Physics - Unit 2 - Projectile Motion

Unit Focus

Students will expand upon 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. Students will continue to develop their understanding of vectors and scalars. Ultimately, students will be evaluating motion to determine the landing position of a projectile.

This unit focuses on the study of motion in two directions and the analysis of projectiles.

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*

Science: 12

- Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. *ETS1.9.B2*
- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *ETS1.9.C1*
- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. *PS3.9.A3*

Transfer

T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.

Meaning

Understanding(s)

U1 For a given height, the time it takes to reach the ground is the same for a projectile launched horizontally and for an object in free fall.
U2 The range of the projectile depends on the horizontal component of the launching velocity.
U3 The height of the projectile depends on the vertical component of the launching velocity.

Essential Question(s)

Q1 How do variables such as launch angle, velocity, and altitude affect the maximum height and range of a launched projectile?
Q2 How is the horizontal motion of a projectile is independent of its vertical motion?
Q3 How can you separate a given vector (size and angle) into its horizontal and vertical component?

Acquisition of Knowledge and Skill

Knowledge

K1 A projectile will spend the most time in the air if launched at 90˚ to the horizontal (i.e. straight up).
K2 A projectile will have the longest range (i.e. travel the farthest) if launched at 45˚ to the horizontal. This is because the parts of velocity are equal in the horizontal and vertical directions . . . so the projectile gets to spend a decent amount of time in the air and also have a decent amount of velocity taking it horizontally.

Skill(s)

S1 Solving for the range of a projectile launched horizontally
S2 Solve for the launch height of a projectile launched horizontally given its range
S3 Finding the complement of an angle to determine which angles give the same range
S4 Quantitatively measuring lab results to obtain percent error ; identifying strategies to increase confidence in lab results

Stage 1: Desired Results - Key Understandings		
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)	**K3** A projectile will travel the highest if launched at 90˚ to the horizontal. **K4** Two projectiles launched at angles that add to 90 (ex. 30˚ & 60˚) will have the same range (i.e. travel the same distance).	