CASTEEL HIGH SCHOOL

Physics Syllabus

2019 – 2020

TEACHER

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Course Description

The AP Physics 1 class is designed to introduce students to the algebra based physics learned at the college level.

At the end of the course, **students will take the AP Test**, which will test students' knowledge of both the conceptual and mathematical formulations of the requisite concepts.

What is Physics?

It was a warm summer's evening in ancient Greece…

Expectations

More specifically, students are expected to **demonstrate** their learning through the creation, interpretation, and analysis of data.

Students will then be assessed through the **production** of their written work, tasks, laboratory reports, practicums, oral presentations, projects, and tests/quizzes.

Required Material

- **Textbook:** **College Physics: A Strategic Approach (3rd Edition)**
  Randall D. Knight (Professor Emeritus) and Brian Jones
- **Graphing Calculator**
- **Notebook**

Grading Categories

Methods of Assessment:

Each Semester, grades will be based on the following:

Classwork/Homework 30%
Regular worksheets/ textbook problems

Labs 35%
Notebook/Reports

Quizzes/Tests 35%

Grades are calculated based on these categories prior to the final

Semester Exams 20%
Required at the end of each Semester. Second semester may be project-based

Calculated by:
Quarter 1 Grade: 40%
Quarter 2 Grade: 40%
Semester Exam Grade: 20%

Assessed through the production of:

- Written work
- Tasks
- Laboratory reports
- Practicums
- Oral presentations
- Projects
- Quizzes
- Tests

Classwork/ Homework	Labs *(Important in college level science class)*	Quizzes/ Tests
❖ Many of the problems we will work on in class in groups and as a whole… It is imperative that you participate, ask questions, make mistakes, and work to understand each concept ❖ Homework will be assigned each class. It will be graded on a completion score… however, the quizzes and tests are based on the homework, make mistakes and struggle on the homework, not the quiz/test ❖ You will want to keep your homework after it has been graded. It is a useful way to study for tests and exams.	❖ Most units will have activities and labs to test theories and concepts. ❖ Lab groups create their own procedures and run experiments collecting data and developing models for the phenomenon. Each lab partner will do their own conclusion or perspective **It is good scientific practice to have:** ✓ Lab Notebooks: Notes for personal reflection on all phases of the lab (Pre-lab, data collection, post-lab) ✓ Lab Reports: Each student is responsible for creating their own formal lab report using the appropriate format	❖ Can be a mixture of multiple choice, free response and anything in between. Most quizzes and tests are based off of previous AP Exam questions. ❖ Quizzes: 1 per week unless having a test that week. ❖ Tests: End of each unit ❖ There are no test corrections or re-takes… however there will be an opportunity to earn bonus points – Freee

Units of Study

Unit 1: Kinematics
Reference Frames and Displacement
Average Velocity and Instantaneous Velocity
Motion at Constant Acceleration
Falling Objects
Adding Vectors by Components
Projectile Motion: projectiles fired horizontally and at an angle
Graphical Analysis of Motion
Textual Readings: *College Physics: Chapter 1, 2, 3*

Unit 2: Dynamics
Forces
Free-Body-Diagrams
Newton's Laws of Motion
Mass and Weight
Applications Involving Friction, Inclines
Textual Readings: *College Physics: Chapter 4, 5*

Unit 3: Circular Motion & Gravitation
Kinematics of Uniform Circular Motion
Dynamics of Uniform Circular Motion
Newton's Law of Universal Gravitation
Gravity Near the Earth's Surface
Satellites and "Weightlessness"
Kepler's Laws
Textual Readings: *Knight: Chapter 6*

Unit 4: Energy
Work
Kinetic Energy and the Work-Energy Theorem
Potential Energy: Gravitational and Elastic
Mechanical Energy and its Conservation
Power
Textual Readings: *College Physics: Chapter 10*

Unit 5: Momentum
Impulse and Change in Momentum
Conservation of Momentum
Conservation of Energy and Momentum in Collisions (1 dimension)
Conservation of Momentum in Collisions (2 dimensions: qualitative
and semi-quantitative only)
Textual Readings: *College Physics: Chapter 9*

Unit 6: Unit Simple Harmonic Motion
Simple Harmonic Motion
SHM Graphs: position, velocity, acceleration, energy
Energy in SHM
Mass-Spring Systems
Simple Pendulum
Textual Readings: *College Physics: Chapter 14*

Unit 7: Torque & Rotational Motion
Torque
Center of Mass (qualitative)
Rotational Kinematics
Rotational Dynamics and Rotational Inertia
Rolling Motion (without slipping)
Rotational Kinetic Energy
Angular Momentum and its Conservation
Textual Readings: *College Physics: Chapter 7*

Unit 8: Mechanical Waves & Sound
Wave Motion
Types of Waves: Transverse and Longitudinal
Energy Transmitted by Waves: relationship of energy and wave amplitude
Reflection and Interference of Waves
Standing Waves
Sources of Sound:
Standing waves for stringed instruments
Standing waves for a tube open at both ends and for a tube closed at one end
Beats
Doppler Effect (qualitative)
Textual Readings: *College Physics: Chapter 15, 16*

Unit 9: Electric Charge & Electric Force
Static Electricity; Electric Charge and its Conservation
Electric Charge in the Atom
Charging Processes
Coulomb's Law
Textual Readings: *College Physics: Chapter 20*

Unit 10: DC Circuits
Electric Current
Ohms Law: Resistance and Resistors
Resistivity
Electric Power
DC Circuits
Resistors in Series and Parallel
Kirchhoff's Rules (circuits with one battery only)
Internal Resistance is NOT covered in AP Physics 1
Textual Readings: *College Physics: Chapter 22, 23*

Contents of Physics 1 Based on 6 Big Ideas

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 occurs 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 phenomenon.

Unit	Chapter	Learning Objectives
1. Kinematics (Big Idea 3) * One dimensional motion: constant velocity and uniform accelerated motion * Vectors: components & resultant * Two dimensional motion: projectile motion	1, 2, 3	3.A.1.1, 3.A.1.2, 3.A.1.3, 4.A.1.1, 4.A.2.1, 4.A.2.3
2. Dynamics (Big Ideas 1, 2, 3, 4) * Forces & free body diagrams * Newton's 1st Law * Newton's 2nd Law * Newton's 3rd Law * Applications of Newton's 2nd Law (Inclines, Atwood's, etc.) * Friction	4, 5	1.C.1.1, 1.C.3.1, 2.B.1.1, 3.A.2.1, 3.A.3.1, 3.A.3.2, 3.A.3.3, 3.A.3.4, 3.A.4.1, 3.A.4.2, 3.A.4.3, 3.B.1.1, 3.B.1.2, 3.B.1.3, 3.B.2.1, 3.C.4.1, 3.C.4.2, 4.A.1.1, 4.A.2.1, 4.A.2.2, 4.A.2.3, 4.A.3.1, 4.A.3.2
3. Circular Motion (Big Ideas 1, 2, 3, 4) * Uniform circular motion * Dynamics of uniform circular motion * Universal Gravitation	6	1.C.3.1, 2.B.1.1, 2.B.2.1, 2.B.2.2, 3.A.3.1, 3.A.3.3, 3.B.1.2, 3.B.1.3, 3.B.2.1, 3.C.1.1, 3.C.1.2, 3.G.1.1, 4.A.1.1, 4.A.2.1, 4.A.2.2, 4.A.2.3
4. Energy (Big Ideas 3, 4, 5) * Work * Power * Kinetic energy * Potential energy (gravitational, elastic) * Conservation of Energy	10	3.E.1.1, 3.E.1.2, 3.E.1.3, 3.E.1.4, 4.C.1.1, 4.C.1.2, 4.C.2.1, 4.C.2.2, 5.A.2.1, 5.B.1.1, 5.B.1.2, 5.B.2.1, 5.B.3.1, 5.B.3.2, 5.B.3.3, 5.B.4.1, 5.B.4.2, 5.B.5.1, 5.B.5.2, 5.B.5.3, 5.B.5.4, 5.B.5.5, 5.D.1.1, 5.D.1.2, 5.D.1.3, 5.D.1.4, 5.D.1.5, 5.D.2.1, 5.D.2.3
5. Momentum (Big Ideas 3, 4, 5) * Impulse * Momentum * Conservation of Momentum * Elastic & Inelastic Collisions	9	3.D.1.1, 3.D.2.1, 3.D.2.2, 3.D.2.3, 3.D.2.4, 4.B.1.1, 4.B.1.2, 4.B.2.1, 4.B.2.2, 5.A.2.1, 5.D.1.1, 5.D.1.2, 5.D.1.3, 5.D.1.4, 5.D.1.5, 5.D.2.1, 5.D.2.2, 5.D.2.3, 5.D.2.4, 5.D.2.5, 5.D.3.1

Unit	Chapter	Learning Objectives
6. Rotational Motion (Big Ideas 3, 4, 5) * Torque * Center of Mass * Rotational kinematics * Rotational dynamics & rotational inertia * Rotational energy * Angular momentum *Conservation of angular momentum	14	3.F.1.1, 3.F.1.2, 3.F.1.3, 3.F.1.4, 3.F.1.5, 3.F.2.1, 3.F.2.2, 3.F.3.1, 3.F.3.2, 3.F.3.3, 4.A.1.1, 4.D.1.1, 4.D.1.2, 4.D.2.1, 4.D.2.2, 4.D.3.1, 4.D.3.2, 5.E.1.1, 5.E.1.2, 5.E.2.1
7. Simple Harmonic Motion (Big Ideas 3 & 5) * Restoring forces * SHM Graphs * Simple Pendulum * Mass-spring systems	7	3.B.3.1, 3.B.3.2, 3.B.3.3, 3.B.3.4, 5.B.2.1, 5.B.3.1, 5.B.3.2, 5.B.3.3, 5.B.4.1, 5.B.4.2
8. Mechanical Waves (Big Idea 6) * Traveling waves * Wave characteristics * Sound * Superposition * Standing waves on a string * Standing sound waves	15, 16	6.A.1.1, 6.A.1.2, 6.A.2.1, 6.A.3.1, 6.A.4.1, 6.B.1.1, 6.B.2.1, 6.B.4.1, 6.B.5.1, 6.D.1.1, 6.D.1.2, 6.D.1.3, 6.D.2.1, 6.D.3.1, 6.D.3.2, 6.D.3.3, 6.D.3.4, 6.D.4.1, 6.D.4.2, 6.D.5.1
9. Electrostatics (Big Ideas 1, 3, 5) * Electric charge & conservation of charge * Electric force: Coulomb's Law	20	1.B.1.1, 1.B.1.2, 1.B.2.1, 1.B.3.1, 3.C.2.1, 3.C.2.2, 5.A.2.1
10. DC Circuits (Big Ideas 1, 5) * Electric resistance * Ohm's Law * DC Circuits * Series & Parallel Circuits * Kirchhoff's Laws	22, 23	1.B.1.1, 1.B.1.2, 1.E.2.1, 5.B.9.1, 5.B.9.2, 5.B.9.3, 5.C.3.1, 5.C.3.2, 5.C.3.3

Laboratory Activities

The Physics course devotes over 25% of the time to laboratory investigations [CR5]. The laboratory component of the course allows the students to demonstrate the seven science practices through a variety of investigations in all of the foundational principles.

The students use ***guided inquiry* (GI)** or ***open inquiry* (OI)** in the design of their laboratory investigations. Some labs focus on investigating a physical phenomenon without having expectations of its outcomes. In other experiments, the student has an expectation of its outcome based on concepts constructed from prior experiences. In application experiments, the students use acquired physics principles to address practical problems.

All investigations are reported in a laboratory journal. Students are expected to record their observations, data, and data analyses. Data analyses include identification of the sources and effects of experimental uncertainty, calculations, results and conclusions, and suggestions for further refinement of the experiment as appropriate. [CR7]

Name	Open-Inquiry or Guided-Inquiry? [CR6b]	Short Description	Science Practices
#1 Speed Lab	Y	Students will design an experiment to determine the range of speeds of a variable speed cart.	2.1, 2.2, 4.1, 4.2, 4.3
Three Cars Racing Simulation	N	A computer simulation of three cars with different accelerations racing.	1.4, 2.2, 4.3, 6.1
#2 Rocket Lab	Y	Students will design an experiment to determine the initial velocity of an air-powered rocket.	1.2, 1.4, 2.1, 2.2, 4.1, 4.2, 4.3
#3 Marble in Cup Lab	N	Students will determine where a paper cup needs to be placed on the floor so that a marble rolled off of the edge of a table will land in it.	1.4, 2.1, 2.2, 2.3, 4.3
#4 Projectile Motion Challenges	Y	Using a projectile launcher, students will be given a series of challenges such as placing a ring stand at the maximum height, or placing a cup at the point where the marble will land.	1.4, 2.1, 2.2, 4.1, 4.2, 4.3
#5 Newton's 2nd Law Lab	Y	What is the relationship between the mass of a system and the acceleration of the system?	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4

Name	Open-Inquiry or Guided-Inquiry? [CR6b]	Short Description	Science Practices
Forces on a Crate Simulation	N	Using a simulation, analyze the motion of a crate. Students can vary the force on the crate, the direction of that force, the initial velocity of the crate, and the coefficient of kinetic friction.	1.1, 1.4, 2.2, 4.3, 6.1
Jupiter's Moons	N	Students will do research on Jupiter and four of its moons. Based on this research, students will mathematically come up with the mass of Jupiter. They will compare this information to the accepted value.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4, 7.1
#6 Pendulum Lab	Y	What factor(s) control the period of a simple pendulum?	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
#7 Mass-Spring Oscillator Lab	Y	Students must determine both the spring constant k of a spring and the mass of three unknown masses. Students must also investigate the conservation of mechanical energy of the system. Materials given: spring with unknown spring constant, known masses, unknown masses.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
#8 Conservation of Linear Momentum Lab	Y	Using a track and collision carts, students will observe seven different collisions and make conclusions about momentum conservation in real life situations.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4, 7.2

Name	Open-Inquiry or Guided-Inquiry? [CR6b]	Short Description	Science Practices
A Two Car Collision Simulation	N	Students will observe a simulation of two identical cars crashing. The elasticity of the collision can be varied.	1.1, 1.4, 2.2, 4.3, 6.1
#9 Introductory Circular Motion Lab	Y	When velocity is kept constant, what is the relationship between the radius of circular motion and the period of circular motion? The speed? The acceleration?	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
#10 Centripetal Force Lab	Y	Using a spinning rubber stopper to lift masses, students will determine the relationship between the acceleration of the stopper and the centripetal force.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
#11 Conservation of Angular Momentum Lab	Y	What is the relationship between the moment of inertia of a system and the angular momentum of a system?	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
Torque Simulation	N	Students will use a computer simulation to study rotational equilibrium.	1.1, 1.4, 2.2, 4.3, 6.1
#12 Coulomb's Law Lab	Y	What is the charge stored on a pair of charged balloons that are repelling each other?	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
Electrostatics Simulation	N	Using a computer simulation involving two positive charges, explore the electrostatic force of repulsion between the charges, the accelerations of the charges, and how the force and acceleration changes with distance.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4

Name	Open-Inquiry or Guided-Inquiry? [CR6b]	Short Description	Science Practices
#13 Series and Parallel Lab	Y	Using a number of resistors, explore current and voltage in resistors hooked up to a power supply when resistors are wired in series with one another and when they are wired in parallel with one another.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
#14 Standing Waves on a Wire Lab	Y	Students will vary wavelength, frequency, and the tension in a wire while looking at standing waves formed on a wire.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.2, 4.3, 4.4, 5.1, 6.1, 6.2, 6.4
#15 Standing Sound Waves in a Tube Lab	N	Students will vary the frequency of sound coming out of a speaker to create standing waves in a tube to determine the speed of sound in the classroom.	1.1, 1.4, 2.1, 2.2, 3.3, 4.1, 4.4, 5.1, 6.1, 6.2, 6.4

Physics and its Applications