Honors Physics - Unit 1 - Kinematics

Unit Focus

Throughout this unit, students will explore one dimensional and two dimensional, projectile, motion. Beginning with evaluating the nuances of distance vs displacement and velocity vs speed, students will learn about scalars versus vectors and how they affect signs and acceleration. Students will discover the various graphical representation of motion and will apply this knowledge to critically analyze motion graphs. Students will expand upon this prior knowledge in linear motion, to begin evaluating two-dimensional motion. Beginning with demonstrations that pose questions about two-dimensional motion, students will explore the relationship between horizontal and vertical motion of objects. Ultimately, students will be evaluating motion to determine the range (landing position), maximum height and time in the air for a given projectile. Students will be able to solve numerical word problems and extend these skills to solve for multiple physical variables.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science Standards (DCI)
Science: 10

- Newton's second law accurately predicts changes in the motion of macroscopic objects. *PS2.9.A1*

NGSS/NSTA Science & Engineering Practices
NGSS Science & Engineering Practices: 9-12

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. *SE.9-12.5.3*
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems. *SE.9-12.5.4*

Madison Public Schools Profile of a Graduate
Critical Thinking

- Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

Transfer

T1 Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery.
T2 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.

Meaning

Understanding(s)	Essential Question(s)
U1 The pattern of an object's motion in various situations can be observed and measured from which predictions can be made. **U2** The motion of objects must be defined by using a frame of reference. **U3** The motion of an object can be determined and/or predicted by using its position, velocity, and acceleration. **U4** Objects in motion remain in straight-line motion at constant speed, and objects at rest remain at rest unless acted upon by unbalanced forces. (Newton's 1st law).	**Q1** What makes an object move the way it does? **Q2** How can I describe and predict patterns of motion? **Q3** How does the launch angle of a projectile impact its range?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 An object in linear motion may travel with a constant velocity or with acceleration.	**S1** Be able to use the definition of a vector to distinguish between speed and velocity, displacement and distance

Stage 1: Desired Results - Key Understandings		
	K2 An object in free fall accelerates due to the force of gravity. Friction and other forces cause the actual motion of a falling object to deviate from its theoretical motion. **K3** The slope of a position - time graph is the velocity of an object **K4** The slope of a velocity - time graph is the acceleration of an object **K5** Displacement, Velocity and acceleration are vectors **K6** Objects near the earth fall at an acceleration rate of 9.8 m/s/s	**S2** Be able to solve problems using the basic definitions of average velocity and acceleration. **S3** Graphical Analysis: • Be able to look at a Position vs. Time graph and explain in words the motion of the object that is described by the graph. • Be able to look at a Velocity vs. Time graph and explain in words the motion of the object that is described by the graph. • Determine velocity from a Position vs. Time graph (i.e. find the slope). • Determine acceleration from a Velocity vs. Time graph (i.e. find the slope) • Create position-time, velocity-time and acceleration-time graphs from a physical description of the motion of an object **S4** Use kinematics equations for constant acceleration, to solve word problems, including problems involving projectile motion **S5** Effectively measure, evaluate and analyze motion variables in a laboratory setting. **S6** Combine vectors to determine the magnitude and direction of a resultant vector