Marshall University

College of Science

Department of Physics

PS 122
Physical Science for Teachers: Physics
Spring 2018

Instructor:	Dr. André Wehner, Science 255, wehnera@marshall.edu, 304.696.2755 Office Hours: TTh 11:00-12:30, 4-6, W 6:30-7:30, or by appointment.
Class:	Section 1: MW 4-5:50; Section 2: TTh 6:30-8:20, Science 179.
Text:	Mastering Physics online course management system (Course ID: **PS122S18**)

Catalog Description

PS 122 is part of a 3 course sequence of Physical Science for K-9 Education majors. Includes 2-hr, 1 credit lab.

Course Description

PS 122 is a one-semester introduction to physics, particularly focused on content related to the Next Generation Science Standards (NGSS). The course is designed to show ways that physics can be related to mathematics topics and language arts projects in the classroom, and to the engineering design practices that are included in these new standards. It will model the type of inquiry-based, interactive learning environment expected of teachers by the NGSS. Lectures will be brief and interspersed with lab activities and investigations designed to foster higher-order learning and enhance critical thinking skills.

Homework will be assigned through the online course system *MasteringPhysics* (MP) (www.masteringphysics.com). You will need an access code for MP, which you can get at the

bookstore or by itself online (it includes an etext of our textbook). This section's course ID is **PS122S18** and will be required to register for MP. You will not need the textbook itself (*College Physics*, by Etkina, Gentile, and Van Heuvelen); however, it is on reserve at the library,

At least half the class will be devoted to hands-on, laboratory-style investigations; design or testing problems; and lecture tutorials. Many of these will be "open-ended" problems. The exact design and procedure of the investigation will be up to you. This is in keeping with both the letter and spirit of the NGSS, so you will have a chance in this course to practice what you will teach. All of your experimental work on the investigations will be kept in your science journal, as well as your conclusions on the results.

Three exams, each covering about the same amount of material, will be conducted throughout the semester. Material from the investigations will be included on the exams. The final exam will be cumulative.

Grading

Your grade will be determined as follows:

3 exams @ 15% each = 45%
Final 20%
Online Homework 20%
Investigations and journal 15%

No extra credit assignments will be given and the lowest score will not be dropped.

The grading scale will be as follows:

A: ≥ 90% B: ≥ 80% C: ≥ 70% D: ≥ 60%

Expectations

I expect you to be on time, prepared for class and to actively participate in the class discussion every day – being prepared means at the very least doing your homework, reading the sections, and looking over notes from previous classes.

Attendance will be recorded, but will not be counted explicitly in the grade. **Four unexcused absences will result in a lowering of the grade. If you miss more than ten classes (excused and unexcused), you will receive a failing grade.**

If you have to miss a test for a valid reason (proof required!), you will be allowed to make it up. If you know in advance you will have to miss a test, you should make arrangements to take it early.

By enrolling in this course, you agree to the University Policies listed below. The full text of each policy is at http://www.marshall.edu/academic-affairs/policies .

Academic Dishonesty/ Excused Absence Policy / Computing Services Acceptable Use/ Dead Week/ Inclement Weather/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities/ Affirmative Action/ Sexual Harassment

The expectation at MU is that the principles of truth and honesty will be rigorously followed in all academic endeavors. This assumes that all work will be done by the person who purports to do the work without unauthorized aids. In addition, when making use of language and some idea not his or her own, whether quoting them directly or paraphrasing them into his or her own words, the student must attribute the source of the material in some standard form, such as naming the source in the text or offering a footnote. University policies are described in detail at: http://www.marshall.edu/academic-affairs/?page_id=802.

Marshall University is committed to equal opportunity in education for all students, including those with physical, learning and psychological disabilities. University policy states that it is the responsibility of students with disabilities to contact the Office of Disabled Student Services (DSS) in Prichard Hall 117, phone 304 696-2271 to provide documentation of their disability. Following this, the DSS Coordinator will send a letter to each of the student's instructors outlining the academic accommodation he/she will need to ensure equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit http://www.marshall.edu/disabled or contact Disabled Student Services Office at Prichard Hall 11, phone 304-696-2271.

Schedule (tentative)

Week	Day	Chapters covered
1	1/9	Introduction, units, Pre-test
	1/11	1: Kinematics
2	1/16	1
	1/18	2+3: Newtonian Mechanics
3	1/23	2+3
	1/25	2+3
4	1/30	4: Circular Motion
	2/1	5: Impulse and Momentum
5	2/6	**Test 1**
	2/8	6: Work and Energy
6	2/13	6
	2/15	7: Extended Bodies
7	2/20	10+11: Fluids
	2/22	10+11
8	2/27	12: Thermodynamics
	3/1	19: Vibrations
9	3/6	20: Waves
	3/8	20
10	3/13	**Test 2**
	3/15	14+15: Electrostatics
11	3/27	14+15
	3/29	14+15
12	4/3	16: Circuits
	4/5	17: Magnetism
13	4/10	18: Induction
	4/12	24: Electromagnetic Waves
14	4/17	**Test 3**
	4/19	21-23: Optics
15	4/24	21-23
	4/26	21-23, Post-test
	5/1	6:30: Final

Disclaimer: The above schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning.

Learning Outcomes:

• Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
• Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a force.
• Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
• Apply Newton's Third Law to design a solution to a problem involving the motion of two objects.
• Support an argument that the gravitational force exerted by Earth is directed down.
• Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
• Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object
• Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
• Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
• Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
• Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
• Define a simple design problem that can be solved by applying scientific ideas about magnets.
• Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
• Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
• Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
• Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
• Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
• Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.
• Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
• Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
• Generate and compare multiple solutions that use patterns to transfer information.
• Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
• Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
• Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
• Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
• Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
• Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.