SCIENCE EDUCATION 201
Matter and Energy in Physical Systems

Course Overview
This is a student-centered, lab-based physics course intended primarily for students pursuing a career in K-8 teaching. The course has two major learning outcomes:

- **Physics content:** Students develop understanding of basic physics concepts of energy and force based on their own investigations. Students apply these concepts to explain real world phenomena.

- **Learning about learning:** Students develop awareness of how their own ideas change and develop, and reflect on specific ways the curriculum and instruction facilitates these changes.

What to expect during class
This is a lab-based course in which students alternate between working through guided activities in small groups and participating in full-class discussions. During small group work, you will make predictions, conduct experiments, complete exercises, and work with computer simulations. You and your partners will be collaboratively making sense of the ideas and formulating explanations. Then, during the full-class discussions, groups will share their ideas and results, allowing you to check, verify, and perhaps modify the ideas from your small group work. Learning is thus student directed, and achieved through collaboration and consensus. The course has little to no lecturing.

Instructors in the course will act as “learning coaches,” providing guidance, and facilitating your work. Some specific roles include: reflecting student ideas back to the class for further discussion, asking questions to draw out and clarify student ideas, summarizing ideas that have emerged in class discussion, and providing feedback on students’ work. The instructors will not in general be a source of answers - but instead will try to provide feedback on student ideas and guide next steps in learning.

The curriculum is designed for you to take charge of your own learning. I hope that you, as a learner, are excited about this approach, but I recognize that it may also be scary and/or frustrating at first. I hope you will find that many of the learning and teaching strategies employed in this course are valuable and appropriate for you to use when you begin your teaching career.
missed/late work
Late work is not accepted, except in the case of an excused absence from class (see Course policies).

grade breakdown
- 5% Surveys
- 15% In-class participation
- 10% Lab notebooks
- 15% Homework
- 20% Quizzes
- 15% Learning Commentary Paper
- 20% Final exam

percentages
A letter grade will be assigned according to the following scale:
- 93% A
- 90% A-
- 87% B+
- 83% B
- 80% B-
- 77% C+
- 73% C
- 70% C-
- 67% D+
- 63% D
- 60% D-
- < 60% F

Course policies
Attendance. Due to the collaborative nature of this class, it is important to attend all class meetings and arrive on time. Your learning depends on being here and participating. In addition, your partners are depending on you. A missed class cannot easily be made up by simply getting notes from another student.

For an absence to be considered excused, you must have a valid reason and contact an instructor prior to class. Valid reasons include: illness, family or personal emergency, or a school related trip (for example, if you are on a Viking sports team that is traveling to a match). Each unexcused absence will drop your course grade by 3%. In addition, a pattern of repeated late arrivals or leaving class early will negatively impact your grade, with a loss of up to 10% of the points for the class. More than three total absences (either excused or unexcused) will prevent a student from receiving credit for the course.

Cell phones. Please keep cell phones silenced and put away during class. Repeated cell phone use during class will result in deduction of course credit.

Internet usage. Homework may require access to the Internet. The instructor will use email and Canvas to communicate; you are expected to check your WWU e-mail account and the Canvas site daily.

Course work
Surveys (5%). You will be asked to complete surveys at the beginning and again at the end of the course. There are 4 in total, 2 the first week of classes and 2 the last week of classes. These will not be graded on the basis of correct or incorrect responses. You will receive credit for completing them. The purpose of the surveys is to evaluate the effectiveness of the course materials and its teaching approaches. See Canvas for the survey links.

In-class participation (15%). In this course, students generate the physics knowledge and understanding through a process of inquiry. Active engagement is thus essential, and includes asking questions, responding to the questions of other students, and offering your own ideas. Engagement is critical both during small group work, in which you will conduct experiments and develop explanations, as well as in the full-class summarizing discussions, which occur at the end of each activity. Credit for in-class participation will involve setting participation goals and self-assessment. More information will be discussed in class the first week and posted on Canvas.

Homework (15%). Homework will be assigned usually after each activity, and may include online and written portions. HW will help reinforce ideas developed in class, provide practice applying the key ideas to new situations, and offer opportunities for feedback on your thinking. Grading will involve a simple rubric, with an opportunity for you to revise and resubmit the HW if you did not get full credit. The goal is to remove stress over grades, keeping the focus of the HW on supporting your learning.
Tentative Schedule

Week at a Glance

- An updated day-by-day schedule is available on Canvas.

**Weeks 1 | Jan 7 – Jan 11**
- Unit EM: Energy-based model for interactions
- Jan 11 | Surveys (link on Canvas)

**Week 2 | Jan 14 – Jan 18**
- Unit EM: Energy-based model for interactions

**Week 3 | Jan 21 – Jan 25**
- No class Jan 21
- Unit EM: Energy-based model for interactions
- Jan 25 | Quiz 1

**Week 4 | Jan 28 – Feb 1**
- Unit EM: Energy-based model for interactions
- Feb 1 | Lab Notebook

**Week 5 | Feb 4 – Feb 8**
- Unit PEF: Potential energy and fields

**Week 6 | Feb 11 – Feb 15**
- No class Jan 21
- Unit PEF: Potential energy and fields
- Feb 15 | Quiz 2

**Week 7 | Feb 18 – Feb 22**
- Unit FM: Force-based mode for interactions

**Week 8 | Feb 25 – Mar 1**
- Unit FM: Force-based mode for interactions
- Mar 1 | Draft of Learning Commentary Paper

**Week 9 | Mar 4 – Mar 8**
- Unit FM: Force-based mode for interactions
- Mar 8 | Lab Notebook
- Mar 8 | Quiz 3

**Week 10 | Mar 11 – Mar 15**
- Unit CF: Combination of forces
- Mar 15 | Learning Commentary Paper
- Mar 16 | Survey (link on Canvas)

**Final exam | Mar 18 | 10:30-12:30 pm**

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**Student Lab Notebooks (10%).** The course materials are not a traditional textbook. Instead, they are more like a workbook, and contain sequences of questions and experiments. As you work through these in your small groups, you will record your ideas, predictions, observations, etc. in a lab notebook. You will add more to this notebook during the full-class discussions - to describe how you are modifying or adding to your thinking based on the ideas of other students in the class. Your lab notebook is thus an ongoing record of your thinking and ideas. The sequences of questions and experiments in the NextGen PET packets, together with your lab notebook, form the text for the course and will be the primary written resource for your learning. A high-quality lab notebook will contain clear statements of the consensus scientific ideas the class has developed, as well as the steps that you personally took to come to an understanding of these ideas. You will draw on your lab notebook when completing homework, studying for exams, and writing a paper (more on that below).

Your lab notebook can be an inexpensive spiral bound notebook, a comp book, or a three-ring binder. Whatever you adopt, make sure that it is portable and easy to bring with you to class, and keeps all your notes and ideas together in one place.

**NOTE:** If you use a 3-ring binder, then you can write some of your ideas and answers directly on the PET pages themselves, and add in sheets of your own paper as needed to record additional ideas that emerge during full class discussion. Keeping a lab notebook to record your ideas is a required part of the course, and is worth course credit. Your lab notebook will be collected and graded twice during the quarter. (Details TBA.)

**Quizzes (20%).** There will be a total of 3 quizzes equally spaced during the quarter (i.e., weeks 3, 6, and 10). Each quiz will be approximately 45 minutes and consist of three questions. Two questions will be on the most recent material covered (since the last quiz), and one question will be a review question.

**Learning Commentary Paper (5% Draft + 10% Revision).** After we complete Units EM and PEF on energy and interactions, you will be assigned a written paper in which you retrace your learning of a key physics concept from those units. The learning commentary will be 4 - 6 pages (typed double spaced, with 1” margins and 12 pt font). A rough draft is required, so that you can have feedback and opportunities to revise. Full credit will be given on the rough draft for completion. Details of the paper will be given approximately two weeks before the rough draft is due. Then, you will have approximately two weeks to revise your paper for final submission.

**Final Exam (20%).** A comprehensive final exam will be given to assess understanding of all major concepts covered in the course. The final exam will occur during the scheduled time for our class during final exams week on Monday, March 18 10:30-12:30 pm.
Academic Integrity Policy

You are expected to be familiar with, and to abide by, Western’s Academic Honesty Policy and Procedure, and Student Rights and Responsibilities Code. These are published in the Western catalog in Appendix C, University Academic Policies. Refer to Plagiarism Policies & Guidelines (libguides.wwu.edu/plagiarism).

Reasonable accommodation

Reasonable accommodation for persons with documented disabilities should be established through disAbility Resources for Students: 650-3083; drs@wwu.edu; http://www.wwu.edu/depts/drs/

Title IX and Sex Discrimination

Title IX makes it clear that violence and harassment based on sex which includes sexual harassment, gender-based harassment, and sexual violence (sexual assault, domestic violence, dating violence, stalking) is prohibited. Under Title IX, rape and sexual assault are forms of illegal sex discrimination.

Survivors of sexual violence have the right to file a discrimination complaint or seek advice and assistance from the Equal Opportunity Office (EOO) in Old Main 345 (360) 650-3307; University Police (360) 650-3911 (emergency) or 650-3555 (report); Bellingham Police, 911 (emergency) or (360) 778-8800 (report).

This syllabus is subject to change. Changes, if any, will be announced in class. Students will be held responsible for all changes.