Course Title – MD Physical Science

Implement start year – 2017-2018

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Unit # 2 – Motion and Stability: Forces and Interactions

Transfer Goal –

Students will be able to independently use their learning to analyze various interactions between objects in order to predict and describe resulting motion, magnetic interactions and electrical behavior. (Science 4, Special Education 2)

Stage 1 – Desired Results

HS-PS2 Motion and Stability: Forces and Interactions

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
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
HS-PS2-4.	Use mathematical representations of Newton's Law of Gravitation to describe and predict the gravitational and electrostatic forces between objects
HS-PS2-5.	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current

ELA/Literacy -

21st Century Themes
(www.21stcenturyskills.org)

_x__ Global Awareness
___Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
___Health Literacy
_x__Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
_x__Information Literacy
_x__Media Literacy

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-PS3-1)* **MP.4** Model with mathematics. (HS-PS3-1) **HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS3-1)	_x__ICT (Information, Communications and Technology) Literacy *Life and Career Skills:* ___Flexibility and Adaptability _x__Initiative and Self-Direction ___Social and Cross-Cultural Skills _x__Productivity and Accountability ___Leadership and Responsibility
Enduring Understandings: *Students will understand that . . .* *EU 1* forces affect motion and acceleration. *EU 2* forces, such as gravity, are used to explain observable physical phenomena. *EU 3* electricity and magnetism can act as an energy source for natural and mechanical objects to work.	**Essential Questions:** *EU 1* • What causes an object to move? • How does force affect motion and acceleration? *EU 2* • How would life be different on Earth if there were no gravity? • How does the pull of gravity affect mass and weight? *EU 3* • How do charges interact? • How does energy change and move? • How can you use electricity safely? • How does a magnetic field generate electricity?
Knowledge: *Students will know . . .* *EU 1* • systems interact with objects outside itself. • total momentum of a system can change. • Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1) • motion is a change in an object's position compared to a fixed object.	**Skills:** *Students will be able to . . .* *EU 1* • accurately predict changes in motion of objects using Newton's Second Law. • define momentum for a particular frame of reference. • describe the motion of an object in terms of its position, velocity and acceleration. • plan and carry out an investigation that determines the average speed of a moving object (pendulum, toy car, motor, person).

• a force is a push or a pull. • speed, velocity and acceleration affect motion. • friction works against movement. • Newton's First Law of Motion states an object at rest will stay at rest and an object in motion will stay in motion in a straight line at constant speed unless acted upon by a net force. • an object's inertia is determined by its mass. *EU 2* • Newton's Law of Universal Gravitation states that any two bodies in the universe attract each other proportional to mass and distance. (HS.PS2.B) • weight is the gravitational force on an object and differs from its mass. *EU 3* • atoms have a positive or negative electrical charge. • lightning is a discharge of static electricity. • basic rules of electrical safety. • forces at a distance are explained by fields (gravitational, electric and magnetic) permeating space that can transfer energy through space. (HS.PS2.B) • magnetic or electrical currents cause magnetic fields. (HS.PS2.B)	• demonstrate that unbalanced forces create movement. • 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. (HS-PS2-1) • apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3) *EU 2* • calculate their weight on different planets. • conduct an experiment to determine gravity's pull on objects with different mass. • describe the implications of losing gravity. • use mathematical representations of phenomena to describe explanations. (HS-PS2-4) *EU 3* • create static electricity using balloons. • identify electrical currents in common household objects. • identify magnets that attract or repel others according to their magnetic forces. • use a compass to find direction. • plan and conduct an investigation to produce data to serve as a basis for evidence. (HS-PS2-5)

Stage 2 – Assessment Evidence

Recommended Performance Tasks:

You are the Drivers Education Teacher at your high school. You will be teaching a lesson to your class on the action/reaction forces that occur during a collision. Use your knowledge on speed, position, velocity, inertia, momentum, friction, acceleration, and gravity to explain what happens to the car, driver and stationary object (potentially hit) during a collision. Create at least one Power Point slide on each of the 8 topics listed to teach your class the science behind a collision. (EU 1)

You are a student at NASA studying to be an astronaut. Retired astronaut Scott Kelly has just returned from his one year stay at the International Space station and you have been assigned to interview him about his experiences living in a zero-gravity environment for an extended period of time. You will then present these findings to your classmates so they can make an informed decision as to whether they want to pursue traveling into space.

Create a list of interview questions for Mr. Kelly and use his many interviews online to find the answers to your the questions. Use this information to create a Power Points showing 10 once-in-a-lifetime experiences of living in zero gravity and 10 negative/scary/health risk experiences of living in zero gravity. Present to your NASA class and allow them to decide if they would ever like to travel to space. (EU 2)

You are an electrician and you are attending your child's class on Career Day. You need to teach a 2nd grade class about electrical safety in a fun and creative way. Create a demonstration, including a visual, to teach 5 important safety tips for electrical safety in the home and community. Research important safety tips about conductors and insulators, grounding, power line safety, outlets, fuses and breakers, surge protectors, and hazards of water. (EU 3)

You have been brought in by the architect of the newest Disney resort being built in Orlando as the electromagnetic specialist. Your task is to provide insight on how electromagnetism could be used to advance technology in and around the hotel property. Provide the architect a list of at least 4 ways electromagnetism could be used to improve the stay of guests. Consider such things as communication technology, room key, fans, unique transportation and security equipment. Draw each of these suggestions and be prepared to explain each of your 4 suggestions to the architect. (EU 3)

Other Recommended Evidence:

- Teacher created note sheets and worksheets
- Teacher created tests and quizzes
- Teacher observation during labs and hands-on activities
- Lab reports
- Visual representation of topic material (ie: poster, brochure, post card, etc.)

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

- Create a KWL chart on forces. (A, M)
- Contribute to a discussion on how forces are experienced in everyday life. (A)
- Use objects in the community as a frame of reference to determine location, position, and movement. (A, M)
- Identify examples of friction in various sports. (A, M)
- Identify and demonstrate push and pull forces in the classroom (A, M)
- Collect data of a matchcar traveling down a ramp at different heights to determine acceleration. (M)
- Identify examples of friction. (A,M)
- Read a speedometer to determine velocity and acceleration (T)
- Conduct a lab to determine the different forces needed to move objects with diferrent mass. (M, T)
- Play a game of tug-of-war to demonstrate how unbalanced forces create motion. (M, T)
- Determine how much time it takes to slow down after a full sprint by using a stopwatch. (M)
- Conduct a lab demonstrating examples of intertia. (M)
- Participate in a lab where objects of various weights are dropped from the same height to determine gravitational force. (M, T)
- Use a website to find different weights of classmates on celestial objects including planets, sun, stars and the moon. (M)
- Draw a picture of a classroom where there is no gravity. (M, T)
- Identify the charge of various atoms by drawing and counting atomic particles. (A,M)
- Find photo examples of lightning and label components of electricity. (A, M)
- Complete a WebQuest to learn about the different parts of a circuit. (A)
- Find classmates with magnets that attract and repel poles. (M).
- Draw and label components of a circuit. (M).
- Use a compass inside and outside to determine direction. (M)
- Build a circuit to power a light bulb (T).
- Label directions on a blank street map to complete directions from point A to point B. (T)