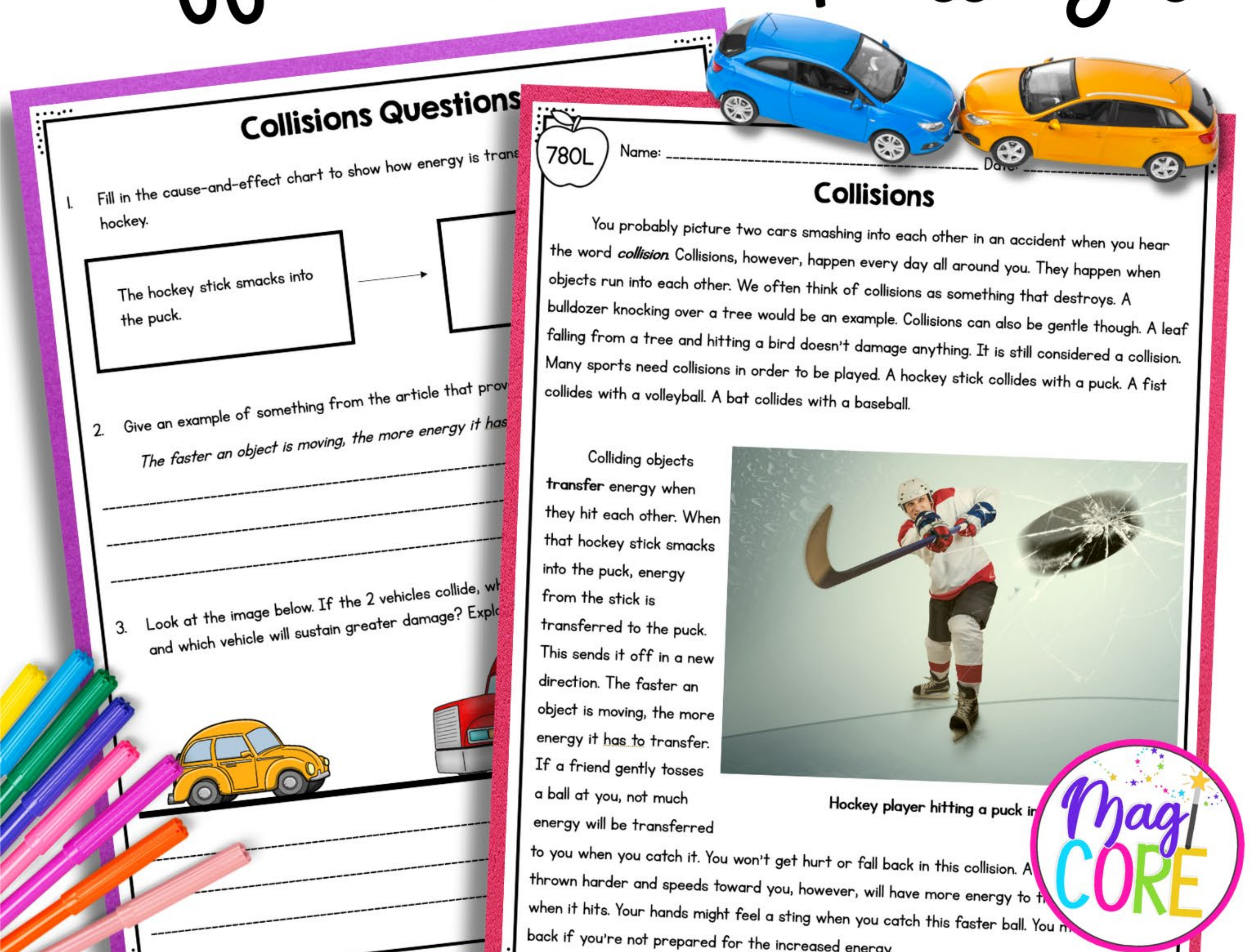
ENERGY IN COLLISIONS

differentiated passages



4th Grade NGSS 4-PS3-3

ABOUT LEXILE LEVELS

MagiCore Learning, LLC is a certified Lexile® Partner. These texts are officially measured and approved by Lexile and MetaMetrics® to ensure appropriate rigor and differentiation for students.

The Lexile Framework® for Reading measures are scientific, quantitative text levels. When the Lexile of a text is measured, specific, measurable attributes of the text are considered, including, but not limited to, word frequency, sentence length, and text cohesion. These are difficult attributes for humans to evaluate, so a computer measures them.

Common Core State Standards uses Lexile level bands as one measure of text complexity. Text complexity ranges ensure students are college and career ready by the end of 12th grade. Lexile measures help educators scaffold and differentiate instruction as well as monitor reading growth.

Grade Band	Lexile® Bands Aligned to Common Core Expectations
K-1	N/A
2-3	420L-820L
4-5	740L-1010L
6-8	1185L-1385L

Keep in mind when using any leveled text that many students will need scaffolding and support to reach text at the high end of their grade band. According to Appendix A of the Common Core Standards, "It is important to recognize that scaffolding often is entirely appropriate. The expectation that scaffolding will occur with particularly challenging texts is built into the Standards' grade-by-grade text complexity expectations, for example. The general movement, however, should be toward decreasing scaffolding and increasing independence both within and across the text complexity bands defined in the Standards."

Energy in Collisions

4th grade

Table of Contents

Each passage set includes two differentiated passages on a fourth-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

4-PS3-3 Energy in Collisions
Ask questions and predict outcomes about the changes in energy that occur when objects collide. (Energy and Matter)

Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.

Assessment Boundary: None

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.

780L

Name: ____ Date: ______________________

Bowling

Bowling is a fun sport. A ball is rolled down an alley. The purpose is to hit ten pins set up at the end of that alley. The outside of bowling balls can be made of plastic, polyester, urethane, or resin. The inside has a filler material. That material surrounds a weight block. The pins are made of rock maple wood. They are coated with a substance such as nylon. The goal is to knock over as many pins as possible. Each bowling game has ten frames which are like rounds. A bowler has two chances to roll the ball.

Girl releasing bowling ball.

A bowling ball has **potential energy** before it is released by a player. That potential energy gets converted to **kinetic energy** when the ball rolls down the alley. The force the player puts on the ball affects its speed as it travels toward the pins. More force equals more speed. **Gravity** will slow the bowling ball down. **Friction** between the ball and the alley's surface will also decrease speed.

A bowler must think about how to best distribute the energy from the ball to the pins in order to knock down the most pins and win. The pins are set up in a triangle with four rows. One pin is out front in the first row. Two pins are behind that. Three pins are in the third row, and four pins make up the back row. A skilled bowler will aim for the ball to collide with the head pin and one of its neighboring pins. A collision at a 30° angle is best. This spreads the force of impact evenly throughout the pins. A strike – knocking down all ten pins with one ball – will be more likely.

Ball colliding with bowling pins.

Energy is transferred from the ball to the pins when the bowling ball has a **collision** with the pins. Once the ball hits some pins, it knocks those pins into nearby pins. Those pins then hit more pins. The pins bounce off each other in all directions. Energy keeps getting transferred as more collisions take place. Some of the energy in the collisions is transformed into sound. The bowling ball *smacks* the pins. The pins *bang* each other. Finally, the pins *clink* to the alley's surface.

Bowling would be impossible without energy transfer. Of course, your ball won't collide with any pins if it lands in the gutters lining the alley on your first turn. Your ball will roll past them. It will then get fed back to the ball return area for you to try again. Hopefully, you put the right amount of force and some good aim into your next release.

Bowling Questions

1. Use the chart below to show how energy is transferred from the bowling ball to the pins when you bowl.

The player releases the ball at the end of the lane. →	→	→	

2. How does the force you apply to the ball affect how many pins you knock down?

____

____

____

3. What happens immediately after the bowling ball connects with the bowling pins?

   (Choose all that apply.)

   a. Energy is transferred from the ball to the pin that was hit
   b. The ball goes in the gutter
   c. Some energy is transferred as sound
   d. The ball is sent back through the ball return

4. Where does a skilled bowler aim his bowling ball? Explain why.

____

____

____

960L

Name: ______________________________ Date: ____________________

Bowling

Bowling is a fun sport in which a ball is rolled down an alley. The purpose is to hit ten pins set up at the end of that alley. The outside of bowling balls can be made of plastic, polyester, urethane, or resin. The inside consists of a filler material surrounding a weight block. The pins are made of rock maple wood and coated with a substance such as nylon. The goal is to knock over as many pins as possible. Each bowling game has ten frames which are like rounds. A bowler has two chances to roll the ball.

Girl releasing bowling ball.

Before a bowling ball is released by a player, it has **potential energy**. That potential energy gets converted to **kinetic energy** when the ball rolls down the alley. The force the player exerts on the ball affects its speed as it travels toward the pins. More force equals more speed. **Gravity,** along with **friction** between the ball and the alley, will slow the bowling ball down as it makes its journey.

With the goal of knocking down the most pins to win the game, a bowler must think about how to best distribute the energy from the ball to the pins. The pins are set up in a triangle with four rows. One pin is out front in the first row. Two pins are behind that, three pins are in the third row, and four pins make up the back row. A skilled bowler will aim for the ball to collide with the head pin and one of its neighboring pins. A collision at a 30° angle is best. This spreads the force of impact evenly throughout the pins and makes a strike – knocking down all ten pins with one ball – more likely.

Ball colliding with bowling pins.

When the bowling ball has a **collision** with the pins, energy is transferred from the ball to the pins. Once the ball hits some pins, it knocks those pins into nearby pins, and those pins hit more pins. The pins bounce off each other in all directions. Energy keeps getting transferred as more collisions take place. Some of the energy in the collisions is transformed into sound. The bowling ball *smacks* the pins. The pins *bang* each other before *clinking* to the alley's surface.

Without energy transfer, bowling would be impossible. Of course, if your bowling ball lands in the gutters lining the alley on your first turn, you won't collide with any pins. Your ball will roll past them and get fed back to the ball return area for you to try again. Hopefully, you put the right amount of force and some good aim into your next release.

Bowling Questions

1. Use the chart below to show how energy is transferred from the bowling ball to the pins when you bowl.

2. How does the force you apply to the ball affect how many pins you knock down?

3. What happens immediately after the bowling ball connects with the bowling pins?

   (Choose all that apply.)

   a. Energy is transferred from the ball to the pin that was hit
   b. The ball goes in the gutter
   c. Some energy is transferred as sound
   d. The ball is sent back through the ball return

4. Where does a skilled bowler aim his bowling ball? Explain why.

780L

Name: ______________________________ Date: ____________________

Playing Pool

Pool is a game played on a felt table with a long cue stick and balls. The cue stick is used to hit a white pool ball into numbered balls of the same size. The goal is to get the numbered balls into pockets at the edges of the table. Some balls are a solid color. Some have a stripe on them. Two players, or two teams, choose either solids or stripes. Then, they take turns trying to get their balls in the pockets.

Pool table

Science is involved in playing pool. The game is all about what happens when objects hit each other. **Collisions** happen between the cue stick and the balls. They also happen between balls and between balls and the sides of the table. **Inelastic** and **elastic collisions** are two types of collisions. **Momentum** is conserved in both kinds. This means the total amount of momentum of the colliding objects you had before the collision will be the same afterward.

How the objects move helps you know whether you have an inelastic or elastic collision. The colliding objects don't bounce off each other in an inelastic collision. Some of the **kinetic energy** is changed to another form of energy. This could be heat or light. An inelastic collision happens in pool when you hit the white ball with the cue stick. The stick moves toward the white ball before the collision. The cue stick stops moving after the collision. Its kinetic energy is transferred to the white ball. That energy sends it rolling. **Friction** between the white ball and the table also causes some of the kinetic energy to be lost.

The kinetic energy in two objects remains the same in elastic collisions. The speed of the two objects is the same after this type of collision. None of the kinetic energy gets transferred to another form. Elastic collisions are hard to find. When two moving balls collide with one another in pool, however, it's pretty close to an elastic collision. The balls bounce off each other when they strike. They continue to move. Some kinetic energy is lost when it's converted to sound energy. The energy loss is very small, though. The balls almost keep their same speeds.

Player about to hit the white ball in a game of pool.

The white ball will stop moving after a straight-on collision with a still ball. All of its kinetic energy will have been transferred to the other ball. That other ball will now move forward at the same speed the white ball had before the collision. Most collisions in pool are not straight on, however. Many times, hitting a ball at an angle is needed to get the ball where you want it. When one ball hits another at an angle, the first ball keeps some of its original speed. Both balls will roll, but now you've changed the speed and direction of the second ball.

Collisions make the game of pool possible and fun. Making choices about energy transfer on the pool table can lead one player or team to a sweet victory.

Playing Pool Questions

1. Use the chart below to give an example of an inelastic and elastic collision.

Type of Collision	Example
Inelastic Collision	
	Two moving pool balls bounce off each other and continue to move in opposite directions.

2. Which of the following is an example of potential energy?
   a. 2 pool balls knocking into each other and making a clinking sound
   b. A pool player holding his stick back, ready to hit the white ball
   c. One of the striped balls falling into a side pocket
   d. The white ball rolling across the table and missing the other balls

3. Which of the following statements supports the claim:

   "The kinetic energy in two objects remains the same in elastic collisions."

   a. When one ball hits another at an angle, the first ball keeps some of its original speed.
   b. The white ball will stop moving after a straight-on collision with a still ball.
   c. The cue stick stops moving after the collision.
   d. The balls almost keep their same speeds.

4. Explain what happened to the energy in the cue stick after it collides with the white ball and stops.

____

____

____

In elastic collisions, the kinetic energy in two objects remains the same. The speed of the two objects is the same after a collision because none of the kinetic energy gets transferred to another form. Elastic collisions are hard to find. When two moving balls collide with one another in pool, however, it's pretty close to an elastic collision. The balls bounce off each other when they strike. They continue to move, but some kinetic energy is lost when it's converted to sound energy. The energy loss is very small, though, and the balls almost keep their same speeds.

Player about to hit the white ball in a game of pool.

When the white ball hits a still ball straight on, the white ball will stop moving after the collision. All of its kinetic energy will have been transferred to the other ball. That other ball will now move forward at the same speed the white ball had been traveling before the collision. Most collisions in pool are not straight on, however. Many times, hitting a ball at an angle is needed to get the ball where you want it. When one ball hits another at an angle, the first ball keeps some of its original speed. Both balls will roll, but now you've changed the speed and direction of the second ball, hopefully to your advantage.

Collisions make the game of pool possible and fun. Making choices about energy transfer on the pool table can lead one player or team to a sweet victory.

Playing Pool Questions

1. Use the chart below to give an example of an inelastic and elastic collision.

Type of Collision	Example

2. Which of the following is an example of potential energy?
   a. 2 pool balls knocking into each other and making a clinking sound
   b. A pool player holding his stick near the white ball
   c. One of the striped balls falling into a side pocket
   d. The white ball rolling across the table and missing the other balls

3. Which of the following statements supports the claim:

   "The kinetic energy in two objects remains the same in elastic collisions."

   a. When one ball hits another at an angle, the first ball keeps some of its original speed.
   b. The white ball will stop moving after a straight-on collision with a still ball.
   c. The cue stick stops moving after the collision.
   d. The balls almost keep their same speeds.

4. Explain what happened to the energy in the cue stick after it collides with the white ball and stops.

____

____

____

Terms of Use

How Can I Use This Resource?

Thank you for trusting MagiCore. Our mission is to create resources that support teachers and promote student success. Please note that this resource is licensed for use by a single teacher in a classroom setting. If you need to use this resource with more than one teacher and/or across multiple classrooms, additional licenses are available at a discount. You can purchase additional licenses by visiting your TPT "Purchases" page and then selecting "Download Additional Licenses" or by contacting me at julie@magicorelearning.com.

Good to Go

- Use this resource personally or with your own children.
- Use this resource in your own classroom with your students.
- Provide this resource to your students to use at your instruction.
- Print and/or copy for use in your own classroom.
- Provide printed pages to a substitute teacher with the sole purpose of instructing your students.
- Share with your students via a secure document portal or electronic learning platform that requires individual user verification and limits access to only the students in your own classroom (e.g. Google Classroom).
- Review this resource with others with the sole purpose of recommending it to others for purchase, provided you share one of the links below:

https://magicorelearning.com/

https://www.teacherspayteachers.com/Store/Magicore

Not O.K.

- Share with others to use personally.
- Share with others to use in another classroom.
- Print or copy any page(s) and distribute them to other teachers or other classrooms.
- Publish or host online in a manner where any of the material is accessible to anyone who is not a student in your own classroom., including but not limited to personal, classroom, or district websites that are accessible to the general public.
- Use this resource commercially (e.g. Outschool).
- Publish, sell, or otherwise distribute this product to anyone in manner inconsistent with these terms of use.

Let's Connect!

www.magicorelearning.com

https://www.teacherspayteachers.com/Store/magicore

https://www.facebook.com/MagiCoreLearning/

https://www.instagram.com/magicorelearning/

https://www.pinterest.com/cckingdom/pins/

Julie@magicorelearning.com

Looking for more?

Membership Opportunity!

If you love these resources and want access to more, check out my membership opportunity with the Core Kingdom Club.

Join my MagiCore Club waitlist!

MagiCore Club opens its membership doors twice a year to offer teachers all the resources you love, with a membership discount. You can also find support through my custom learning plan.

Find out more https://magicorelearning.com/membership

CREDITS