Conceptual Physics - Unit 1 - Forces and Motion

Unit Focus

Students will explore the relationship between forces on an object and the motion of that object. Students will examine how physics operates in everyday life as well as the objects they create in class. Students will engage in lessons that challenge them to use the scientific process as they perform several inquiry-based experiments to uncover and investigate fundamental principles of physics, such as acceleration and velocity. Students will practice important science skills such as metric system measurements and conversions as well as creating and analyzing graphs.

Stage 1: Desired Results - Key Understandings

Standard(s)

Common Core
Mathematics: 9-12

- Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. *CCSS.MATH.CONTENT.HSA.CED.A.1*
- Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *CCSS.MATH.CONTENT.HSA.CED.A.4*

Next Generation Science
High School Physical Sciences: 9 - 12

- Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. *HS-PS2-1*

Middle School Physical Science: 6 - 8

- Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. *MS-PS2-2*

Transfer

T1 Use the scientific process to generate evidence that addresses the original questions.
T2 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.

Meaning

Understanding(s)	Essential Question(s)
U1 Scientists examine evidence to formulate interesting questions and solve problems. **U2** Good experimental design leads to precise and accurate data. **U3** The motion of objects must be defined by using a frame of reference. **U4** The acceleration of an object depends upon its mass and the net force acting on it. **U5** Graphs are used by scientists to communicate information and to interpret the relationship between physical variables	**Q1** What do the results tell me? What patterns do I see or what conclusions can I draw? **Q2** How do I explain my results? What questions do I wonder about now? **Q3** How can an object be moving from one perspective but from another perspective, be considered to be stationary? **Q4** How can an object with no force acting on it be moving? **Q5** How can an object be moving if all the forces on the object are balanced?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 velocity is the change in position with respect to time **K2** acceleration is the change in velocity with respect to time and it has a direction (it is a vector) **K3** velocity = delta x / delta t ; a = delta v/ delta t ; delta x = 1/2 at2	**S1** Interpreting motion graphs to describe the behavior of an object. Conversely, sketch motion graphs given the qualitative description of an object's motion. **S2** Solving motion problems using mathematical computations.

Stage 1: Desired Results - Key Understandings

Next Generation Science Standards (DCI) *Science: 9* • Newton's second law accurately predicts changes in the motion of macroscopic objects. *PS2.9.A1* **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) *Creative Thinking* • Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)	**K4** A free body diagram (FBD) is used to graphically depict the forces on an object and to predict the motion of the object	