

Course Title: Integrated Science

Implement Start Year: 2017-2018

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Unit #2 - Forces and Motion

Transfer Goal –

Students will be able to independently use their learning to evaluate the motion of an object and the effects of force on the object's motion by using quantitative and qualitative analysis.

Stage 1 – Desired Results

Established Goals

Next Generation Science Standards

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.

21st Century Themes

(www.21stcenturyskills.org)

- ___ Global Awareness
- ___ Financial, Economic, Business and Entrepreneurial Literacy
- ___ Civic Literacy
- ___ Health Literacy
- ___ Environmental Literacy

	<p style="text-align: center;"><u>21st Century Skills</u></p> <p><i>Learning and Innovation Skills:</i> <input checked="" type="checkbox"/> Creativity and Innovation <input checked="" type="checkbox"/> Critical Thinking and Problem Solving <input checked="" type="checkbox"/> Communication and Collaboration</p> <p><i>Information, Media and Technology Skills:</i> <input type="checkbox"/> Information Literacy <input type="checkbox"/> Media Literacy <input checked="" type="checkbox"/> ICT (Information, Communications and Technology) Literacy</p> <p><i>Life and Career Skills:</i> <input checked="" type="checkbox"/> Flexibility and Adaptability <input checked="" type="checkbox"/> Initiative and Self-Direction <input checked="" type="checkbox"/> Social and Cross-Cultural Skills <input checked="" type="checkbox"/> Productivity and Accountability <input checked="" type="checkbox"/> Leadership and Responsibility</p>
<p><u>Enduring Understandings:</u> <i>Students will understand that. . .</i></p> <p><i>EU 1</i> the motion of objects moving in a straight line can be described both qualitatively and quantitatively by the use of equations, graphs, and other models.</p> <p><i>EU 2</i> a net force will change the motion of an object.</p>	<p><u>Essential Questions:</u></p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> ● What type of model best represents motion? ● How can understanding the properties about motion be useful in our everyday lives? ● How does the motion of a falling bowling ball compare to a falling golf ball? <p><i>EU 2</i></p> <ul style="list-style-type: none"> ● What causes an object to move? ● How much force is necessary for an object to stay in motion?
<p><u>Knowledge:</u> <i>Students will know. . .</i></p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> ● displacement is overall change in position of an object and may differ from the total distance that it travels. ● average speed is the rate of change of the position of an object. ● average velocity is the rate of change of an object's displacement and takes direction into account. ● acceleration is the rate of change of velocity. ● a freely falling object accelerates at 9.8 m/s^2. ● objects that accelerate in the opposite direction of their motion will 	<p><u>Skills:</u> <i>Students will be able to. . .</i></p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> ● 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). ● analyze and interpret data gathered from a scientific investigation.

slow down.

EU 2

- an object's inertia is determined by its mass.
- inertia is the tendency of an object to maintain its state of motion.
- weight is the gravitational force on an object and differs from its mass.
- 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 (Newton's First Law).
- net forces cause acceleration.
- Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1)
- all forces exist in pairs.
- a free body diagram is a model that represents all of the forces that act on an object.

EU 2

- determine whether or not an object or system of objects is in equilibrium.
- calculate the frictional force acting on an object.
- compute the weight of an object.
- justify which of Newton's Laws is evidenced in a variety of examples.
- interpret and construct free-body diagrams to analyze an object's state of motion.
- analyze data to support mathematical relationships between the net force that acts on an object, its mass, and the resulting acceleration.
- 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)

Stage 2 – Assessment Evidence

Other Recommended Evidence: *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

- Tests/Quizzes on One-Dimensional Motion, Forces
- Informal lab investigations
- Formal lab write ups
- Average velocity investigation
- Checked homework
- Class discussion
- Summarizers

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.*

- Teacher led discussions on the relationships between force and motion (A, M)
- Using visual aids to relate physics concepts (Microsoft PowerPoint, Prezi, YouTube, etc.) to show the relationships of force, inertia, and motion (A, M)
- Gravity on other Planets Activity- Students will calculate their weight and age from the acceleration on other planets (M, T)
- Parachute Lab (M, T)
- Various Inertia Demos, such as simultaneous vertical horizontal demonstration (M)
- Various Inertia Activities, such as pulling the tablecloth from under the table setting (M, T)
- Measuring Friction Lab (M)
- Identifying types of forces from visual cues or videos (A)
- Researching the evolution of the car in relation to friction (A, M)
- Spinning STEM paper helicopters to demonstrate Air Pressure (A, M)
- Pen Cap Cartesian Diver to demonstrate the force generated by the water pressure (M)
- Conservation of Motion Lab - students will create a track out of meter sticks and a block of wood, they will drop marbles of different sizes from different distances along the track (A, M)
- Calculating Average Speed Lab- students walk forwards/backwards, running, etc. over the same distance, teacher time the activities. After this is completed, students will calculate the speed and the average speed as a class of their activities. (M, T)
- Free body diagram worksheets (M, T)
- Graphic Organizer for different types of equations- speed, force, pressure, etc. (A)
- Front Load the Words Worksheet (definition, equation, real life examples, illustration) of Topical Vocabulary (A)
- Analyze Scientific Literature about the significance of force and motion in our current world (A, M, T)
- What if gravity disappeared? (Activity that analyzes daily activities without gravity) (M,T)