Unit 3: Motion, Forces, Energy

Content Area: **Science**
Course(s): **Fundamentals of Science**
Time Period: **3rd Marking Period**
Length: **14 Weeks**
Status: **Published**

Unit Overview

This unit is designed to teach the students how and why things move.

Transfer

Students will be able to relate the things they learn in this unit to things they see everyday! It will allow them to trouble shoot simple problems life like slipping on ice or pushing a heavy piece of furniture across the floor.

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

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

Meaning

Understandings

Students will understand how an object's motion can change and what factors are responsible for that change. They will also understand that doing work on an abject give that object energy and that the energy can then be transferred to different forms of energy.

Essential Questions

1) Am I moving or not moving...why does this question all of a sudden seem harder?

2) How could I mathematically prove to someone that something is moving? Speeding up? Slowing down? No one ever believes me!!!

3) Why do things come to a stop when they are slid across the floor and why is it so much harder to start pushing something heavy than continue pushing something heavy?

4) Blah! please tell me when exactly do I see these three boring laws everyday? I doubt it!

5) What the heck really is this gravity thing holding me to the Earth, why can't I just jump up and be free?

6) If I went to the moon would my mass change, weight change, or both? I just want to know what I should pack on my moon vacation...

7) How could I tell my mom I am "working" without lying, but still be relaxing?

8) I feel like when I do work I am losing energy, if this true can we prove it so I can at least get a nap afterwards?

Application of Knowledge and Skill

Students will be able to navigate the physical world better with their new knowledge of forces and motion. They will be able to use Newton's Laws of Motion to tackle problems like building a balloon rocket, or completing the great "table cloth trick".

Students will know...

1) Students will understand what it really means to "be in motion".

2) Students will understand the difference between speed and velocity and why it is important to know this difference.

3) Students will understand how acceleration relates to a change in velocity.

4) Students will understand how balanced and unbalanced forces have different affects on objects.

5) Students will understand the difference between static and kinetic friction along with understanding there are times when friction is good and times when it is bad.

6) Students will understand how all of Newton's Three Laws relate to motion in everyday life.

7) Students will understand how the law of gravitation affects objects, but at the same time why all objects fall at the same rate on the Earth's surface.

8) Students will understand how mass and weight are different, specifically answering why your weight would change on the moon, but not your mass.

9) Students will understand work and power are and how they relate.

10) Students will understand that work done on an object equate to a change in the energy of that object.

11) Students will understand the different forms energy can come in and how it can be transferred from one kind to another.

Students will be skilled at...

1) Students will be able to navigate the physical world better with their new knowledge of forces and motion.

2) Students will be able to solve for velocity and acceleration of an object.

3) Students will be able to convert units using the factor label method.

4) Students will be able to solve Newton's Second Law for all variable.

5) Students will be able to solve for work, power, energy, and all other variables involved in these equations.

Academic Vocabulary

Academic Vocabulary	Application Vocabulary
Motion	Interpret
Speed	Distance Traveled
Velocity	Displacement
Vector	Reference Point
Constand Speed	Directly Related
Instantaneous Speed	Indirectly Related

Acceleration	Orbit
Centripetal Acceleration	Exponential
Constant Acceleration	Newton
Force	Balanced
Friction	Unbalanced
Air Resistance	Rate
Inertia	Reference Plane
Weight	Transfer
Work	Conservation
Power	Kinetic
Energy	Elastic
	Graviational
	Steep
	Shallow

Learning Goal 1

SWBAT explain how an object's change in position relates to the motion of that object and the different ways to describe this motion.

Proficiency Scales

- SWBAT explain how an object's change in position relates to the motion of that object and the different ways to describe this motion.

MA.N-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.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
SCI.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. An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.

Target 1

SWBAT Describe motion and the difference between distance traveled and displacement.

- SWBAT Describe motion and the difference between distance traveled and displacement.

Target 2

SWBAT describe the difference between speed and velocity, as well as describe each quantitatively and qualitatively.

- SWBAT describe the difference between speed and velocity, as well as describe each quantitatively and qualitatively.

Target 3

SWBAT Describe how an object's velocity changing is directly related to acceleration qualitatively and quantitatively.

- SWBAT Describe how an object's velocity changing is directly related to acceleration qualitatively and quantitatively.

Learning Goal 2

SWBAT to use Newton's Three Laws of motion to describe real world forces interact.

Proficiency Scale

- SWBAT to use Newton's Three Laws of motion to describe real world forces interact.

MA.N-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.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
SCI.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.
SCI.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.
SCI.HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
SCI.HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.

Target 1

SWBAT describe how balanced and unbalanced forces will affect and object, along with distinguishing between static and kinetic friction.

- SWBAT describe how balanced and unbalanced forces will affect and object, along with distinguishing between static and kinetic friction.

Target 2

SWBAT recite Newton's Three Laws of Motion along with giving real world examples of all the laws and mathematically solve solving the second law.

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Target 3

SWBAT Describe the Law of Gravitation and explain why all objects on the Earth's surface fall at the same rate.

- SWBAT Describe the Law of Gravitation and explain why all objects on the Earth's surface fall at the same rate.

Target 4

SWBAT to explain specifically why your weight would change, but your mass would not if you went to the moon.

- SWBAT to explain specifically why your weight would change, but your mass would not if you went to the moon.

Learning Goal 3

SWBAT describe how the work done on an object can cause a change in energy.

Proficiency Scale

- SWBAT describe how the work done on an object can cause a change in energy.

MA.N-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.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.A-REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MA.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
SCI.HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
SCI.HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
SCI.HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
	An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.

Target 1

SWBAT to describe work and power quantitatively and qualitatively.

- SWBAT to describe work and power quantitatively and qualitatively.

Target 2

SWBAT to describe how work and energy relate, and how this energy can be transferred from one form to another with no work being done.

- SWBAT to describe how work and energy relate, and how this energy can be transferred from one form to another with no work being done.

Formative Assessment and Performance Opportunities

Lab Reports

Worksheets

PowerPoints with Notes

Homework and Classwork Activities

Group Activities

In Class Discussion

Do Nows and Closures

Class Polling

Observation

Summative Assessment

Unit Assessment will be created collaboratively and used for every student in the course. In addition, there will be other assessments in the form of lab reports, pen and paper tests, and quizzes. Common Assessment is administered through LinkIt.

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Accommodations/Modifications

- Provide additional study guides and reviews to reteach complex content before summative and formative assessments.
- All instruction, labs, activities, and assessments will be modified and enhanced to adhere to individual student's IEPs and 504s. As well differentiated classroom management strategies will be utilized as to adhere to these students individual plans as well.
- Pair students for activities that include complex math skills.

Unit Resources

Teacher generated PowerPoints, Notes, Labs and Worksheets

Textbooks

Resource Books

Internet Resources

Computer Based Activities

Projector

Smart Board

Calculators

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
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.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
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.CRP10.1	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.