Window Rock High School
Advance Placement (AP) Physics 1 Syllabus
Teacher: Joshua Nielsen
2025 - 2026

Course Description:

AP Physics 1 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 Physics 1 Test, which will test students' knowledge of both the conceptual and mathematical formulations of the requisite concepts. Topics covered include classical physics topics with an emphasis on mechanics.

Expectations:

This is NOT a regular science class, this class is part science, part math, and part philosophy. AP Physics is challenging not just because of the math, but because of how you will solve problems. You will need to observe, identify, think and then apply concepts to solve problems.
You will struggle in this class and that's ok, but I expect you to do your best each day. All material in this class builds on the units that came before them, therefore it is crucial that you stay up to date on your lessons.

Required Materials:

Text:

Knight, Randall J., Brian Jones, and Stuart Field. College Physics: A Strategic Approach. 4th Edition. Pearson.

Graphing Calculator:

Please check the AP Exam Calculator Policy for a list of approved graphing calculators. Using your calculator throughout the school year will help ensure you are familiar with it for the AP Assessment.

AP Calculator Policies: https://apstudents.collegeboard.org/exam-policies-guidelines/calculator-policies
Google Account, **3 Ring Binder**, **college ruled paper**

Grading:

A – 90% - 100%, B – 80% - 89%, C – 70% - 79%, D – 60% - 69%, F - 0% - 59%

Assignment	
Formal Assessments (Unit Test, NWEA, Quizzes)	50 %
Project Based (Science Fair, Lab Reports, Models, etc.)	30 %
Class works, Homework, RACES, Philosophical Chairs	20 %

Semester 1		Semester 2	
Quarter 1	40 %	Quarter 3	40 %
Quarter 2	40 %	Quarter 4	40 %
Semester 1 Exam	20 %	Semester 2 Exam	20 %

Units of Study:

Unit 1: Kinematics (Quarter 1)

1.1 Scalars and Vector in One Dimension
1.2 Displacement, Velocity, and Acceleration
1.3 Representing Motion
1.4 Reference Frames and Relative Motion
1.5 Vectors and motion in Two Dimensions

Unit 2: Forces and Translational Dynamics (Quarter 1)

2.1 Systems and Center of Mass
2.2 Forces and Free-Body Diagrams
2.3 Newton's Third Law
2.4 Newton's First Law
2.5 Newton's Second Law
2.6 Gravitational Force
2.7 Kinetic and Static Friction
2.8 Spring Force
2.9 Circular Motion

Unit 3: Work, Energy, & Power (Quarter 2)

3.1 Translational Kinetic Energy
3.2 Work
3.3 Potential Energy
3.4 Conservation of Energy
3.5 Power

Unit 4: Linear Momentum (Quarter 2)

4.1 Linear Momentum
4.2 Changes in Momentum and Impulse
4.3 Conservation of Linear Momentum
4.4 Elastic and Inelastic Collisions

Unit 5: Torque & Rotational Dynamics (Q3)

5.1 Rotational Kinematics
5.2 Connecting Linear and Rotational Motion
5.3 Torque
5.4 Rotational Inertia
5.5 Rotational Equilibrium and Newton's First Law in Rotational Form
5.6 Newton's Second Law in Rotational Form

Unit 6: Energy and Momentum of Rotating Systems (Quarter 3)

- 6.1 Rotational Kinetic Energy
- 6.2 Torque and Work
- 6.3 Angular Momentum and Angular Impulse
- 6.4 Conservation of Angular Momentum
- 6.5 Rolling
- 6.6 Motion of Orbiting Satellites

Unit 7: Oscillations (Quarter 4)

- 7.1 Defining Simple Harmonic Motion (SHM)
- 7.2 Frequency and Period of SHM
- 7.3 Representing and Analyzing SHM
- 7.4 Energy of SImple Harmonic Oscillation

Unit 8: Fluids (Quarter 4)

- 8.1 Internal Structure and Density
- 8.2 Pressure
- 8.3 Fluids and Newton's Laws
- 8.4 Fluids and Conservation Laws

Lab Work:

At minimum 25% of our class time will be dedicated to hands-on learning: this includes but is not limited to:

1. Prelab - Designing, setting up, discussion, safety orientation
2. Experimentation - Observations, measurements, trials
3. Postlab - Data Analysis, Graphing, identify trends, conclusions, presentations/reports

Lab Notebook:

Students are expected to keep a lab notebook where they will maintain a record of their laboratory work.

Unit	Lab Overview	Science Practice
Unit 1: Kinematics (Quarter 1) 1.1 Scalars and Vector in One Dimension 1.2 Displacement, Velocity, and Acceleration 1.3 Representing Motion 1.4 Reference Frames and Relative Motion 1.5 Vectors and motion in Two Dimensions	**Grid Carts** - Students will use a floor grid to determine x, and y components of diagonal motion **Motion and Time**: Students will use a ramp and the available sensors to measure and graph displacement, velocity and acceleration of a cart over time	1.A, 1.B, 2.A, 2.B, 2.D, 3.C
Unit 2: Forces and Translational Dynamics (Quarter 1) 2.1 Systems and Center of Mass 2.2 Forces and Free-Body Diagrams 2.3 Newton's Third Law 2.4 Newton's First Law 2.5 Newton's Second Law 2.6 Gravitational Force 2.7 Kinetic and Static Friction	**Create Free Body Diagrams**: Create free body diagrams for given scenarios **Newton's 2nd Law:** Calculate the force needed to pull/lift common objects. **Hooke's Law:** Design and conduct an experiment to find the spring constant of an unknown spring.	1.A, 1.B, 1.C, 2.B, 2.C, 2.D, 3.A, 3.B

2.8 Spring Force 2.9 Circular Motion		
Unit 3: Work, Energy, & Power (Quarter 2) 3.1 Translational Kinetic Energy 3.2 Work 3.3 Potential Energy 3.4 Conservation of Energy 3.5 Power	**Work Lab:** Using a cart and a spring scale to calculate the work done on various systems. **Roller Coaster:** Graph the Potential and Kinetic energy over time as the roller coaster proceeds.	1.A, 1.B, 1.C, 2.B, 2.C, 2.D, 3.B
Unit 4: Linear Momentum (Quarter 2) 4.1 Linear Momentum 4.2 Changes in Momentum and Impulse 4.3 Conservation of Linear Momentum 4.4 Elastic and Inelastic Collisions	**Collision Lab 1:** Calculate the force of impact using carts. **Collision Lab 2:** Design a cart to minimize the impact force of a collision.	2.A, 2.B, 2.C, 2. D, 3.A, 3.B, 3.C
Unit 5: Torque & Rotational Dynamics (Q3) 5.1 Rotational Kinematics 5.2 Connecting Linear and Rotational Motion 5.3 Torque 5.4 Rotational Inertia 5.5 Rotational Equilibrium and Newton's First Law in Rotational Form 5.6 Newton's Second Law in Rotational Form	**Bridge Lab:** Design and conduct and experiment to test the effect of different masses placed on a bridge **Rotation:** Compare Rotational Forces for symmetric and non symmetrical objects	1.C, 2.B, 2.C, 3.A, 3.B, 3.C
Unit 6: Energy and Momentum of Rotating Systems (Quarter 3) 6.1 Rotational Kinetic Energy 6.2 Torque and Work 6.3 Angular Momentum and Angular Impulse 6.4 Conservation of Angular Momentum 6.5 Rolling 6.6 Motion of Orbiting Satellites	**Down the slope:** Design an experiment to compare rolling and sliding motion down a ramp **Rotation 2:** Design an process for finding the angular momentum of an object dropped onto a spinning disk	1.A, 1.C, 2.A, 2.B, 2.C, 2. D, 3.A, 3.B, 3.C
Unit 7: Oscillations (Quarter 4) 7.1 Defining Simple Harmonic Motion (SHM) 7.2 Frequency and Period of SHM 7.3 Representing and Analyzing SHM 7.4 Energy of Simple Harmonic Oscillation	**Pendulums 1:** Graph the Potential and Kinetic energy of a pendulum over time. **Springs and Harmonics:** Calculate the frequency and Period of a mass connected to a spring	1.A, 1.B, 1.C, 2.A, 2.B, 2.C, 2.D, 3.B
Unit 8: Fluids (Quarter 4) 8.1 Internal Structure and Density	**Hydraulics:** Design a hydraulic system to move a set amount of mass.	1.C, 2.A, 2.B, 2.C, 2.D, 3.B, 3.C

8.2 Pressure 8.3 Fluids and Newton's Laws 8.4 Fluids and Conservation Laws	**Under Pressure:** Calculate the pressure within various vessels at various depths	

Science Practice 1: Creating Representations (sketch, draw, or plot)

1.A Create Diagrams,tables,charts, or schematics to represent physical situations.
1.B Create Quantitative Graphs with appropriate scales and units, including plotting data.
1.C Create qualitative sketches of graphs that represent features of a model or the behavior of a physical system.

Science Practice 2: Mathematical Routines (calculate, compare, derive, determine, estimate, or show)

2.A Derive a symbolic expression from known quantities by selecting and following a logical mathematical pathway.
2.B Calculate or estimate an unknown quantity with units from known quantities, by selecting and following a logical computational pathway.
2.C Compare physical quantities between two or more scenarios or at different times and locations in a single scenario.

2.D Predict new values or factors of change of physical quantities using functional dependence between variables.

Science Practice 3: Scientific Questioning and Argumentation (claim, describe, design, explain, indicate, justify, predict, or state.)

3.A Create experimental procedures that are appropriate for a given scientific question.
3.B Apply an appropriate law,definition, theoretical relationship, or model to make a claim.
3.C Justify or support a claim using evidence from experimental data, physical represe

AP Physics 1 Exam Overview:

The AP Physics 1 Exam assesses student application of the science practices and understanding of the learning objectives outlined in the course framework. The exam is 3 hours long and includes 40 multiple choice questions and 4 free-response questions. A four-function scientific or graphing calculator is allowed on both sections of the exam. The details of the exam, including exam weighting and timing, can be found below:

Section	Type of Questions	Number of Questions	Weighting	Timing
I	Multiple-choice questions	40	50%	80 minutes
II	Free-response questions	4	50%	100 minutes
	Question 1: Mathematical Routines			
	Question 2: Translation Between Representations			
	Question 3: Experimental Design and Analysis			
	Question 4: Qualitative/Quantitative Translation			

Exam Weighting for the Multiple-Choice Section of the AP Exam

Units of Instruction	Exam Weighting
Unit 1: Kinematics	10–15%
Unit 2: Force and Translational Dynamics	18–23%
Unit 3: Work, Energy, and Power	18–23%
Unit 4: Linear Momentum	10–15%
Unit 5: Torque and Rotational Dynamics	10–15%
Unit 6: Energy and Momentum of Rotating Systems	5–8%
Unit 7: Oscillations	5–8%
Unit 8: Fluids	10–15%

WRHS P.R.I.D.E.:

Prepare for Success

*complete all assignments & homework
*study every night, all the time
*listen, observe, remember, share (LORS)
*have positive participation in class

Respect School and Community

*follow school and district rules
*follow class Norms
*stay on task and avoid disruptive behaviors

*treat each other as you want to be treated

Interact Safely

*be aware of surroundings
*follow safety guidelines
*keep hands, feet and hurtful words to yourself

Dependable and Responsible Actions

*take responsibility for your learning and education
*do all assignments to the best of your ability
*clean up after yourself

Enthusiastic for Learning

*be in class on time and ready to learn by having your laptops, notebooks, pens/pencils and homework ready
*work toward completing all your assignments and submitting them on time
*come every day with growth mindset

Other Classroom Policies:

Late Assignments:

Late assignments will have 10% deduction per day, until they are submitted or until they are worth 0%. Late assignments must be submitted during office hours. Grade checks will not be done during class as they are a distraction.

Office Hours:

Office hours are an additional time for students to ask questions and follow up with grades and assignments. Office hours will generally be 30 minutes before school, during lunch, and after school. Listing of exact times will be made on the board and/or the school website.

Extra Credit:

Extra Credit opportunities will be given from time to time. In general, extra credit opportunities will be for those that go above and beyond on their assignments. Individual extra credit will be rare

Cell Phones:

Cell phones will NOT be used during regular instructional time, and may only be used during designated labs to allow for the use of the phones sensors (phyphox)

Food/Drinks:

Food and drinks will not be allowed during any labs or instruction.

School Website:

Weekly agendas, assignments, and important links will be available on the class webpage on the school's website https://www.wrschool.net/Domain/1905