

AP Physics 2 Syllabus
Hutchison High School Room 140 479-2261 ext. 144
Email: lars.hansen@k12northstar.org
Assignment Website: <http://hut-lhansen.weebly.com>

Text:

College Physics – 7th Edition. Wilson, J. and Buffa, A. San Francisco, CA: Addison-Wesley.

Course Overview:

AP Physics 2 is a college level introductory physics course governed by an organization called the College Board. We cover the general topics of fluid mechanics, thermodynamics, electricity (electric potential, capacitance, RC circuits), magnetism, geometric and physical optics, and quantum & atomic physics. All students are encouraged to take the AP Physics 2 test at the end of the school year. High scores can be applied to many colleges for credit.

AP Physics 2 requires a thorough understanding of algebra 2 and trigonometry. The course is recommended for students who are planning to be pre-med majors in college, as a foundation course for students who are planning to be engineering or physics majors and will take a calculus-based physics course as college freshmen, or for non-physics majors who want to get some core college science credits in high school so that they can take other classes as college freshmen. This course will be covered in a full year. The emphasis of this course is to understand the concepts of physics, and use them to formulate and solve real world problems. Hands-on inquiry based lab work is presented as an integral part of this course. A topical unit assessment completes each unit. There is a cumulative final exam at the end of each semester.

Physics class will typically meet 4 days a week, for approximately 270 minutes total. Collaboration between students, including peer teaching and review, is strongly emphasized. Students are encouraged to work together on homework assignments, labs, and projects.

Course goals include developing each student's intuition, creativity, and investigative skills to:

- A. Read, understand, and interpret physical information.
- B. Use the scientific method to analyze a particular physical phenomenon or problem.
- C. Use mathematical reasoning in a physical situation or problem.
- D. Perform experiments, interpret the results of observations and communicate results, including error analysis.

Grading Policy: Weighted Percentage Scale.

Assessments (Tests & Quizzes)	35%
Labs	25%
Homework	15%
Projects	10%
Final Exam	15%
Total:	100%

Grade	Percent
A	90% - 100%
B	80% - 89%
C	70% - 79%
D	60% - 69%

Assessments (Tests and Quizzes):

There will be several unit tests each semester, as well as proficiency quizzes covering concepts within individual units. Non cell-phone calculators are essential.

Additionally, I will provide one AP Equation sheet per unit, upon which students can make handwritten notes. See Resources Page 1 and 2 to see the Equation Sheet. This is to prepare students for the AP Exam in the spring. Save all of them for the final!

Labs:

All labs require data acquisition and written responses made in your Lab Notebook (provided). I will check your lab work off when I collect Booklets at the end of a unit.

For any lab, I will offer a question and answer session after all groups have finished their data collection, and before the lab is due. This most likely will occur at the start of next class.

Homework Checks:

Daily Booklet Homework: 3 to 8 problems follow a section of notes, and are scored at the end of a unit. I will forewarn all students before collecting or checking Booklets – typically after a test or quiz. Early Booklets receive extra credit. Students are welcome to ask questions on specific problems the day after they're assigned.

Unit Review Problems: students should work on them during the course of the unit, and fill in the bubble sheet once the questions have been answered. On the due date, I will collect booklets and scan them. I will indicate which ones were missed and write down scores, then return Booklets.

If a student is late submitting answers to a Unit Review Problem set, there is a 50% reduction in score. Also, if all work is not shown on problems, an incomplete fee will be assessed per problem.

Throughout your Booklet, actual old AP Test questions will appear periodically.

Projects:

All students are responsible for two projects throughout the school year, which are described below. These projects will occur outside of the lab environment, and will focus on specific learning objectives. The intention of these projects is to allow students to apply physics and gather data in real world scenarios, and to compare their findings with other students. When different topics are studied, students will present their findings to the class and be critically assessed by others.

Semester Final:

The comprehensive semester final is worth 15% of your grade. You can use all six of your collected AP Physics Equation sheets, or generate new ones if you've lost any during the semester.

Redo Policy:

Students have the option of redoing any incorrect answers on Booklet assignments and labs for at least 50% credit back. For example, if a student missed six points on an assignment and does all corrections, s/he will earn three points back. Corrections must be done in a different color in your Booklet, and can be turned at any time before the end of the quarter. Please make corrections ASAP.

Unit Review Problems can also be corrected, in that you will always have two attempts at each set, if it is on time. These are also due by the end of the quarter.

Redoing tests and quizzes is different. Students correct all their mistakes on a separate sheet of paper, staple it to the original, and give that to me for correction. Problems must be reworked, and answered completely. For example, don't just write A, B, C, or D for multiple choice, explain your

correction thoroughly. Afterwards, they have the right to take another version of the test before the end of the quarter. The best score will be recorded.

Late Work:

You will be told exactly when assignments are due. Work submitted after due dates will be accepted, with a late fee. Work turned in after the last day of each **quarter** will receive no credit.

Additionally, I will conduct a weekly check as to the completion of assignments. Any student with missing work will have one day to turn it in, and after that they will receive daily lunch detentions, to be spent in Room 140 working on assignments until they are done.

Attendance:

It is your responsibility to ask for any work missed due to excused, unexpected absences when you return. Alternatively, if you are keeping track of where we are in the semester in the Semester Plans portion of your Booklet, you'll have a fair idea as to what you'll be missing. Assignments you miss are due upon your return. Missed labs must be made up within two weeks of your return.

Cheating Policy

Students (and accomplices if any) caught cheating on assessments will:

1st Time: Receive a zero on the assessment and call home. Administrators will be informed
2nd & Onwards: Receive a zero, call home, and receive an office referral.

Class Expectations and Repercussions:

1. Be in class on time, with all necessary materials.
2. Show respect to all people in the class, as well as the classroom itself.
3. While **all school and district rules must be followed**, I emphasize:
 - a. Responsible cell phone use. We will periodically use Smartphones for academic purposes. Phones taken to class must be placed face down on your desk, in silent no-vibration mode. Students caught checking their phones will get one warning per school year, and if they check them again the phone will be sent to the office, to be recovered at the end of the day.
 - b. No hats, hoods, or headgear.
 - c. Wear school and science lab appropriate clothing.
 - d. Leave all backpacks and large purses in your locker unless it's the last class of the day.
 - e. Have a hall pass or an escort to leave the room.
 - f. Computers are permitted **ONLY** if they are used in a scholastic context.
4. I will establish a seating chart that will divide students into lab groups shortly after school starts. You are responsible for your seat and surrounding area; please report any graffiti immediately, so you don't get blamed for it.

Not meeting expectations will result in the following tracked repercussions:

1. Verbal reminder of what is expected,
2. Second verbal reminder and one lunch detention
3. Third verbal reminder, two lunch detentions, and guardian contact.
4. Office referral.

Supply List:

School issued: textbook, Homework Booklet, Lab Notebook
Writing sticks (pens / pencils),
3-Ring binder with paper OR spiral notebook,
Scientific Calculator (recommended)

Physics Booklet:

Each semester, students will be provided a Booklet that contains all of the lecture-based problem sets, labs, projects, and resources needed to complete the course. This booklet will periodically be collected for grading homework assignments or labs contained therein. Also, labs will require the student to produce a more formal written product in an additional Lab Notebook.

Each unit in the Booklet ends with a set of application problems pertinent to the unit of study. This is a means to prepare students for an assessment. Students are placed in groups, and work on the problem set. After a certain time, each group is assigned a set of problems, which they have to present to the class. The class must respectfully find errors in the presented problems if any exist.

Periodically, extra credit questions (called Wizard Challenges) will be available to try. You will see a reminder in your booklet when these problems arise. Extra credit points will be assigned directly into the Assessments category of your grade.

Preparation for AP Test; Grading Considerations

Many students take AP classes to earn advance credit in college classes they intend to take. At the end of the school year, the College Board provides a test that students can take to earn credit. It is not required that students take this test to pass AP Physics 1. It is completely optional. I recommend it for students who feel comfortable with their understanding of physics by the time registration season comes, because most colleges accept AP test results. We will talk more about registration and the AP test later.

To prepare students for the AP test, this booklet contains problems that are in the format of an AP question. The multiple choice questions will have one or two correct answers, and the free response questions are taken from old AP tests. In class, these AP format questions are labeled, and we will go over each one as we encounter them.

As far as grade value is concerned, AP classes weigh on your transcripts differently than standard classes. An 'A', for example, rather than counting towards your GPA as a 4.0, will count as a 5.0. A 'B' counts as a 4.0; a 'C' a 3.0, and a 'D' is a 2.0. An 'F' is still 0.0.

Big Ideas Concept:

The AP program Physics format focuses on recurring fundamental themes called Big Ideas. As students progress through different topics, they will be reminded of these themes so they recognize the interworkings of systems in the universe, from the level of the very small to the very large.

The six Big Ideas featured in AP Physics 1 are:

1. Objects and systems have properties such as mass and charge. Systems may have internal structure.
2. Fields existing in space can be used to explain interactions.
3. The interactions of an object with other objects can be described by forces.
4. Interactions between systems can result in changes in those systems.
5. Changes that occur as a result of interactions are constrained by conservation laws.
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.

Course Outline:

The following list is the expected sequence of topics and assignments that students will experience during the year. Each topic is anchored to one or more of the Big Ideas mentioned earlier.

Fall Semester:

Unit 0 – Measurement, Vector Review, AP Strategies – Big Idea 1

1. Notes 0.1 – Measurement and Significant Figures
2. Notes 0.2 – Vector Manipulation, Trigonometry
3. Notes 0.3 – AP Exam Strategies

Unit 1 – Fluid Mechanics – Big Ideas 1, 3, 4, 5

1. Notes 1.1 – Fluid & Pressure
2. Notes 1.2 – Pascal’s Law
3. Notes 1.3 – Buoyancy and Archimedes’ Principle
→ Buoyancy Lab
4. Notes 1.4 – Fluid Dynamics
5. Notes 1.5 – Bernoulli’s Principle
→ Bernoulli’s Principle Lab
→ Unit 1 Application Problems
→ Unit 1 Review Problems
→ Unit 1 Test and Booklet Check

Unit 2 – Kinetic Theory, Heat, and Thermodynamics – Big Ideas 1, 3, 4, 5, 7

2.A – Temperature and Kinetic Theory

1. Notes 2.A.1 – Temperature and Heat
2. Notes 2.A.2 – Defining Ideal Gases & Gas Laws
→ Boyle’s Law Lab
3. Notes 2.A.3 – Thermal Expansion
4. Notes 2.A.4 – Kinetic Theory
→ Unit 2.A Application Problems
→ Unit 2.A Review Problems
→ Unit 2.A Test and Booklet Check

2.B – Heat

1. Notes 2.B.1 – Definition and Units of Heat
2. Notes 2.B.2 – Specific Heat and Calorimetry
→ Specific Heat Lab
3. Notes 2.B.3 – Phase Changes and Latent Heat
→ Specific Heat Quiz
4. Notes 2.B.4 – Heat Transfer
→ Unit 2.B Application Problems
→ Unit 2.B Review Problems
→ Unit 2.B Test and Booklet Check

2.C – Thermodynamics

1. Notes 2.C.1 – First Law of Thermodynamics: Heat, Internal Energy, Work
2. Notes 2.C.2 – Thermodynamic Processes
3. Notes 2.C.3 – Second Law of Thermodynamics: Entropy
4. Notes 2.C.4 – Heat Engines
 - Steam Engine Lab
5. Notes 2.C.5 – Carnot Cycle & Third Law of Thermodynamics: Absolute Zero vs. Entropy
 - Unit 2.C Review Problems
 - Unit 2.C Application Problems
 - Unit 2.C Test and Booklet Check:

Semester Project Introduction

Unit 3 – Electricity Review and Capacitance – Big Ideas 1, 2, 3, 4, 5

3.A –Electric Charge, Forces, Fields

1. Notes 3.A.1 – Electric Charge
2. Notes 3.A.2 – Electric Force
 - Electric Force Lab
3. Notes 3.A.3 – Electric Fields
4. Notes 3.A.4 – Conductors, Gauss' Law
 - Unit 3.A Application Problems
 - Unit 3.A Review Problems
 - Unit 3.A Test and Booklet Check

Semester Project Movie Registration

3.B –Electric Potential and Capacitance

1. Notes 3.B.1 – Electric Potential
2. Notes 3.B.2 – Capacitance
3. Notes 3.B.3 – Dielectrics
 - Capacitor Lab
4. Notes 3.B.4 – Capacitor Circuits
 - Unit 3.B Review Problems
 - Unit 3.B Application Problems
 - Unit 3.B Test and Booklet Check

Heading Down the Backstretch

- Fall Project Presentations
- Fall Semester Review
- Fall Semester Final Exam

Spring Semester:

Unit 3 Continued – DC and RC Circuits – Big Ideas 1, 2, 3, 4, 5

3.C – Electric Current and Resistance

1. Notes 3.C.1 – Batteries, Direct Current, and the Ampere
→ Build Your Own Battery Challenge
2. Notes 3.C.2 – Resistance
3. Notes 3.C.3 – Ohm’s Law
4. Notes 3.C.4 – Power
5. Notes 3.C.5 – Serial, Parallel Resistance Circuits
→ Resistor Circuit Lab
6. Notes 3.C.6 - Kirchoff’s Laws
7. Notes 3.C.7 – Steady State RC Circuits
→ RC Circuit Lab
→ Unit 3.C Application Problems
→ Unit 3.C Review Problems
→ Unit 3.C Test and Booklet Check

Unit 4 – Magnetism – Big Ideas 1, 2, 3, 5

1. Notes 4.1 – Permanent Magnets, Poles, Magnetic Field Direction
2. Notes 4.2 – Magnetic Fields
3. Notes 4.3 – Magnetic Force
4. Notes 4.4 – Particles in Magnetic Fields, Current Carrying Wires
5. Notes 4.5 – Electromagnetism
6. Notes 4.6 – Electromagnetic Induction
→ Magnetic Force Lab
7. Notes 4.7 – Electric Generators, Back EMF
→ Unit 4 Application Problems
→ Unit 4 Review Problems
→
Unit 4 Test and Booklet Check

Unit 5 – Geometric and Physical Optics – Big Idea 6

5.A – Light, Reflection, and Refraction

1. Notes 5.A.1 – Electromagnetic Waves
2. Notes 5.A.2 – Reflection
→ Plane Mirror Lab
3. Notes 5.A.3 – Refraction
→ Refractive Index of Vegetable Oil Lab
4. Notes 5.A.4 – Optics and Dispersion
→ Shooting Fish in a Barrel Challenge
→ Unit 5.A Application Problems
→ Unit 5.A Review Problems
→ Unit 5.A Test and Booklet Check:

5.B – Geometric Optics

1. Notes 5.B.1 – Plane Mirrors
2. Notes 5.B.2 – Spherical Mirrors
→ Spherical Mirror Lab
3. Notes 5.B.3 – Lenses and Aberrations
→ Lens Challenge
→ Unit 5.B Application Problems
→ Unit 5.B Review Problems
→ Unit 5.B Test and Booklet Check

5.C – Physical Optics

1. Notes 5.C.1 – Young’s Double Slit Experiment
2. Notes 5.C.2 – Thin Film Interference
3. Notes 5.C.3 – Diffraction
→ Measuring Diffraction Lab
4. Notes 5.C.4 – Polarization and Scattering
→ Unit 5.C Application Problems
→ Unit 5.C Review Problems
→ Unit 5.C Test and Booklet Check:

Unit 6– Modern Physics – Big Ideas 1, 3, 4, 5, 6, 7

1. Notes 6.1 – Quantum Physics:
2. Notes 6.2 – The Photoelectric Effect
3. Notes 6.3 – The Compton Effect
4. Notes 6.4 – Atomic Physics
5. Notes 6.5 – Wave Particle Duality
6. Notes 6.6 – Nuclear Physics
→ Radioactive Decay Lab
7. Notes 6.7 – Mass-Energy Equivalence
→ Unit 6 Application Problems
→ Unit 6 Review Problems
→ Unit 6 Test and Booklet Check:

Heading Down the Backstretch

- Spring Project Presentations
- Semester Review and Study Guide
- Spring Semester In-Class Review
- Spring Semester Final Exam