May 5A Gr. 8: Kinetic Energy

Content Area: **Science**
Course(s):
Time Period: **May**
Length: **3Weeks**
Status: **Published**

Unit Overview

Kinetic energy is the energy that a moving object has as a result of its mass and its motion. On the rollercoaster ride, energy changes forms between potential and kinetic every time the cars move up or down.

Enduring Understandings

Lesson Objectives

By the end of the lesson, students should be able to:

- Explain how the kinetic energy of an object depends on its mass and velocity.
- Generate examples of kinetic energy.
- Compare kinetic energy to potential energy.
- Model how kinetic energy can be transformed into potential energy and how potential energy can be transformed into kinetic energy.

Essential Questions

- **Overarching Question**
    - How is energy transferred and conserved?
- **Focus Question**
    - What is energy?
- **Lesson Questions**
    - What is the relationship between the kinetic energy of an object and its velocity and mass?
    - How is kinetic energy transformed into potential energy?
- **Can You Explain?**

- What are some real-world examples that illustrate the relationship between kinetic energy and potential energy?

Instructional Strategies & Learning Activities

- The Five E Instructional Model

  Science Techbook follows the 5E instructional model. As you plan your lesson, the provided Model Lesson includes strategies for each of the 5Es.

- Engage (45–90 minutes)

  Students are asked to consider the concepts of energy and work as they might experience them every day. Students begin to formulate ideas around the Can You Explain? (CYE) question.

- Explore (90 minutes)

  Students investigate questions about the relationships between an object's velocity, mass, and the type of energy it possesses at various times by using evidence from text and media assets.

- Explain (45–90 minutes)

  Students construct scientific explanations to the CYE question by including evidence of how kinetic energy relates to and is different from potential energy.

- Elaborate with STEM (45–135 minutes)

  Students apply their understanding of kinetic energy as they learn about how simulation engineers work to solve various types of design problems.

- Evaluate (45–90 minutes)

  Students are evaluated on the state science standards, as well as Standards in ELA/Literacy and Standards in Math standards, using Board Builder and the provided concept summative assessments.

Integration of Career Readiness, Life Literacies and Key Skills

Students will work in small groups or partnerships to conduct investigations, build models or prototypes and present findings.

Students will learn about careers in simulation engineers.

	An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
	Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
WRK.9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
	Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.
	Multiple solutions often exist to solve a problem.
WRK.9.2.8.CAP.12	Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
WRK.9.2.8.CAP.11	Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics.
WRK.9.2.8.CAP.3	Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
TECH.9.4.8.CI	Creativity and Innovation
TECH.9.4.8.IML.1	Critically curate multiple resources to assess the credibility of sources when searching for information.
TECH.9.4.8.CT	Critical Thinking and Problem-solving
TECH.9.4.8.TL.2	Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
	Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.
TECH.9.4.8.TL.3	Select appropriate tools to organize and present information digitally.
WRK.9.2.8.CAP	Career Awareness and Planning

Technology and Design Integration

Technology is fully integrated using Discovery Techbook.

CS.6-8.DA	Data & Analysis
	Engineering design is a systematic, creative, and iterative process used to address local and global problems. The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes.
CS.6-8.8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
	People use digital devices and tools to automate the collection, use, and transformation of data. The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data.

Interdisciplinary Connections

LA.SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate

	eye contact, adequate volume, and clear pronunciation.
LA.RI.8.1	Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
LA.W.8.1	Write arguments to support claims with clear reasons and relevant evidence.
LA.RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
LA.W.8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
MA.6.EE.A.2	Write, read, and evaluate expressions in which letters stand for numbers.
LA.RI.8.7	Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.
LA.W.8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
LA.RI.8.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
LA.RI.8.10	By the end of the year read and comprehend literary nonfiction at grade level text-complexity or above, with scaffolding as needed.
LA.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
MA.7.RP.A.2a	Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
MA.7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
MA.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
MA.7.EE.B.4	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
MA.8.F.A.3	Interpret the equation □ = □□ + □ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form □^{2} = □ and □^{3} = □, where □ is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.

Differentiation

Struggling Students

1. Using a two-column chart, ask students

ELL

1. Preview and

Accelerated Students

1. Ask students to make a

to compare and contrast kinetic and potential energy.
2. Discuss what "the square of its velocity" means. Students might also need clarification on the distinction between *speed* and *velocity*.
3. The formulas presented in Kinetic Energy and Rowing can be overwhelming as viewed on the page and within the text. Write the formula for kinetic energy on the board and systematically go over the meaning and use of each term, leading to a completed value for kinetic energy.

briefly discuss the following concepts that appear in the readings:
    - mass
    - force
    - energy
2. Help students with the distinction between speed, velocity, and acceleration. Be prepared to utilize both real objects and graphical representations.

Venn diagram using kinetic energy and potential energy.
2. Ask students to make a concept map of energy.
3. Have students make a list of five different examples of potential energy being transformed into kinetic energy. Ask them to list five different ways kinetic energy can be transformed into potential energy.

Differentiation in science can be accomplished in several ways. Once you have given a pre-test to students, you know what information has already been mastered and what they still need to work on. Next, you design activities, discussions, lectures, and so on to teach information to students. The best way is to have two or three groups of students divided by ability level.

While you are instructing one group, the other groups are working on activities to further their knowledge of the concepts. For example, while you are helping one group learn the planet names in order, another group is researching climate, size, and distance from the moon of each planet. Then the groups switch, and you instruct the second group on another objective from the space unit. The first group practices writing the order of the planets and drawing a diagram of them.

Here are some ideas for the classroom when you are using differentiation in science:

- Create a tic-tac-toe board that lists different activities at different ability levels. When students aren't involved in direct instruction with you, they can work on activities from their tic-tac-toe board. These boards have nine squares, like a tic-tac-toe board; and each square lists an activity that corresponds with the science unit. For example, one solar system activity for advanced science students might be to create a power point presentation about eclipses. For beginning students, an activity might be to make a poster for one of the planets and include important data such as size, order from the sun, whether it has moons, and so on.

- Find websites on the current science unit that students can explore on their own.

- Allow students to work in small groups to create a project throughout the entire unit. For example, one group might create a solar system model to scale. Another group might write a play about the solar system. This is an activity these groups can work on while they are not working directly with you.

Differentiation in science gets students excited to learn because it challenges them to expand their knowledge and skills, instead of teaching the whole group concepts they have already mastered

Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.

Modifications and Accommodations used in this unit:

In addition to differentiated instruction, IEP's and 504 accommocations will be utilized.

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Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).

Formative Assessments used in this unit:

See assessments located in links above.

Summative Assessments

Summative assessments evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

Summative assessments for this unit:

See assessments located in links above.

Instructional Materials

See materials located in links above.

Discovery Techbook

Teacher made materials

Additional labs are available through NJCTL on-line curriculum

Standards

SCI.MS.PS3.A	Definitions of Energy
SCI.MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
	Analyzing and Interpreting Data
SCI.MS.PS3.B	Conservation of Energy and Energy Transfer
	Construct and interpret graphical displays of data to identify linear and nonlinear relationships.
	Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.
	Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.
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.
6-8.MS-PS2-1.PS2.A	Forces and Motion
6-8.MS-PS2-1.PS2.A.1	For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law).
6-8.MS-PS3-1.PS3.A.1	Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.
6-8.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.
6-8.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.
6-8.MS-PS3-1.PS3.A	Definitions of Energy