Textbook: Physics, by Serway and Vuille, 10th edition, pub. CENGAGE, copyright 2014. Online texts, via Webassign, will be provided near the end of first quarter.

Course description: AP Physics 1 is a college-level, algebra-based physics class. On “A” days class will meet in the lecture hall (room 070) and on “B” days class will meet in room 241. At the end of the year students will be prepared to take the AP tests, worth 4-5 college credits total. Students are encouraged, though not required, to take the AP test during the afternoon of Tuesday, May 7, 2019. The course is also Dual Enrolled through UNO, and students will have opportunities to earn 4 lecture and 1 lab credit at UNO. The course is designed around six “big ideas:”

Big Idea 1 – Objects and systems have properties such as mass and charge. Systems may have internal structure.
Big Idea 2 – Fields existing in space can be used to explain interactions.
Big Idea 3 – The interactions of an object with other objects can be described by forces.
Big Idea 4 – Interactions between systems can result in changes in those systems.
Big Idea 5 – Changes that occur as a result of interactions are constrained by conservation laws.
Big Idea 6 – Waves can transfer energy and momentum from one location to another without the permanent transfer of mass and serve as a mathematical model for the description of other phenomena.

Coursework & Grading: Students will have something to work on every night—this will include lab work, daily problems, and/or studying for quizzes and tests. Daily problem sets are to be done each night and will be recorded in the “practice” folder in the grade book. For every five homework assignments a formative homework grade will be recorded. Answers to these problems are posted so students can check the accuracy of their work. There will be also be periodic homework quizzes over those assignments, and students who haven’t done the work are not likely to perform well. Lab work is done in groups in class, but each student is responsible for completing an individual lab report as described below. You must stay up-to-date on homework—turning in an entire unit’s work on the last day is not beneficial, and that won’t be accepted. Formative grades will consist of homework grades, homework quizzes and lab work. Summative quizzes will be given roughly every 2-3 weeks to gauge student understanding. These quizzes are structured like AP tests, and just as on an AP test, no re-quizzes will be given. Two larger tests will also be administered during each semester. Occasionally, particularly large labs might be put into the summative grade folder as well. Each assignment will be graded using the district standards below, and your final grade will consist of your formative grade x 0.35 + your summative grade x 0.65.
<table>
<thead>
<tr>
<th>Level of Performance</th>
<th>Score</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Advanced</td>
<td>4</td>
<td>The student consistently demonstrates a thorough understanding of course content/grade level standard by making in-depth inferences and showing extended applications of the course content/grade level standard(s). The student performs consistently at a high level of difficulty, complexity, or fluency that is above the expected course content/grade level standard. Exceeds expected course content/grade level standard Applies skills and strategies in new and unfamiliar situations</td>
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<tr>
<td>Proficient + (Approaching Advanced)</td>
<td>3.5</td>
<td>The student demonstrates partial success at showing a thorough understanding of course content/grade level standard by making in-depth inferences and applications of the course content/grade level standard(s). The student performs with partial success at a high level of difficulty, complexity, or fluency that is above the expected course content/grade level standard. Demonstrates success toward exceeding course content/grade level standard Applies skills and strategies consistently in familiar situations, and at times, in unfamiliar situations</td>
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<tr>
<td>Proficient</td>
<td>3</td>
<td>The student demonstrates a proficient understanding of the expected course content/grade level standard(s). The student performs at the level of difficulty, complexity, or fluency that is at the expected course content/grade level standard. Meets expected course content/grade level standard Retains information and applies skills and strategies in familiar situations</td>
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<tr>
<td>Basic + (Approaching Proficient)</td>
<td>2.5</td>
<td>The student demonstrates an adequate understanding of the information for the course content/grade level standard(s). The student performs with partial success at the level of difficulty, complexity, or fluency that is at the expected course content/grade level standard. Partially meets expected course content/grade level standard Retains information and at times applies skills and strategies in familiar situations</td>
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<tr>
<td>Basic</td>
<td>2</td>
<td>The student demonstrates a basic understanding of the information expected for the course content/grade level standard(s). The student performs the skills required for the course content/grade level standard at a basic level of difficulty, complexity, or fluency. Partially meets expected course content/grade level standard Retains information and simple processes in familiar situations</td>
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<tr>
<td>Approaching Basic</td>
<td>1.5</td>
<td>The student demonstrates some basic understanding of the information expected for the course content/grade level standard(s). The student struggles to perform the skills required for the course content/grade level standard at a basic level of difficulty, complexity, or fluency. Partially meets some of expected course content/grade level standard Retains some information and simple processes in familiar situations</td>
</tr>
<tr>
<td>Below Basic</td>
<td>1</td>
<td>The student demonstrates difficulty in understanding the information and performing the skills expected for the course/grade level standard(s). Performs below expected course content/grade level on the standard. Has difficulty retaining information and applying skills and strategies</td>
</tr>
<tr>
<td>Failing</td>
<td>0</td>
<td>The student demonstrates little or no evidence of understanding the information or skills required for the course content/grade level standard(s).</td>
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Topics covered/Approximate time allotted:

I. Mechanics
    a. Kinematics (Big Idea 3)/15 days
       i. Scalars, vectors, and trigonometry
       ii. One-dimensional kinematics, including free-fall and graphical analysis
       iii. Two-dimensional kinematics
    b. Dynamics (Big ideas 1, 2, 3, and 4)/23 days
       i. Newton’s laws
       ii. Free-body diagrams
       iii. Friction
    c. Work, energy and power (Big Ideas 3, 4, and 5)/7 days
       i. Work
       ii. Energy, potential and kinetic
       iii. The work-energy theorem
       iv. The law of conservation of energy
       v. Power
    d. Momentum (Big Ideas 3, 4, and 5)/12 days
       i. Momentum and impulse
       ii. Conservation of linear momentum
    e. Rotational Motion (Big Ideas 3, 4, and 5)/23 days
       i. Rotational kinematics
       ii. Rotational energy
       iii. Torque and rotational dynamics
       iv. Angular momentum
       v. Conservation of angular momentum
    f. Newton’s Universal Law of Gravitation (Big Ideas 1, 2, 3 and 4)/4 days
       i. Newton’s Universal Law of Gravitation
       ii. Circular motion
    g. Simple Harmonic Motion (Big Ideas 3 and 5)/5 days
       i. Pendula
       ii. Spring-mass systems

One week for unit test

Two days to present outside labs (first semester)

Two days to present “real-world” physics applications (2nd semester)

II. Electricity
    a. Electrostatics (Big ideas 1, 2, 3, 4, and 5)/6 days
i. Electric Force (Coulomb’s Law)
ii. Elementary Charges and Fundamental Particles
iii. Electric Field
iv. Electric Potential

b. DC Circuits (Big Ideas 1, 4, and 5)/13 days
   i. Electric Current, Potential Difference, and Ohm’s Law
   ii. Electrical power
   iii. Kirchhoff’s Laws
   iv. Analysis of DC circuits

III. Mechanical Waves and Sound (Big Idea 6)/9 days
   a. Wave characteristics
   b. Speed of sound
   c. Waves in strings
   d. Standing waves
   e. Doppler effect
   f. Superposition/interference

IV. Review for Final Exam, given two weeks before the AP Physics 1 test/10 days

V. Final Exam/2 days (one day free-response, one day multiple-choice)

VI. Review final exam/5 days

VII. Post AP test, prep for AP Physics 2.

Lab work: 25% of the time in this class will be spent doing lab activities. While the data collection will be done in class as part of a small lab group, some individual prep time outside class may be required before a lab, and more time will be spent later preparing a lab report. A separate lab report should be done by each student for each lab, and students are encouraged to maintain a lab notebook as evidence of the work done in this course. The specific components of each lab report will be given to you on a separate document.

Outside the classroom lab experiences: In addition to our in-class lab work, students will engage in an exercise outside the regular lab experience. Students may choose between one of the following, due in early December.

a. Using an accelerometer app for their smart phone (SPARKvue is one), students will analyze accelerations they experience every day. They can take the data while moving down the hall between classes, while on the school bus, on an amusement park ride, or anything else they want (within reason – safety first!). Students will present a description of the motion they experienced (not only acceleration, but velocity and displacement, too), both quantitatively and qualitatively, including graphs. Their presentation will be peer critiqued and/or questioned, and they will answer the questions with supporting evidence.
b. Students will take two pictures – one of an object in translational equilibrium, and one of an object in rotational equilibrium. The objects also must have more than three forces acting on them. They will then construct free-body diagrams for each object, and determine the magnitude of each force acting on each object. For the object in rotational equilibrium, students will also find the magnitude of each torque acting on the object. Students will present their work in class. Their presentation will be peer critiqued and/or questioned, and they will answer the questions with supporting evidence.

**Real-World physics applications.**

In order for students to become scientifically literate citizens, it is important to apply physics knowledge to a “real-world” question. Students may choose between one of the following during second semester (exact date to be determined later).

a. Students will pick a movie and point out three or more examples of bad physics. Students will present these to the class, with both qualitative and quantitative descriptions.

b. Students will pick an alternative energy source (such as wind, geothermal, or nuclear) and research advantages and disadvantages of this energy source as compared to traditional fossil fuels. Students will present their results to the class.

c. Students will go to the insurance institute of highway safety website (iihs.org) and will look at the safest cars in a crash. They will present to the class qualitative and quantitative information as to why these cars are safer and how the safety features keep people safe.