PHYS 170 Physics 1 with Lab — 4 credits

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Prerequisites: College Algebra and HS physics

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Contact Information: Faculty may be contacted through the Canvas messaging system

Additional Information: www.portagelearning.edu[1*]

Course meeting times: PHYS 170 is offered continuously

Course Description: This course is an algebra-based introductory college-level physics course. It begins with a section of prerequisite math skills and how they apply to real world measurements and calculations, with special attention given to scientific notation, significant figures, rounding, accuracy, and precision. The course then explores Newtonian mechanics starting with linear motion, then rotational motion, and finally oscillatory motion. The course ends with a section on fluid statics.

Course Outcomes: Upon successful completion of the coursework, students should be able to:

- Calculate measured values to the correct number of significant figures (Module 1)
- Solve one and two dimensional kinematics problems (Module 2)
- Draw free-body diagrams and successfully analyze systems of equilibrium using Newton's Three Laws of Motion (Module 3)
- Explain and apply the Conservation of Energy to solve work, energy, and power relationships (Module 4)
- Analyze the mechanics of physical interactions through an understanding of the conservation of momentum and the impulse momentum theorem. (Module 5)
- Explain torque, conditions for equilibrium, and mechanical advantage and the purpose of any simple machine (Module 6)

[1*] Portage Learning college courses are offered by Geneva College, which is accredited by the Middle States Commission on Higher Education and Bushnell University, which is accredited by Northwest Commission on Colleges and Universities. The Faculty Senate of both institutions have vetted and approved the courses as part of their curriculum.

- Solve rotational kinematics problems and, using a table of rotational inertias, relate rotational dynamics to torque. (Module 7)
- Using Hooke's Law, analyze the motion of a simple harmonic oscillator and apply this motion to wave propagation. (Module 8)
- Relate solid object mechanics to fluids and hydraulics by analyzing density, buoyancy, displacement of ships, Archimedes' Principle, and Pascal's Principle. (Module 9)

*Please see the *Module & Lab Topics* section below for expanded course outcomes.

The PHYS 170 student learning outcomes are measured:

Directly by: (1) Module application problems (with instructor feedback)
(2) Adaptive Learning Exercises
(3) Module Exams
(4) Cumulative final exam

Indirectly by an end of course student-completed evaluation survey

Course Delivery: This course is asynchronously delivered online. Contact hours include 50 - 60 hours of reviewed module assignments with instructor feedback and video lectures. There are 10 additional contact hours composed of secure online exams.

Course Progression: It is the policy for all Portage Learning courses that only one (module/final) exam is to be completed within a 48-hour period. Research on the best practices in learning indicates that time is needed to process material for optimal learning. This means that once an exam has been completed, the next exam may not be opened or taken until 48 hours after the submission of the previous module exam. This allows for instructor feedback/class expectations as the student moves through the material. Instructors, like the College, are not available during the weekend; grading, therefore, is M-F and may take up to 72 hours during these days. Also, it is the policy of Portage Learning to support a minimum of 28 days to complete a course; this is not a negotiable time period. Please plan your time accordingly.

Note: Professors reserve the right to reset any exam taken in violation of these guidelines.

Required readings, lectures and assignments: Portage courses do not use paper textbooks. Students are required to read the online lesson modules written by the course author which contain the standard information covered in a typical course. Please note the exam questions are based upon the readings. Video lectures which support each lesson module subject should be viewed as many times as is necessary to fully understand the material.

We do not support the use of outside resources to study, except for the ones listed in the syllabus under "Suggested External References". If you have questions about the material or would like further explanation of the concepts, please contact your instructor.

Module Review Questions: The practice problems within the modules are a part of your final grade, and the module work will be reviewed for completeness (not correctness) by the instructor. Be sure to answer all of the problems, being careful to answer the questions in your own words at all times since this is an important part of adequate preparation for the exams. For problems that require calculations, you must show your work by including the initial set up for the problem and your final answer. Problem sets submitted with only a final answer will not be considered complete. After you answer the practice problems, compare your answers to the solutions provided at the end of the module. If your answers do not match those at the end, attempt to figure out why there is a difference. If you have any questions, please contact the instructor via the Canvas messaging system (see Inbox icon).

Academic Integrity is a serious matter. In the educational context, any dishonesty violates freedom and trust, which are essential for effective learning. Dishonesty limits a student's ability to reach his or her potential. Portage places a high value on honest independent work. We depend on the student's desire to succeed in the program he or she is entering. It is in a student's own best interests not to cheat on an exam or put their work into question, as this would compromise the student's preparation for future work. It is the student's responsibility to review the **Student Handbook** and all policies related to academic integrity. If clarification is necessary, the student should reach out to their instructor for further explanation **before** initiating module one.

Required Computer Accessories: It is recommended that students use a desktop or laptop computer, PC or Mac, when taking the course. Some tablet computers are potentially compatible with the course, but not all features are available for all tablet computers. The latest full version of Google Chrome, Firefox, Edge, or Safari browser is required for the optimal operation of the Canvas Learning Management System. In addition, this course will use the Respondus Lockdown Browser for exams; a strong internet connection is needed. You are also **required to use LockDown Browser with a webcam**, which will record you during an online, nonproctored exam. (The webcam feature is sometimes referred to as "Respondus Monitor.") **Your computer must have a functioning webcam and microphone. Additionally, students will need a photo ID that includes your picture and full name is required. Please note, Chromebooks and tablets (other than iPad) are not compatible on exams using the Lockdown Browser.** Instructions on downloading and installing this browser will be given at the start of the course. We highly recommend using a high-speed Internet connection to view the video lectures and labs. You may experience significant difficulties viewing the videos using a dial-up connection.

For more information on basic system and browser requirements, please reference the following:
Canvas browser and system requirements: https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-

are-the-browser-and-computer-requirements-for-Canvas/ta-p/66

Respondus Requirements: https://web.respondus.com/he/lockdownbrowser/resources/

Respondus Monitor Requirements: https://web.respondus.com/he/monitor/resources/

Additional Tools: A built-in **scientific calculator** for the course has been incorporated into the website and can be found in the tool bar above each module and exam page. If you choose to purchase a calculator, keep in mind that you do not need to purchase an expensive calculator as the features you will need are available on basic scientific calculators with a cost of less than $20.

The only calculator that is permitted during an exam is the one that is provided in the course introductory materials and within the exam. It would be wise to familiarize yourself with this calculator and use it for both the practice problems and module problem sets. A tutorial is also provided in the course introductory material. You are allowed to copy and paste your answers from the calculator into the answer boxes. If you have any questions regarding how to input numbers or perform certain calculations, please contact your instructor for assistance before moving forward in the course.

Modules

Module 1: Introduction to Physics

This module covers the requisite math for the course and how to correctly calculate measured values with significant figures. Fundamental base units and derived units are explained, as well as the SI unit system. An introduction into motion, scalars, vectors, and displacement ends this module.

Module 2: Linear Kinematics

Module 2 introduces kinematics which is the study of how things move. This module covers the definitions of displacement, velocity, and acceleration both graphically and quantitatively. The three big kinematic equations of motion are introduced and utilized frequently to set up two-dimensional kinematics and projectile motion, which closes the module.

Module 3: Linear Dynamics

In Module 3, students are introduced to the concept of force, which is an interaction between two objects or systems of objects. We will revisit and build upon the models and representations presented in the kinematics module (2)—specifically through the introduction of the free body diagram. Students will further analyze the effect of forces on systems when they encounter Newton's second law in rotational form in Module 6. Static equilibrium is analyzed through the lens of Newton's three laws of motion.

Module 4: Work, Energy, Power

In Module 4, students will focus on the big idea that is the conservation of energy. As in earlier modules, students will once again utilize both familiar and new models and representations to analyze physical situations, now with force or energy as major components. Students will analyze work done to and by systems and the energy changes therein.

Module 5: Linear Momentum

Module 5 introduces students to the relationships between force, time, impulse, and linear momentum via calculations, data analysis, designing experiments, and making predictions. Students will focus on the conservation of momentum to get a more complete picture of forces and opportunities and revisit misconceptions surrounding Newton's third law. Students will also make connections between momentum and kinetic energy of objects or systems and see under what conditions these quantities remain constant.

Module 6: Torque and Rotational Dynamics

Module 6 reinforces the Module 3 ideas of force and linear motion by introducing students to their rotational analogs—torque and rotational motion. During their study of torque and rotational motion, students will be introduced to different ways of modeling forces. Students will analyze the conditions for equilibrium by evaluating simple machines.

Module 7: Rotational Motion and Angular Momentum

In Module 7, students will apply their knowledge of energy and momentum to rotating systems. Similar to the approach used for kinematics, translational energy, and momentum concepts in Modules 2, 4 and 5, it is important that students have conceptual understanding of how angular momentum and rotational energy change due to external torque(s) on a system. Additionally, articulating the conditions under which the rotational energy and/or angular momentum of a system remains constant is foundational to working through more complex scenarios.

Module 8: Oscillations and Waves

In Module 8, students will apply previously encountered models and methods of analysis to simple harmonic motion and waves. They will also be reminded that, even in new situations, the fundamental laws of physics remain the same. Students will also use the skills and knowledge they have gained to make and justify claims, as well as connect new concepts with those learned in previous topics. Students will explore resonance and sound.

Module 9: Fluid Statics

In Module 9, students consider how the forces and conservation laws studied in the linear Modules can be applied to the study of ideal fluids. Module 9 ties together the thematic threads that have been woven throughout the course, including the interactions between systems and the conservation of fundamental quantities.

Labs

Lab 1: The Quality of Calculated Measurements

In this lab, students will go out in the field—literally—and take measurements. They will have to determine an acceptable value for the number of blades of grass in the field based upon measurements taken with only a meterstick (if they have one) or a printed out metric ruler. The focus of this lab is to get students to start thinking scientifically with the scientific method and to recognize that although their calculators will always give them answers, they might not necessarily be valid and they will have to justify the number of significant figures they choose for their answer.

Lab 2: Ramp Kinematics

In this lab, students will analyze motion as collected with both photogates and sonic motion detectors. Displacement data will be shared with students, who will then have to plot velocity and acceleration graphs.

Lab 3: Ramp Dynamics

In this lab, students will analyze a car attached to a pulley on a ramp with a weight hanging off of the other side. They will get force sensor data as the angle of the ramp is changed. Then they will analyze a friction block on the same setup instead of the car to determine the coefficient of friction based on photogate data of the pulley motion.

Lab 4: Work and the Conservation of Energy

Students will analyze the result of spring-launching a cart up the ramp. Using Hooke's Law, students will determine the spring constant of the spring, and then make a prediction for how high up the ramp the car should go based on the Work-Kinetic Energy Theorem and the Conservation of Energy.

Lab 5: Ballistic Pendulum

A paintball will be fired into a coffee can ballistic pendulum. Students will be given the angle of deflection of the pendulum, the mass of the paintball, the length of the pendulum, and the mass of the coffee can. From this, they will logic their way through the conservation of energy and the conservation of momentum within this completely inelastic collision to determine the muzzle velocity of the paintball marker.

Lab 6: Torque and Equilibrium Lab

Students will analyze various configurations of simple machines to understand mechanical advantage as it relates to work and force.

Lab 7: Rotational Kinematics and Dynamics

In this lab, students will observe a rotating object of a particular mass, and then a reconfiguration of the exact same parts configured differently to see the difference in rotational inertia. The lab apparatus will involve a string that is attached to a hanging weight over a pulley which is attached to a photogate to generate linear acceleration data as the string unwinds the axle of the rotating object. From this data, students can generate angular acceleration data and apply it to make predictions about angular velocity and displacement, as well as calculate the object's rotational inertia

Lab 8: Simple Harmonic Motion

In this lab, students will observe both simple pendulums and oscillating springs. They will also use a PhET simulation with different springs to complete their lab exercise.

Lab 9: Barge Loading Capacity

In this lab, students will be tasked with calculating the displacement of a barge that is loaded with different materials and sent down the river. They will need to determine the draft of the barge. They will observe a model made out of a beaker floating in water in a larger beaker to simulate the river and understand Archimedes' Principle.

Suggested Timed Course Schedule (to complete the course within a typical college semester)

All Portage courses are offered asynchronously with no required schedule to better fit the normal routine of adult students, but the schedule below is suggested to allow a student to complete the course within a typical college semester. Students may feel free to complete the course on a schedule determined by them within the parameters outlined under "Course Progression."

Time Period	Assignments	Subject Matter
Days 1-12	Module 1, Exam 1	Introduction to Physics
	Lab 1, Lab 1 Assignments	The Quality of Calculated Measurements
Days 13-24	Module 2, Exam 2	Linear Kinematics
	Lab 2, Lab 2 Assignments	Ramp Kinematics
Days 25-36	Module 3, Exam 3	Linear Dynamics
	Lab 3, Lab 3 Assignments	Ramp Dynamics
Days 37-48	Module 4, Exam 4	Work, Energy, Power
	Lab 4, Lab 4 Assignments	Work and the Conservation of Energy

Days 49-60	Module 5, Exam 5	Linear Momentum
	Lab 5, Lab 5 Assignments	Ballistic Pendulum
Days 61-72	Module 6, Exam 6	Torque and Rotational Dynamics
	Lab 6, Lab 6 Assignments	Torque and Equilibrium Lab
Days 73-84	Module 7, Exam 7	Rotational Motion and Angular Momentum
	Lab 7, Lab 7 Assignments	Rotational Kinematics and Dynamics
Days 85-96	Module 8, Exam 8	Oscillations and Waves
	Lab 8, Lab 8 Assignments	Simple Harmonic Motion
Days 96-108	Module 9, Exam 9	Fluid Statics
	Lab 9, Lab 9 Assignments	Barge Loading Capacity
Days 109-120	Final Exam	Comprehensive - including all course material

Grading Rubric:

Check for Understanding =	1 pt.
9 Module exams = 100 pts. each x 9 =	900 pts.
Problem Sets = 10 pts. each x 9 =	90 pts
Lab Notebooks = 30 pts. each x 9 =	270 pts.
Lab Applications = 10 pts. each x 9 =	90 pts.
Final exam = 200 pts.	200 pts.
Total	1551 pts.

Grading Scale:

96.5% - 100% = A+
92.5% - 96.4% = A
89.5% - 92.4% = A-
86.5% - 89.4% = B+
82.5% - 86.4% = B
79.5% - 82.4% = B-
76.5% - 79.4% = C+
72.5% - 76.4% = C
69.5% - 72.4% = C-
66.5% - 69.4% = D+
62.5% - 66.4% = D
59.5% - 62.4% = D-
0% - 59.4% = F

Suggested External References:

If the student desires to consult a reference for additional information, the following textbooks are recommended as providing complete treatment of the course subject matter.

- Urone and Hinrichs, **College Physics**, OpenStax Publishing

NOTE: We do not support the use of outside resources to study, except the ones listed above.

Learning Support Services:

Each student should be sure to take advantage of and use the following learning support services provided to increase student academic performance:

Video lectures: Supports diverse learning styles in conjunction with the text material of each module

Messaging system: Provides individual instructor/student interaction

Tech support: Available by submitting a help ticket through the student dashboard

Accommodations for Students with Learning Disabilities:

Students with documented disabilities may be eligible to receive reasonable accommodations in accordance with the Americans with Disabilities Act (ADA) and applicable federal and state laws.

Documentation Requirements

Documentation must be dated within the past four (4) years and submitted for review.
To initiate a request, students should contact Student Services at **studentservices@portagelearning.edu** to obtain a link to our secure documentation upload site. Please do not email documentation directly, as we are only able to review materials submitted through the secure site to protect your privacy.

Once documentation has been received, the Accommodation Review Committee will evaluate the materials and notify the student of any approved accommodations within seven (7) business days (excluding weekends).

Examples of Approved Accommodations (when supported by documentation) may include:

1. Extended time on examinations
2. Reduced-distraction testing environment (students select their testing location)
3. Closed captioning for video lectures (available to all students)
4. Use of approved memory aids
5. One scheduled break during examinations

Accommodations are determined on an individualized basis following review of appropriate documentation.

One-on-one Instruction:
Each student is assigned to his/her own instructor. Personalized questions are addressed via the student dashboard messaging system.

Online learning presents an opportunity for flexibility; however, a discipline to maintain connection to the course is required; therefore, communication is essential to successful learning. **Check your messages daily.** Instructors are checking messages daily Monday-Friday to be sure to answer any questions that may arise from you. It is important that you do the same so you do not miss any pertinent information from us.

Holidays:
During the following holidays, all administrative and instructional functions are suspended, including the grading of exams and issuance of transcripts.

- New Year's Day
- Easter
- Juneteenth
- Labor Day
- Christmas Break
- MLK Day
- Memorial Day
- Independence Day
- Thanksgiving weekend

The schedule of holidays for the current calendar year may be found under the Student Services menu at www.portagelearning.edu

Code of Conduct: Students are expected to conduct themselves in a way that supports learning and teaching and promotes an atmosphere of civility and respect in their interactions with others. Verbal and written aggression, abuse, or misconduct is prohibited and may be grounds for immediate dismissal from the program.

This is a classroom; therefore, instructors have the academic freedom to set forth policy for their respective class. Instructors send a welcome e-mail detailing the policy of their class, which students are required to read prior to beginning the course.

Grievances: If a student has a complaint about the coursework or the instructor, the student is advised to first consult the instructor, who will be willing to listen and consider your concern. To file a formal grievance for consideration by the Academic Review Committee, the process must be initiated by requesting an appeal form from academics@portagelearning.edu.

Remediation: At Portage Learning we allow a "one-time" only opportunity to re-take an alternate version of **one** module exam on which a student has earned a grade lower than 70%. This option must be exercised before the final exam is started. If an exam is retaken, the original exam grade will be erased and the new exam grade will become a permanent part of the course grade. However, before scheduling and attempting this retest, the student must resolve the questions they have regarding the material by reviewing both the old exam and the lesson module material. Once ready to attempt the retest of the exam they must contact their instructor to request that the exam be reset for the retest. Remember, any module retest must be requested and completed **before** the final exam is opened.

Note: Exams on which a student has been penalized for a violation of the academic integrity policy may not be re-taken.

Syllabi are subject to change as part of ongoing educational review practices. Students are responsible for accessing and using the most recent version of the course syllabus.