Unit 01C: Momentum NJ NGSS

Content Area: **Science**
Course(s): **Generic Course**
Time Period: **Marking Period 1**
Length: **3**
Status: **Published**

Standards

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS2-1),(HS-PS2-3)
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (SLO 1, 2 & 3), (HS-PS2-1)
- Use mathematical representations of phenomena to describe explanations. (SLO 1, 2 & 4), (HS-PS2-2)
- Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3)

- Newton's second law accurately predicts changes in the motion of macroscopic objects. (SLO 1, 2 & 3),(HS-PS2-1)
- Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. (SLO 5),(HS-PS2-2)
- If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS-PS2-2),(HS-PS2-3),(SLO 5)
- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary to HS-PS2-3)
- 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. (HS-PS2-3)
- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1)
- Systems can be designed to cause a desired effect. (HS-PS2-3)
- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)
- Theories and laws provide explanations in science. (HS-PS2-1)
- Laws are statements or descriptions of the relationships among observable phenomena. (HS-PS2-1)

http://www.state.nj.us/education/modelcurriculum/sci/physicsu1.shtml

SCI.9-12.HS-PS2-1	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.

SCI.9-12.HS-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
SCI.9-12.HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

Essential Questions

- How do we describe the motion of an object?
- Can we predict the motion of an object?
- How do rules of motion in our universe affect objects?
- What rules determine the motion of an object?
- How can one predict an object's continued motion, changes in motion, or stability?

Content / Skills

- Explain the meaning of a conserved property. (Accelerated & CP)
- Define and calculate the momentum of a particle. (Accelerated & CP)
- State the law of conservation of momentum. (Accelerated & CP)
- Apply conservation of momentum to collisions in one dimension. (Accelerated & CP)
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- Define and calculate impulse as a product of force and time. (Accelerated & CP)
- Give examples of how the product of the time of application of a force on an object will change its momentum. (Accelerated & CP)
- Explain how momentum is conserved in an explosion. (Accelerated)