

Materials Science, B.S.

Learn more about the Bachelor of Science in Materials Science.

The Bachelor of Science in Materials Science provides both a strong preparation for those wishing to attend graduate school in materials science or related disciplines and for those who intend to enter the scientific workforce upon completion of a bachelor's degree. Students who wish to transfer into this program in 2021-2022 should consult first with the Physics Faculty Advisor.

The Bachelor of Science in Materials Science stands at the interface between physics, chemistry, computer & information science, and applied mathematics, with innovation and technology applications bridging to applied sciences. Its foundational structure is embedded in multiple CST disciplines. Indeed, the frontiers of the subject now demand participation of artificial intelligence/machine learning (AIS) methodologies. Materials science is important as a research and education driver that reaches students in almost every discipline of science and technology. Graduates proficient in this area are more and more in demand. Indeed, the national initiative in Quantum Information Science makes it clear that Quantum Materials will be a focus for industry and academia. The Temple CST Bachelor of Science program in Materials Science focuses on the science behind materials science, and is not an engineering program.

As a discipline, materials science represents the confluence of quantum theory, computational design, synthesis, and characterization, in a feedback loop to produce advanced materials for technology applications and subsequent processing by industry. Importantly, the theory and computational design component now harnesses artificial intelligence and machine learning to create heretofore unknown "designer" materials. These ideas are prominent in Department of Energy (DOE) and National Science Foundation "big ideas" such as the "Quantum Leap" that establish an understanding of complex matter-energy relationships, leading to next-generation quantum materials and technologies for sensing and computing, modeling, and communicating, from the micro- or nano-structure of materials to their physical, mechanical and chemical properties.

Materials Science evolved historically from the metallurgy of naturally occurring elements and their alloys (and glass) to embrace not only an enormous variety of "hard" elemental (metallic and semiconducting) alloys and oxide-based materials (superconductors, catalysts, etc.) that underpin technology applications, but also a vast array of "soft" materials including synthetic and natural polymers, as well as more recently the two-dimensional graphene-like constructs, which will be needed for future advanced/strategic technologies.

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Bachelor of Science

Summary of Requirements for the Degree

- University Requirements (123 total s.h.)
 - Students must complete all University requirements including those listed below.
 - All Temple students must take a minimum of two writing-intensive courses at Temple as part of their major. The specific writing-intensive course options for this major are:

Code	Title	Credit Hours
PHYS 2796	Introduction to Modern Physics	4
SCTC 2396	Writing for Science and Technology	3

- Students must complete the General Education (GenEd) requirements.
 - See the General Education section of the *Undergraduate Bulletin* for the GenEd curriculum.
 - Students who complete CST majors receive a waiver for 2 Science & Technology (GS) and 1 Quantitative Literacy (GQ) GenEd courses.
- Students must satisfy general Temple University residency requirements.

2. College Requirements

- 45 Upper Level (2000+) credits within the College of Science & Technology (CST), the College of Liberal Arts (CLA), or the College of Engineering (ENG).
- 90 credits within the College of Science & Technology (CST), the College of Liberal Arts (CLA), or the College of Engineering (ENG).
- All students in the College of Science and Technology are required to take a one credit first year seminar. SCTC 1001 CST First Year Seminar is the appropriate course option for every entering first year CST major. Transfer students should use SCTC 2001 CST Transfer Seminar to fulfill this requirement. Other courses that fulfill this requirement may be found on the CST College Requirements page.

3. Major Requirements for Bachelor of Science (74-77 s.h.)

A least 9 courses required for the major must be completed at Temple. At least 8 Physics courses must be completed at Temple.

Code	Title	Credit Hours
Chemistry		
Select one of the following:		4
CHEM 1031 & CHEM 1033	General Chemistry I and General Chemistry Laboratory I	
CHEM 1951 & CHEM 1953	Honors General Chemical Science I and Honors Chemical Science Laboratory I	
Select one of the following:		4
CHEM 1032 & CHEM 1034	General Chemistry II and General Chemistry Laboratory II	
CHEM 1952 & CHEM 1954	Honors General Chemical Science II and Honors Chemical Science Laboratory II	
Mathematics and Quantitative Methods		
MATH 1041 or MATH 1941	Calculus I Honors Calculus I	4
MATH 1042 or MATH 1942	Calculus II Honors Calculus II	4
MATH 2043 or MATH 2943	Calculus III Honors Calculus III	4
SCTC 1013	Elements of Data Science for the Physical and Life Sciences	3
Physics		
Select one of the following:		4
PHYS 1061	Elementary Classical Physics I	
PHYS 1961	Honors Elementary Classical Physics I (F)	
PHYS 2021	General Physics I	
PHYS 2921	Honors General Physics I (F)	
Select one of the following:		4
PHYS 1062	Elementary Classical Physics II	
PHYS 1962	Honors Elementary Classical Physics II (S)	
PHYS 2022	General Physics II	
PHYS 2922	Honors General Physics II (S)	
Select two of the following: ¹		3
PHYS 2511	Scientific Computing I	
PHYS 3511	Scientific Computing II	
PHYS 4511	Scientific Computing III	
PHYS 2063	Wave Physics (F)	3
PHYS 2796	Introduction to Modern Physics (S)	4
PHYS 27XX	(Optical and Electronic Properties of Materials: Thin Films, Nanomaterials, and Energetic Materials)	3
PHYS 28XX	(Quantum Materials: Properties, Characterization, and Application)	3
Select one of the following: ²		3
PHYS 37XX	(Computational Design of Novel and Quantum Materials)	
PHYS 38XX	(Computational Materials Science)	

Materials Science Electives

Select five of the following: 15-18

CHEM 2201 & CHEM 2203	Organic Chemistry I and Organic Chemistry Laboratory I
CHEM 2921 & CHEM 2923	Organic Chemistry for Honors I and Organic Honors Laboratory I
CHEM 2202 & CHEM 2204	Organic Chemistry II and Organic Chemistry Laboratory II
CHEM 2922 & CHEM 2924	Organic Chemistry for Honors II and Organic Honors Laboratory II
CHEM 3001	Inorganic Chemistry
CHEM 3301	Physical Chemistry Lecture I
CHEM 4004	Crystallography and Diffraction ³
CHEM 4503	Introduction to Polymer Chemistry ⁴
PHYS 3701	Introduction to Quantum Mechanics I ⁵
PHYS 37XX	(Computational Design of Novel and Quantum Materials) ²
PHYS 38XX	(Computational Materials Science) ²
PHYS 4101	Thermal Physics (F)
PHYS 4302	Optics ⁶
PHYS 4701	Introduction to Solid State Physics (S, even years) ⁷
ENGR 2331	Engineering Statics
ENGR 2333	Mechanics of Solids
ENGR 3201	Material Science for Engineers
ENGR 4201	Micro- to Nano-sized Machines
MEE 4212	Tribology and Surface Engineering
MEE 5205	Microscopy and Microanalysis of Materials

Senior Capstone and Research

3 credits of research in each semester of senior year

Fall semester of senior year, select one of the following: 3

CHEM 4891	Undergraduate Research
PHYS 4091	Undergraduate Research

Spring semester of senior year, select one of the following: 3

CHEM 4891	Undergraduate Research
PHYS 4091	Undergraduate Research

Writing Intensive

SCTC 2396 Writing for Science and Technology 3

Total Credit Hours 74-77

Code	Title	Credit Hours
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(F) - Fall only course

(S) - Spring only course

- 1 Students with prior programming experience may be prepared to begin in PHYS 3511. Please see a Physics Faculty Advisor for more information.
- 2 One of these courses is required. The course not selected may be taken as a Materials Science Elective.
- 3 CHEM 3001 is a prerequisite for this course.
- 4 CHEM 2202 and CHEM 3301 are prerequisites for this course.
- 5 PHYS 2502 is a prerequisite for this course.
- 6 CHEM 3301 is a prerequisite for this course.
- 7 PHYS 3701 is a prerequisite for this course.

Calculation of Major GPA

Courses listed under the major requirements for the degree will be included in the calculation of the major GPA. Courses that could not apply toward the major as an elective or required course would not be counted in the calculation of the major GPA. This would include MATH 1022, for example.

Distinction in Major

A student who wishes to graduate with distinction in the major must complete all courses required for the physics major with a GPA of 3.5 or better, and carry out an independent study or undergraduate thesis project. Consult the undergraduate physics advisor for more details.

Suggested Academic Plan

Please note that this is a suggested academic plan. Depending on your situation, your academic plan may look different.

Bachelor of Science in Materials Science

Requirements for New Students starting in the 2021-2022 Academic Year

Year 1		Credit Hours
Fall		
MATH 1041 or 1941	Calculus I	4
Select one of the following:		4
PHYS 1061	Elementary Classical Physics I	
PHYS 1961	Honors Elementary Classical Physics I (F)	
PHYS 2021	General Physics I	
PHYS 2921	Honors General Physics I (F)	
SCTC 1001	CST First Year Seminar	1
SCTC 1013	Elements of Data Science for the Physical and Life Sciences	3
ENG 0802, 0812, or 0902	Analytical Reading and Writing [GW]	4
Term Credit Hours		16
Spring		
MATH 1042 or 1942	Calculus II	4
Select one of the following:		4
PHYS 1062	Elementary Classical Physics II	
PHYS 1962	Honors Elementary Classical Physics II (S)	
PHYS 2022	General Physics II	
PHYS 2922	Honors General Physics II (S)	
Select one of the following: ¹		1.5
PHYS 2511	Scientific Computing I	
PHYS 3511	Scientific Computing II	
PHYS 4511	Scientific Computing III	
IH 0851 or 0951	Intellectual Heritage I: The Good Life [GY]	3
GenEd Breadth Course		3
Term Credit Hours		15.5
Year 2		
Fall		
Select one of the following:		4
CHEM 1031 & CHEM 1033	General Chemistry I	
CHEM 1951 & CHEM 1953	Honors General Chemical Science I	
MATH 2043 or 2943	Calculus III	4
PHYS 2063	Wave Physics (F)	3
Select one of the following:		1.5
PHYS 2511	Scientific Computing I	
PHYS 3511	Scientific Computing II	
PHYS 4511	Scientific Computing III	

IH 0852 or 0952	Intellectual Heritage II: The Common Good [GZ]	3
Term Credit Hours		15.5
Spring		
Select one of the following:		4
CHEM 1032 & CHEM 1034	General Chemistry II	
CHEM 1952 & CHEM 1954	Honors General Chemical Science II	
PHYS 2796	Introduction to Modern Physics [WI] (S)	4
GenEd Breadth Course		3
Elective		3
Elective		1
Term Credit Hours		15
Year 3		
Fall		
PHYS 27XX	(Optical and Electronic Properties of Materials: Thin Films, Nanomaterials, and Energetic Materials)	3
PHYS 28XX	(Quantum Materials: Properties, Characterization, and Application)	3
GenEd Breadth Course		3-4
GenEd Breadth Course		3
Elective		3-2
Elective		1
Term Credit Hours		16
Spring		
SCTC 2396	Writing for Science and Technology [WI]	3
Materials Science Elective 1 ²		3-4
Materials Science Elective 2 ²		3-4
GenEd Breadth Course		3
Elective		3-1
Term Credit Hours		15
Year 4		
Fall		
Select one of the following: ³		3
PHYS 37XX	(Computational Design of Novel and Quantum Materials)	
PHYS 38XX	(Computational Materials Science)	
Select one of the following:		3
CHEM 4891	Undergraduate Research	
PHYS 4091	Undergraduate Research	
Materials Science Elective 3 ²		3-4
Elective		3
Elective		3-2
Term Credit Hours		15
Spring		
Select one of the following:		3
CHEM 4891	Undergraduate Research	
PHYS 4091	Undergraduate Research	
Materials Science Elective 4 ²		3
Materials Science Elective 5 ²		3
Elective		3
Elective		3
Term Credit Hours		15
Total Credit Hours:		123

Code	Title	Credit Hours
(F) - Fall only course		
(S) - Spring only course		
1	Students with prior programming experience may be prepared to begin in PHYS 3511. Please see a Physics Faculty Advisor for more information.	
2	Select from the Materials Science Electives list under Requirements.	
3	One of these courses is required. The course not selected may be taken as a Materials Science Elective.	