| SUBJECT: Principles of Physics | GRADE: 11-12 |
|---|---|
| **Unit Title: SCIENTIFIC PRACTICES** | Time frame: throughout the year |
| **UNIT OVERVIEW** | |
| This unit is covered throughout the coursework integrating measurement and technology, as well as engineering and design principles through relevant labs and projects throughout the year. (Pneumatic Rockets, Bridges, Mousetrap Cars) | |
| **LRG SKILLS AND DISPOSITIONS** | **STEELS** |
| Critical Thinking & Problem Solving<br>Collaboration and Teamwork | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.B,I,J,Q<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K,AA,Q,R,S |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can design, prototype utilizing CAD & CNC machines, test and refine an experiment (or project) to meet given parameters, conduct and collect data, analyze results and present my findings.<br>*(CNC machines include: 3D printers, laser/blade cutters, plasma cutters, routers etc…)* | ● I can plan and carry out a valid scientific investigation.<br>● I can analyze and interpret data.<br>● I can make an argument based on evidence.<br>● I can obtain, evaluate, and communicate information.<br>● I can create and use spreadsheets to organize and analyze data, as well as create appropriate graphs and charts.<br>● I can design and refine design projects using CAD and CNC machines.<br>● I can carry out projects that require optimization goals. |

| SUBJECT: Principles of Physics | GRADE: 11-12 |
|---|---|
| **Unit Title: MOTION** | Time frame: ~5 weeks |

| UNIT OVERVIEW |
|---|
| Students will measure, study & explain motion through the study of kinematics and carry out calculations using both scalar and vector quantities. |

| LRG SKILLS AND DISPOSITIONS | STEELS |
|---|---|
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.I,J,K,L,M<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |

| COMPETENCIES | LEARNING TARGETS |
|---|---|
| I can describe and analyze motion using a variety of methods including words, graphs, and equations. | ● I can sketch and interpret multiple graphs and diagrams to represent the motion of an object, including both constant and changing velocities.<br>● I can use kinematic equations to solve problems involving motion.<br>● I can solve problems and perform calculations involving objects experiencing projectile motion.<br>● I can explain phenomena related to projectile motion using the concepts of Newton's Laws and kinematics.<br>● I can explain, identify and represent vector & scalar quantities both verbally and graphically. |

| SUBJECT: Principles of Physics | GRADE: 11-12 |
|---|---|
| **Unit Title: FORCES AND INTERACTIONS (Linear & 2D)** | Time frame: ~8 weeks |

| UNIT OVERVIEW |
|---|
| This unit will look at force interactions on the macroscopic scale including real-world situations involving transportation (cars, planes, etc…). |

| LRG SKILLS AND DISPOSITIONS | STEELS |
|---|---|
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.I,J,K,L,M<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |

| COMPETENCIES | LEARNING TARGETS |
|---|---|
| I can understand and analyze the interactions between objects in terms of Newton's Laws and momentum. | ● I can account for all the forces acting on an object using a free body diagram.<br>● I can draw conclusions about the resulting motion of an object subject to both balanced and unbalanced forces.<br>● I can solve routine and nonroutine problems using Newton's Second Law (Fnet = ma).<br>● I can calculate the sliding friction between an object and the surface it is sliding upon.<br>● I can calculate momentum and impulse, including direction and proper units. |

| SUBJECT: Principles of Physics | GRADE: 11-12 |
|---|---|
| **Unit Title: ENERGY** | Time frame: ~8 weeks |
| **UNIT OVERVIEW** | |
| This unit will study mechanical energy in macroscopic systems (trebuchets, Rube Goldberg apparatus, roller coasters, etc…). | |
| **LRG SKILLS AND DISPOSITIONS** | **STEELS** |
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.P,Q,R,S<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I understand energy as one of the central ideas underpinning our understanding of the physical universe, including a working definition of energy, an understanding of energy conservation, and the ability to perform energy calculations. | ● I can solve problems involving energy and conservation of energy.<br>● I can solve problems involving work and the work-energy theorem. |

| SUBJECT: Principles of Physics | GRADE: 11-12 |
|---|---|
| **Unit Title: CIRCULAR MOTION** | Time frame: ~8 weeks |
| **UNIT OVERVIEW** | |
| This unit will focus on the application of previously studied content in linear systems applied to objects undergoing circular motion. | |
| **LRG SKILLS AND DISPOSITIONS** | **STEELS** |
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.I,J,K,L,M<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can apply previously studied concepts of kinematics, forces and energy to systems in circular motion | ● I can correctly apply the concepts of force and kinematics to rotational systems<br>● I can solve problems involving centripetal forces, angular velocities & acceleration in rotational systems<br>● I can calculate the gravitational force between two masses using Newton's Law of Universal Gravitation and explain how this law can be used to explain real-world gravitational phenomena. |

| **SUBJECT: Principles of Physics** | **GRADE: 11-12** |
|---|---|
| **Unit Title:**<br>**WAVES AND ELECTROMAGNETIC RADIATION** | ***Time frame: Under development/Future implementation*** |
| UNIT OVERVIEW | |
| In this unit students will learn how to use principles of wave motion to solve problems involving sound and other waves | |
| **LRG SKILLS AND DISPOSITIONS** | **STEELS** |
| | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.T,U,V,W,X<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |
| **COMPETENCIES** | **LEARNING TARGETS** |
| | |
| I can use the properties of waves and light to perform optics and audio experiments. | ● I can relate the wavelength and frequency of a wave to one another by the speed of travel of the wave, which itself depends on the type of wave and the medium through which it is passing.<br>● I can use knowledge of wave diffraction and interference principles to make predictions and explain basic optics phenomena.<br>● I can explain what happens when light is incident upon matter and draw conclusions about light and matter based on these results. |

| **SUBJECT: Principles of Physics** | **GRADE: 11-12** |
|---|---|
| **Unit Title:**<br>**FLUID MECHANICS** | ***Time frame: Under development/Future implementation*** |
| **UNIT OVERVIEW** | |
| Will study situations and solve problems involving the motion of and the force applied by fluids. | |
| **LRG SKILLS AND DISPOSITIONS** | **STEELS** |
| | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.I,J,K,L,M<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can solve problems involving the motion of and the force applied by fluids**.** | ● I can solve problems involving buoyancy, hydrostatic pressure, and fluids in motion using Bernoulli's Equation. |

| SUBJECT: Principles of Physics | GRADE: 11-12 |
|---|---|
| **Unit Title:**<br>**HEAT & THERMODYNAMICS** | ***Time frame: Under development/Future implementation*** |
| **UNIT OVERVIEW** | |
| Will see how the laws of thermodynamics can be used to solve problems involving the transfer of heat in a system. | |
| **LRG SKILLS AND DISPOSITIONS** | **STEELS** |
| | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.N,R<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can solve problems involving the transfer of heat in a system. | • I can explain how heat is related to molecular motion and internal energy, how heat and energy are transferred, and how to apply the First and Second Laws of Thermodynamics. |

| SUBJECT: Principles of Physics | GRADE: 11-12 |
|---|---|
| **Unit Title:**<br>**ELECTRICITY & MAGNETISM** | ***Time frame: Under development/Future implementation*** |
| **UNIT OVERVIEW** | |
| This unit will cover the properties of electricity as applied to electrical circuits as well as the concepts of magnetic and electromagnetic forces. | |
| **LRG SKILLS AND DISPOSITIONS** | **STEELS** |
| | PA 3.2 PHYSICAL SCIENCE<br>3.2.9-12.Q,S<br><br>PA 3.5 TECHNOLOGY AND ENGINEERING 9-12<br>3.5.9-12.K |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can use the properties of electrical energy and electro-magnetic forces to solve circuit and electro-magnetic force problems. | ● I can explain and site examples of how electricity and magnetism are related and explain how electrical energy is generated.<br>● I can explain electric charge, electrical force, electrical fields, electrical energy and current, Ohm's Law, open and closed circuits, simple and complex circuits, and how to solve problems involving electricity and circuits |