Student Assessment Plan

Department Learning Goals:

Upon successful completion of the requirements for the physics major, students will be able to ...

1. Demonstrate an understanding of physical phenomena and the models that describe them.
2. Apply the analytical, numerical, and computational skills necessary to solve complex problems in physics.
3. Apply the technical skills necessary to design and complete laboratory projects in physics.
4. Present scientific information clearly, logically, and critically, both orally and in writing.
5. Apply the professional skills necessary to complete scientific work both independently and collaboratively.

Curriculum Mapping:

Course	DLG 1 (Science)	DLG 2 (Math)	DLG 3 (Technical)	DLG 4 (Presentation)	DLG 5 (Professional)
MATH 130		I			
MATH 140		I			
MATH 260		D			
PHYS 235	I	I	I	I	I
PHYS 245	I	I	I	I	I
PHYS 305	D	D		D	D
PHYS 315	D	D	D	M	D
PHYS 340	D	D	M	D	D
PHYS 420	D	M		M	M
PHYS 430	D	M		M	M
PHYS 470	D	M		M	M
PHYS 480	D	M		M	M
CAPSTONE Exam	M				

Plans for Gathering Information:

Department Learning Goal 1:	Demonstrate an understanding of physical phenomena and the models that describe them.
Direct Assessment:	Capstone Rubric (See Appendix A)
Indirect Assessment:	Exit Survey Question 6 (See Appendix F)
Assessment Years:	2020, 2025, 2030

Department Learning Goal 2:	Apply the analytical, numerical, and computational skills necessary to solve complex problems in physics.
Direct Assessment:	PHYS 4XX Rubric (See Appendix B)
Indirect Assessment:	Exit Survey Question 7 (See Appendix F)
Assessment Years:	2021, 2026, 2031

Department Learning Goal 3:	Apply the technical skills necessary to design and complete laboratory projects in physics.
Direct Assessment:	PHYS 340 Rubric (See Appendix C)
Indirect Assessment:	Exit Survey Question 8 (See Appendix F)
Assessment Years:	2022, 2027, 2032

Department Learning Goal 4:	Present scientific information clearly, logically, and critically, both orally and in writing.
Direct Assessment:	Communication Rubric (See Appendix D)
Indirect Assessment:	Exit Survey Question 9 (See Appendix F)
Assessment Years:	2023, 2028, 2033

Department Learning Goal 5:	Apply the professional skills necessary to complete scientific work both independently and collaboratively.
Direct Assessment:	Departmental Conversation, LG5 Rubric (See Appendix E)
Indirect Assessment:	Exit Survey Question 10 (See Appendix F)
Assessment Years:	2024, 2029, 2034

Subject	Introductory	Developing	Mastery (Capstone)
Mechanics	Students demonstrate familiarity with basic concepts of space, time, momentum, and energy. Students can apply conservation laws and basic Newtonian methods to solve problems in dynamics.	Students can apply Newtonian techniques and normal mode analysis to solve complex problems in oscillatory and wave motion. Students demonstrate understanding of the implications of special relativity on the nature of space, time, momentum, and energy.	Students can apply Hamiltonian, Lagrangian, and advanced Newtonian techniques to solve complex problems in dynamics.
Electricity & Magnetism	Students can apply conservation laws and basic Newtonian methods to solve problems in electrostatics and in magnetostatics. Students demonstrate familiarity with the connection between electricity and magnetism through Faraday's law and with elementary optics.	Students demonstrate understanding of wave mechanics and can show how electromagnetic waves are consequence of Maxwell's Equations.	Students can solve Maxwell's equations with multiple approaches to draw conclusions about the fields, potentials, and energies in physical systems.
Thermal & Statistical Physics	Students demonstrate familiarity with concept of entropy and use the Boltzmann distribution to make predictions about the energy of many-particle systems. Students can apply the ideal gas law to solve problems.	Students demonstrate understanding of how the black-body radiation spectrum is a consequence of the quantization of electromagnetic energy.	Students demonstrate understanding of how macroscopic thermodynamic laws follow from statistical descriptions of microscopic systems and can solve complex problems in thermal systems.
Quantum Mechanics	Students demonstrate a familiarity with the concept that energy is quantized in bound systems and that photons are emitted when electrons make transitions in atoms.	Students demonstrate an understanding of how the postulates of quantum mechanics follow from experimental evidence and can solve problems that address the wave-particle duality of matter and energy.	Students can use the Schrodinger equation to evolve initial quantum states in time and make probabilistic predictions for the outcomes of measurements on quantum systems.

Subject	Introductory	Developing	Mastery
Analytical	Students identify key variables in a simplified physical system, and draw a simple diagram showing necessary information. They can select the correct formula that is appropriate for the problem from a list of formulae. Students create and interpret basic graphs of physical data, including correct labelling of axes	Students can identify key variables in a system that is not simplified, and draw detailed diagrams necessary to analyze the problem. They produce tables and graphs with appropriate labels, units, and professional formatting.	Students are able to derive equations from first principles, identify key variables, and draw diagrams for complex physical systems such as those that include multiple masses, coupled masses, and solid objects.
Numerical	Students solve basic mathematics problems using introductory level skills from calculus, trigonometry, geometry, and algebra.	Students solve basic mathematics problems using introductory level skills from calculus, differential equations, vector calculus, linear algebra, and multivariable calculus.	Students solving problems using intermediate level mathematics skills from geometry, calculus, differential equations, vector calculus, linear algebra, and multivariable calculus. Students use numerical methods to solve equations that cannot be solved analytically.
Computational	Students can modify an existing computer code to reflect a simplified physical system.	Students can write a simple computer code to reflect a physical system.	Students can write a computer code to simulate a complex physical system.

Subject	Introductory	Developing	Mastery
Idea	Idea is not unique but is reasonably well-articulated.	Idea is not unique but is clearly articulated.	Idea is unique and clearly articulated.
Implementation	Device as implemented functions largely as expected with some unusual or not-well-understood behavior. Contains analog and digital components but one is not present at a significant level. The components may be simple implementations of things done in class.	Device is well-implemented and functions as expected. Contains analog and digital components but one may not be present at a particularly significant level. The analog or digital components may not significantly build on what was done in class.	Device is well-implemented and functions as expected. Contains significant analog and digital components that builds on what was done in class.
Circuit Diagram	The final circuit diagram is disorganized but largely employs standard notation and symbols. Components and values are largely labeled.	The final circuit diagram is reasonably clear and largely employs standard notation and symbols. Components and values are labeled.	The final circuit diagram is presented clearly using standard notation and symbols with components and values well-labeled.

Subject	Introductory	Developing	Mastery
Written Communication	The student writes up legible and complete solutions to problems.	The student satisfies introductory level criteria AND accurately describes physical phenomena in grammatically correct writing.	The student satisfies developing level criteria AND shows a writing style that is precise and concise. Their organization is clear and logical, and the student incorporates mathematics seamlessly into their prose.
Oral Communication	The student listen to peers and can accurately capture their group's motivations and thought process when reporting out solutions.	The student satisfies introductory level criteria AND uses evidence to that they have appropriate knowledge of the subject and its relevance.	The student satisfies developing level criteria and can deliver oral presentations that are well organized and use visual aids effectively. The student engages the audience and communicates/inspires enthusiasm for the topic.

Subject	Introductory	Developing	Mastery
Engagement	The student actively takes notes in class and project work.	The student satisfies the introductory criteria AND can both reproduce and explain work they have already done.	The student satisfies the developing criteria AND is intellectually engaged in tasks and projects. They reliably document their progress and identify what needs to be done.
Timeliness	The student is punctual and communicate in a timely manner.	The student satisfies the introductory criteria AND can successfully complete projects that span multiple weeks by following a scaffolded assignment with imposed deadlines. The final work is on time.	The student satisfies the developing criteria AND can successfully complete projects that span multiple weeks by incorporating internal deadlines. The final work is on-time.
Respectfulness	The student is respectful of others, including supervisors and peers. The student demonstrates the ability to listen to others. The student contributes appropriately.	The student satisfies the introductory criteria AND can incorporate constructive feedback into their work.	The student satisfies the developing criteria AND can offer constructive feedback to collaborators.
Independence	The student can follow directions in order to complete useful tasks.	The student asks of supervisors good questions to which the answers will help the student complete useful tasks.	The student can not only identify those questions to which the answers will help them complete useful task, but they also can identify resources available to answer those questions on their own.

Hendrix College Department of Physics
Exit Survey

1. In what year did you receive your degree from Hendrix College? *

2018

2. How much physics did you have? *

Select your answer

3. If you had it to do again, would you change the way you majored/minored?

Enter your answer

4. In the next year, which of the options below best describes your professional status? Please feel free to elaborate in the next question. *

- ○ Graduate Study in Physics
- ○ Graduate Study in another STEM (Science, Technology, Engineering, and Mathematics) field
- ○ Graduate Study in Non-STEM field
- ○ Dual-Degree Program in Engineering
- ○ Employment in STEM-related field
- ○ Employment in non-STEM field
- ○ Unemployed
- ○ Other (please explain)

5. Please feel free to elaborate on your professional status over the next year.

Enter your answer

6. Some of the areas typically covered in undergraduate physics programs are listed below. How do you feel about your preparation in each of these areas? (Part 1) *

	Very Well Prepared	Adequately Prepared	Exposed To	Not Prepared At All	N/A
Atomic Physics (Experimental foundations of Quantum Mechanics)	○	○	○	○	○
Biological Physics	○	○	○	○	○
Condensed Matter	○	○	○	○	○
Electricity and Magnetism	○	○	○	○	○
Electronics	○	○	○	○	○
General Relativity	○	○	○	○	○
Mathematical Methods	○	○	○	○	○
Mechanics	○	○	○	○	○
Nuclear Physics	○	○	○	○	○
Nonlinear Dynamics	○	○	○	○	○
Optics	○	○	○	○	○
Particle Physics	○	○	○	○	○
Plasma Physics	○	○	○	○	○
Quantum Mechanics	○	○	○	○	○
Special Relativity	○	○	○	○	○
Statistical Mechanics	○	○	○	○	○
Thermal Physics	○	○	○	○	○
Waves	○	○	○	○	○

7. Please rate how strongly you agree or disagree with the following statements about your physics education at Hendrix. *

	Strongly Agree	Somewhat Agree	Unsure	Somewhat Disagree	Strongly Disagree	N/A
I have a good understanding of how the different areas of physics connect to each other.	○	○	○	○	○	○
My study of physics has developed or improved my analytical thinking and problem-solving skills.	○	○	○	○	○	○
My study of physics has developed or improved my quantitative skills.	○	○	○	○	○	○
My study of physics has developed or improved my computational programming skills.	○	○	○	○	○	○

8. Please rate how strongly you agree or disagree with the following statements about your physics education at Hendrix. *

	Strongly Agree	Somewhat Agree	Unsure	Somewhat Disagree	Strongly Disagree	N/A
I was provided with adequate hands-on laboratory experiences.	○	○	○	○	○	○
My study of physics has developed or improved my technical skills necessary to complete laboratory projects.	○	○	○	○	○	○
My study of physics has developed or improved my technical skills necessary to design laboratory projects.	○	○	○	○	○	○

9. Please rate how strongly you agree or disagree with the following statements about your physics education at Hendrix. *

	Strongly Agree	Somewhat Agree	Unsure	Somewhat Disagree	Strongly Disagree	N/A
My physics education improved my ability to communicate ideas about science.	○	○	○	○	○	○
My physics education helped me develop and improve my ability to write clearly, logically, and critically.	○	○	○	○	○	○
My physics education helped me develop and improve my ability to orally communicate clearly, logically, and critically.	○	○	○	○	○	○

10. Please rate how strongly you agree or disagree with the following statements about your physics education at Hendrix. *

	Strongly Agree	Somewhat Agree	Unsure	Somewhat Disagree	Strongly Disagree	N/A
The department provided an atmosphere conducive to cooperative learning.	○	○	○	○	○	○
My participation in departmental activities helped me feel that I was a member of a community of scholars.	○	○	○	○	○	○
My physics education helped me develop the professional skills necessary to work independently.	○	○	○	○	○	○
My physics education helped me develop the professional skills necessary to work collaboratively.	○	○	○	○	○	○

11. In the summer of 2017, the Department of Physics wrote and adopted a statement on Community Standards for inclusion in syllabi in the 2017-2018 academic year and after. That statement reads:

    "The Hendrix College physics department values diversity and inclusion in all forms. We expect our faculty, staff, and students to be respectful of diversity in gender, sexuality, disability, age, socioeconomic status, ethnicity, race, religion, and culture. We strive to create a learning environment that is comfortable and effective for all. We should all be open to the views of others, appreciate the opportunity that we have to learn from each other in this community, and value each other's opinions and communicate in a respectful manner."

    In what ways is the department fostering a community that values diversity and inclusion, and in what ways does the department need to improve? *

    Enter your answer

12. Did you complete a research project? *

    - ○ Yes, I did research within the department
    - ○ Yes, I did research at another institution
    - ○ Yes, I did research projects both within and outside the department.
    - ○ No

13. If you did research, in what ways was that experience useful?

    Enter your answer

14. For the Senior Capstone Experience in Physics, which option did you choose? *

    - ◉ GRE Physics Exam administered by ETS
    - ○ Written Comprehensive Exam administered by the Physics Department
    - ○ I did not take the Physics Senior Capstone

15. What is your opinion of how the Senior Capstone is done in physics? What do you think would make an appropriate capstone for a physics education?

Enter your answer

16. What suggestions do you have for how we might improve our program?

Enter your answer

17. Are there things that we are doing that are especially effective? If so, should we focus more energy on these things? Are there things that we are doing that we should change or discontinue?

Enter your answer

18. Would you like for a member of the department to contact you to discuss this survey further? If, so, please add your name and contact information below.

    Either way, thank you for taking the time to help us out like this!

Enter your answer