 Life: Processes and lab Bio 401 Biochemistry	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Chemistry, including organization of matter and energy, electrochemistry, thermodynamics, and bonding	Chem 111/115 General Chemistry I and lab Chem 112/116 General Chemistry II and lab Chem 221/225 Organic Chemistry I and lab Chem 222/226 Organic Chemistry II and lab Chem 251/255 Quantitative Analysis and lab Chem 341/345 or 342/346 Physical Chemistry I or Physical Chemistry II Chem 363/365 Inorganic Chemistry and lab	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Earth sciences or astronomy related to structure of the universe, energy, and interactions of matter	Geol 201 Introductory Physical Geology Astr 307 University Astronomy	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C
Mathematical and statistical concepts and skills including statistics and the use of differential equations and calculus	Chem 251/255 Quantitative Analysis Math 151 Calculus I Math 152 Calculus II Math 251 Calculus III	C or better in all science courses Transfer students must have equivalent coursework and laboratory experience with a minimum grade of C

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