General Education Course NMHED Recertification Form

This form has been designed to guide you through the recertification process for the UNM General Education course in question. Please fill out your contact information below, and then review the information about the course provided to us by the New Mexico Department of Higher Education *(*NMHED*). After this, you will be instructed to fill out three separate narratives concerning the course and its relevance to NMHED's area and skills associated with the course.*

UNM Course Information

Prefix	**PHYS**
Number	**1230**
Name	**Algebra-based Physics I**

Contact Information

Name	Leandra Goldflam
Title	Lecturer III
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NMHED's Description and Outcomes for the Common Course

The description and student learning outcomes below come from NMHED's Common Course Catalog, *which can be found here, and is meant to designate standard descriptions and outcomes of courses registered as a NMHED* Common Course.

PHYS 1230: Algebra-based Physics I

An algebra-based treatment of Newtonian mechanics. Topics include kinematics and dynamics in one and two dimensions, conservation of energy and momentum, rotational motion, equilibrium, and fluids.

Student Learning Outcomes:

Upon completion of this course, the student will be able to:
1. Demonstrate converting units and other aspects of dimensional analysis in the working of numerical problems.
2. Apply principles of Newtonian mechanics to predict and account for simple phenomena modeled by the motion of particles in one and two dimensions.
3. Apply principles of Newtonian mechanics to predict and account for simple phenomena modeled by the motion of a rigid body in two dimensions.
4. Apply Newton's theory of gravitation to circular orbits and demonstrate understanding of how Kepler's laws of planetary motion provide the empirical foundation for Newton's theory.
5. Apply the mathematics of vectors to the principles of Newtonian mechanics.
6. Apply principles of Newtonian mechanics to the case of static and dynamic incompressible fluids, including Archimedes' and Bernoulli's principles.

Optional topics may include (some schools include these in Physics I, others in Physics II):
1. sound
2. waves
3. heat
4. oscillatory motion
5. thermodynamics Optional Student Learning Outcomes
1. Describe the fundamental properties of periodic motion.
2. Explain and apply the basic concepts of sound and wave motion.
3. Explain the basic concepts of heat and thermodynamics.

Institution-specific Student Learning Outcomes

Please add additional SLOs of the general education course to the ones provided by NMHED, or if no SLOs are provided by NMHED, input the SLOs used in assessment for the course.

Area and Essential Skills

Below gives information concerning the area and associated skills of the course to be re-certified. The area here matches the General Education Area of UNM; the "Essential Skills" and their respective Component Skills are characterizations of the area determined by NMHED. You will use this information to fill out the narratives below.

Area in which *PHYS 1230* resides: Science

Essential Skills in the Area:

Critical Thinking

Problem Setting: Delineate a problem or question. Students state problem/question appropriate to the context.

Evidence Acquisition: Identify and gather the information/data necessary to address the problem or question.

Evidence Evaluation: Evaluate evidence/data for credibility (e.g. bias, reliability, and validity), probable truth, and relevance to a situation.

Reasoning/Conclusion: Develop conclusions, solutions, and outcomes that reflect an informed, well-reasoned evaluation.

Personal and Social Responsibility

Intercultural reasoning and intercultural competence

Sustainability and the natural and human worlds

Ethical Reasoning

Collaboration skills, teamwork and value systems

Civic discourse, civic knowledge and engagement -- local and global

Quantitative Reasoning

Communication/Representation of Quantitative Information: Express quantitative information symbolically, graphically, and in written or oral language.

Analysis of Quantitative Arguments: Interpret, analyze and critique information or a line of reasoning presented by others.

Application of Quantitative Models: Apply appropriate quantitative models to real world or other contextual problems.

Narrative Input

In the boxes provided, write a short (~300 words) narrative explaining how the course weaves the essential skills associated with the content area throughout the course. Explain what students are going to do to develop the essential skills and how you will assess their learning. The narrative should be written with a general audience in mind and avoid discipline specific jargon as much as possible.

Be sure to address the component skills listed next to each essential skills. The number of component skills that must be addressed by your narrative is listed.

Critical Thinking: *Problem Setting; Evidence Acquisition; Evidence Evaluation; Reasoning/Conclusion.*

In Physics 1230, students are taught to solve problems related to specific areas of physics such as motion, forces, and energy. Critical thinking is crucial in successful problem solving and students must use all of the component skills associated with this essential skill. Problem Setting: the student must first setup the problem by stating what they are being asked to solve for in the problem. Evidence Acquisition: Next the student must identify the information given in the problem. Evidence Evaluation: Students are given many different equations in each chapter. From the information given in the problem and what is being asked to solve for, students must determine which of those equations are relevant to the problem at hand and will allow them to finish the problem. Reasoning/Conclusion: After finishing their calculations, students must always evaluate whether their answers make physical sense. Their answers must be neither too large nor too small based upon the physical system that the problem is based on. For example, calculating that speed of a turtle to be thirty miles per hour should inform a student that their answer is incorrect. Once the validity of the answer has been established, conclusions about physical systems may be inferred.

These skills will be modeled in the lecture class by the instructor. Students will develop these skills by repeatedly practicing them throughout the semester. Instructors will assess these skills in a variety of ways. They may choose to start assessing them in lecture with in-class exercises using response systems such as I-clicker or Pearson's Learning Catalytics. Online and in-class homework will also be used to assess the students' progress in developing these essential skills as high averages demonstrate student commitment to

Personal and Social Responsibility: *Intercultural reasoning and intercultural competence; Sustainability and the natural and human worlds; Ethical Reasoning; Collaboration skills, teamwork and value systems; Civic discourse, civic knowledge and engagement -- local and global.*

As with all sciences, Personal and Social responsibility is an important part of Physics 1230. Like all scientists, students are expected to be ethical individuals who contribute to the well-being of society and to the entire world, and, as such, are expected to develop all of the component skills in this essential skill. Sustainability and the natural and human worlds: Physics is a natural science; therefore, all of its topics touch directly on the natural world and most of them are directly related to sustainability. Specific examples from Physics 1230 include the motion of the earth around the sun and its relation to the seasons and conservation of energy and its profound implications of earth's future sustainability. From in-class polling, homework, and exam questions on these particular topics, students will develop a deep appreciation of sustainability and the natural world. Assessment data from these assignments or student surveys can be gathered to determine student proficiency. Collaboration skills, teamwork and value systems: Physics is a collaborative subject. Most of the great discoveries in physics have been made by teams of physicists working together. As such, students are encouraged to work together as often as possible. In-class exercises using polling systems such as I-clicker or Learning Catalytics are ideal in gathering assessment data for this component skill as it can track student engagement and peer learning. In classes where polling systems are not used, student surveys can be used to determine the growth and development of this component skill.

Quantitative Reasoning: *Communication/Representation of Quantitative Information; Analysis of Quantitative Arguments; Application of Quantitative Models.*

Since its invention, physics has used graphs to convey information simply and efficiently. In lecture, on homework, and on exams, students are expected to acquire information from graphs presented to them and to make their own graphs from data or information given in problems. As such, students will develop and can be assessed on all of the component skills of this essential skill. Communication/Representation of Quantitative Information: Physics 1230 begins its studies of graphs early as one of its first topics is the graphing of the position and velocity of moving objects as functions of time. From these graphs, students are supposed to discover the famous interrelation between them, first discovered by Newton himself, that the slope of the position graph gives the velocity while acceleration is the slope of the velocity graph. Through assessment data gathered from homework and exams, students will be able to show their mastery and understanding of this cornerstone of physics. Gathering information from and the making of graphs is a skill that continues throughout the semester. The calculating of the physical quantities impulse and work for forces that change during motion both require making graphs and the ability to find the area under those graphs. The final topic covered in the Physics 1230 is that of periodic motion and waves, both of which make extensive use of sinusoidal graphs. Students are expected to be able to determine physical properties of the motion, such as the motion's period, from these graphs. Assessment of this ability from homework or exams is a simple matter. Analysis of Quantitative Arguments: Students must always interpret, analyze, and critique the information given to them from their instructor if they are to incorporate the subject matter into their mental models. Moreover, classes which use polling response systems such as I-clicker or Pearson's Learning Catalytics along with peer instruction, require students to habitually interpret, analyze, and critique the information coming from their classmates. Using the polling data available from these systems, it will be possible to assess the students'progress in developing this component skill. In classes where peer instruction is not used, Student survey data could instead be gathered. Application of Quantitative Models: As a natural science, all topics covered in physics quantitatively model problems and aspects from the real world. The specific topics of motion, forces, and energy covered in Physics 1230 are no exception. By participating in in-class exercises or solving homework and exam solutions, students are developing and then showing their mastery of

Additional Information

Course Materials

NMHED requires that both a syllabus and a sample course assignment (project, paper, exam,etc.) from the course in question to be attached to the recertification form. Be sure and pick an assignment that correlates with the descriptions provided in the narratives above.

Assessment Plan

When it is submitted to NMHED, each general education course will also have attached the assessment plan that is used for General Education Assessment at UNM. For more information on this process, please visit this page from UNM's Office of Assessment.

Master Syllabus Physics 1230

Course Title: Algebra-based Physics I

Course Number: PHYS 1230

Credit Hours: 3

Instructor:	**Email:**
Office Location:	**Contact Phone Number:**
Office Hours:	

Class Meeting Day(s):	**Class Time:**
Class Location/Room:	**Term/Semester:**

Course Description:

At a minimum enter the description listed in the UNM course catalog. Alternatively, describe the course content, purpose, contributions, etc and what the learner may expect if enrolled in the course.

Course Catalog Description: Mechanics, sound, heat, fluid, waves. The sequence (PHYS 1230, 1230L, 1240, 1240L) is required of pre-medical, pre-dental, and pre-optometry students. Only 1230 and 1240 are required of pharmacy students. Credit for both this course and PHYS 1310 may not be applied toward a degree program. Meets New Mexico Lower-Division General Education Common Core Curriculum Area III: Science. Prerequisite: MATH 1240 or MATH 1250 or MATH 1430 or MATH 1512 or ACT Math =>28 or SAT Math Section =>660 or ACCUPLACER College-Level Math =>100. {Summer, Fall, Spring}

Course Goals:

An algebra-based treatment of Newtonian mechanics. Topics include kinematics and dynamics in one and two dimensions, conservation of energy and momentum, rotational motion, equilibrium, and fluids. The overall objective is that the students can describe these physical phenomena using a variety of models and develop certain analytical skills associated with problem solving.

Student Learning Outcomes (aka Objectives):

Listed are both the state and UNM-specific outcomes. Instructors are free to add any specific outcomes of their own.

NMHED's Description and Outcomes for the Common Course

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4. Apply Newton's theory of gravitation to circular orbits and demonstrate understanding of how Kepler's laws of planetary motion provide the empirical foundation for Newton's theory.
5. Apply the mathematics of vectors to the principles of Newtonian mechanics.
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Optional topics may include (some schools include these in Physics I, others in Physics II):
1. sound
2. waves
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Optional Student Learning Outcomes
1. Describe the fundamental properties of periodic motion.
2. Explain and apply the basic concepts of sound and wave motion.
3. Explain the basic concepts of heat and thermodynamics.

UNM Specific SLO's

Outcome 1: Conservation of Energy: Students will be able to solve problems involving the Conservation of Energy. These two laws enable introductory students to solve a wide variety of practical problems. Possible examples of problems include elastic and inelastic collisions and the basic concepts of kinetic energy, gravitational potential energy, thermal energy, and elastic potential energy.

Addresses UNM/HED Area 3, Competencies, 2, 4, 5

Outcome 2: Vectors: Students will be able to do simple operations with vectors. These include resolving a vector into components, adding vectors using components, finding the magnitude of a vector given its components and finding the direction of a vector given its components.

Addresses UNM/HED Area 3, Competencies, 2, 4, 5

Outcome 3: Motion with Constant Acceleration: Students will be able to solve problems involving motion with constant acceleration. Many everyday type events will be modeled as

problems of this type. These include both horizontal motion (examples, an aircraft taking off on the runway, an automobile coming to a stop) and vertical motion near Earth's surface where the acceleration of gravity can be considered constant (for example, a ball thrown straight up in the air). Projectile motion problems also fall into this category; these involve objects experiencing vertical and horizontal motion at the same time (for example, a baseball hit at an angle of 30 degrees above the horizontal).

Addresses UNM/HED Area 3, Competencies, 2, 4, 5

Outcome 4: Newton's Second Law: Students will be able to solve a variety of problems with Newton's second law. This law which deals with forces, inertial mass and acceleration is a foundation of Newtonian Mechanics and has wide application to science and engineering. Problems of various types (possible examples include effects of forces on objects, circular motion, orbits of planets, inclined planes and motion with friction) will be analyzed.

Addresses UNM/HED Area 3, Competencies, 2, 4, 5

Outcome 5: Fluids: Students will be able to solve problems involving fluid statics and fluid flow. Applications of fluid statics may, for example, include pressure in a fluid and buoyancy. Use of Bernoulli's equation and the continuity equation are examples of fluid flow.

Addresses UNM/HED Area 3, Competencies, 2, 4, 5

Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements:

List the required and/or recommended textbooks as well as any other supplies, materials or equipment needed to successfully complete the course. List the technology to which students must have access and the technical requirements of that technology. Courses requiring specific computer hardware and software should include product specifications needed for student success within the syllabus. These should include minimum computer and software requirements and internet configurations, or a link to a detailed reference document.

The syllabus for a courses requiring student-owned laptops should contain a reference or link to any requirements. An example is shown below.

You are required to bring your laptop to this class to follow along with or complete our in-class research exercises. UNM Law School requires that all entering students own a laptop computer. The law school does not require a particular brand but has determined a minimum hardware configuration. For more information please go to the Law School's IT Services page at:
http://lawschool.unm.edu/students/it/laptop-program.php

Course Requirements:

List and describe all assessments which contribute to course score. May include exams, portfolios, participation, attendance, papers, oral reports, group projects, assignments, etc. Include possible point

(percentage) value of each. NOTE: for dual listed courses (undergrad and graduate) list requirements for each separately.

Grading:

Indicate how a final course grade (including credit/no credit) will be assigned, calculated, or otherwise determined. UNM uses a fractionalized final course grade system—see catalog.

Course Schedule:

List all relevant dates – lecture titles/topics; academic holidays; Spring break, exams, assignment due dates etc. An exact listing in full detail is not necessary – a representative listing is adequate.

NOTE: A disclaimer about change in syllabus is wise. For example; The Schedule of Activities is subject to change. Minor changes will be announced in class, major ones provided in writing.

Accommodation Statement:

An Accommodation statement is required for all syllabi. There is no specifically required wording. Listed below are two options acceptable to Accessibility Resource Center. NOTE: HSC, Law and distant campuses have/may have alternative and acceptable wording.

"In accordance with University Policy 2310 and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she are not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow. Contact Accessibility Resource Center at 277-3506 for additional information."

OR

Accessibility Resources Center (Mesa Vista Hall 2021, 277-3506) provides academic support to students who have disabilities. If you think you need alternative accessible formats for undertaking and completing coursework, you should contact this service right away to assure your needs are met in a timely manner. If you need local assistance in contacting the Accessibility Resources Center, see the *<enter your academic program office and/or contact information here>*.

Title IX Statement:

There is no University specific language nor is there a requirement that Title IX be included in the syllabus. Please check for your department, school, college or campus requirements a preferred wording. Two options are listed below.

In an effort to meet obligations under Title IX, UNM faculty, Teaching Assistants, and Graduate Assistants are considered "responsible employees" by the Department of Education (see pg 15 http://www2.ed.gov/about/offices/list/ocr/docs/qa-201404-title-ix.pdf). This designation requires that any report of gender discrimination which includes sexual harassment, sexual misconduct and sexual violence made to a faculty member, TA, or GA must be reported to the Title IX Coordinator at the Office of Equal Opportunity (oeo.unm.edu). For more information on the campus policy regarding sexual misconduct, see: https://policy.unm.edu/university-policies/2000/2740.html.

OR

A Note about Sexual Violence and Sexual Misconduct: As a UNM faculty member, I am required to inform the Title IX Coordinator at the Office of Equal Opportunity (oeo.unm.edu) of any report I receive of gender discrimination which includes sexual harassment, sexual misconduct, and/or sexual violence. You can read the full campus policy regarding sexual misconduct at https://policy.unm.edu/universitypolicies/2000/2740.html . If you have experienced sexual violence or sexual misconduct, please ask a faculty or staff member for help or contact the LoboRESPECT Advocacy Center

Academic Integrity Statement:

There is no University specific language or requirement that an Academic Integrity Statement be included in the syllabus although many recommend it. Departments, schools, colleges or campuses may require different wording. Listed below is the statement listed in the UNM Student Handbook

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Other Items:

Each course, program, department, school/college, campus may have other specific requirements beyond those listed above. Feel free to include such topics at your discretion while recognizing that inclusion of such is not a requirement for review by the Faculty Senate Curriculum Committee.

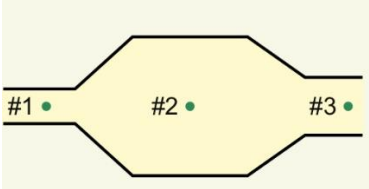
Critical Thinking

Problem Setting: Delineate a problem or question. Students state problem/question appropriate to the context.
Evidence Acquisition: Identify and gather the information/data necessary to address the problem or question.
Evidence Evaluation: Evaluate evidence/data for credibility (e.g. bias, reliability, and validity), probable truth, and relevance to a situation.
Reasoning/Conclusion: Develop conclusions, solutions, and outcomes that reflect an informed, well reasoned evaluation.

Sample Assessment Questions (Open-ended questions could be given as homework, on an exam, or in a student survey. Multiple-choice questions could be given on an exam or as a clicker question in class.):

1. Can an automobile with a velocity towards the north simultaneously have an acceleration towards the south? Explain your answer.

2. Given that 1.00 in = 2.54 cm, which of the following is the correct conversion of 5 cm/s into in/hr?
    a. 5 cm/s x 1 in/2.54 cm x 3600 s/1 h= 7090 in/hr
    b. 5 cm/s x 2.54 cm/1 in x 3600 s/1 h= 45700 in/hr
    c. 5 cm/s x 1 in/2.54 cm x 60 s/1 h = 118 in/hr
    d. 5 cm/s x 1 in/2.54 cm x 1 h/3600 s =0.000547 in/hr
    e. None of the these are correct
3. A ball is pulled upward with a constant speed using a rope. If the weight of the rope itself is small enough to ignore, what can we conclude about the tension force exerted by the rope and the weight of the ball?
    a. The tension must be smaller in magnitude than the weight.
    b. The tension must be equal in magnitude that the weight.
    c. The tension must be greater in magnitude than the weight.
4. Water flows from right to left through a pipe whose width varies as shown. At which of the points shown, would the pressure be largest? Or would the pressure be the same at all three points?

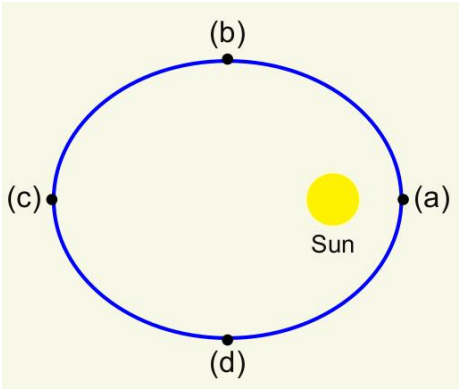


Personal and Social Responsibility - Address 2 of the 5 component skills

Intercultural reasoning and intercultural competence
Sustainability and the natural and human worlds
Ethical Reasoning
Collaboration skills, teamwork and value systems
Civic discourse, civic knowledge and engagement -- local and global

Sample Assessment Questions (Open-ended questions could be given as homework, on an exam, or in a student survey. Multiple-choice questions could be given on an exam or as a clicker question in class.):

1. Every time a moving car stops at a stoplight, its kinetic energy is released into the environment as heat. Should we be worried that this additional heat is contributing to climate change? Explain why or why not.
2. Shown is the exaggerated orbit of the earth around the sun. At which of the points shown do we have summer here in Albuquerque?

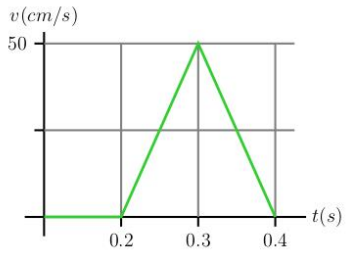


Quantitative Reasoning

Communication/Representation of Quantitative Information: Express quantitative information symbolically, graphically, and in written or oral language.
Analysis of Quantitative Arguments: Interpret, analyze and critique information or a line of reasoning presented by others.
Application of Quantitative Models: Apply appropriate quantitative models to real world or other contextual problems.

Sample Assessment Questions (Open-ended questions could be given as homework, on an exam, or in a student survey. Multiple-choice questions could be given on an exam or as a clicker question in class.):

1. A train, initially traveling at 5 m/s, has a constant acceleration of 1.2 m/s^2 for 30 s. The train then travels another 1500 m as it slows down (with a constant acceleration) until its speed is again 5 m/s.
   a. Make a graph of the train's velocity versus time. For full points, you must show all of your calculations and both axes must be labeled with the correct time and position values.
   b. Make a graph of the train's position versus time. For full points, you must show all of your calculations and both axes must be labeled with the correct time and velocity values.
2. If the speed of the blood flowing through a vein during one heartbeat is given by this graph, how far does the blood travel during one beat?



   a. 5 cm
   b. 7.5 cm
   c. 10 cm
   d. 15 cm
   e. 20 cm
3. Three blocks are sitting atop of each other as shown. A pulling force is applied to the middle block, but due to static friction, none of the blocks move. Sketch three free-body diagrams, one for each block.