Haufler Award For PHSX 211

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Physics Program Learning Goals

Students will be able to…

1. describe and apply physics concepts.

2. use mathematics and physics concepts to solve quantitative problems.

3. design and conduct experiments, analyze and interpret data.

4. communicate effectively to other physicists and to non-technical audiences.

5. apply ethical principles in professional activities such as citing of sources, collaborating with colleagues and considering the societal implications of their work.

6. acquire and evaluate information on new developments in the field of physics.

ABET Student Outcomes

1. an ability to apply knowledge of mathematics, science and engineering

2. an ability to design and conduct experiments, as well as to analyze and interpret data

3. an ability to design a system, component, or process to meet desired needs

4. an understanding of professional and ethical responsibility

5. an ability to communicate effectively

6. the broad education necessary to understand the impact of engineering solutions in a global and societal context

7. the recognition of a need for, and an ability to engage in life-long learning

8. a knowledge of contemporary issues

9. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Assessment Data

Department goal is to efficiently use the data we collect

- Find overlap between various goals and surveys
  - Already doing assessment for ABET

We decided to build upon the format used for ABET data collection and analysis

- Program assessment
- KU Core assessment

Opportunity for course improvement

- Student achievement
- Student retention

PHSX 211: General Physics I

- Large enrollment gateway course
  - Approximately 75% SoE students

- Introductory Course
  - Introduction to physics
  - Introduction to applied mathematics
    - Calculus-based

- Focus of department curriculum reform efforts
  - CLAS Course Transformation Initiative

Course Format

- Course taught in a hybrid format.
    - Essential for developing critical thinking skills.

- Class time will be devoted to active learning exercises
    - Conceptual quizzes
    - Discussion
    - Problem solving (in groups)
    - Demonstrations

- Undergraduate teaching assistants (UTAs) assist students in their group work
    - The UTAs also organize additional recitation sessions outside of class.
    - Students who do well in the course are then recruited to work as UTAs in subsequent semesters.

PHSX 211 Course Objectives

This course is the first semester of a sequence of introductory calculus-based physics courses that are designed primarily for students in the physical sciences and engineering. The main subjects covered this semester are classical mechanics and thermodynamics, which involve describing how and why things move. As such, this course has four principal objectives:

Develop an understanding of the principles and methods of physics
Department Learning Goal 1, Department Learning Goal 6, KU Core Goal 3

Develop your ability to apply mathematical principles and associated quantitative reasoning to solving problems
Department Learning Goal 2, KU Core Goal 1.2

***Practice your ability to think abstractly about mathematics*.**
Department Learning Goal 2

Develop and practice your capacity for critical thinking
Department Learning Goal 1, Department Learning Goal 2, KU Core Goal 1.1

Course Assessment

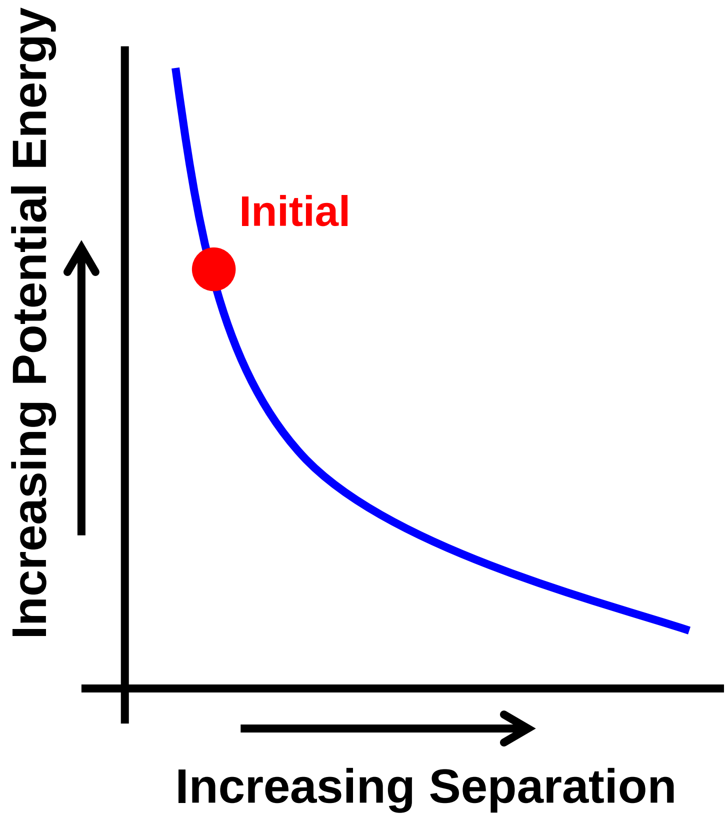
Student achievement of learning outcomes assessed through student performance on exam and quiz questions.

Example: KU Core Goal 1.1. Students must…

- analyze the information given in a problem.
- assess the validity of any assumptions required for the application of a particular concept, equation, or approach.
- correctly synthesize their mathematics knowledge from other courses into their problem solving.
- test the validity of their solution either by demonstrating that it makes physically realistic predictions under certain limits or by deriving it through an independent approach.

A system consists of two long parallel wires carrying electricity in opposite directions. The presence of this electricity in the two wires results in a potential energy being created for the system. This potential energy has a dependence on the separation distance between the two wires that can be described using the figure at right.

The two wires are initially held in place close together and then released. After they are released, the two wires:

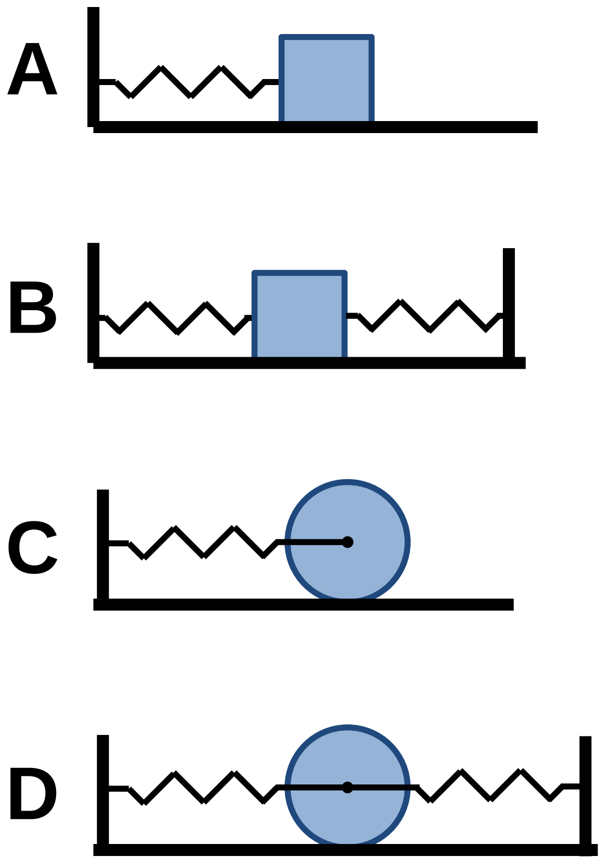


A. Move apart

B. Move together

C. Don’t move

Rank the magnitude of the angular frequency of the following harmonic oscillators. The object in C and D is a cylinder which rolls without slipping as it oscillates. All springs are identical and the mass of each oscillating object is the same.



A. $\omega_A > \omega_B > \omega_C > \omega_D$

B. $\omega_C > \omega_A = \omega_D > \omega_B$

C. $\omega_A = \omega_D > \omega_C > \omega_B$

D. $\omega_B > \omega_A = \omega_D > \omega_C$

E. $\omega_B > \omega_D > \omega_A > \omega_C$

Assessment Data

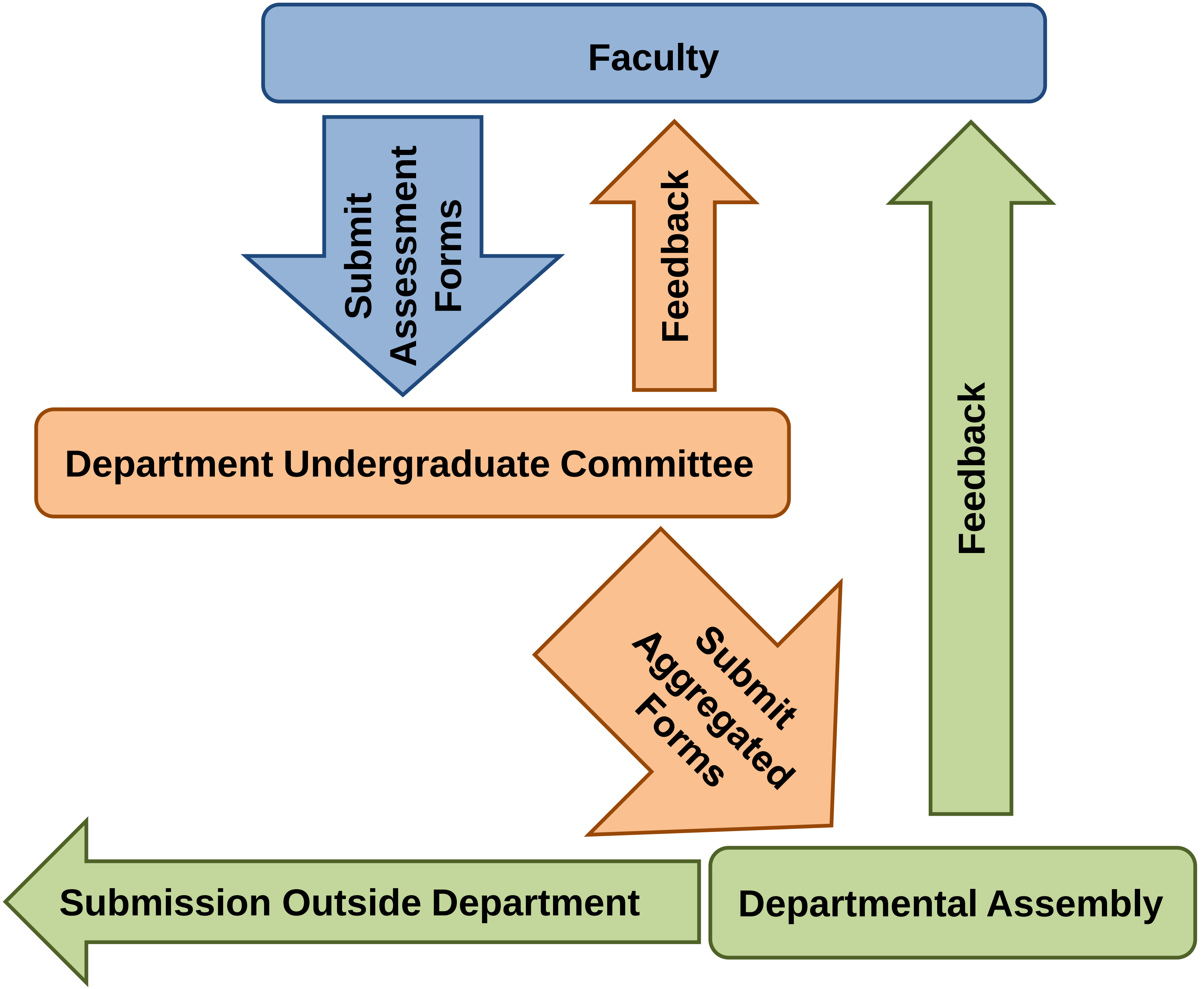
- Faculty use a minimum of 10 questions to assess achievement of KU Core learning outcomes.
    - A database of "*department approved/tested*" questions and records of past student results are kept on Blackboard.

- Student results tabulated and reported

Excellent > 89%	Very Good 80% to 89%	Good 70% to 79%	Satisfactory 60% to 69%	Unsatisfactory < 60%
27	47	59	18	4

- Form includes space for faculty discussion of results and suggestions for changes.

- We look forward to more detailed analysis once more data has been collected.
    - Are some questions more discriminating than others, *e.g.*


Faculty
Submit Assessment Forms
Feedback
Feedback
Department Undergraduate Committee
Submit Aggregated Forms
Submission Outside Department
Departmental Assembly

Using Assessment Data

KU Core Goal 1.1

- Incorporate more “rank-ordering” problems.
- Develop coordinated critical thinking curriculum for PHSX 211 and PHSX 212.

KU Core Goal 1.2

- Implement calculus early and often.
  - Revised standard order of material presentation.

KU Core Goal 3

- Incorporate more application examples of course material.

Good overall feedback loop for course improvement!

Making Things Easy for the Faculty

- Clearly defined goals/outcomes make the assessment process easier.
    - “Pre-packaged” material makes the assessment procedure straightforward for faculty.

- Having defined learning goals/outcomes encourages uniform presentation of material without sacrificing academic freedom.

- Having defined learning goals/outcomes enables a more uniform and coherent total curriculum for the program.

Acknowledgements

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CLAS Course Transformation Initiative