**Physics Curriculum**

**Standard P1: INQUIRY, Reflection, and Social Implications**

*Students will understand the nature of science and demonstrate an ability to practice scientific reasoning by applying it to the design, execution, and evaluation of scientific investigations. Students will demonstrate their understanding that scientific knowledge is gathered through various forms of direct and indirect observations and the testing of this information by methods including, but not limited to, experimentation. They will be able to distinguish between types of scientific knowledge (e.g., hypotheses, laws, theories) and become aware of areas of active research in contrast to conclusions that are part of established scientific consensus. They will use their scientific knowledge to assess the costs, risks, and benefits of technological systems as they make personal choices and participate in public policy decisions. These insights will help them analyze the role science plays in society, technology, and potential career opportunities.*

**P1.1 Scientific Inquiry**

Science is a way of understanding nature. Scientific research may begin by generating new scientific questions that can be answered through replicable scientific investigations that are logically developed and conducted systematically. Scientific conclusions and explanations result from careful analysis of empirical evidence and the use of logical reasoning. Some questions in science are addressed through indirect rather than direct observation, evaluating the consistency of new evidence with results predicted by models of natural processes. Results from investigations are communicated in reports that are scrutinized through a peer review process.

P1.1A Generate new questions that can be investigated in the laboratory or field.

P1.1B Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.

P1.1C Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity–length, volume, weight, time interval, temperature–with the appropriate level of precision).

P1.1D Identify patterns in data and relate them to theoretical models.

P1.1E Describe a reason for a given conclusion using evidence from an investigation.

P1.1f Predict what would happen if the variables, methods, or timing of an investigation were changed.

P1.1g Based on empirical evidence, explain and critique the reasoning used to draw a scientific conclusion or explanation.

P1.1h Design and conduct a systematic scientific investigation that tests a hypothesis. Draw conclusions from data presented in charts or tables. P1.1i Distinguish between scientific explanations that are regarded as current scientific consensus and the emerging questions that active researchers investigate.

**P1.2 Scientific Reflection and Social Implications**

The integrity of the scientific process depends on scientists and citizens understanding and respecting the “Nature of Science.” Openness to new ideas, skepticism, and honesty are attributes required for good scientific practice. Scientists must use logical reasoning during investigation design, analysis, conclusion, and communication. Science can produce critical insights on societal problems from a personal and local scale to a global scale. Science both aids in the development of technology and provides tools for assessing the costs, risks, and benefits of technological systems. Scientific conclusions and arguments play a role in personal choice and public policy decisions. New technology and scientific discoveries have had a major influence in shaping human history. Science and technology continue to offer diverse and significant career opportunities.

P1.2A Critique whether or not specific questions can be answered through scientific investigations.

P1.2B Identify and critique arguments about personal or societal issues based on scientific evidence.

P1.2C Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.

P1.2D Evaluate scientific explanations in a peer review process or discussion format.

P1.2E Evaluate the future career and occupational prospects of science fields.

P1.2f Critique solutions to problems, given criteria and scientific constraints.

P1.2g Identify scientific tradeoffs in design decisions and choose among alternative solutions.

P1.2h Describe the distinctions between scientific theories, laws, hypotheses, and observations.

P1.2i Explain the progression of ideas and explanations that lead to science theories that are part of the current scientific consensus or core knowledge.

P1.2j Apply science principles or scientific data to anticipate effects of technological design decisions.

P1.2k Analyze how science and society interact from a historical, political, economic, or social perspective.

**Unit 1**

**Dimensional Analysis, Speed, Velocity, Acceleration and Significant Digits.**

**Big Ideas (Core Concepts):**

-The students will know how to convert from non standard units (pounds) to standard units (Kg).

- The students will know the difference between a scalar and a vector.

-The Students will be able to calculate speed, velocity and acceleration.

-The students will know the difference between instantaneous velocity and average velocity.

- The students will know how to count significant digits and how to make calculations with the proper amount of significant digits.

Standards:

P.2

Content Standards:

P2.1g Solve problems involving average speed and constant acceleration in one dimension.

Clarification: It is **not** expected that students will solve problems involving situations where the acceleration is changing in magnitude or direction.

**Olivet High School:**

**The students will read, write, discuss and investigate speed, velocity and acceleration. The students will conduct experiments used to calculate average velocity and the instantaneous velocity of a ball right before it hits the ground.**

P2.1h Identify the changes in speed and direction in everyday examples of circular (rotation and revolution), periodic, and projectile motions.

Clarification: Circular examples include a car turning a curve on a horizontal road, the earth rotating on its axis and revolving around the sun, a child on a merry-go-round. Periodic examples include the pendulum of a clock and a wave on a string. Projectile motions include the shooting of a cannon and the hitting of a baseball. Independence of horizontal and vertical motion for projectiles will be excluded.

**Olivet High School:**

**The students will be presented notes on circular motion and conduct an experiment that allows them to discover the path of a ball being spun in a circular motion.**

P2.2e Use the area under a velocity-time graph to calculate the distance traveled and the slope to calculate the acceleration.

Clarification: No calculus should be required. For the purposes of this calculation, straight-line graphs (constant slopes) with easily calculated areas should be used. The area under the velocity-time graph would represent the change in position of an object as opposed to the distance traveled.  
**Olivet High School:**

**The students will be presented with notes and an activity that requires them to find the slope of a distance vs. time graph.**

P2.3a - Describe and compare the motion of an object using different reference frames

Clarification: Descriptions and comparisons need be made only for one-dimensional motion. It is not expected that students will describe and compare the motion of an object using accelerated reference frames.

P2.2f Describe the relationship between changes in position, velocity, and acceleration during periodic motion.

**Olivet High School:**

**The students will be presented with notes and assigned a handout that requires them to graph velocity vs. time. They will find the slope of the graph to calculate acceleration.**

P2.3a - Describe and compare the motion of an object using different reference frames

Clarification: Descriptions and comparisons need be made only for one-dimensional motion. It is not expected that students will describe and compare the motion of an object using accelerated reference frames.

**Vocabulary:**

Acceleration  
Average Speed  
Circular Motion  
Constant Acceleration  
Displacement  
Frame of Reference  
Function  
Graph  
Linear Motion  
Motion  
Motion diagram  
Position  
Relative Motion  
Scalar  
Speed,Time,Vector  
Velocity

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| **Lesson** | **Material** | **Skills/Strategies** | **CCE’s** | **Assesment** |
| **Metric Conversions and Scientific Notation** | **Notes, Conversions/Scientific Notation Hand out** | **Read, Write and Discuss.** | **P.2** | **FA** |
| **Speed, Velocity and Acceleration** | **Notes, Stop watches, Meter sticks, toy cars, balls, Calculations** | **Lecture, Speed and Velocity lab. Acceleration lab** | **Same** | **FA** |
| **Vectors, scalars and Significant Digits** | **Notes, S. digit handout** | **Read, Write and discuss** | **Same** | **FA** |

**Unit 2**

**Gravity, Distance of an accelerating object, Newton’s Laws, Momentum and Impulse.**

**Big Ideas (core concepts):**

-The students will measure the distance and time an object falls in order to calculate the average velocity, final velocity and acceleration of a falling object (9.8 m/s2).

-The students will be able to calculate the distance of an accelerating object.

-The students will know Newton’s 3 laws of motion and how they are related to acceleration.

-The students will know how to give a falling object a direction.

-The students will know what impulse and momentum are and how to calculate them.

Standards:

Content Standards:

P3.3b Predict how the change in velocity of a small mass compares to the change in velocity of a large mass when the objects interact (e.g., collide).

Clarification: Exclude momentum in two dimensions. Students having a qualitative or semi-quantitative understanding (e.g., mathematical relationships such as proportionality) is more important than calculating particular quantities.

**Olivet High School:**

**The students will read, write, discuss and investigate the concepts of velocity and momentum. Collision cars and masses will be used in lab to calculate the change in momentum when mass and velocity are changed.**

**P3.4 Forces and Acceleration**

The change of speed and/or direction (acceleration) of an object is proportional to the net force and inversely proportional to the mass of the object. The acceleration and net force are always in the same direction.

**Olivet High School:**

**The students will read write and discuss the concept of Newton’s 2nd law.**

P3.4e Solve problems involving force, mass, and acceleration in two-dimensional projectile motion restricted to an initial horizontal velocity with no initial vertical velocity (e.g., ball rolling off a table).

Clarification: Air resistance should be ignored.

P3.4f Calculate the changes in velocity of a thrown or hit object during and after the time it is acted on by the force.

Clarification: Apply the relationship between variables described in Newton’s Second Law, Fnet = ma, with acceleration equal to Dv/Dt.

P3.4g Explain how the time of impact can affect the net force (e.g., air bags in cars, catching a ball).

Clarification: Explanation uses the relationships described in the P3.4f clarification.

**Olivet High School:**

**The students will construct a “landing pad” for an egg drop competition and write a paragraph that describes which part of the impulse equation that they manipulated.**

P3.5a - Apply conservation of momentum to solve simple collision problems  
Clarification: Exclude momentum and collisions in two dimensions.

**Olivet High School:**

**The students will measure the momentum of two colliding cars, change the momentum of one of them and use the conservation of momentum to solve for the velocity of the 2nd car after the collision.**

P3.6d Calculate force, masses, or distance, given any three of these quantities, by applying the Law of Universal Gravitation, given the value of *G*.

**Vocabulary:**

Position  
Velocity  
Average speed  
Average acceleration, Acceleration due to gravity  
Proportional  
Net Force  
Inversely proportional

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| Lesson | Material | Skills/Strategies | CCE’s | Assesment |
| Final Velocity and Calculating “G” | Notes, Stop watch, meter stick, ball, Calculations | Read write and discuss the mentioned concepts | P3 | FA |
| Distance of an acceleration object | Notes, Calculations, toy car, ramp | Write, discuss and calculate the distance of objects with varying accelerations | Same | FA |
| Newton’s Laws | Notes, Video, Scooters | Investigate, discuss the relationship between a constant force and a changing velocity (acceleration) | Same | FA |

**Unit 3**

**Gravity, Work, Power and Drawing Vector additions to Scale.**

**Big ideas (core concepts):**

-The learner will calculate gravity’s acceleration (9.8 m/s2).

-The learner will know what the center of gravity is and how to locate in several examples.

-The learner will know what work and power are and how to calculate them.

-The learner will know what torque is, how to calculate it and how to change it.

**Standards:**

**Content Standards:**

P3.6e Draw arrows (vectors) to represent how the direction and magnitude of a force changes on an object in an elliptical orbit.

**Olivet High School:**

**The students will read, write, and discuss Vectors that interact. They will also, use protractors and rulers to draw vector additions to scale. The students will use a force table to build force vectors and find the magnitude of the resultant.**

**P4.1x Energy Transfer — Work**

Work is the amount of energy transferred during an interaction. In mechanical systems, work is the amount of energy transferred as an object is moved through a distance, W = F d, where d is in the same direction as F. The total work done on an object depends on the net force acting on the object and the object’s displacement.

**Olivet High School:**

**The students will read, write and discuss work and power. They will also, investigate the difference between the amount of work and power used when they walk/run the length of the gym floor.**

P4.1cExplain why work has a more precise scientific meaning than the meaning of work in everyday language.

P4.1dCalculate the amount of work done on an object that is moved from one position to another.

Clarification: Include analysis a force vs. distance graph for variable or constant force situations, in addition to W = Fd calculations. Work done by forces applied at common angles (such as 30, 45, and 60 degrees) should also be addressed.

P4.1eUsing the formula for work, derive a formula for change in potential energy of an object lifted a distance h.

**Vocabulary:**

change in direction  
change in speed, scalar  
speed  
strong nuclear force  
tension  
velocity  
vector  
weak nuclear force  
weight

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| Lesson | Material | Skills/Strategies | CCE’s | Assesment |
| Work and power | Notes. Hand out, Stop watch, Meter Stick | Work and power lab. | P4 | FA |
| Center of Gravity, Torque and levers | Notes, Fork, toothpicks, Levers | Fork Phenom Demo. Torque lab | Same | FA |
| Drawing Vectors to scale. | Notes, Hand out, force table. | Draw and build force vector lab | Same | FA |

**Unit 4**

**Calculating Vectors using Tangent, Law of Cosine and the Law of Sine.**

**Big Ideas (core concepts):**

-The learner will know how to solve vectors using basic trig functions.

-The Learner will know the forces involved with a sail boat and why it can travel faster at an angle to the wind rather than when the wind is directly behind the boat.

**Strands:**

**Benchmark Strands:**

P3.6e Draw arrows (vectors) to represent how the direction and magnitude of a force changes on an object in an elliptical orbit.

**Olivet High School:**

**The students will read, write and discuss vector additions and how to solve them using trig. They will also, compare the accuracies of building, drawing and using the Law of cosine and the Law of sine when solving vector additions.**

**Vocabulary:**

**Vectors**

**Sail boats**

**Beam Reach**

**Keel**

**Lift**

**Resultant**

**Law of Cosine**

**Tangent**

**Law of Sine**

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| **Lesson** | **Material** | **Skills/Strategies** | **CCE’s** | **Assessment** |
| **Vectors, Law of Cosine, finding “angle c”, Sail Boats and the forces that move them** | **Notes, Force table, Vector Handouts (I-V).** | **Comparing Resultant lab, Physics Olympics, Toy car crossing moving paper lab** | **P3** | **FA** |

**Unit 5**

**Waves, Light, Images, Temperature Conversions and**

**Calculating Focal Point.**

**Big Ideas (Core Concepts):**

-The learner will know what waves, the different parts of a wave, and the two different kinds (transverse and compressional).

-The learner will know what kind of wave light is and how it behaves.

-The learner will know what reflection and refraction are.

-The learner will know what a real and virtual images are.

-The learner will know what the focal point of a lens is and how to calculate it.

-The learner will know what Snell’s law is and how to calculate the index of refraction of material that light travels through.

-The learner will know how to convert temperatures from F to K and C.

**Standards:**

**Benchmark Standards:**

**P4.4x Wave Characteristics — Calculations**

Wave velocity, wavelength, and frequency are related by *v* = l*f*. The energy transferred by a wave is proportional to the square of the amplitude of vibration and its frequency.

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P4.4d Demonstrate that frequency and wavelength of a wave are inversely proportional in a given medium.

**Olivet High School:**

**The students will read, write and discuss the concepts above. They will investigate, measure and calculate the different parts of a wave (Crest, trough, amplitude, wavelength, frequency, period and velocity).**

P4.4e Calculate the amount of energy transferred by transverse or compression waves of different amplitudes and frequencies (e.g., seismic waves).

P4.8e Given an angle of incidence and indices of refraction of two materials, calculate the path of a light ray incident on the boundary (Snell’s Law).

Clarification: The use of Snell’s law in problems or to explore the relationship in the lab is needed, but not a derivation the formula from first principles.

P4.8f Explain how Snell’s Law is used to design lenses (e.g., eye glasses, microscopes, telescopes, binoculars).

**Olivet High School:**

**The students will investigate the behavior of light when it is reflected (off of a mirror) and refracted through both water and through a convex lens.**

Absorption   
Acceleration  
Analog  
Angle of incidence  
Angle of reflection  
Angle of refraction  
Antenna  
Charges  
Diffraction  
Digital  
Electric field  
Electromagnetic Wave  
Energy  
Frequency  
Incident wave  
Infrared waves  
Interference  
Law of Reflection  
Lens  
Magnetic field  
Microwaves  
Modulation  
Radio waves  
Ray diagram  
Reception  
Reflected wave  
Reflection  
Refracted wave  
Refraction  
Snell’s Law  
Sound waves  
Speed of light  
Transmission

Ultraviolet light  
Visible light  
Wavelength  
X-rays

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| **Lesson** | **Material** | **Skills/Strategies** | **CCE’s** | **Assessment** |
| **Waves, Reflection and Refraction** | **Notes, Slinkys, Mirrors, Plastic boxes, Pennies, ruler** | **Lecture. Reflection lab. Refraction lab. Slinky lab** | **P4** | **FA** |
| **Snell’s law** | **Notes, Optical benches** | **Lecture. Mirage Demo. Snell’s law lab. Candle lab** | **Same** | **FA** |
| **Temperature conversions and Polarized light** | **Notes, Polarizers, Conversion handout** | **Lecture. Temp problems. Polarizer lab** | **Same** | **Fa** |

**Unit 6**

**Heat, Thermal Equilibrium, Buoyancy,**

**Potential and Kinetic Energy**

**Big ideas (core Concepts):**

-The students will know what heat is, how to calculate it and what the units are (Calorie)

-The students will know what kinetic and potential energies are, how to calculate them and how they are related to the conservation of energy.

-The students will know what specific heat is and how to calculate it.

-The students will know what thermal equilibrium is and how to find it.

-The students will know what buoyancy is and how it is related to Archimedes’ Principle.

**Standards:**

**Benchmark standards:**

P4.2e Explain the energy transformation as an object (e.g., skydiver) falls at a steady velocity.

P4.2f Identify and label the energy inputs, transformations, and outputs using qualitative or quantitative representations in simple technological systems (e.g., toaster, motor, hair dryer) to show energy conservation.

Clarification: Label energy transfer diagrams to give simple quantitative and qualitative examples of how energy moves into and out of a system.

**Olivet High School:**

**The students will read, write and discuss about how a cell phone works.**

**P4.3x Kinetic and Potential Energy — Calculations**

The kinetic energy of an object is related to the mass of an object and its speed: *KE* = 1/2 mv2.

P4.3d Rank the amount of kinetic energy from highest to lowest of everyday examples of moving objects.

Clarification: This will require the use of the kinetic energy formula, KE= ½mv2, in symbolic or numerical forms.

P4.3e Calculate the changes in kinetic and potential energy in simple mechanical systems (e.g., pendulums, roller coasters, ski lifts) using the formulas for kinetic energy and potential energy.

P4.3f Calculate the impact speed (ignoring air resistance) of an object dropped from a specific height or the maximum height reached by an object (ignoring air resistance), given the initial vertical velocity.

**Olivet High School:**

**The Students will investigate the transfer of potential energy of a toy car at the top of a track to the kinetic energy at the bottom of the track. The students will also calculate potential and kinetic energy for several examples.**

energy transfer  
force  
gravitational energy  
gravitational potential energy  
impact speed  
KE= ½mv2  
kinetic energy  
magnitude of a force  
mechanical systems  
net force

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| **Lesson** | **Material** | **Skills/Strategies** | **CCE’s** | **Assessment** |
| **Heat, The Calorie and Thermal Equilibrium** | **Notes, Cut 2 liter, food coloring, peanut, cashew.** | **Lecture, reading, Thermal equilibrium lab. Calories of 2 nuts lab.** | **P4** | **FA** |
| **Buoyancy, Center of gravity and Archimedes Principle** | **Notes, over flow cups, Foil.** | **Lecture. Build a boat lab** | **Same** | **FA** |
| **Potential and Kinetic Energy** | **Notes, toy car, plastic track, Calculations handout** | **Lecture. Potential and Kinetic energy of a toy car lab** | **Same** | **FA** |

**Unit 7**

**Sound and Electricity**

**Big Ideas (core concepts):**

-The learner will know what kind of wave sound is and why it can’t travel in a vacuum.

-The learner will know what the different parts of sound are and what they depend on.

-The learner will know what static and current electricity.

-The learner will know what coulomb’s law is and how to use the equation.

-The learner will know the difference between induction and conduction.

**Standards:**

**Benchmark Standards:**

**P3.7x Electric Charges — Interactions**

Charged objects can attract electrically neutral objects by induction.

**Olivet High School**

**The students will read, write, discuss and investigate friction charging, flowing electrons and be given several examples of these scenerios (balloon, VandeGraff generator).**

P3.7c Draw the redistribution of electric charges on a neutral object when a charged object is brought near.

Clarification: The redistribution of charge is the result of the movement of negative charges in an object caused by the type of charge that is brought near that object.

**Olivet High School:**

**The students will explain why a charged balloon attracts paper pieces, flowing water and the wall.**

P3.7d Identify examples of induced static charges.

P3.7e Explain why an attractive force results from bringing a charged object near a neutral object.

P3.7f Determine the new electric force on charged objects after they touch and are then separated.

Clarification: Note that the amount of force after they touch and are separated can vary from zero up to the amount of force that was present before they touched depending on the amount and type of charge on each object and whether or not the objects are conductors or insulators. Each of these scenarios should be addressed.

P3.7g Propose a mechanism based on electric forces to explain current flow in an electric circuit.

Clarification: Even though the flow of positive charge is the conventionally accepted model of flow of charge through a circuit, the movement of electrons due to electric forces will also have to be explained.

**P3.p8 Magnetic Force (prerequisite)**

Magnets exert forces on all objects made of ferromagnetic materials (e.g., iron, cobalt, and nickel) as well as other magnets. This force acts at a distance. Magnetic fields accompany magnets and are related to the strength and direction of the magnetic force. *(prerequisite)*

P3.p8A Create a representation of magnetic field lines around a bar magnet and qualitatively describe how the relative strength and direction of the magnetic force changes at various places in the field. *(prerequisite)*

**P3.8x Electromagnetic Force**

Magnetic and electric forces are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces and moving magnets produce electric forces (e.g., electric current in a conductor).

P3.8b Explain how the interaction of electric and magnetic forces is the basis for electric motors, generators, and the production of electromagnetic waves.

**Olivet High School:**

**The students will build a generator out of magnets and wire and measure the amount of volts that their generator produces.**

charged object  
conductor  
contact forces  
Coulomb’s Law  
direction of a force  
distribution of electric charge  
electric charge  
electric circuit  
electric force  
electric generator  
electric motor  
electric potential  
electrical current  
electrically neutral  
electromagnetic force  
electromagnetic wave  
electron  
force  
forces at a distance  
friction  
gravitational force  
induction  
inverse square law  
inversely proportional  
like charge  
magnet  
magnetic force  
magnitude of a force  
magnitude of charge  
moving electrical charge  
moving magnet  
net force  
opposite charge  
proportional  
proton  
repel/attract  
static charge  
Van de Graff generator

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| **Lesson** | **Materials** | **Skills/Strategies** | **CCE’s** | **Assessment** |
| **Sound, its parts and the Doppler effect.** | **Notes, tuning forks, Record player, plastic boxes, rubber bands** | **Read, write and discuss. Lecture. Tuning fork lab. Rubber band lab** | **P3** | **FA** |
| **Static Electricity** | **Notes, balloons, Vandergraff Generator, Hand Generator.** | **Lecture. Balloon lab. Vandegraff Demo. Hand Generator demo.** | **P3** | **FA** |
| **Current electricity** | **Notes, Circuit board, bulbs and Batteries (9V).** | **Lecture. Parallel and series lab. Build a generator contest** | **P3** | **FA** |

**Unit 8**

**Projectile Motion and**

**Law of Gravity**

**Big Idea (core concepts):**

-The learner will know what the vertical and horizontal component of a projectile are.

-The learner will calculate the velocity of a dart coming out of a Nerf gun.

- ‘The learner will calculate the vertical and horizontal components of a projectile to calculate the distance the projectile will go,

-The learner will know what Newton’s Gravitational law is and how to use the equation.

**Standards:**

**Benchmark standards:**

P3.1b - Explain why scientists can ignore the gravitational force when measuring the net force between two electrons

Clarification: The main point here is that for small, charged objects the electrical forces can be very much greater than the gravitational force that acts upon them.

**Olivet High School:**

**The students will read write and discuss the law of Gravity and carry out example calculation usint the equation.**

P3.2d Calculate all the forces on an object on an inclined plane and describe the object’s motion based on the forces using free-body diagrams.

Clarification: Inclines should include both frictionless and friction-based systems. Inclined plane force scenarios should include ones that cause the object to be at rest, moving up a plane, and moving down a plane. Forces involve calculations; the motion involves only a description.

P3.3c Explain the recoil of a projectile launcher in terms of forces and masses.

P3.3d Analyze why seat belts may be more important in autos than in buses.

P2.2g Apply the independence of the vertical and horizontal initial velocities to solve projectile motion problems.

**Olivet High School:**

**The students will calculate the distance that a Nerf dart gun will shoot a dart.**

Vertical velocity  
Horizontal velocity  
Projectile motion  
Projectile  
Mass  
Two-dimensional projectile motion  
Inclined plane  
Free-body diagrams

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| **Lesson** | **Material** | **Skills/Strategies** | **CCE’s** | **Assessment** |
| **Gravitation** | **Notes, lap tops** | **Read, write and discuss. Lecture. Calculations** | **P2** | **FA** |
| **Velocity of a Dart** | **Dart guns, stop watch.** | **Lecture. Velocity of a dart gun lab.** | **Same** | **FA** |
| **X and Y components** | **Dart gun, stop watch** | **Lecture. Distance of a dart when shot at 45 degrees lab** | **Same** | **FA** |