Physics B.A.

Physics Major

The B.A. Physics Major is suitable for students who are interested in physics but are looking for a more interdisciplinary experience than the B.S. Physics Major. Potential careers include, for example, computer science, data science, medicine, business, or law. The B.A. Physics Major requires a minimum of 120 total hours for graduation. This includes the major requirements and electives specified below, as well as UNIFI/General Education requirements.

The B.A. Physics major has four emphases: Custom Emphasis, Data Science Emphasis, Physical Chemistry Emphasis, and Computer Science and Data Science. Students should choose one emphasis. Each emphasis requires completion of a common physics core, a common mathematics core and electives. The Data Science Emphasis has an additional core of data science-related courses and a required project.

Custom Emphasis

The Custom Emphasis is designed to combine a core understanding of physics with additional course work from other disciplines. The flexibility of this major makes it ideal for students interested in dual majors or one or more minors. The rigor of the program allows students to better prepare themselves for careers in any field, especially those related to science or technology. Students work with an advisor to create an individualized emphasis to best meet their needs.

Required Physics Core:		
PHYSICS 1100	First-Year Projects in Physics	1
PHYSICS 1701	Physics I for Science and Engineering	4
PHYSICS 1702	Physics II for Science and Engineering	4
PHYSICS 2300	Physics III: Theory and Simulation	3
PHYSICS 4100/5100	Modern Physics	4
PHYSICS 4110/5110	Modern Physics Laboratory	2
Required Mathematics Core:		
MATH 1420	Calculus I	4
MATH 1421	Calculus II	4
Electives:		
Physics:		7
3000-level and above		
No more than 2 hours of PHYSICS 3000 Undergraduate Research		
Natural Sciences or Other Disciplines		9
Elective courses must count toward a major in the department that offers the course.		
Mathematics courses must be higher level than MATH 1421.		
Total Hours		**42**

Data Science Emphasis

The Data Science Emphasis integrates significant course work in physics, statistics and business analytics with electives from other areas such as Geographic Information Systems and computer programming. The goal is for students to develop broad-based skills in the analysis of data and the extraction of gainful information about a variety of systems.

Required Physics Core		
PHYSICS 1100	First-Year Projects in Physics	1
PHYSICS 1701	Physics I for Science and Engineering	4
PHYSICS 1702	Physics II for Science and Engineering	4
PHYSICS 2300	Physics III: Theory and Simulation	3
PHYSICS 4100/5100	Modern Physics	4
PHYSICS 4110/5110	Modern Physics Laboratory	2
Required Mathematics Core		
MATH 1420	Calculus I	4
MATH 1421	Calculus II	4
Required Data Science Core		
STAT 1772	Introduction to Statistical Methods	3
STAT 4772/5772	Statistical Computing I	3
ECON 1011	Statistics for Business Analytics	3
ECON 2090	Decision Analytics	3
Required Data Science Project		
PHYSICS 3000	Undergraduate Research in Physics	1
or PHYSICS 3500	Internship in Applied Physics	
Electives		3-4
Elective requirements should be chosen from the following: (Other choices will need departmental approval)		
CS 1510	Introduction to Computing	
GEOG 2410	Geographic Information Systems I	
ACT SCI 3780/5780	Mathematics of Finance	
STAT 3752/5752	Introduction to Probability	
STAT 3771/5771	Applied Statistical Methods for Research	
Total Hours		**42-43**

Physical Chemistry Emphasis

The Physical Chemistry Emphasis is intended to facilitate deeper study of physics by chemistry or biochemistry majors. The study of more-advanced physics topics will enhance problem-solving skills and promote greater understanding of chemistry and biochemistry though connections with quantum mechanics, electricity & magnetism, and classical mechanics studied in physics.

Physics B.A.

Required Physics Core:

PHYSICS 1100	First-Year Projects in Physics	1
PHYSICS 1701	Physics I for Science and Engineering	4
PHYSICS 1702	Physics II for Science and Engineering	4
PHYSICS 2300	Physics III: Theory and Simulation	3
PHYSICS 4100/5100	Modern Physics	4

Required Chemistry Core:

CHEM 1110 & CHEM 1120	General Chemistry I and General Chemistry II	5-8
or CHEM 1130	General Chemistry I-II	
CHEM 4420/5420	Physical Chemistry I	3
CHEM 4430/5430	Physical Chemistry II	3

Required Mathematics Core:

MATH 1420	Calculus I	4
MATH 1421	Calculus II	4

Advanced Laboratory: **2**

Choose one of the following

PHYSICS 4110/5110	Modern Physics Laboratory
CHEM 4440/5440	Physical Chemistry Laboratory *

Applied Physics: **3-4**

PHYSICS 4750/5750	Physics of Modern Materials *
or PHYSICS 4500/5500	Biological Physics
or PHYSICS 4300/5300	Introduction to Electronics

Electives: **2-3**

3000-level Physics or above (no more than 1 hour of PHYSICS 3000 Undergraduate Research in Physics); or 3000-level Chemistry/Biochemistry or above (no more than 1 hour of CHEM 3600 Undergraduate Research in Chemistry)

Total Hours **42-47**

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* CHEM 4440/5440 has CHEM 2320 and CHEM 2330 and CHEM 4420/5420 and junior standing as prerequisites PHYSICS 4750/5750 has PHYSICS 1701 and PHYSICS 1702 and MATH 2422 and junior standing as prerequisites.

Computer Science and Data Science Emphasis

The Computer Science and Data Science Emphasis is suitable for students majoring in computer science who are seeking a deeper background in physics and data science. It may also function as a standalone major. It is especially appropriate for students who intend to pursue careers in software engineering related to data science or science and technology.

Physics Core

PHYSICS 1100	First-Year Projects in Physics	1
PHYSICS 1701	Physics I for Science and Engineering	4
or PHYSICS 1511	General Physics I	
PHYSICS 1702	Physics II for Science and Engineering	4

PHYSICS 2300	Physics III: Theory and Simulation	3
PHYSICS 3100	Introduction to Quantum Computing	3
PHYSICS 4100/5100	Modern Physics	4
PHYSICS 4160/5160	Data Visualization, Modeling and Simulation	3

Computer Science and Data Science

CS 1510	Introduction to Computing	4
CS 2150	Computing for Data Science	3-7
OR		
CS 1520 & CS 1800	Data Structures and Discrete Structures	
CS 3140/5140	Database Systems	3
STAT 4784/5784	Introduction to Machine Learning	3

Mathematics and Statistics

MATH 1420	Calculus I	4
MATH 1421	Calculus II	4
STAT 1772	Introduction to Statistical Methods	3

Total Hours **46-50**

Four-Year Plan

Physics: Custom, B.A.

This is a sample plan of study with a suggested sequencing of classes for the major. University electives may be applied to earn additional academic majors, minors, or certificates. Students should regularly meet with their academic advisor to plan their specific semester schedule to include UNIFI/General Education program and/or university elective hours required.

Course	Title	Hour
Freshman		
Fall		
MATH 1420	Calculus I (satisfies UNIFI: Quantitative Reasoning)	4
PHYSICS 1100	First-Year Projects in Physics	1
PHYSICS 1701	Physics I for Science and Engineering (satisfies UNIFI: Scientific Reasoning)	4
UNIFI: Written Communication		3
UNIFI: Human Expression		3
	Hours	**15**
Spring		
MATH 1421	Calculus II	4
PHYSICS 1702	Physics II for Science and Engineering	4
UNIFI: Oral Communication		3
UNIFI: Human Condition (Global)		3
	Hours	**14**
Sophomore		
Fall		
PHYSICS 2300	Physics III: Theory and Simulation	3
UNIFI: Human Condition (Domestic)		3
Physics Elective		3
University Electives		7
	Hours	**16**

Spring

PHYSICS 4100/5100	Modern Physics	4
PHYSICS 4110/5110	Modern Physics Laboratory	2
UNIFI: Responsibility		3
Natural Science or other Major Elective		3
University Elective		3
	Hours	**15**

Junior

Fall

UNIFI: Connect		3
Physics Elective		4
Natural Science or other Major Elective		3
University Elective		6
	Hours	**16**

Spring

UNIFI: Connect		3
University Electives		12
	Hours	**15**

Senior

Fall

UNIFI: Connect		3
Natural Science or other Major Elective		3
University Electives		9
	Hours	**15**

Spring

UNIFI: Connect		3
University Electives		11
	Hours	**14**
	Total Hours	**120**

Physics: Data Science, B.A.

This is a sample plan of study with a suggested sequencing of classes for the major. University electives may be applied to earn additional academic majors, minors, or certificates. Students should regularly meet with their academic advisor to plan their specific semester schedule to include UNIFI/General Education program and/or university elective hours required.

Course	Title	Hour
Freshman		
Fall		
MATH 1420	Calculus I (satisfies UNIFI: Quantitative Reasoning)	4
PHYSICS 1100	First-Year Projects in Physics	1
PHYSICS 1701	Physics I for Science and Engineering	4
UNIFI: Written Communication		3
UNIFI: Human Expression		3
	Hours	**15**
Spring		
MATH 1421	Calculus II	4
PHYSICS 1702	Physics II for Science and Engineering	4
UNIFI: Oral Communication		3
UNIFI: Human Condition (Global)		3
	Hours	**14**
Sophomore		
Fall		
PHYSICS 2300	Physics III: Theory and Simulation	3
STAT 1772	Introduction to Statistical Methods	3

UNIFI: Human Condition (Domestic)		3
University Electives		7
	Hours	**16**
Spring		
PHYSICS 4100/5100	Modern Physics	4
PHYSICS 4110/5110	Modern Physics Laboratory	2
ECON 1011	Statistics for Business Analytics	3
UNIFI: Responsibility		3
University Elective		3
	Hours	**15**
Junior		
Fall		
ECON 2090	Decision Analytics	3
STAT 4772/5772	Statistical Computing I	3
UNIFI: Connect		3
University Electives		6
	Hours	**15**
Spring		
UNIFI: Connect		3
Data Science Elective		3-4
University Electives		8
	Hours	**14-15**
Senior		
Fall		
PHYSICS 3000	Undergraduate Research in Physics (Data Science Project)	1
UNIFI: Connect		3
University Electives		12
	Hours	**16**
Spring		
UNIFI: Connect		3
University Electives		12
	Hours	**15**
	Total Hours	**120-121**

Physics: Physical Chemistry, B.A.

This is a sample plan of study with a suggested sequencing of classes for the major. University electives may be applied to earn additional academic majors, minors, or certificates. Students should regularly meet with their academic advisor to plan their specific semester schedule to include UNIFI/General Education program and/or university elective hours required.

Course	Title	Hour
Freshman		
Fall		
CHEM 1110	General Chemistry I	4
PHYSICS 1701	Physics I for Science and Engineering	4
MATH 1420	Calculus I	4
UNIFI/General Education or University Electives		3
	Hours	**15**
Spring		
CHEM 1120	General Chemistry II	4
PHYSICS 1702	Physics II for Science and Engineering	4
MATH 1421	Calculus II	4
UNIFI/General Education or University Electives		3
	Hours	**15**

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Course	Title	Hours
Sophomore		
Fall		
PHYSICS 1100	First-Year Projects in Physics	1
PHYSICS 2300	Physics III: Theory and Simulation	3
UNIFI/General Education or University Electives		12
Hours		**16**
Spring		
PHYSICS 4100/5100	Modern Physics	4
UNIFI/General Education or University Electives		12
Hours		**16**
Junior		
Fall		
CHEM 4420/5420	Physical Chemistry I	3
UNIFI/General Education or University Electives		13
Hours		**16**
Spring		
CHEM 4430/5430	Physical Chemistry II	3
CHEM 4440/5440	Physical Chemistry Laboratory (or PHYSICS 4110 Modern Physics Lab)	2
UNIFI/General Education or University Electives		9
Hours		**14**
Senior		
Fall		
PHYSICS 4750/5750	Physics of Modern Materials (or PHYSICS 4500 Biological Physics or PHYSICS 4300 Introduction to Electronics)	3
UNIFI/General Education or University Electives		11
Hours		**14**
Spring		
UNIFI/General Education or University Electives		11
Physics/Chemistry Elective		3
Hours		**14**
Total Hours		**120**

Physics: Computer Science and Data Science, B.A.

This is a sample plan of study with a suggested sequencing of classes for the major. University electives may be applied to earn additional academic majors, minors, or certificates. Students should regularly meet with their academic advisor to plan their specific semester schedule to include UNIFI/General Education program and/or university elective hours required.

Course	Title	Hour
Freshman		
Fall		
PHYSICS 1701	Physics I for Science and Engineering	4
PHYSICS 1100	First-Year Projects in Physics	1
MATH 1420	Calculus I	4
UNIFI: Written Communication		3
UNIFI: Human Condition (Domestic)		3
Hours		**15**
Spring		
PHYSICS 1702	Physics II for Science and Engineering	4
MATH 1421	Calculus II	4
UNIFI: Oral Communication		3
UNIFI: Human Condition (Global)		3
STAT 1772	Introduction to Statistical Methods	3
Hours		**17**
Sophomore		
Fall		
PHYSICS 2300	Physics III: Theory and Simulation	3
CS 1510	Introduction to Computing	4
UNIFI: Human Expression		3
University Electives		6
Hours		**16**
Spring		
PHYSICS 4100/5100	Modern Physics	4
PHYSICS 4110/5110	Modern Physics Laboratory	2
CS 2150	Computing for Data Science	3
UNIFI: Responsibility		3
University Elective		3
Hours		**15**
Junior		
Fall		
PHYSICS 3100	Introduction to Quantum Computing	3
CS 3140/5140	Database Systems	3
UNIFI: Connect		3
University Electives		6
Hours		**15**
Spring		
PHYSICS 4160/5160	Data Visualization, Modeling and Simulation	3
UNIFI: Connect		3
University Electives		9
Hours		**15**
Senior		
Fall		
STAT 4784/5784	Introduction to Machine Learning	3
UNIFI: Connect		3
University Electives		9
Hours		**15**
Spring		
University Electives		12
Hours		**12**
Total Hours		**120**

Learning Outcomes

Physics: Custom, B.A.

- Apply Techniques of Experimental Physics
- Understand Principles of Theoretical Physics
- Apply Techniques of Computational Physics

A student who has earned a bachelor's degree in physics from the University of Northern Iowa must demonstrate competence at the introductory (second-year) level in all three content areas (experimental, theoretical, and computational) through course-level outcomes aligned with each branch. A student with the Custom Emphasis must also acquire and demonstrate knowledge and understanding of physics beyond the introductory level.

Physics: Data Science, B.A.

- Apply Techniques of Experimental Physics
- Understand Principles of Theoretical Physics
- Apply Techniques of Computational Physics

A student who has earned a bachelor's degree in physics from the University of Northern Iowa must demonstrate competence at the introductory (second-year) level in all three content areas (experimental, theoretical, and computational) through course-level outcomes aligned with each branch. A student with the Data Science Emphasis must also meet learning outcomes of courses in statistics and data analytics taken outside of the Physics Department.

Physics: Physical Chemistry, B.A.

- Apply Techniques of Experimental Physics
- Understand Principles of Theoretical Physics
- Apply Techniques of Computational Physics

A student who has earned a bachelor's degree in physics from the University of Northern Iowa must demonstrate competence at the introductory level (second-year) in all three content areas (experimental, theoretical, and computational) through course-level outcomes aligned with each branch. A student with the Physical Chemistry Emphasis must also meet the learning outcomes of their chemistry courses.

Physics: Computer Science and Data Science, B.A.

- Apply Techniques of Experimental Physics
- Understand Principles of Theoretical Physics
- Apply Techniques of Computational Physics

A student who has earned a bachelor's degree in physics from the University of Northern Iowa must demonstrate competence at the introductory level (second-year) in all three content areas (experimental, theoretical, and computational) through course-level outcomes aligned with each branch. A student with the Computer Science and Data Science Emphasis must also meet the learning outcomes of the required courses in computer science and data science.

Related Programs

- Chemistry B.A. or B.S.
- Mathematics B.A.