



# 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	<b>PHYS</b>
Number	<b>1230L</b>
Name	<b>Algebra-based Physics I Lab</b>

## Contact Information

Name	<input type="text"/>
Title	<input type="text"/>
Phone	<input type="text"/>
Email	<input type="text"/>

# 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 1230L: Algebra-based Physics I Lab**

*A series of laboratory experiments associated with the material presented in PHYS 1230. Pre- or co-requisite: PHYS 1230 Algebra-based Physics I*

### **Student Learning Outcomes:**

Upon completion of this course, the student will be able to:

1. Explain the scientific method.
2. Test ideas using modern laboratory equipment.
3. Estimate experimental uncertainties using statistical methods.
4. Use computers to analyze and report laboratory results.
5. Draw appropriate conclusions from quantitative scientific observations.
6. Accurately and clearly communicate the results of scientific experiments.

## **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 1230L* 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.

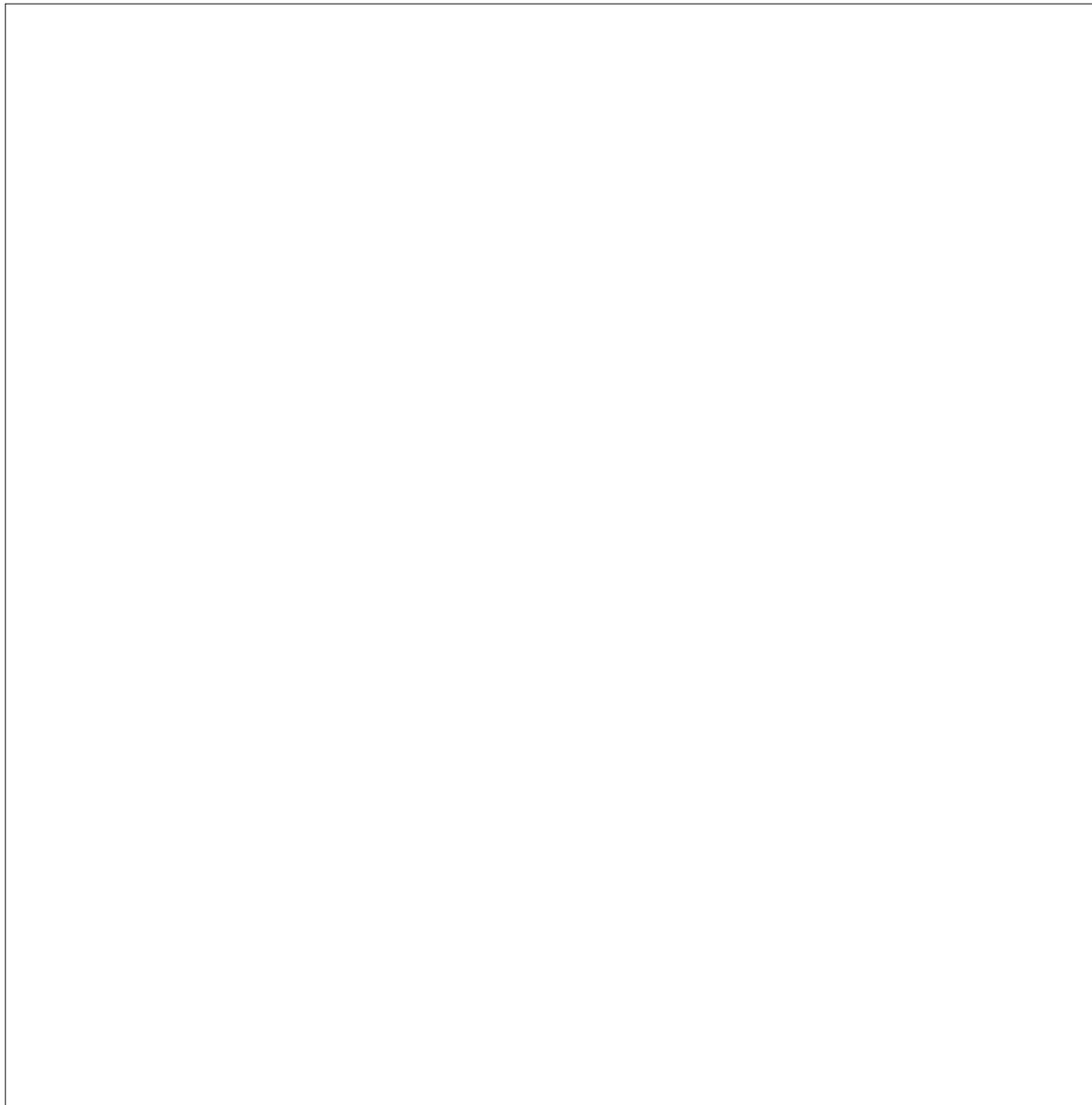
*Be sure to address the component skills listed next to each essential skills. The number of component skills that must be addressed by your narrative is listed.*

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

**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; Analysis of Quantitative Arguments; Application of Quantitative Models.*



## **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.*

## Physics 1230L Syllabus – Fall 2019

**TA:**  
**email:**

Welcome to Physics 1230L! I am here to help you do your labs and learn some physics that may help you in your lecture and future courses. Always feel free to ask questions or make suggestions. Also, feel free to talk to the Lab Director in room RH 113, phone 277-2751.

### Description

Physics 1230L is a companion course to Physics 1230 covering topics in mechanics, heat and waves at the algebra level. Lab experiments mirror and enhance lecture topics: motion (kinematics), interactions between objects and the resulting effects on their motions (dynamics), the effects of forces acting over displacements (work and energy), the effects of forces acting over time (impulse and momentum), thermal energy (first law of thermodynamics), and the physical nature of waves. Real time experiments involving computer assisted data acquisition and analysis give a better conceptual framework for understanding physics.

**(Pre- or co-requisite: Physics 1230)**

### Objectives

This course serves to reinforce concepts presented in lecture, to give you experience working as a member of a team and to familiarize you with various experimental techniques.

Lab students will:

- Communicate and cooperate as a team to accomplish technical goals
- Read and interpret procedural instructions
- Gather and analyze data using computers interfaced to various probes
- Interpret graphical data
- Estimate uncertainties in measurements
- Use basic laboratory equipment (e.g., timer, balance, rods, clamps, etc.)

**List of Experiments** – schedule is posted <http://regenerlab.unm.edu/>

- Uncertainty in Measurement
- Introduction to Motion
- Vector Addition
- Changing Motion
- Force and Motion
- More on Forces
- Impulse – Momentum
- Work and Energy
- Collisions in One Dimension
- Collision!
- Torque
- Periodic Motion
- Thermal Energy
- Introduction to Waves

### Materials

Lab workbooks are available at the UNM Copy Center in Dane Smith Hall. Every student is required to purchase one before the second week of lab. No copies will be provided.

### Students with Disabilities

Qualified students with disabilities needing appropriate academic adjustments should contact me as soon as possible to ensure your needs are met. Handouts are available in alternative accessible formats upon request.

**Attendance**

Lab attendance is mandatory. You are responsible to perform all experiments.

- **Tardiness**  
You are expected to arrive on time to lab. If you are late, you will still be required to do the entire lab but your grade may be diminished at my discretion.
- **Excused absences**
  - If you cannot make it to lab and know in advance, contact me and we will arrange a time for you to do the lab.
  - If something comes up unexpectedly (sudden illness, accident, family emergency, etc.) contact me as soon as possible. Unscheduled absences WITH A VAILD EXCUSE must be made up. Contact me to arrange a mutually convenient time.
  - Missed labs must be made up promptly. If you do not make up a missed lab within one week, your grade may be diminished at my discretion.
- **Unexcused absences**  
One unexcused absence will reduce your final grade by one letter grade. Two unexcused absences will cause you to fail the class.

**Conduct:**

UNM has strict guidelines for both student and TA conduct, which are outlined in the University catalogue. Both the students and the instructor are expected to adhere to these policies. In particular:

- **Please do not answer cell phones, texts, or tweets in the lab room!! If urgent,** Calls may be taken in the hallway so long as classes are not disturbed.
- **Drinks must be in a container with twist cap or other sealed top and kept on the floor or at the front of the room.** Food in the lab is not allowed without special permission from the instructor.

**Grading**

Each week, you will receive a grade with two components: one for attendance/participation, and one for the physics and other details in the lab report. Attendance and participation will count for 1/3 of your semester grade. Lab report grades and quizzes which may be given at announced times will count for 2/3 of your semester grade.

**Attendance/Participation Guidelines**

<b>A</b>	Active Participation	Example behaviors: helps with set up, participates in data taking, asks questions, participates in discussions, etc.
<b>B</b>	Passive Participation	Example behaviors: is tardy to lab, merely records data, does not help with set up, does not participate in discussions, copies partners, etc.
<b>C</b>	Poor Participation	Example behaviors: Reads newspaper, does homework, antagonizes lab partners, etc.
<b>0</b>	No Participation	Not present in your section. Attendance in another section not verified by TA.

**Lab Report Guidelines**

<b>A</b>	Standard	The report is everything I would expect. All entries are complete, all questions meaningfully answered, data record including graphs is clear and correct, all calculations and units are correct. The report is organized and legible.
<b>A-</b>	Good	Report has minor error(s).
<b>B</b>	Acceptable	Report is OK, but there are errors and/or missing entries.
<b>C</b>	Unacceptable	Report has significant errors, unanswered questions, missing data, etc.
<b>0</b>	No Report	No report is turned in. Authorship not verified by TA.

**UNM Academic Dishonesty Policy:**

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.

### **Title IX**

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](http://oeo.unm.edu)). If you want to retain anonymity, instead report the incident to other units on campus, namely Student Health and Counseling (SHAC), Counseling and Resource Center (CARS), a licensed medical practitioner on campus, or off campus to the Rape Crisis Center of Central New Mexico, or a sexual assault nurse examiner. If you report the incident to the LoboRESPECT advocacy center, Women’s Resource Center, or the LGBTQ Resource Center, you retain anonymity but an anonymous record is made for statistical purposes. See more information at [https://policy.unm.edu/university-policies/2000/2740.html#\\_Toc414642678](https://policy.unm.edu/university-policies/2000/2740.html#_Toc414642678).

## 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.

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Sample Assessment Questions (These questions are all taken directly from the lab manual and could be used as an embedded assessment. More traditional assessments such as the Force Concept Inventory could also be used here.):

1. From the “Force and Motion” lab: Check the calibration. First **Zero** the force probe. Then **Collect** data, and pull on the force probe with the spring scale with several different forces, each 2.0 N or smaller. Use the **Examine** tool to record the force probe readings and corresponding spring scale readings in the table below. How well do your force probe readings correspond to your spring scale readings?
2. From the “More on Forces” lab: You have a tug-of-war with someone who is much smaller and lighter than you are, but stronger. You both pull as hard as you can, and it’s a tie. One of you might move a little in one direction or the other, but mostly you are both at rest. Predict the relative magnitudes of the forces between person 1 and person 2. Place a check next to your prediction.  
\_\_\_ Person 1 exerts a larger force on Person 2. \_\_\_ The people exert equal forces on each other \_\_\_ Person 2 exerts a larger force on Person 1.
3. From the “More on Forces” lab: Can an astronaut experience weightlessness? Masslessness? Explain.

## 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

These post-lab questions come from the “Work and Energy” lab and could be used to evaluate the Sustainability and the natural and human worlds component skill.

A glance at an old bill from PNM shows that I was charged for electrical energy in units of kilowatt-hours.

$$1 \text{ kilowatt-hour} = (1,000 \text{ watts}) \times (3,600 \text{ seconds}) = 3,600,000 \text{ J}$$

I was charged \$57.97 for 589 kWh of energy. This works out to a little more than 9.8 ¢ per kWh including tax and other charges. For the following estimations, use 10¢ as the cost per kWh.

**Q10** How much would I pay to operate a 100-watt light bulb for one hour?  
cost: \_\_\_\_\_

**Q11** Looked at another way, according to the Energy Information Agency, the average monthly residential electric energy use in the United States in 2009 was 908 kWh. Suppose that lifting 16 tons through a height of one meter represents the amount of work a strong person can do in one day. If that person worked 365 days per year, how many years would it take to produce the electric energy used in one month in one household?

This activity comes from the “More on Forces” lab and could be used to evaluate the students’ ability to work collaboratively.

## Activity 2 Tutorial

### Counterintuitive Ideas: Newton’s Third Law

#### A. Newton’s Third Law and Common Sense

Often, Newton’s Third law just makes sense. But in some cases, it seems not to. Consider a heavy truck ramming into a parked, unoccupied car.

1. (*Work together*) According to *common sense*, which force (if either) is larger during the collision: the force exerted by the truck on the car, or the force exerted by the car on the truck? Explain the intuitive reasoning.

2. (*Work together*) We’ve asked this question of many students, and a typical response goes like this:

Intuitively, the car reacts more during the collision. (You’d rather be riding in the truck!)

So the car feels the bigger force.

Is your group’s explanation in part A similar to or different from this?

Explain.

3. (*Work together*) According to Newton’s third law, which of those forces (if

either) is bigger?

4. *Experiment.* Is this a case where Newton's third law doesn't apply? At the front of the room, the TA has set up an experiment that simulates a truck ramming a car. Go do the experiment and record the results here. You can also test whether Newton's third law holds for other collisions.

### **B. What to do with the contradiction between common sense and Newton's 3rd Law**

Let's consider the contradiction we just found between physics and common sense.

1. (*Work individually*) For most people, Newton's third law contradicts the common-sense intuition that the car reacts more during the collision. Which one of the following best expresses your attitude toward this contradiction?

a. We shouldn't dwell on these kinds of contradictions and should instead focus on learning exactly when Newton's third law does and doesn't apply.

b. There's probably some way to reconcile common sense with Newton's third law, though I don't see how.

c. Although physics usually can be reconciled with common sense, here the contradiction between physics and common sense is so blatant that we have to accept it.

Briefly explain why you chose the answer you chose.

2. Discuss your answer in your group. Is there a consensus or disagreement? If there was disagreement explain how you group decided to deal with this disagreement.

## Quantitative Reasoning

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The following activity from the “Changing Motion” lab is just one of many that could be used to gather assessment data for quantitative reasoning. Given that this lab is very early in the semester, it could even be thought of as a pre-test of their ability to express quantitative information graphically.

### Activity 2 Speeding Up “Away”

In this activity you will look at the motion of a cart when its speed is changing.

1. Set up the cart, ramp, pulley, and motion detector as illustrated below. Make sure that the end stop catches the cart before the hanging mass reaches the ground. If the cart has a friction pad, make sure that it does not drag. The cart should never get closer than 0.15 m to the detector.

2. **Prediction** What will the position and velocity graphs look like? *Ignore the acceleration graph for now.* Sketch predictions with **d-a-s-h-e-d---l-i-n-e-s**.

3. Test your predictions.

a. Open **L02A1-1(Speeding Up).cmbl**. Before releasing the cart, click **Collect** and move the cart with your hand to make sure that the detector can "see" the cart all the way to the end of the board. You may need to make adjustments.

b. Hang 50g from the end of the string. This will cause the cart to speed up when released. Hold the front of the cart until you are ready to graph. Hold it in such a way that *the motion detector does not see your hand*.

c. **Collect** data, and when you hear the clicks of the motion detector, release the cart from rest. Repeat, if necessary, until you get a nice set of graphs.

d. Change the position and velocity scales if necessary so that the graphs fill the axes. Save your data for Activity 6. Select **Save as . . .** from the **File** Menu, give your file a new name such as **SPEEDUP** \_\_ \_\_ \_\_.cmbl, where are your initials, then click on **Save**.

e. Sketch your position and velocity graphs neatly on the previous axes with a solid line.

One of the final labs of the semester is a lab on thermal energy. This post-lab question could be used as a post-test.

Describe what happens to the temperature of a water-ice mixture originally at  $0^{\circ}\text{C}$  when heat energy is transferred to it at a constant rate. Sketch a temperature history on the axes below. Indicate on your graph where the ice disappears.