Grade 8 Unit Name: Contact Forces

Content Area: **Science**
Course(s): Grade 8
Time Period: **Marking Period 1**
Length: **10 weeks**
Status: Revised 7/19/21

Course Pacing Guide

Unit 8.1 10 Weeks

Unit Overview

This unit is based on the New Jersey Student Learning Standards for Science. Throughout the Physics unit students will develop a deep understanding of the inner workings of the world around us by modeling, analyzing and exploring phenomena that provide students with anchors of understanding. Students will gain an understanding that can be applied to explain phenomena that they experience in their everyday lives.

The course will begin with an introduction based around an anchoring phenomenon. The concept will focus on the impacts of collisions on objects and why collisions cause different objects to react in the ways that they do. Because of this, the unit is broken into three major sections. Part 1 will allow students to make observations about collisions and their impacts on a variety of objects and materials. This will include an introduction to such concepts as collisions, speed, velocity, force, momentum and Kinetic and Potential Energy.

Part 2 of this uiit will focus on providing students with the ability to generate a mathematical model to coincide with the observable conclusions that they students have gained form Part 1 of this unit. This will allow students to both generate and explore the mathematical models that can help to explain the natural world around them.

In Part 3, students will take what they have learned and apply their findings to create a prototype design for a protective device for a cell phone. This will allow students to make a working model while utilizing the concepts that they have both observed and analyzed throughout the entirety of this unit. Finally, students will be asked to create a sales pitch for their product, highlighting Scientific principles along with the concrete data that they have collected through their investigations within this unit. This will act as a performance assessment, putting on display the learning of all students throughout this unit.

Enduring Understandings

Overarching concepts

- All objects and systems in nature move relative to each other.
- Forces either maintain or cause changes in this motion.
- Collisions are controlled by a variety of factors including mass, force, speed, momentum, material, and other external factors.

Essential Questions

Overarching concepts

- Why are reference points so important when describing motion?
- What are the differences between balanced and unbalanced forces and what type of motion will each cause?
- How can Newton's three laws be applied to analyze the motion of any object?
- How is speed is related to the energy of a moving object.
- What causes energy transfer occurs in a collision.
- Why do pushes and pulls have different strengths and directions.
- How do pushes and pulls change the speed or direction of an object (they can start or stop it).
- Why is it that when objects touch or collide, they push on one another.
- Why does a bigger push or pull makes things speed up or slow down more quickly

Introduction

- How is speed calculated?
- How is speed and velocity related?
- Why do collisions cause damage to objects involved?

Exploration

- What is the main cause of acceleration?
- What is acceleration?
- What is needed for a change in motion?
- How is force calculated?
- What are Newton's Laws of Motion and how are they applied to a closed system?
- Why don't the forces created in Newton's 3rd law of motion cancel each other out?
- In what ways are forces transferred from one object to another?
- What is the force that always opposes motion ?
- Why is force and momentum conserved in a closed system?
- What unit is used to measure force?
- What is the difference between elastic and inelastic collisions?

Design

- How can peak force be reduced?
- How can materials be structured to reduce impact force?
- What role do ergonomics play in design constraints?
- What is the importance for the redesign phase of prototyping?
- What is the importance for following constraints in a design project?
- Why is it important to think about all consumers when making a product, not just yourself?

New Jersey Student Learning Standards

MS-PS2-

1.

Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*[Clarification Statement: Examples

of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a

space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one

dimension.] 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. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative

comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary:

Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time.

Assessment does not include the use of trigonometry.]

MS-PS2-

3.

Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples

of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the

effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed

of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and

algebraic thinking.]

MS-PS2-

4.

Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the

masses of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or

digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.]

[Assessment Boundary: Assessment does not include Newton's Law of Gravitation or

Kepler's Laws.] MS-PS2-

5.

Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on
each other even though the objects are not in contact. [Clarification Statement: Examples of this phenomenon could include the interactions of

magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or

simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of

fields

Interdisciplinary Connections

MA.8.EE.B.5 - [*Standard*] - Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways

Used when graphing data to compare results

MA.8.SP.A.3 - [*Standard*] - Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept

Using graphing to calculate speed. acceleration, time, etc...

Technology Standards

8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results

21st Century Themes/Careers

CRP4. Communicate clearly and effectively and with reason.

It is important that students can articulate an understanding of content both verbally and in written explanation. This skill will carry over to all aspects of life.

Instructional Strategies & Learning Activities

- Quiz quiz trade
- Alpha block

- Gallery Walk
- Reaction Time (Speed and Velocity)
- Momentum
- Force
- Newton's Laws
- Gravity
- Weight
- Speed/Velocity
- Acceleration
- Metric System
- Scientific Method
- Egg Drop
- Cell Phone/Sugar Glass Protection

Differentiated Instruction (already completed)

Examples may include:
Inquiry/Problem-Based Learning
Learning preferences integration (visual, auditory, kinesthetic)
Sentence & Discussion Stems
Tiered Learning Targets
Meaningful Student Voice & Choice
Relationship-Building & Team-Building
Self-Directed Learning
LMS use
Student Data Inventories
Mastery Learning (feedback toward goal)
Grouping
Rubrics
Jigsaws
Assessment Design & Backwards Planning
Student Interest & Inventory Data

Formative Assessments

- Current Science Assignments
- Classwork on various topics
- Homework Assignments
- Differentiated Projects
- Teacher observations
- Discussion/Class participation
- Lab Reports
- Performance Assessment
- Exit Tickets

Summative Assessment

End of Unit Test
Performance Assessment
- Cell phone protection

Tests and quizzes

Benchmark Assessments (already completed)

Fall/Winter LinkIt Assessments

Alternate Assessments (already completed; can change if needed)

Modifications to assessments based on IEP/504; alternate assessments may include oral explanations, scaffolded templates, digital choice for final model representations

Resources & Technology

http://www.glencoe.com/sites/common_assets/science/virtual_labs/E12/E12.html
https://www.thephysicsaviary.com/Physics/Programs/Labs/find.php

BOE Approved Texts

IScience Physical Science McGraw Hill Copyright 2017

Closure (already completed)

Individual classes and lessons will end with a closure activity that reinforces what students figured out during class, and helps navigate toward next steps.

Closure activities may include:

- Scientists' Circle
- Post-it reflection
- Google form exit ticket
- Group performance reflection
- Science notebook jot

ELL (already completed)

- Alternate Responses
- Extended Time
- Teacher Modeling
- Simplified Written and Verbal Instructions
- Frequent Breaks
- Google Translate

Special Education (already completed)

Accommodations will be made in accordance with students' IEPs. The following list provides examples:

- Shorten assignments to focus on mastery of key concepts.
- Substitute alternatives for written assignments (clay models, posters, panoramas, collections, etc.)
- Keep workspaces clear of unrelated materials.
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Maintain adequate space between desks.
- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have students repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Allow the student to complete an independent project as an alternative test.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.
- Mark the correct answers rather than the incorrect ones.
- Use a pass-fail or an alternative grading system when the student is assessed on his or her own growth.

504 (already completed)

Examples of accommodations in 504 plans include but are not limited to:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits

At Risk (already completed)

Examples may include:

- Have students restate information
- Provision of notes or outlines
- Concrete examples
- Assistance in maintaining uncluttered space
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
- Peer or scribe note-taking
- Use of manipulatives
- No penalty for spelling errors or sloppy handwriting
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Adjusted assignment timelines
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects
- Preview test procedures
- Film or video supplements in place of reading text
- Pass/no pass option
- Cue/model expected behavior
- Use de-escalation strategies
- Use peer support and mentoring
- Have parents sign homework/behavior chart

Gifted and Talented (already completed)

Examples may include:

- Offer choice
- Speak to Student Interests
- Allow G/T students to work together
- Tiered learning
- Focus on effort and practice
- Encourage risk taking