



SCIENCE EDUCATION 201: MATTER and ENERGY IN PHYSICAL SYSTEMS

Fall 2022

Class meetings: MWF 10:00 - 11:50 AM (face-to face in SL 240)
Instructor: Dr. Norda Stephenson (she/her), CB 245 stephen2@wwu.edu
Teaching Assistant: Jack Brady, SL 220 bradyj3@wwu.edu
Office/student hours: MW 1-2 PM (CB 245) or by appointment

COURSE OVERVIEW and LEARNING GOALS

This is a student-centered, discussion-oriented physics course intended for students pursuing a career in K-8 teaching. The course has the following major learning goals:

- 1) **Physics content.** Students develop deep understanding of basic physics concepts and reasoning in order to explain everyday phenomena. Topics include those that are covered in the elementary school science curriculum.
- 2) **Learning about learning.** Students will develop awareness of how their own ideas change and develop, and how the structure of the learning environment and curriculum facilitates these changes.
- 3) **Scientific practices.** Students will develop their knowledge of matter and science using scientific practices defined in the *Framework for K-12 Science Education*, including analyzing and interpreting data, engaging in argument from evidence, and developing and using scientific models.
- 4) **Use quantitative and scientific reasoning to frame and solve problems.** As an LSCI GUR, this course also fulfills this GUR competency.
- 5) **Diversity, Equity & Inclusion in STEM fields.** Students will develop awareness of structural and cultural issues that limit representation in STEM by women and certain racial and ethnic groups. Students will learn how limited representation in STEM limits the inherent equity and advancement of STEM and society, and will explore its implications for K-8 STEM instruction.

YOU WILL NEED:

A SCED 201 course pack (purchased at the bookstore). This packet contains modules from the Physics and Everyday Thinking (PET) curriculum, specifically developed for future teachers.

COURSE STRUCTURE

WHAT TO EXPECT DURING CLASS MEETINGS

SCED 201 is a student-centered, lab-based physics course intended primarily for students interested in a career in K-8 teaching, but is open to all students. The course is focused on the foundational concepts of energy and force. We will develop and apply an energy-based model and a force-based model for motion and interactions for real-world situations and phenomena. There will be little traditional lecturing in this course. Instead, students generate knowledge through their own work and discussion. The instructor will serve as facilitator rather than the source of knowledge and answers. Thus, learning is student-directed and achieved through collaboration and consensus.

CLASSROOM CLIMATE

We will establish and maintain a classroom climate that is inclusive and respectful of all students. Learning includes being able to voice and hear a variety of perspectives, and classroom discussion is essential to building your knowledge and understanding. We will work hard to create an environment where it is safe to share ideas, even if they may be different from other students' ideas, or if we are afraid they might be wrong. We will also commit to honoring each person's identity by learning and using preferred names and personal pronouns.

ATTENDANCE AND PARTICIPATION POLICIES

Because of the highly collaborative nature of this class, attendance is required. It is important to attend all class meetings and arrive on time. Your learning, as well as that of your partners, depend on being present and participating. As such, *late arrivals* are unacceptable and will negatively impact your grade. Three late arrivals (5+ minutes each) will be marked as an unexcused absence. If you miss a class, you must make up the work prior to the next class. You may have up to 3 excused absences, with no penalty to your grade. You must contact the instructor, before class, to get an absence excused. Each absence thereafter, or unexcused absence will drop your course grade by 3%.

Excusable absences include:

- If you are ill and not well enough to participate in class (please don't ask for a note from the health center; your word is enough);
- A planned trip away from campus that is associated with a school organization.

Reasons that will not be excused include:

- A family vacation for which your plane ticket was already purchased;
- Going to the office hours of the instructor for one of your other classes; etc.

COMMUNICATION

Generally, I use Canvas announcements to communicate with the whole class and email to communicate with individual students. You are expected to check your WWU email account and Canvas daily. If you need to make contact with me, please email stephen2@wwu.edu. (Please put "SCED 201" in the subject line. I try to respond within 24 hours on weekdays; response time on weekends is likely to be longer.)

ASSIGNMENTS and GRADING POLICIES

Your final grade in SCED 201 will be determined by your scores and completed work. For grades awarded for completion, your work must demonstrate a good faith effort. Work that violates this good faith effort or which is not turned in on time will not be considered complete and will affect your grade. For work not based on completion, grades are awarded based on correctness. Each assignment type is worth a percentage of your base grade, as shown below. You should strive to complete all the assignments, because they are the way you will learn the material. If circumstances arise where you will need added flexibility (e.g., long-term illness), please email me and we can work out a plan. Some assignments will be administered by/turned in to Canvas.

Participation (15%)

In this course, students generate physics knowledge and understanding through a process of collaborative discovery. Your participation score will be based on active course participation in small and large group discussions, as well as maintaining an up-to-date workbook. Active participation includes asking questions, responding to your classmates' questions, offering ideas, either in class or on discussion boards, among others.

Surveys (5%)

One or more surveys may be administered at the start, middle, and end of the quarter. They are not intended to evaluate individual performance, but rather to help evaluate the impacts of the course as a whole. You will also be asked to complete self and peers assessment evaluations related to course participation.

Discussion Activities and Review Assignments (15%)

Discussion activities will be done using discussion boards on Canvas. Discussion activities may involve readings, watching videos, listening to podcasts, among others, and then responding to question prompts related to these activities. The specifics of each discussion activity will be provided later.

Review Assignments are provided after completion of most (class) activities. These reinforce ideas developed in the activities, provide practice applying the key ideas to new situations, and offer opportunities for feedback on your thinking.

Responses/posts for review assignment and discussion activities are expected to reflect a good faith effort. Violation of this will result in assignments or activities being considered incomplete.

Extension Activities (15%)

Extension activities are online multiple-choice activities that check understanding from class and introduce some new ideas. These will be administered through Canvas, and are assigned after we complete most activities. You will have an unlimited number of opportunities to take the Extension activities, within the timeline.

Commentaries/Explanations/Reflections (10%)

This course will provide opportunities to engage in reflection about various aspects of the course and course-related matters, and to share that reflection as a written document, or in other forms, which we can negotiate. You will also have opportunities to engage in additional scientific explanation of phenomena and in writing commentaries. There are various types of commentaries to choose from. Details will be provided via Canvas. You will be expected to engage in at least 3 of these activities over the life of the course.

Midterms (and Revisions) (25%)

There will be two midterms. You may refer to your notes and other materials from class as well as relevant resources online for midterms. After your midterm is returned, you will make revisions based on the feedback you receive.

Final exam (15%)

The final will be according to the following dates. (Details of the final exam and any changes to these dates will be discussed in class.)

- Tuesday, Dec 06: 10:30 - 12:30 (SL 240N)

GRADING SCALE

Your course grade will then be determined using the following grading scale:

	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
%	93+	90	87	83	80	77	73	70	67	63	60	59-

SCED 201 TENTATIVE SCHEDULE FALL 2022

Dates	Units/Topics	Guiding questions
Week 1 Sep 21-23	<ul style="list-style-type: none"> • Course overview • Course norms • Mystery Tube Activity 	<ul style="list-style-type: none"> • What is the structure of this course? • How do I succeed in this course? • How can we create a collaborative and productive classroom environment? • What is scientific modeling and why is it important?
Week 2 Sep 26-30	<ul style="list-style-type: none"> • NGSS Standards • EM-A1: Interactions and Motion • EM-A2: Motion and Energy 	<ul style="list-style-type: none"> • What is important to teach about science in elementary and middle school? Why? • How is an object's motion affected by an interaction? • How can we represent motion graphically? • What is needed (if anything) to change the kinetic energy of an object? • What is evidence that energy is changing? • How can we represent energy changes and transfers?
Week 3 Oct 03-07	<ul style="list-style-type: none"> • EM-A2: Motion and Energy • EM-A3: Slowing and Stopping • Subjectivity in Science 	<ul style="list-style-type: none"> • Why do moving objects tend to slow down and stop? Where does the energy go? • What happens to the rate of change of speed of moving objects as the amount of friction changes? • How can we describe friction interactions in terms of energy? • How can we describe more than one interaction that combine to produce multiple changes in energy for multiple objects in a system? • What is the nature of physics?
Week 4 Oct 10-14	<ul style="list-style-type: none"> • PEF-A1: Elastic objects and energy • PEF-A3: Magnetic and Static Electric interactions and energy • PEF-A4: Gravitational interactions and energy 	<ul style="list-style-type: none"> • What energy changes take place in elastic objects when they are involved in contact push/pull interactions? • How can we describe magnetic and static electric interactions in terms of energy? • What energy changes take place when an object falls? • How can we describe gravitational interactions in terms of energy?
Week 5 Oct 17-21	<ul style="list-style-type: none"> • Review of energy-based models • Underrepresentation in STEM • EM-A4: Warming and Cooling • Take home midterm #1 due Fri, Oct 21 	<ul style="list-style-type: none"> • What is common among different types of potential energy? • How can we describe interactions in terms of energy transfers and transformations? • Why are certain groups underrepresented in physics and other STEM disciplines? Why does representation matter? • What other interactions can change the temperature of objects? • How do we describe these interactions?

Dates	Units/Topics	Guiding questions
Week 6 Oct 24-28	<ul style="list-style-type: none"> • EM-A5: Electric circuit interactions • EM-A6: More on keeping track of energy • Energy as a Cross-Cutting Concept/ Energy Theater 	<ul style="list-style-type: none"> • How can we trace the flow of energy through a system of interacting objects (including the surroundings)? • How can we keep track of amounts of energy as it flows through a system of interacting objects (including the surroundings)? • How does energy help explain things in different science disciplines? • Why is energy important to teach?
Week 7 Oct 31- Nov 04	<ul style="list-style-type: none"> • Meritocracy • FM-A1: Interactions and Force • FM-A2: Motion with a continuous force 	<ul style="list-style-type: none"> • How do people become who they are? • When does the force of a quick push stop acting on an object? • When an object is moving, does this mean there must be a force pushing it in the direction of its motion? • How does an object move when a force of constant strength continuously pushes it forward?
Week 8 Nov 07- 11	<ul style="list-style-type: none"> • FM-A3: Pushes and slowing down • FM-A4: Forces and friction No class 11/11 – Veterans’ Day 	<ul style="list-style-type: none"> • What effect does a ‘backward’ push have on the motion of an object? • What happens if a continuous ‘backward’ push is applied to a moving object? • Is friction a force? If so, in what direction does it act? • How does friction work?
Week 9 Nov 14- 18	<ul style="list-style-type: none"> • FM-A5: Changing force strength and mass • FM-A6: Falling objects • Review force model • Take home midterm #2 due Mon, Nov 14 	<ul style="list-style-type: none"> • When a single force acts on an object, how is the object’s motion affected by 1) the strength of that force and 2) the object’s mass? • How does the mass of an object affect how it falls? • How do we describe gravitational interactions in our force model? • What do we know so far about how to model interactions with forces? • What are the affordances and limitations of energy and force diagrams?
Week 10 Nov 21- 25	<ul style="list-style-type: none"> • CF-A1: Combinations of forces No class 11/23 & 11/25 	<ul style="list-style-type: none"> • How do objects behave when more than one force acts on them?
Week 11 Nov 28- Dec 02	<ul style="list-style-type: none"> • CF-A2: Motion with Balanced Forces • Review and wrap up quarter 	<ul style="list-style-type: none"> • What is an object’s motion like when a balanced combination of forces acts on it? • How can we put our ideas about forces and energy together to explain different phenomena?
Dec 05-09	FINALS WEEK	

UNIVERSITY RESOURCES and POLICIES

I want each of you to thrive at WWU, and in this class. I encourage you to check out and utilize the following list of resources. Check out this [Overview of Student Services](#) for even more.

- [WWU Counseling Center](#): Asking for help is OK! Please stop by, virtually or in-person, if you are feeling anxious, depressed, overwhelmed, or just need to talk with someone.
- [Student Health Center](#): In case of a medical concern or question
- [Office of Student Life](#): In case of a family or personal emergency
- [University Police](#): In case of a health and safety concern
- [Resources for Racial Justice](#): self-care, learning, and Black-led LGBTQ+ organization

Reasonable Accommodation. Reasonable accommodation for persons with documented disabilities should be established within the first week of class and arranged through the [Disability Access Center](#): telephone 360-650-3083; email drs@wwu.edu; and on the web at [disability.wwu.edu](#). Review their [Documentation Guidelines](#) for the procedure for providing reasonable accommodations for students with disabilities. See also the [Accessibility Map](#).

Religious Accommodation. Western provides reasonable accommodation for students to take holidays for reasons of faith or conscience or for organized activities conducted under the auspices of a religious denomination, church, or religious organization. Students seeking such accommodation must provide written notice to their faculty within the first two weeks of the course, citing the specific dates for which they will be absent. "Reasonable accommodation" means that faculty will coordinate with the student on scheduling examinations or other activities necessary for completion of the course or program and includes rescheduling examinations or activities or offering different times for examinations or activities. Additional information about this accommodation can be found in [SB 5166: Providing religious accommodations for postsecondary students](#).

Academic Integrity

Academic Honesty: All Western Washington University students have an obligation to fulfill their responsibilities as members of an academic community. Academic integrity is demanded; moreover, academic dishonesty at Western is a serious infraction dealt with severely. No student shall claim as his or her own the achievements, work, or arguments of others, nor shall he or she be a party to such claims. It is the instructor's responsibility to confront a student and to take appropriate action if such academic dishonesty has occurred. See [Appendix D: Academic Honesty Policy & Procedure](#) of the catalog for examples, procedures, and methods of appeal and [Ensuring Academic Honesty](#) for appeal rules and timeline.

Plagiarism: Plagiarism is presenting as one's own—in whole or in part—the argument, language, creations, conclusions, or scientific data of another without explicit acknowledgement. See the Library's [Plagiarism Policies & Guidelines](#) for examples and citation guides. See [Appendix D: Academic Honesty Policy & Procedure](#) of the catalog for examples, procedures, and methods of appeal and [Ensuring Academic Honesty](#) for appeal rules and timeline.

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