AP Physics 1

COURSE OBJECTIVES: BIG IDEAS

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.*

FIRST NINE WEEKS

UNIT 1. KINEMATICS

- Kinematics in one-dimension: constant velocity and uniform accelerated motion
- Vectors: vector components and resultant
- Kinematics in two-dimensions: projectile motion

Big Idea 3

Learning Objectives: 3.A.1.1, 3.A.1.2, 3.A.1.3

UNIT 2. DYNAMICS

- Forces, types, and representation
- Newton's First Law
- Newton's Third Law
- Newton's Second Law
- Applications of Newton's Second Law
- Friction
- Interacting objects: ropes and pulleys

Big Ideas 1, 2, 3, 4

Learning Objectives: 1.C.1.1, 1.C.1.3, 2.B.1.1, 3.A.2.1, 3.A.3.1, 3.A.3.2, 3.A.3.3, 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

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Big Ideas 1, 2, 3, 4

Learning Objectives: 1.C.1.1, 1.C.1.3, 2.B.1.1, 3.A.2.1, 3.A.3.1, 3.A.3.2, 3.A.3.3, 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

SECOND NINE WEEKS

UNIT 3. ENERGY

- Work
- Power
- Kinetic energy
- Potential energy: gravitational and elastic
- Conservation of energy

Big Ideas 3, 4, 5

Learning Objectives: 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

UNIT 4. MOMENTUM

- Impulse
- Momentum
- Conservation of momentum
- Elastic and inelastic collisions

Big Ideas 3, 4, 5

Learning Objectives: 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 5. CIRCULAR MOTION AND GRAVITATION

- Uniform circular motion
- Dynamics of uniform circular motion
- Universal Law of Gravitation

Big Ideas 1, 2, 3, 4

Learning Objectives: 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.C.2.1, 3.C.2.2, 3.G.1.1, 4.A.2.2

THIRD NINE WEEKS

UNIT 6. ROTATIONAL MOTION

- Torque
- Center of mass
- Rotational kinematics
- Rotational dynamics and rotational inertia

- Rotational energy
- Angular momentum
- Conservation of angular momentum

Big Ideas 3, 4, 5

Learning Objectives: 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

UNIT 7. SIMPLE HARMONIC MOTION

- Linear restoring forces and simple harmonic motion
- Simple harmonic motion graphs
- Simple pendulum
- Mass-spring systems

Big Ideas 3, 5

Learning Objectives: 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

UNIT 8. MECHANICAL WAVES

- Traveling waves
- Wave characteristics
- Sound
- Superposition
- Standing waves on a string
- Standing sound waves

Big Idea 6

Learning Objectives: 6.A.1.1, 6.A.1.2, 6.A.1.3, 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

FOURTH NINE WEEKS

UNIT 9. ELECTROSTATICS

- Electric charge and conservation of charge
- Electric force: Coulomb's Law

Big Ideas 1, 3, 5

Learning Objectives: 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

UNIT 10. DC CIRCUITS

- Electric resistance
- Ohm's Law
- DC circuits
- Series and parallel connections
- Kirchhoff's Laws

Big Ideas 1, 5

Learning Objectives: 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.3.15.C.3.2, 5.C.3.3

- AP Exam Review

<u>Major Laboratories</u>

Scientific Practices

White boarding reading and discussion training lab
Relationship between number of noodles and weight supported

Kinematics

1. Investigate the relationship between distance and time, with a constant velocity vehicle
   Application lab- Predict the location of a crash between two constant velocity vehicles
2. Investigate the relationship between distance and time with and accelerated motion vehicle
   Application lab- Predict the location of a crash between two accelerated motion vehicles
3. Investigate the relationship between distance and time of a projectile fired horizontally
   Application lab- At a given angle place a hoop and target so that the fired projectile will pass through the hoop and land on the target
   Science Practices 1.1, 1.2, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4, 7.2

Dynamics

4. Examine the factors that affect the acceleration of a simple atwood machine
   Application lab- predict the time for an atwood machine to move a given distance, with a set coefficient of friction
5. Investigate the relationship between the angle of an incline and the velocity of an object
   Application lab- find the mass necessary to balance an atwood machine on an inclined plane
   Science Practices 1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2

Energy

6. Investigate the relationship between the compression of a spring and a cart's motion up an incline
   Application lab- Predict the height a ball will launch into the air based on the amount of compression on a given spring
   Science Practices 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 6.5, 7.2

Momentum

7. Investigate the relationship between the mass and velocity of two carts as the crash
   Application lab- Given a ball rolling down an incline and colliding with a cup, predict the landing point
   Science Practices 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4, 7.2

Circular Motion and Gravitation

8. Investigate the relationship between the radius of a circle and the acceleration of an object traveling that path
   Application lab- Predict the velocity of a weight needed to lift a given weight through a tube
   Science Practices 1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2

Rotational Motion

9. Investigate the factors affecting the motion of a flying pig conical pendulum
   Application lab- Predict the angle the tether makes when given the length and a flying pig
   Science Practices 1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.4, 7.2

Simple Harmonic Motion

10. Investigate the factors affecting the Period of a pendulum
    Application lab- Create a pendulum to use as a clock to time a cart rolling across the table
    Science Practices 1.1, 1.4, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.3, 6.1, 6.4, 7.2

Mechanical Waves

11. Investigate the relationship between the wavelength and the frequency of a wave and determine the relationship of the frequency of a standing wave and the number of antinodes on the string
    Application lab- Predict the resonate frequency of a given pipe and test for proper superposition
    Science Practices 1.2, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 6.1, 6.2, 6.4, 7.2

DC Circuits

12. Investigate different circuit layouts and the relationship to current and voltage
    Application lab- Construct a circuit with given materials to light all the given bulbs
    Science Practices 1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.4, 7.2

Science Practices

Science Practice 1: The student can use representations and models to communicate scientific phenomena and solve scientific problems.
1.1 The student can create representations and models of natural or man-made phenomena and systems in the domain.
1.2 The student can describe representations and models of natural or manmade phenomena and systems in the domain.
1.3 The student can refine representations and models of natural or man-made phenomena and systems in the domain.
1.4 The student can use representations and models to analyze situations or solve problems qualitatively and quantitatively.
1.5 The student can reexpress key elements of natural phenomena across multiple representations in the domain.

Science Practice 2: The student can use mathematics appropriately.
2.1 The student can justify the selection of a mathematical routine to solve problems.
2.2 The student can apply mathematical routines to quantities that describe natural phenomena.
2.3 The student can estimate numerically quantities that describe natural phenomena.

Science Practice 3: The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
3.1 The student can pose scientific questions.

3.2 The student can refine scientific questions.
3.3 The student can evaluate scientific questions

Science Practice 4: The student can plan and implement data collection strategies in relation to a particular scientific question.
4.1 The student can justify the selection of the kind of data needed to answer a particular scientific question.
4.2 The student can design a plan for collecting data to answer a particular scientific question.
4.3 The student can collect data to answer a particular scientific question.
4.4 The student can evaluate sources of data to answer a particular scientific question.

Science Practice 5: The student can perform data analysis and evaluation of evidence.
5.1 The student can analyze data to identify patterns or relationships.
5.2 The student can refine observations and measurements based on data analysis.
5.3 The student can evaluate the evidence provided by data sets in relation to a particular scientific question.

Science Practice 6: The student can work with scientific explanations and theories.
6.1 The student can justify claims with evidence.
6.2 The student can construct explanations of phenomena based on evidence produced through scientific practices.
6.3 The student can articulate the reasons that scientific explanations and theories are refined or replaced.
6.4 The student can make claims and predictions about natural phenomena based on scientific theories and models.
6.5 The student can evaluate alternative scientific explanations.

Science Practice 7: The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains.
7.1 The student can connect phenomena and models across spatial and temporal scales.
7.2 The student can connect concepts in and across domain(s) to generalize or extrapolate in and/or across enduring understandings and/or big idea