SCALE

"Storing and Transferring of Energy"
Student Reading

Essential Question: How is energy stored and transferred?

EXPLAIN 1

To help you answer the essential question, you will read from our 8th Grade Science Textbook. Download the reading into Notability so that you will be able to underline and highlight, as well as circle text as needed.

Part 1: Close-Reading Protocol:

1. **Purpose of reading the article**

   The article will help you answer the following questions:

   a. What is Potential Energy?

   b. What is Kinetic Energy?

   c. How is Potential Energy transferred to Kinetic Energy and back again?

   d. What does distance have to do with energy? What does mass have to do with energy?

   e. What does the Law of Conservation of Energy tell us?

2. **First read: Read independently**

   a. **Read with a pencil**: As you read, **annotate** the text.

   b. Following are some ideas for how to annotate.

Mark It Up!

Left Margin ● What is the author saying? ○ Summarize a selected amount of text. **Highlight** key information (use sparingly) ● Main idea ● Claims ● Relevant data/evidence ● Significant phrases **Underline** words, phrases, or sentences that are unclear or stand out to you. **Circle** known words used in unfamiliar ways. **Symbols:** You can use some symbols to save time. Make sure you know what your symbols mean. For example: ● Question mark (?) = I have a question about this. ● Asterisk (*) = This idea is new to me. ● Check mark (✓) = I knew this.	**Right Margin** ● Questions ● Comments ● Connections ● Directions

3. **Partner talk**
    a. Turn to a partner to discuss the article.
    b. Use these sentence starters/frames if you have trouble getting started:
        i. A word or phrase I [did not know / found confusing / found interesting] is _____ because _____.
        ii. One pattern I noticed is _____.
        iii. I think the author wants me to know _____.
4. **Class discussion 1**
    a. Share the ideas that you and your partner discussed.
    b. Share words or phrases that were unfamiliar or unclear, and explain how you and your partner

tried to figure out their meaning.

5. **Second read: Read for understanding**
    a. Read the article again.
        i. Try to find the answers to the questions you still have.
        ii. Identify any additional questions.

6. **Answer questions using the Listening Triads Role Cards** *(see questions below the article)*
    a. Answer the questions that follow the "newton's First Law of Motion" article using the Talker, Questioner, and Listener roles that you used previously.
    b. Review the Listening Triads Role Cards.
    c. Decide who will be the first Talker, Questioner, and Listener.
    d. The Talker will share ideas about one of the questions. The Questioner can ask the Talker questions to clarify. The Listener should record the answers.
    e. Switch roles after each question.

7. **Class discussion 2**
    a. Share any new understanding from your group discussion.

Listening Triads Role Cards

TALKER

Your role is to express your ideas, arguments, or evidence to your group members.

- My reason for saying that is...
- Because...
- I have noticed that...
- I see it differently...
- If...
- What if...?
- Why?
- I have a suggestion...
- I think...because...
- I know...

LISTENER

Your role is to listen carefully to what is being said by the Talker and Questioner and record what you think are the main points being made, any questions asked, and/or evidence presented in the conversation between the Talker and Questioner. You must be silent during the conversation.

QUESTIONER

Your role is to ask the Talker questions that encourage them to elaborate, give evidence, and clarify.

- What do you think?
- Why do you think that?
- Let's think again...
- Can you say a bit more?
- What else do we know?
- I can tell you about...
- Can you explain?
- I hadn't thought of that until you said...
- I disagree because...
- But...
- I agree but...
- I believe that...
- I think...
- A different point of view would be...
- I can't see how your point fits in with...

Listening Triad Role Cards adapted from a Strategic Education Research Partnership Assessment Strategy, 2009; Role Cards developed by Lisa Ernst, Alice Fong Yu Alternative School, San Francisco Unified School District

8th Grade Science

for Utah SEEd Standards

2018-2019

8th Grade

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Utah State Board of Education OER
2018-2019

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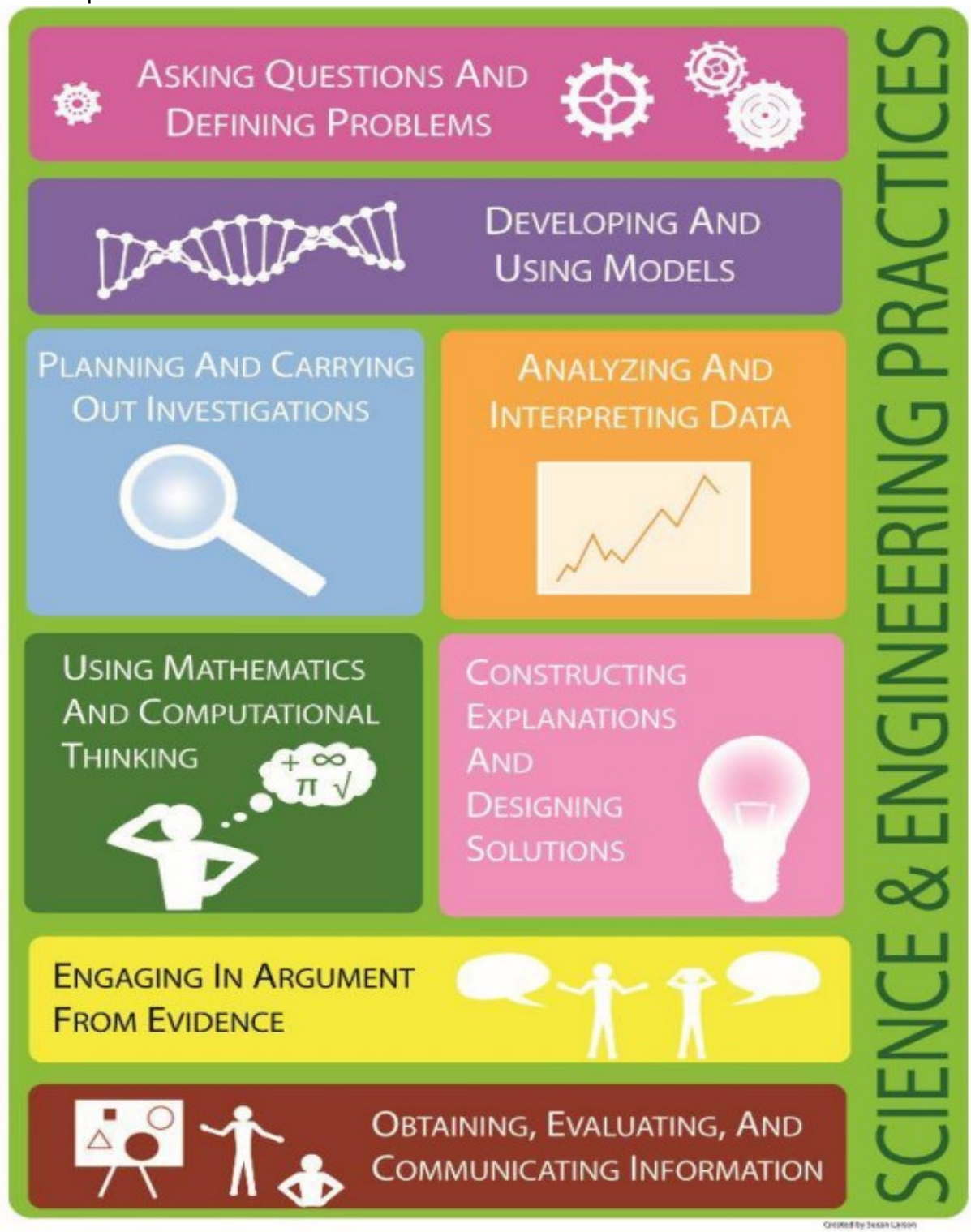
Using this Book

Credits and Copyright

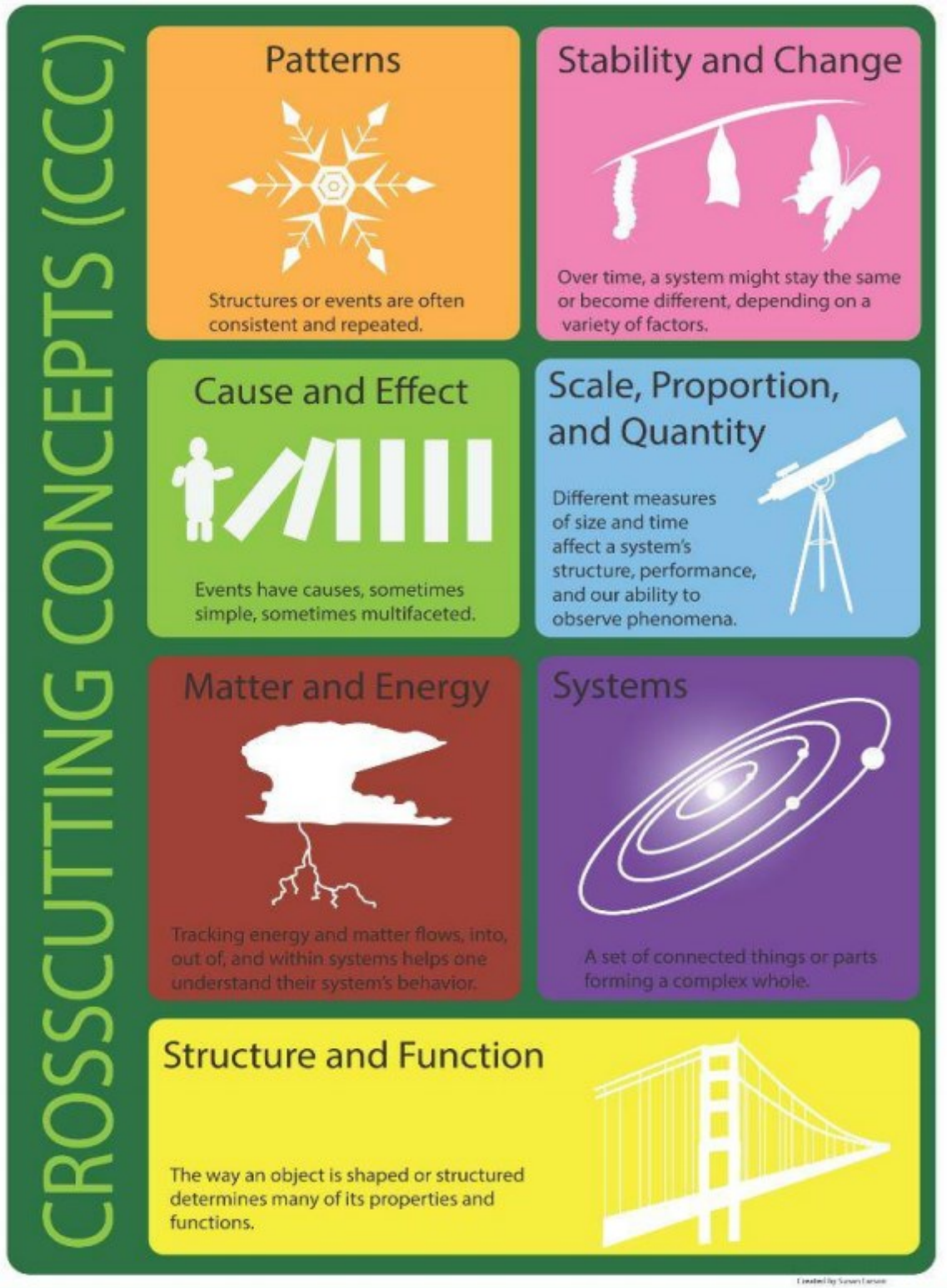
Science and Engineering Practices

Science and Engineering Practices are what scientists do to investigate and explore natural phenomena.



Cross Cutting Concepts

Crosscutting Concepts are the tools that scientists use to make sense of natural phenomena.



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CHAPTER 2

Strand 2: Storing and Transferring Energy

Chapter Outline

Objects can store and transfer energy within systems. Energy can be transferred between objects, which involves changes in the object's energy. There is a direct relationship between an object's energy, mass, and velocity. Energy can travel in waves and may be harnessed to transmit information.

2.1 Energy Speed and Mass (8.2.1)

Explore this Phenomenon

These two trucks run into an empty building. One truck causes more damage to the building than the other.

1. What observations can you make about the trucks?

2. What questions can you ask to determine why one truck causes more damage than the other?

3. How would you explain why one truck causes more damage than the other?

8.2.1 Energy: Speed and Mass

Use computational thinking to **analyze data** about the relationship between the mass and speed of objects and the relative amount of kinetic energy of the objects. Emphasis should be on the quantity of mass and relative speed to the observable effects of the kinetic energy. Examples could include a full cart vs. an empty cart or rolling spheres with different masses down a ramp to measure the effects on stationary masses. Calculations of kinetic and potential energy will be learned at the high school level.

In this section, focus on scale, proportion, and quantity and cause and effect. Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) coupled with quantity measurements (mass) provide information about the magnitude of an object's kinetic energy. Cause and effect relationships may be used to predict relative amounts of kinetic energy.

Kinetic Energy

What do these four photos have in common?

Energy exists in many different forms, but the one you should be very familiar with is kinetic energy. Kinetic energy is often thought of as the energy of motion because it is used to describe matter that is moving. The spinning saw blade, flying bee, racing motorcycle, and the flowing water in the photos are moving; therefore, the common factor in all the pictures is kinetic energy.

Factors Affecting Kinetic Energy

An object's kinetic energy depends on two things, its mass and speed. The greater the mass, more kinetic energy the object has. Speed, which is how fast an object is moving (meters/second), also influences kinetic energy. The greater the speed, the greater the kinetic energy. Think back to the questions you were asked at the beginning of this section about the truck pictures. Which moving truck would have more kinetic energy due to its mass, the large dump truck or the smaller truck? How would speed affect the truck's kinetic energy?

Putting It Together

1. Explain how your understanding of kinetic energy has changed.

2. Think of another phenomenon that applies to how mass & speed affect kinetic energy.

3. Explain what the difference in kinetic energy will be for these two trucks based on what you have learned in this section.

2.2 Potential Energy (8.2.2)

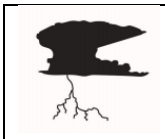
Explore this Phenomenon

1. What observations can you make about the climbers in the photo?

2. What questions could you ask to help you explore the amount of energy each one has?

8.22 Potential energy

Ask questions about how the amount of potential energy varies as distance within the system changes. **Plan and conduct an investigation** to answer a question about potential energy. Emphasize comparing relative amounts of energy. Examples could include a cart at varying positions on a hill or an object being dropped from different heights. Calculations of kinetic and potential energy will be learned at the high school level.



In this section, focus on energy and matter. The transfer of energy can be tracked as energy flows through a system.

Potential Energy

Potential energy is energy that is stored in an object. Objects have potential energy because of their position or shape. The climbers have energy because of their position on the cliff. They used kinetic energy to get to that position. Now the energy is stored in the form of potential energy because of how high up the cliff they are. They have the potential to go down. If they were to fall, their potential energy would be converted to kinetic energy again.

Gravitational potential

Potential energy caused by the position of an object to a gravitational pull is known as gravitational potential. If an object has gravitational potential it can fall. Like a diver on a diving board or the skydiver from a plan, anything that is above Earth's surface has the potential to fall because of gravity. The amount of gravitational potential energy an object has depends on the object's mass and its distance above the ground. Between

the two previous pictures the skydiver is higher above the earth and so has the greatest gravitational potential energy.

How could the child on the sled increase their potential energy?

If the gymnast increased their mass how would that affect their potential energy?

Elastic Potential

An object's shape can also give it potential energy if when let go it tries to return to its original shape. This kind of potential energy is known as elastic potential. The girl in the photo is giving the elastic band of her slingshot potential energy by stretching it. This is known as elastic potential energy. Stretched rubber bands, inflated balloons, and springs that are uncoiled are examples of objects that have elastic potential energy due to their shape.

How does the amount of potential energy vary as distance changes?

Think about climbers on a cliff. If one climber climbed higher than the other, how would the added distance influence the amount of potential energy involved? The higher climber invested more energy climbing to a greater height, therefore there is more potential energy stored in the higher position. If you stretch out a rubber band on a slingshot to a farther distance it will have more potential energy because of the bigger change in shape. It also required more kinetic energy from you to pull it out farther.

Can you think of other examples of how varying distances change the amount of potential energy involved?

Where on the roller coaster would the cart have the most potential energy?

Where would it have the least?

How is distance related to the amount of energy?

Putting It Together

1. Explain how your new understanding of potential energy helps explain the amount of energy of the people in this picture.

2. Think of another phenomenon that applies to potential energy.

3. Explain how potential energy and distance is involved in what the climbers are doing in this picture.

2.3 Energy Transfer (8.2.3)

Explore this Phenomenon

*https://pxhere.com/en/photo/495963

As the boy skates down the ramp, he gets faster, when he skates up the ramp he gets slower.

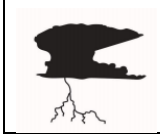
1. What observations can you make about the skater?

2. What questions can you ask about the skater's energy?

3. How can you explain what happens to the skater's kinetic energy?

8.2.3 Energy Transfer

Engage in argument to identify the strongest evidence that supports the claim that the kinetic energy of an object changes as energy is transferred to or from the object. Examples could include observing temperature changes as a result of friction, applying force to an object, or releasing potential energy from an object.



In this section, focus on energy and matter. Energy can be transferred to or from objects and when it is transferred it often changes forms such as kinetic energy to heat energy or potential energy to kinetic energy.

Kinetic-Potential Energy Changes

Energy is neither created nor destroyed only transferred from one form into another. One of the most common energy changes occurs between kinetic and potential energy. Kinetic energy is the energy of moving objects. Potential energy is energy that is stored in objects, typically because of their position or shape. Kinetic energy can be used to change the position such as climbing to the top of a slide or shape of an object such as pulling back on a rubber-band, giving it potential energy. Potential energy gives the object the potential to move. If the potential energy is released then the object will move and change the potential energy back to kinetic energy.

To investigate how potential and kinetic energy are related in a roller coaster simulator, visit http://go.uen.org/b0tl

The girl in the photo just finished coming down the water slide. When she was at the top of the slide, she had potential energy. Why? She had the potential to slide down into the water because of the pull of gravity. As she moved down the slide, her potential

energy changed to kinetic energy. By the time she reached the water, the potential energy had changed to kinetic energy.

How could the girl regain her potential energy? She could climb up the steps to the top of the slide. It takes kinetic energy to climb the steps and this energy would be stored in her position on the stairs as she climbed. By the time she got to the top of the slide, she would have the same amount of potential energy as before.

Friction, which is the resistance of an object to movement, also causes changes in kinetic energy. Rub your hands rapidly together. What do you feel? Friction causes the kinetic energy of the rubbing hands to be converted to heat energy which is why your hands feel warm. On a normal slide, friction would help convert some of the girl's kinetic energy to heat energy. As her kinetic energy decreased, she would slow down. Since this is a water slide the water reduces friction, her kinetic energy won't be converted to heat as much and she can get going much faster. To investigate how kinetic and potential energy are related, and the role friction can play, visit the skate park simulator at http://go.uen.org/b0x .

Putting It Together

***https://pxhere.com/en/photo/495963**

1. Explain how your understanding of the energy transfer has changed.

2. Think of another phenomenon that applies to transfer of energy.

3. Explain what happens to the skater's energy as he skates up and down the hills in the skate park.

4. If the skater dragged his foot on the ground as he skates down the ramp, what will happen to his speed?

5. What would happen to his kinetic energy if he did this?

6. What evidence can you use to support your answer?