

Grade 8 Unit 1: Storyline, Phenomena, and Segments

Storyline Overview

Students make sense of the key disciplinary ideas of forces (including gravitational forces), motion, and energy related to mass, and how these concepts can be used to explain phenomena including collisions, the changes in motion that result, and the effect of collisions on objects.

Anchor Phenomenon

In this unit, the anchor phenomenon is about the effects of collisions between objects. The teacher may start with an image or video of a collision in a sport (e.g., a ball and person, golf club, ground, etc.). An image or video can be a starting point for discussions about collisions in various sports, the effects of those collisions on an object's motion, and the factors that affect the forces and changes in motion.

Measurement Target

Students are able to apply science and engineering practices with emphasis on planning investigations related to the scale of motion of an object and interactions between objects and constructing and interpreting graphical displays of data in support of an argument to explain interactions between energy, forces, and motion in a system.

Relationship to Prior and Subsequent Learning

Unit 1 focuses on forces and energy. Unit 2 focuses on space systems, especially those within the sun / Earth / moon system and across the solar system, with particular focus on the role of gravitational forces on motion. By building familiarity with ideas related to forces and motion early in the year, students are prepared to put their knowledge to work in various physical system settings in later units.

Segment 1: Students measure contact forces in different situations and analyze data to support models about force relationships during collisions. Students will then design solutions to the problem of controlling damage during a collision.

Develop an initial model that explains the collision presented in the anchoring phenomenon

Analyze data to explain relationships of direction and magnitude of forces

Carry out investigations to obtain evidence about equal and opposite forces

Use Newton's third law to revise initial explanation of collision presented in anchoring phenomenon

Design a water powered rocket based on Newton's third law

Segment 2: Students develop explanations that describe the relationship between changes in an object's mass and changes in motion and models that include the sum of all forces acting on an object and the object's mass as a basis for predicting changes in the object's motion.

Carry out investigations involving changing motions and forces

Investigate the relationship between force, mass, and acceleration

Examine the relation of sum of forces and mass on motion

Refine the model of a collision to include masses

Obtain and communicate information about Newton's laws of motion

Use Newton's second law to revise the explanation of collision presented in the anchoring phenomenon

Segment 3: Students develop graphical representations of the relationships between mass and velocity and kinetic energy and use these representations as evidence in models of how kinetic energy changes during collisions, contributing to solutions to the problem of controlling damage during a collision.

Investigate how speed and mass affect the motion and energy of an object

Obtain and communicate information about the relations between mass and kinetic energy

Create models of (1) mass and energy and (2) speed and energy

Use the relationship between mass and kinetic energy to revise the explanation of collision presented in the anchoring phenomenon

Segment 4: Students examine the effect and the size of gravitational forces on motion, and the effect of distance on the magnitude of gravitational forces. Students represent how the variables of distance and mass impact the motion of objects and engage in arguments involving gravitational interactions. Students then use their models to develop solutions of controlling damage during collisions.

Observe motions as water flows downward

Use a simulation to study changes in gravitational forces with mass and distance

Use the relationship between force and gravity to revise the explanation of collision presented in the anchoring phenomenon

Apply understanding of forces and motions to a design project