Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Kinematics**

Time Allotment: 3 weeks **Unit Sequence: 1**

Major Concepts to be learned:

- Difference between vector and scalar quantities.
- Relationships between displacement, velocity, and acceleration.
- Independence of vertical and horizontal components in projectile motion.

Expected Skills to be demonstrated:

- Interpret a position-time or velocity-time graph.
- Solve 1D and 2D kinematic problems.

PA Standards/Anchors:

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Forces**

Time Allotment: 3 weeks **Unit Sequence: 2**

Major Concepts to be learned:

- Newton's Laws of Motion.
- The nature of gravity.
- The nature of friction.

Expected Skills to be demonstrated:

- Apply Newton's Second Law to solve 1D or 2D force problems including problems involving gravity, friction, and/or centripetal acceleration.

PA Standards/Anchors:

3.2.9-12.I
3.2.9-12.L
3.2.6-8.B
3.3.9-12.D

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Work and Energy**

Time Allotment: 3 weeks **Unit Sequence: 3**

Major Concepts to be learned:

- What is work.
- Nature of energy.
- The difference between conservative and nonconservative forces.
- Law of Conservation of Energy.

Expected Skills to be demonstrated:

- Apply the definitions of work, kinetic energy, elastic potential energy, and gravitational potential energy along with the law of conservation of energy to solve problems.

PA Standards/Anchors:	Eligible Content:
3.2.6-8.L 3.2.9-12.P 3.2.9-12.Q	

Instructional Strategies:	Assessments:
• Problem solving activities • Lecture • Hands-on activity • Note Taking	• Test • Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Linear Momentum**

Time Allotment: 2 weeks **Unit Sequence: 4**

Major Concepts to be learned:

- Vector nature of momentum.
- Law of Conservation of Linear Momentum.
- Elastic versus inelastic collisions.

Expected Skills to be demonstrated:

- Apply Law of Conservation of Energy and Law of Conservation of Linear momentum to solve both elastic and inelastic collision problems in 2 dimensions.
- Use Newton's second law (momentum form) to solve impulse-momentum problems.

PA Standards/Anchors:	Eligible Content:
3.2.6-8.G 3.2.6-8H 3.2.9-12.J	

Instructional Strategies:	Assessments:
• Problem solving activities • Lecture • Hands-on activity • Note Taking	• Test • Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Rotational Motion**

Time Allotment: 2 weeks **Unit Sequence: 5**

Major Concepts to be learned:

- The analogous relationship between the physics of rotational motion and the physics of linear motion.
- That rolling motion is a combination of linear and rotational motion.

Expected Skills to be demonstrated:

- Use rotational kinematics, the definition of torque, the definition of moment inertia, the rotational form of Newton's Second Law of Motion, the definition of angular momentum, the Law of Conservation of Angular Momentum, the definition of rotational kine

PA Standards/Anchors:	Eligible Content:

Instructional Strategies:	Assessments:
• Problem solving activities • Lecture • Hands-on activity • Note Taking	• Test • Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Simple Harmonic Motion**

Topic Time Allotment: 2 weeks **Unit Sequence: 6**

Major Concepts to be learned:

- Energy transformations in a simple harmonic oscillator.
- Mathematical relationship between uniform circular and simple harmonic motion.
- Sinusoidal nature of simple harmonic motion.
- Resonance.
- Standing waves.

Expected Skills to be demonstrated:

- Find equations for the position, velocity and acceleration of a simple harmonic oscillator as a function of time.
- Calculate the energy, period, and frequency of a simple harmonic oscillator.

PA Standards/Anchors:

3.2.6-8.Q
3.2.9-12.T

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Sound**

Time Allotment: 1 week **Unit Sequence: 7**

Major Concepts to be learned:

- Sound as a compressional wave.

Expected Skills to be demonstrated:

- Calculate the intensity level of a sound.
- Calculate the Doppler shift for a moving source/listener.
- Calculate the beat frequency.
- Calculate the fundamental frequency/selected overtones for standing waves on strings or in open/closed columns of air.

PA Standards/Anchors:

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Thermodynamics**

Time Allotment: 3 weeks **Unit Sequence: 8**

Major Concepts to be learned:

- Difference between temperature and thermal energy.
- 1st Law of Thermodynamics
- 2nd Law of Thermodynamics
- Carnot cycle
- Entropy

Expected Skills to be demonstrated:

- Calculate amount of expansion for a heated material.
- Calculate heat transfer via conduction and radiation.
- Use 1st Law of Thermodynamics to calculate work done by isothermal, adiabatic, isobaric, and isochoric processes.
- Calculate ideal and actual efficiency/coefficient of performance for heat engines/refrigerators and heat pumps.
- Explain the 2nd Law of Thermodynamics using entropy.

PA Standards/Anchors:

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Electrostatics**

Time Allotment: 2 weeks **Unit Sequence: 9**

Major Concepts to be learned:

- Electric field and field lines
- Coulomb's Law
- How dielectrics work

Expected Skills to be demonstrated:

- Calculate net force on one charge due to other point charges (2D only).
- Calculate the electric field at a point due to point charges (2D only).
- Sketch electric field lines that describe an electric field.
- Calculate the capacitance and potential energy of a parallel plate capacitor.

PA Standards/Anchors:

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Performance task
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Electric Currents**

Time Allotment: 3 weeks **Unit Sequence: 10**

Major Concepts to be learned:

- Kirchhoff's rules are based on conservation of charge and energy.
- Ohm's Law is more of an empirical description of certain materials than a law.
- Capacitors store energy, not charge.

Expected Skills to be demonstrated:

- Be able to analyze a direct current circuit using Kirchhoff's rules.
- Be able to apply Ohm's law to solve problems.
- Be able to calculate total resistance for series and parallel circuits.
- Be able to calculate the time constant for RC ciruits.

PA Standards/Anchors:

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Grade: 11 & 12 **Course Title: Physics** **Topic/Concept: Magnetism**

Time Allotment: 3 weeks **Unit Sequence: 11**

Major Concepts to be learned:

- Magnetic effects require moving charge.
- Use of appropriate right hand rule.
- Electric and magnetic force are two aspects of the same force.

Expected Skills to be demonstrated:

- Be able to determine the magnetic field produced by moving charges for simple geometries.
- Be able to determine the force on a moving charge in a uniform magnetic field.
- Be able to analyze simple alternating current circuits.

PA Standards/Anchors:

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Hands-on activity
- Note Taking

Assessments:

- Test
- Lab

Major Concepts to be learned:

- The conflict between Newtonian relativity and Maxwell's theory of electromagnetic waves.
- General relativity is a theory of gravity.
- The physics of tiny objects and high speeds describes a world with which we are not familiar.

Expected Skills to be demonstrated:

- Be able to calculate dilated time and contracted length.
- Be able to apply Hubble's Law.

PA Standards/Anchors:

3.3.9-12.A
3.3.9-12.B
3.3.9-12.C

Eligible Content:

Instructional Strategies:

- Problem solving activities
- Lecture
- Note Taking

Assessments:

- Test
- Lab