Englewood Public School District
Science
Grade 3
Second Marking Period

Unit 2: Force and Motion

Overview: During this unit of study, students are able to determine the effects of balanced and unbalanced forces on the motion of an object. The crosscutting concepts of patterns and cause and effect are identified as organizing concepts for these disciplinary core ideas. In the third-grade performance expectations, students are expected to demonstrate grade-appropriate proficiency by planning and carrying out investigations. Students are expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 3-PS2-1 and 3- PS2-2.

Time Frame: 15 to 20 days

Enduring Understandings:
Cause-and-effect relationships are routinely identified.
Objects in contact exert forces on each other.
The patterns of an object's motion in various situations can be observed and measured.

Essential Questions:
What must be known about a force to predict how it will change an object's motion?
How does applying a force affect the way an object moves?

Standards	Topics and Objectives	Activities	Resources	Assessments
3-PS2-1: **Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** **3-PS2-2.** **Make observations and/or measurements of an object's motion to**	**Topics** Motion Forces Twenty-First Century Themes and Skills include: Environmental Literacy • The Four C's • Environmental Literacy • Global Awareness	**Balanced and Unbalanced Forces:** Students will watch a tug of war video and discuss what type of forces they see in the video. Then students will experiment with a ruler and a tennis ball to see how balanced and unbalanced forces impact the ball's movement. Students will make observations and draw	**Balanced and Unbalanced Forces:** **Video:** **https://www.youtube.com/watch?v=rP2MviNn52g** **Additional Texts:** **Forces and Motion: A Question and Answer Book**	**Formative Assessments**: Do Now/Ticket to Leave **Investigating Motion:** Student Science Journal **Benchmark Assessment:** Exact Path **Summative Assessments:**

provide evidence that a pattern can be used to predict future motion.	**Objectives** **Balanced and Unbalanced Forces:** Students will investigate the effects of balanced and unbalanced forces on a ball. **Investigating Motion:** Using observation skills and data analysis students will investigate what causes objects to move and/or move farther than others. **Force and Motion Investigation:** Conduct an investigation collaboratively on the effect of force applied on an object to produce data to serve as the basis for evidence, by using fair tests in which variables are controlled and the number of trials are considered. **Robo Arm:** Students will work in small groups to design a robotic arm to lift a cup off a table.	conclusions based on their investigation. (RI.3.1, W.3.8) **Investigating Motion:** Students will work in pairs to make predictions and observe how different objects move. Students will place objects on a white board, make a prediction on how far object will move, then make object move and record the actual distance. Student will review predictions and actual data to make a concluding statement. (MP.2, MP.4, W.3.7) **Force and Motion investigation:** Students will work in pairs to evaluate how far a ping pong ball and bouncy ball will roll on a white board surface after pushing it with a pencil. Students will complete three trials with each ball and measure in cm. They will complete a chart and bar graph with their data. (MP.4, MP.5) **Robo Arm**: **Step 1**: Discuss the challenge and how each material would mirror a body part. Watch Robo Arm video if possible. Watch Robotic Arm video: https://www.youtube.com/watch?v=zbwV0fs5-xU&feature=player_embedde	**Forces Make Things Move** **Galileo's Leaning Tower Experiment** **Give It a Push! Give It a Pull! A Look at Forces** **Gravity Is a Mystery** **Gut-Wrenching Gravity and Other Fatal Forces** **I, Galileo** **Motion** **Investigating Motion:** **Materials:** Materials needed for Teacher Demonstration: • Beach ball • Bat • Bowling ball Materials Needed for Student Investigation: 1 per student: • Science journal • Pencil 1 for each pair of students: • Centimeter ruler • 3 to 4 everyday objects (pattern block, unsharpened pencil, small paper clip, foam ball and a heavy object such as a stapler, are a few suggestions)	**Balanced and Unbalanced Forces:** Lab Sheet **Force and Motion Investigation:** Data Table Bar Graph Force Reflection Worksheet **Robo Arm:** Robotic Arm Design **Alternative Assessments:** Identify cause-and-effect relationships. Use fair tests in which variables are controlled and the number of trials considered. Students need opportunities to read content-specific texts to deepen their understanding of force and motion. Pre/Post tests Students should be encouraged to answer questions and cite evidence from the text to support their thinking. Multiple choice quiz

		d (8.1.5.F.1, CRP.4, CRP.8) **Step 2:** Students build two-part Robo Arm using available materials. The students will then use their Robo Arm to play "Kick the Cup" game. **Step 3:** Students will then use a paper clip to add a hook to their cup. Students will then play two additional games – Round Robin and Relay Race. **Step 4**: Students discuss their experiences using their robotic arms. (CRP.6, 9.2.4.A.1)	• White board marker **Suggested Books:** • What is Motion? By Mary Clare Goller, level G • Push, Pull, Lift! , Level I Moving with Machines, level K • Move It! by Jaime A. Schroeder, level M • Forces and Motion on Earth by Glen Phelan, level V • Forces and Motion in Sports by Glen Phelan, level W **Force and Motion Investigation:** Procedure Worksheet Rubric Investigation Page Sample Investigation Page Three Things I Know **Robo Arm:** • 1 large strip of corrugated • Cardboard (about 5 x 20 • Centimeters [2 x 8 inches]) with a hole punched in one corner • 1 small strip of corrugated • Cardboard (Cut a large strip in half.) Punch a hole in one corner.	Students can conduct short research projects about simple force-and-motion systems and the interactions that occur among forces and objects within the systems. Essays / Capstone Projects Students could draw a model of the force and motion system, identifying the structures and forces that interact within the system. Students could find the mass of an object in order to understand that the heavier something is, the greater the force needed to cause a change in its motion. Students could use rulers or tape measures to measure the distance an object moves. Student can then record and analyze their data to determine patterns of change and explain cause-and-effect relationships, while reasoning abstractly and quantitatively. Graphs, tables, journals Rubrics https://3dsciassessment.weebly.com/uploads/3/0/3/0/3030889/3dspa3rdgrademotionandstabilityperformancetask.pdf

		• 1 medium (i.e., 1-inch) brass fastener • 1 straw, cut into 2.5-centimeter • (1-inch) lengths • 100 centimeters (39 inches) of smooth string (e.g., kite string) • 2 large paper clips • 2 paper cups (3-ounce) • Tape https://www.helpteaching.com/questions/Forces_and_Motion/Grade_3 https://www.opened.com/search?category=motion-and-stability-forces-and-interactions-k-5&grade=3&grade_group=elementary&offset=0&standard_group=next-generation-science-standards

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity in planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
• Speak and display terminology • Teacher modeling • Peer modeling • Provide ELL students with multiple literacy strategies. • Word walls • Use peer readers • Give page numbers to help the students find answers • Provide a computer for written work • Provide two sets of textbooks, one for home and one for school • Provide visual aides • Provide additional time to complete a task • Use graphic organizers	• Utilize modifications & accommodations delineated in the student's IEP • Work with paraprofessional • Use multi-sensory teaching approaches. • Work with a partner • Provide concrete examples • Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA). • Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).	• Using visual demonstrations, illustrations, and models • Give directions/instructions verbally and in simple written format. Oral prompts can be given. • Peer Support • Increase one on one time • Teachers may modify instructions by modeling what the student is expected to do • Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. • Review behavior expectations and make adjustments for personal space or other behaviors as needed. • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide opportunities for students to connect with people of similar	• Curriculum compacting • Inquiry-based instruction • Independent study • Higher order thinking skills • Adjusting the pace of lessons • Interest based content • Real world scenarios • Student Driven Instruction • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understand -ings. • Use project-based science learning to connect science with observable phenomena. • Structure the learning around explaining or solving a social or community-based issue. • Collaborate with after-school programs or clubs to extend learning opportunities.

		backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	

Interdisciplinary Connections:

ELA-NJSLS/ELA:
RI.3.1: Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-1)
W.3.7: Conduct short research projects that build knowledge about a topic. (3-PS2-1), (3-PS2-2)
W.3.8: Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-PS2-1), (3-PS2-2)

Mathematics:
MP.2: Model with mathematics. (1-ESS1-2)
MP.5: Use appropriate tools strategically. (1-ESS1-2)
MP.4: Reason abstractly and quantitatively. (K-2-ETS1-1)

Career Ready Practices:
CRP6: Demonstrate creativity and innovation**.**
CRP4: Communicate clearly and effectively and with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Integration of Technology Standards NJSLS 8:
8.1.5.F.1: Apply digital tools to collect, organize, and analyze data that supports a scientific finding.

Integration of 21st Century Standards NJSLS 9:
9.2.4.A.1: Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals.

Key Vocabulary:
Force: an influence (as a push or pull) that tends to produce a change in the speed or direction of motion of something
Motion: an act or process of changing place or position
Push: to force forward, downward, or outward
Pull: to use force on so as to cause or tend to cause motion toward the force
Friction: the rubbing of one thing against another
Gravity: a force of attraction between particles or bodies that occurs because of their mass, is stronger as mass is increased, and is weaker as the distance between the objects is increased

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<u>Planning and Carrying Out Investigations</u> • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1) • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)	**<u>PS2.A: Forces and Motion</u>** • Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1) • The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)	**<u>Cause and Effect</u>** • Cause and effect relationships are routinely identified. (3-PS2-1) **<u>Patterns</u>** • Patterns of change can be used to make predictions. (3-PS2-2) - ***Connections to Nature of Science*** **Science Knowledge is Based on Empirical Evidence** • Science findings are based on recognizing patterns. (3-PS2-2) **Scientific Investigations Use a Variety of Methods** • Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

	(3-PS2-2) **PS2.B: Types of Interactions** • Objects in contact exert forces on each other. (3-PS2-1)	

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Unit 3: Electrical and Magnetic Forces

Overview: In this unit of study, students determine the effects of balanced and unbalanced forces on the motion of an object and the cause-and-effect relationships of electrical or magnetic interactions to define a simple design problem that can be solved with magnets. The crosscutting concept of *cause and effect*, and the *interdependence of science, engineering, and technology, and the influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions and defining problems*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 3-PS2-3, 3-PS2-4, and 3-5-ETS1-1.

Time Frame: 15 to 20 days

Enduring Understandings:
Electric and magnetic forces between a pair of objects do not require that the objects be in contact.
The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.
Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.

Essential Questions:
What are the relationships between magnetic and electrical forces?
How can magnets be used to solve problems?

Standards	Topics and Objectives	Activities	Resources	Assessments
(3-PS2-3) **Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.** **(3-PS2-4)** **Define a simple design problem that can be solved by applying scientific ideas about magnets.*** **(3-5-ETS1-1)** **Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**	**Topics** Electricity Magnets Twenty-First Century Themes and Skills include: Environmental Literacy • The Four C's • Environmental Literacy • Global Awareness **Objectives** Students will be able to understand that the magnetic force is greatest when the object is the closest to the magnet, and that the magnetic force decreases as the distance increases between the object and the magnet. **Magnet to Magnet:** Students will be able to label the poles of a magnet and investigate the attraction and repulsion of magnets. **Investigating Static Electricity:** Students will investigate and record what attracts and repels the charged balloon. Students will discover how static electricity relates to lightning.	**Change in the Sand:** Using the materials provided students must design a magnetic tool to retrieve keys and change. They must meet the following requirements: • Stay on the boardwalk (which is 10 "feetabove" the sand.) • Retrieve change and keys without retrieving sand along with it. • Demonstrate understanding of magnets and separating mixtures in your discussion, project log, and design. **Magnetic Force Field:** **Day 1:** In small groups students will complete experiment. Students will evaluate the magnetic pull of a bar magnet on paper clips from varying distances. This information will be recorded in their science journal. **Day 2:** Students will share their data with other groups. Students will draw conclusions about magnetic force based on their data. (3-PS2-3) **Magnet to Magnet:** **Part 1:** Teacher will introduce the lab by Read Pulling Together, Pushing Apart by Natalie Rosins. Students will then complete magnet predictions worksheet. (RI.3.3, (3-PS2-4) **Part 2**: The magnets would already be labeled north and south. The students will make predictions of what happens to the magnets when	**Magnetic Force Field** • Bar magnet • 20+ large metal paper clips • Roll of masking tape • Ruler • Science journal • Pencil to record the experiment, data, and results **Magnet to Magnet:** • Book Magnets: Pulling Together and Pushing Apart By Natalie Rosinsky • Magnet to Magnet: Interactions Record Sheet • Bar Magnets • Pencil • Paper Clips • Nails • Circular Labels • Marker **Investigating Static Electricity:** • Balloons • String • Tape • Various materials to attract to balloons (paper scraps, empty aluminum cans, confetti, dry cereal, etc.) • Film canisters • Cardboard wrapped in foil • Styrofoam picnic plate taped onto foil cardboard • Aluminum pie tin	**Formative Assessments:** **Magnetic Force Field** Student science journal Participation in whole group discussion **Magnet to Magnet:** Student record sheets **Benchmark Assessment:** Exact Path **Summative Assessments**: **Change in the Sand** Magnetic Tool **Investigating Static Electricity:** Record sheet **Alternative Assessments:** Define a simple problem that can be solved through the development of a new or improved object or tool. Identify and test cause-and-effect relationships in order to explain change.

	Change in the Sand: Students will demonstrate understanding of magnets and separating mixtures by designing a magnetic tool to retrieve change from 10 feet above sand dune.	they come in contact with each other. Then the students will take two magnets and then record and describe what happens to the magnets when they come in contact with each combination. Students will use their findings to label, non-labeled magnets. Record observations on t (RI.3.8, 3-5-ETS1-1,MP.4) **Part 3:** The students will continue to work with their partner. The groups will be given two magnets and four nails or four paper clips. Have the students make predictions of how a magnet and unrubbed nail or paper clip interact and how a rubbed nail and paper clip would interact with a magnet, and a rubbed nail or paper clip interact with a unrubbed paper clip and ail. Next have the students investigate the different combinations and record their results. (SL.3.3, 8.2.5.A.2, MP.5) **Investigating Static Electricity:** Students will experiment with static electricity using balloons. After investigating how balloons attract and repel various objects, students will watch a simulation of static electricity to help gain an understanding of the movement of the charged protons and electrons. Finally, students will observe how static electricity can create a spark of "lightning". (8.2.5.A.1, 8.2.5.A.2, MP.2)	Styrofoam cup taped onto pie tin **Video Links:** http://www.sciencemadesimple.com/static.html https://www.instructables.com/id/Evaluate-magnetic-field-variation-with-distance/ **Change in the Sand:** **Resources:** http://www.childrensengineering.com/everydaydesignbriefs.htm **Materials:** • Cardboard tubes • String • Masking tape • Magnets • Pails • Sieves • Netting • Paper • Sand • Coins • Keys • Ladder	Ask questions that can be investigated based on patterns such as cause-and-effect relationships. Students should be given opportunities to conduct short research projects that build knowledge about electric and magnetic forces. Students should use information to answer questions, describe cause-and-effect relationships, make comparisons, and explain interactions between objects when electrical or magnetic forces are involved. Students will take notes, use graphic organizers, such as Venn diagrams and use T-charts to sort supporting evidence into provided categories. Students could find the mass of an object in order to understand that the more mass an object has, the greater the force needed to attract, repel, or move it.

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
• Speak and display terminology • Teacher modeling • Peer modeling • Provide ELL students with multiple literacy strategies. • Word walls • Use peer readers • Give page numbers to help the students find answers • Provide a computer for written work • Provide two sets of textbooks, one for home and one for school • Provide visual aides • Provide additional time to complete a task	• Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Utilize modifications & accommodations delineated in the student's IEP • Work with paraprofessional • Use multi-sensory teaching approaches. • Work with a partner	• Using visual demonstrations, illustrations, and models • Give directions/instructions verbally and in simple written format. Oral prompts can be given. • Peer Support • Increase one on one time • Teachers may modify instructions by modeling what the student is expected to do • Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. • Review behavior expectations and make	• Increase the pace of lessons • Inquiry-based instruction • Independent study • Higher order thinking skills • Interest based content • Real world scenarios • Student Driven Instruction • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understand -ings. • Use project-based science learning to connect science with observable phenomena. • Structure the learning around explaining or solving a social

• Use graphic organizers	• Provide concrete examples • Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).	adjustments for personal space or other behaviors as needed. • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	• or community-based issue. • Collaborate with after-school programs or clubs to extend learning opportunities.	

Interdisciplinary Connections:

ELA-NJSLS/ELA:
RI.3.1: Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-3)
RI.3.3: Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3)
RI.3.8: Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). (3-PS2-3)
SL.3.3: Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. (3-PS2-3)

Mathematics:
MP.2: Model with mathematics. (1-ESS1-2)
MP.5: Use appropriate tools strategically. (1-ESS1-2)
MP.4: Reason abstractly and quantitatively. (K-2-ETS1-1)

Career Ready Practices:
CRP4: Communicate clearly and effectively and with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Integration of Technology Standards NJSLS 8:
8.2.5.A.1: Compare and contrast how products made in nature differ from products that are human made in how they are produced and used.
8.2.5.A.2: Investigate and present factors that influence the development and function of a product and a system.

Integration of 21st Century Standards NJSLS 9:
9.2.4.A.1: Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals.

Key Vocabulary:
Electricity: a form of energy that is found in nature but that can be artificially produced by rubbing together two unlike things
Magnets: a piece of some material that is able to attract iron
Attract: to pull to or towards
Poles: either one of the two ends of a magnet
Repel: to force something to move apart

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data • Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) **Asking Questions and Defining Problems** • Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3) • Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)	**PS2.B: Types of Interactions** • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4) **ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3) --- ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Scientific discoveries about the natural world can often lead to new and improved technologies, which are

• Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)	limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)	developed through the engineering design process. (3-PS2-4)