Unit 02: Forces and Motion (Week 11-16)

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **6 weeks**
Status: **Published**

Standards Alignment

PS2.A: Forces and Motion

- 6-PS2-1: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- 6-PS2-2: Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- 6-PS2-4: Analyze data to determine the factors that affect the strength of electric and magnetic forces.

PS2.A: Forces and Motion

- 7-PS2-4: Construct and interpret graphical representations of data to explain how the motion of an object changes due to forces acting upon it.
- 7-PS2-5: Apply scientific ideas to design, test, and refine a device that minimizes the force of impact during a collision.

PS2.A: Forces and Motion

- 8-PS2-1: Analyze and interpret data to determine the relationship between force and motion for an object.
- 8-PS2-2: Design and evaluate a solution to a problem involving the motion of objects and forces.

New Jersey Student Learning Standards

PS2: Motion and Stability: Forces and Interactions
PS2.A: Forces and Motion

For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1)

The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)

All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MSPS2-2)

PS2.B: Types of Interactions

Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4)

Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1)

Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. In any system, total momentum is always conserved. (HS-PS2-2)

SCI.3-PS2	Motion and Stability: Forces and Interactions
SCI.3.PS2.A	Forces and Motion
SCI.3.PS2.B	Types of Interactions
SCI.MS-PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
SCI.MS-PS2-2	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.

Integration of Career Readiness, Life Literacies and Key Skills

CAEP.9.2.8.B.2	Develop a Personalized Student Learning Plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
CAEP.9.2.8.B.5	Analyze labor market trends using state and federal labor market information and other resources available online.
CAEP.9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.
CAEP.9.2.8.B.7	Evaluate the impact of online activities and social media on employer decisions.

Technology / Integration of Computer Science and Design Thinking

CS.6-8.8.1.8.AP.6	Refine a solution that meets users' needs by incorporating feedback from team members and users.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

LA.RL.7.2	Determine a theme or central idea of a text and analyze its development over the course of the text; provide an objective summary of the text.
LA.RL.7.4	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of rhymes and other repetitions of sounds (e.g., alliteration) on a specific verse or stanza of a poem or section of a story or drama.
LA.RI.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

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Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

Our understanding of the laws of motion and how forces interact allows us to make predictions. These predictions can be helpful when making cars, amusement park rides, and sports safer as well as help improve our understanding of the natural world.

Meaning

Essential Questions

Essential Questions

1. How do Newton's Laws apply to all objects in the universe?

2. How do forces impact the motion of an object?

3. How can we use the laws of motion and forces to make predictions?

4. How can our understanding of these concepts improve our quality of life?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

1. Newton's laws of motion apply to all moving objects.

2. A change in an objects motion is based upon the resulting forces acted upon the object(s).

3. Newton's laws and our understanding of forces help us make predictions about how things move/interact.

4. Being able to make predictions about an objects motion impacts society in positive ways by (1) making cars, amusement park rides, and sports safer (2) helping us to understand the natural world (3) making simple and complex tasks easier by way of engineering design.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

1. The relationship between work and energy (potential and kinetic) and related mathematical applications

2. The three laws of motion (Newton's Laws) and their mathematical applications

3. How Newton's laws of motion are applied to objects

4. Unbalanced and balanced forces

5. The types of forces that acts on objects

6. The difference between speed, velocity, and acceleration and their mathematical applications

7. What momentum is and it's mathematical applications

8. How we can apply understanding of forces and motion to improve quality of life

Skills

Skills

Student will be skilled at …

1. Define potential and kinetic energy

2. Apply the concepts of potential and kinetic energy to objects and solve related word problems.

3. Define work and energy and motion (point of reference)

4. Define the three laws of motion and solve related world problems

5. Apply Newton's laws to everyday objects/activities

6. Define unbalanced and balanced forces and solve related word problems

7. Identify and Define the types of forces that act on objects and explain their everyday applications

8. Compare and contrast speed, velocity and acceleration and solve related word problems

9. Interpret speed, velocity, and acceleration graphs

10. Define momentum and solve related word problems

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

1. Projector

2. Lab Materials (see learning activities for more detail)

3. Elmo

4. Interactive notebooks

5.Interactive notebook materials

6. Student copies (see learning activities for more detail)

Formative Assessment Strategies

Formative Assessment Strategies

1. Quizzes (Wrap-ups)

2. Virtual labs

3. Interactive notebook activities/assignments

4. Labs (based on lab availability/scheduling conflicts).

5. Informal questioning

Learning Activities/Unit of Study

Learning Activities/Unit of Study

1. Nasa Rocket Builder (See attachment)

2. The science of flight and motion (see attachment)

3. Virtual Lab 2nd Law of Motion (see attachment)

4. Virtual Labs: Basics: Net Force, Motion, Friction, Acceleration (see attachment)

Nasa Rocket Builder
The science of flight and motion
Virtual Lab (2nd Law of Motion)
Virtual labs (Basics: Net Force, Motion, Friction, Acceleration

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful

units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.