Unit: Experimenting with Forces and Motion:(Advanced Science/Grade 8)

Content Area: **Science**
Course(s): **Integrated Science 8**
Time Period: **2nd Marking Period**
Length: **13 Weeks**
Status: **Not Published**

Unit Overview

Different kinds of forces can act on objects. Forces can change the motion of objects and can transform energy from one form to another.

Transfer

Students will be able to independently use their learning to…

- Understand how the principles of physics affect your daily life.
- Develop an interest in investigating forces, energy, and motion.
- Recognize the contributions of many people to our understanding of forces, energy, and motion.
- Understanding how science and technology complement each other in applying and using what we know about forces, energy, and motion.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

We encounter gravity, elastic forces, friction, and magnetic forces frequently. These forces can act on objects and change their speed and direction. Kinetic energy and potential energy can be transformed from one form to another.

Essential Questions

Students will keep considering...

- How do simple machines make our lives easier?
- How does force cause change?
- How do you know if something is moving?

Application of Knowledge and Skill

Students will know...

- An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far.
- Forces have magnitude and direction. Forces can be added. The net force on an object is the sum of all the forces acting on the object. An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force.

Students will be skilled at...

- Calculating the speed of an object when given distance and speed.
- Comparing the motion of an object acted on by balanced forces with the motion of an object acted on by unbalanced forces in a given specific scenario.

Content Specific Vocabulary

action/reaction	kilogram
average speed	kinetic energy
calibration	Law of Inertia

conservation of energy	magnet
counterbalance	magnetic field
dependent variable	magnetic Pole
diamagnetic	magnetism
direct proportion	mass
drag	motion
earth’s magnetism	net force
elastic Force	Newton
extrapolation	Newton’s third laws of motion
fair test	normal force
force	paramagnetic
friction	potential Energy
gravity	repulsion
gravitational potential energy	sliding friction
independent variable	static Friction
inertia	surface area
	terminal Velocity
	time
	unbalanced force
	velocity
	weight
	work

Cognitive Vocabulary

- Fair test
- Self-assessment

- research plan
- constraints

Learning Goal 1

Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.8	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
SCI.MS-PS2-1	Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.
TECH.8.1.8.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.

Target 1 (Lesson 12)

SWBAT explain that forces occur in equal and opposite pairs.

Learning Goal 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.

MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking

	measurements, or performing technical tasks.
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
MA.7.EE.B	Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.1	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
SCI.MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
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.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.

Target 1 (Lesson 2)

SWBAT explain and apply the concept that the weight of an object depends upon the mass of an object.

Target 2 (Lesson 4)

SWBAT explain that the force of sliding friction varies with surface area and mass.

Target 3 (Lesson 7)

SWBAT explain that the motion of an object can be measured by determining the speed and direction in which the object moves.

Target 4 (Lesson 12)

SWBAT explain that the energy can be stored in systems and that unbalanced forces can transform kinetic and potential energy from one form to another.

Learning Goal 3

Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.1	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
SCI.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Target 1 (Lesson 5)

SWBAT understand that magnets can exert a force on other materials.

Target 2 (Lesson 6)

SWBAT understand that a magnetic compass aligns in the Earth's magnetic field.

Learning Goal 4

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

attractive and depend on the masses of interacting objects.

LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
LA.WHST.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
SCI.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.

Target 1 (Lesson 12)

SWBAT explain that energy can be stored in system and that unbalanced forces can transform kinetic and potential energy from one form to another.

Learning Goal 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.

LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
LA.WHST.6-8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.1	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

SCI.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.

Target 1 (Lesson 5)

SWBAT understand how magnets can exert a force on other materials and the magnetic force combined magnets changes.

Target 2 (Lesson 6)

SWBAT understand that magnetic compass aligns in the Earth's magnetic field.

Learning Goal 6

Construct and interpret graphical displays of data to describe the relationship of kinetic energy to the mass of an objects and to the speed of an object.

MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
MA.7.EE.B	Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
LA.WHST.6-8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
LA.6-8.CCSS.ELA-Literacy.CCRA.R.1	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.10	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
SCI.MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

Target 1 (Lesson 7)

SWBAT explain that the motion of an object can be measured by determining the speed and direction in which an object moves.

Summative Assessment

All assessments are differentiated and aligned to the science standards and curriculum. Alternate assessments may include projects or presentations, or a common paper/pencil assessment or both.

Common summative assessment will include the assessment contained in the corresponding STC Kit.

The summative assessment from *STC Forces and Motion* under tab 4, lesson 13.

Common Assessment administered through LinkIt.

21st Century Life and Careers

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of

	problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP11.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Formative Assessment and Performance Opportunities

- anecdotal records
- Diagnostic testing prior to instruction
- Learning logs, journals, exit cards or periodic quizzes
- Paper and pencil test
- Rough drafts of essays, papers or drawings
- science notebook
- Self assessment, peer assessment or teacher observation
- Small group assignments during which students investigate or practice concepts or skills
- Student displays
- Student experiments
- Student presentation.
- student sheets
- Teacher directed Q and A, conferencing with students, or class discussions

Differentiation

- alternative assessments
- Choice of activities
- collaboration on various activities
- Flexible grouping
- Goal setting with students
- group investigations
- homework options
- independent research projects
- multiple intelligence options
- multiple texts
- problem based learning
- re-teach skills
- Student notebook entries
- tiered activities/assignments
- varied supplemental materials
- work alone/together

Enrichment

- Bill Nye
- Brainpop
- Current Events
- Demonstrations
- Newton's Laws
- Posters
- Presentations/Research Projects
- Real world applications
- Videos
- WebQuests

Unit Resources

Black line masters	Interactive White Board

Internet	Listening Centers
Supplemental text.	Pasco Probes
Digital Camera	Scanners
Document Camera	Student Laptops
Flash Drives	Student Response Systems
Flip Camera	Telescopes
Global Positioning Handhelds	