

AP Physics C: Mechanics and E&M

Mr. Bates

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Syllabus - 2020-2021 Distance Learning

This course will parallel college freshman-level physics classes in the study of both Mechanics and Electricity & Magnetism, and will prepare you to take either or both of the AP Physics C exams in May. Topics will align with those commonly found as components of introductory physics classes at a variety of technical colleges and universities.

Class Philosophy

This is not a do-the-problems-get-the-grade class. As a college-level subject, we will pursue complex, open-ended inquiries, by experiment, research, calculation, and simulation, to discover, describe, analyze, and refine our understanding of the fundamental laws that govern our universe. It's difficult, it takes time, and it can be frustrating - but it's also 100% authentic learning. **You must put in learning time outside of class.** Start your UT Quests early. Find a study partner. Ask for help. This is tough stuff, but I know you can do it.

Grading policy

Grades for this course will be calculated as follows:

10% Video Checks 90% Everything Else

Video Checks	Your first point of contact with the material will be through your textbook or through annotated video lectures on PlayPosit. You should expect 1-2 videos per week. It is imperative that you watch all videos and take notes on-time as per myMCPS.
UT Quests	Weekly practice problem sets will be completed on UT Quest; all unit problem sets will generally be released on the first Monday of a unit, and will generally be due on Sunday. Most weeks will have a problem set due. UT Quests will be assessed <i>only</i> for correct completion; I do not take off points for using guesses. Extensions are available by request; extensions will be one-time per problem set, and provide an additional two days. Further extensions will not be provided.
Labs	Inquiry-based labs are the heart and soul of physics; in the current Distance Learning environment, we will figure out how to do labs. A physical lab journal is usually required in class; here, a Google Doc will suffice.
Quizzes	Quizzes will occur approximately once a week, and will take the form of selected Multiple Choice questions or Free Response Questions. Short quizzes will generally be about 10-15 points, and take about 7-15 minutes. Multiple Choice Quizzes may be reassessed once each on an alternate "retake" version, provided you have reviewed the original quiz and completed all videos. Free Response Questions may not be reassessed, but will instead be graded on an AP-style scale.
Exams	There will be one, 45-minute, AP-style exam for each unit of study; exams will be cumulative and will <i>always</i> include questions on earlier material. These will be timed and administered on myMCPS. Exams will be effectively half of an AP exam - 17

multiple choice questions (scaled to 22.5 points) and 1½ free response questions (for 22.5 points), for a total of 45 points. Test corrections are available for up to 50% of points back. Final exam There may be two cumulative semester final exams; Mechanics (near the end of Semester A), and E&M (prior to the AP exam). They will be full, 90-minute mock-AP exams, and further details will be announced as appropriate.

These points, as a percentage of the total points, will constitute your grade *exactly* as follows:

$$89.5 \leq A \leq 100; 79.5 \leq B < 89.5; 69.5 \leq C < 79.5; 59.5 \leq D < 69.5; E < 59.5$$

I expect you to keep track of your grade to make sure it is accurate; if there's a problem, please bring it to my attention. Students with a D or an E as a current grade may be summoned for additional support.

ALL ASSIGNMENTS WILL BE POSTED ON MYMCPS!!

Grading Codes

New this year, assignments will be coded in gradebook for additional clarity. Notably:

- Videos will start with the prefix “PA” (for “practice assignment”)
- All other assignments will start with the prefix “FA” or “SA”, depending on if it’s a formative or summative assessment
- Some assignments will have an “R” suffix, indicating that the assignment may be reassessed; note that redoing an assignment may require reteaching or remediation prior to being able to resubmit or retake the assignment. The reassessment grade replaces the original grade, if higher than the grade previously earned. Assignments that have been reassessed will appear in the gradebook with an unusual decimal grade - for instance, a grade that was previously a “6/10” might appear in the gradebook as “7.01/10” to indicate that the reassessed grade is a 7/10.
- A “Z” in the gradebook may be used to denote that the student did not submit an assignment by the due date/deadline, but may still turn it in. A Z calculates as a zero in Gradebook. Late assignments will be assessed a 10% late fee until the end of the unit, at which point the Z will revert to a zero.

No grade lower than a 50% will be assigned to a completed task/assessment. However, if a teacher determines the student did not attempt to meet the basic requirements of the task/assessment, or if the student did not adhere to the academic honesty policy, the teacher may assign a zero.

Zoom Live Sessions

- The general expectation is that students
 - attend live classes
 - turn their cameras on for the entirety of class
- **Recording Live Lessons:** All teachers will record live lessons to provide flexibility for students
 - Teachers will post lessons to MyMCPS Classroom
 - Access to the video will be limited to students in the class with MCPS email accounts
 - The video will not be downloadable
 - Recordings will be available for 72 hours and will automatically delete after that time.
 - Parents/guardians can OPT OUT of recording by completing MCPS Form 281-13.
 - Students **may not** record, download, or screenshot any part of the lesson. Unauthorized sharing will result in disciplinary action.
- **Attendance:**
 - Attendance will be taken in these ways:
 - Logging into the live zoom session
 - Engaging in a discussion thread or attendance check on MyMCPS Classroom
 - Completing daily classwork.
 - If a student misses class, the video recording may be watched within the 72 hour period. Complete the school google form on the Wheaton High School website to have the absence entered as “Present - other.”

- We will be using breakout rooms throughout this semester. Here are the ground rules for break out rooms.
- **Break Out Sessions—Ground Rules**
 - No break out sessions will be recorded unless there is a legitimate educational reason for doing so, and if so, students and parents will be notified
 - All provisions of the Student Code of Conduct apply in break out rooms and will be enforced
 - Students acting inappropriately during break out sessions will, at a minimum, not be able to engage in break out sessions and will be given alternate assignments

Late and Make-Up Work

If you miss class, it is your responsibility to determine the work missed. [Refer to myMCPS](#) to figure out what happened.

If you miss an exam, you must email me by the end of **that** school day. The email should explain to me why you are absent and when you intend to make-up the test.

There will be a flat 10% “late fee” deducted from **all** late formative work (this does not apply to UT Quests if you have an approved extension). The deadline for all late work is the Unit Exam for that unit; work will no longer be accepted after that date, and retakes of quizzes will no longer be available.

These are very strange times. I can be flexible with you, but only if you communicate with me!

Class activities

I expect you to attend all live sessions, and complete all assignments posted on myMCPS. In the event you are unable to attend live class, I expect you to contact me, and either make up the work on your own time, or work out a schedule with me. I can be flexible with you in this weird time, but only if you communicate your needs.

Notebook

You should keep an organized notebook. It should be a bound notebook, not a bunch of papers. Take careful notes on videos and textbook readings. If you keep a careful notebook, it will help in your studying for tests and exams. If you’re not sure how to take good notes, ask - it’s time to learn.

All work submitted must be neat, organized, and readable. If I can’t read it, it’s not right.

Honesty

Don’t cheat yourself. This is an AP class, and a tough one. Collaboration is the norm - find good partners and work with them, but do your own work. Cheating will be reported in all circumstances. Lying about cheating is extra bad.

Academic support

I will be available as often as possible during scheduled support hours after class and on Wednesdays. I am not available at lunch during distance learning. However, I am always available via email or Remind, and am happy to arrange a time to talk by appointment. If you’re not in the habit of making appointments for help, develop it now. It will serve you very well in college. Making an appointment requires emailing or coming to me and asking “Mr. Bates, can we chat this evening/this week?” I will nearly always say yes, or schedule a time when we can meet.

Crucial Class Codes:
UT Quest: Bates2021
PlayPosit: 1233156-924840
Remind: bk3he8

Course Outline

The course discusses topics in two broad categories:

- (1) Mechanics
- (2) Electricity & Magnetism.

Students are prepared to take one **or both** of the Advanced Placement Physics C examinations at the end of this course: AP Physics C Mechanics Test **and/or** AP Physics C E&M Test.



Students in AP Physics C **MUST** either be currently enrolled in Calculus (AB or BC), or must have previously taken Calculus. The methods of differential and integral calculus - including, but not limited to, taking derivatives, integration, related rates, volume and area integrals, and differential equations - are *essential* to the study of physics at the college level.

Our text will be ***Physics for Scientists and Engineers (3rd Ed.)*** by **Randall D. Knight**. This is a comprehensive, calculus-based text covering all necessary topics (and then some).

Semester A (16 weeks)

AP Physics C: Mechanics	# of Weeks
Kinematics <ul style="list-style-type: none">- 1-Dimensional- 2-DimensionalIncluding Projectiles	3
Newton's laws of Motion <ul style="list-style-type: none">- Static Equilibrium (1st)- Dynamics of a single particle (2nd)- Systems of 2 or more objects (3rd)	3
Work Energy Power <ul style="list-style-type: none">- Work/Work Energy- Forces and Potential Energy- Conservation of Energy- Power	2
Linear Momentum <ul style="list-style-type: none">- Center of Mass- Impulse and Momentum- Conservation of Linear momentum and collisions	2
Circular Motion & Rotation <ul style="list-style-type: none">- Uniform Circular Motion- Torque and Rotational Statics- Rotational Kinematics and Dynamics- Moment of Inertia- Conservation of Angular Momentum	3
Oscillations and Gravitation <ul style="list-style-type: none">- Simple Harmonic Motion- Mass on Spring- Pendulum / Other Oscillations- Newton's Law of Gravity- Circular Orbits of Planets / Satellites	3

Semester B (14 weeks before AP Exam)

AP Physics C: Electricity and Magnetism	# of weeks
Electrostatics <ul style="list-style-type: none"> - Charge and Coulomb's Law - Electric Field & Electric Potential (point charges) - Gauss's Law - Fields and Potentials of Charge Distributions 	3
Conductors, Capacitors <ul style="list-style-type: none"> - Electrostatics with Conductors - Capacitors <ul style="list-style-type: none"> -Capacitance -Parallel Plate -Spherical and Cylindrical - Dielectrics 	2
Electric Circuits <ul style="list-style-type: none"> - Current, Resistance, Power - Steady-state direct current circuits with batteries and resistors only - Capacitors in circuits <ul style="list-style-type: none"> -Steady State -Transients in RC Circuits 	3
Magnetic Fields <ul style="list-style-type: none"> - Forces on Moving Charges in Magnetic Fields - Forces on Current-Carrying Wires in Magnetic Fields - Fields of Long Current-Carrying Wires - Biot-Savart Law and Ampere's Law 	2
Electromagnetism <ul style="list-style-type: none"> - Electromagnetic Induction (Faraday's Law & Lenz's Law) - Inductance (including LR and RC circuits) - Maxwell's Equations 	2
Mock AP Tests/Review (MC and FR)	2
AP EXAM	
3 Weeks remain after the AP Exam	
Additional Laboratory Exercises	
Final Project Lab Practicum	

Laboratory Work

Students are expected to spend at least 20% of the work time of class engaged in the below lab activities (we'll do a lot more than that). Each lab will consist of pre-lab questioning, an **open-ended inquiry** requiring student ingenuity and intuition to design, execute, and evaluate an approach, and a written lab report at the conclusion of the exercise. This requirement is reflective not only of the AP exam's focus on measurement and lab approaches, but also of the expectations of a college-bound science student.

MECHANICS LABS (at least 5 will be completed)

General Labs

Error Analysis
Density
Vector Addition

Kinematics Labs

Position vs Time
High-Speed Video Analysis
Measuring "g"
Air Drag (Coffee Filter)

Projectile Motion Labs

Muzzle Velocity of a
Projectile Launcher

Newton's Laws and Force Labs

$a = F/m$
Force Equilibrium
Frictional Coefficient
Centripetal Force
Atwood Machine

Simple Harmonic Motion Labs

Hooke's Law
Simple Pendulum
Physical Pendulum

Work, Energy, and Momentum Labs

Non-Conservative Work
Linear Momentum
2D Collisions
Rotational Dynamics
Torque
Angular Momentum

Electricity & Magnetism LABS (at least 5 will be completed)

Electricity Labs

1. Mapping Electric Fields
2. Resistivity of Unknown Metal
3. Internal Resistance of a Battery

DC Circuit Labs

4. Ohm's Law
5. Series vs. Parallel Circuits
6. Wheatstone Bridge
7. Kirchhoff's Laws

AC Circuit Labs

8. Induction of a Slinky
9. RLC Circuit
10. Ampere's Law

Magnetism Labs

11. Electric Balance
12. Mass of an Electron
13. Measuring Earth's Magnetic Field

ONLINE HOMEWORK RESPONSIBILITIES

UT Homework: <http://quest.cns.utexas.edu>

In addition to your Lab work and readings, you will be responsible for completing practice homework assignments on the University of Texas's Quest website. This website is specifically registered for Wheaton High School students and will allow you to work on, submit, and verify answers for various Physics problems.

You WILL be able to work in groups on these problems and I STRONGLY encourage you to work with others!! You can / will work on these problems on your own time, but you are always able to ask me for help during class, during lunch or after school and/or via email.