

FORMS OF ENERGY – LESSON PLAN 2.2

The Law of Conservation of Energy

This lesson is designed for 3rd – 5th grade students in a variety of school settings (public, private, STEM schools, and home schools) in the seven states served by local power companies and the Tennessee Valley Authority. Community groups (Scouts, 4-H, after school programs, and others) are encouraged to use it as well. This is one lesson from a three-part series designed to give students an age-appropriate, informed view of energy. As their understanding of energy grows, it will enable them to make informed decisions as good citizens or civic leaders.

This lesson plan is suitable for all types of educational settings. Each lesson can be adapted to meet a variety of class sizes, student skill levels, and time requirements.

Setting	Lesson Plan Selections Recommended for Use
Smaller class size, higher student ability, and /or longer class length	<ul style="list-style-type: none"> The “Modeling” Section contains teaching content. While in class, students can do “Guided Practice,” complete the “Recommended Item(s)” and any additional guided practice items the teacher might select from “Other Resources.” NOTE: Some lesson plans do and some do not contain “Other Resources.” At home or on their own in class, students can do “Independent Practice,” complete the “Recommended Item(s)” and any additional independent practice items the teacher selects from “Other Resources” (if provided in the plan).
Average class size, student ability, and class length	<ul style="list-style-type: none"> The “Modeling” Section contains teaching content. While in class, students complete “Recommended Item(s)” from “Guided Practice” section. At home or on their own in class, students complete “Recommended Item(s)” from “Independent Practice” section.
Larger class size, lower student ability, and/or shorter class length	<ul style="list-style-type: none"> The “Modeling” Section contains teaching content. At home or on their own in class, students complete “Recommended Item(s)” from “Independent Practice” section.

Electrical Safety Reminder: Teachers should remind students that electricity is dangerous and that an adult should be present when any recommended activities or worksheets are being completed at home. Always obey instructions on warning labels and ensure one has dry hands when touching electronics or appliances.

Performance Objectives

By the end of this lesson, students will be able to:

- Identify when energy is converted.
- List the different forms of energy.
- Explain why there is no loss of energy.
- Provide examples of energy conservation.

Public School System Teaching Standards Covered

State Science Standards

- AL 3.2 3rd
- AL 3.13 3rd
- AL 4.1 4th
- AL 5.4.1 and 2 4th
- GA S3CS4 3rd
- GA S3PI 3rd
- GA S4CS4 4th
- GA S4P3 4th
- GA S5CS4 5th
- KY Big Idea: Motion and Forces 4th
- KY SC-EP-1.2.3 4th
- NC 3.P.1 and 3 3rd
- NC 4.P.1 and 3 4th
- NC 5.P.1 5th
- TN GLE 0307.10.1 3rd
- TN Conceptual Strand 10 3rd, 4th, 5th
- TN GLE 0407.11.3 and 4 4th
- TN GLE 0507.10.1.2 and 5 5th
- VA 3.3 3rd
- VA 3.11 3rd
- VA 4.1.L 4th
- VA 4.2.c and d 4th

Common Core Language Arts/Reading

- ELA.CCSS.W.3.1 AL, TN, GA, NC 3rd
- ELA.CCSS.W.4.1 AL, TN, GA, NC, KY 4th
- ELA.CCSS.W.5.1 AL, TN, GA, NC 5th

I. Anticipatory Set (Attention Grabber)

? Essential Question

How is energy used? (Students need to understand that energy is converted into different forms and that it is never lost.)

II. Modeling (Concepts to Teach)

The Law of Conservation of Energy states that the total energy in a system remains constant. So, when people say they are “using” energy, what they really mean to say is that they are “converting” energy from one form to another form. Energy is never created or destroyed, but it is transformed from one type to another. For example, when a car burns fuel (chemical potential energy) that fuel is not “used up”; it is transformed into mechanical energy that is then transformed into moving energy (kinetic energy). None of the energy is lost; it is conserved. Just the same, solar panels transform solar (radiant) energy into electrical energy and wind turbines use wind to cause the blades of the turbine to rotate, then that energy is converted into electricity. **Sometimes it looks like energy is lost, but this is usually due to a certain amount of the energy in the system transforming into heat and sound energy.**

http://www.energyeducation.tx.gov/energy/section_1/topics/law_of_conservation/

When people ride a roller coaster, the following happens:

First, the car is pulled to the highest part of a track. At the top of the track, the car has potential energy. As the car rolls down the first steep slope, some of the potential energy changes into kinetic energy. At the bottom of the hill, all the potential energy has changed into kinetic energy.

When the car climbs to the top of the next hill, the kinetic energy changes back into potential energy. This process repeats itself throughout the ride. Normally, after the first hill, the car moves without outside help. Each time it coasts down a hill it gains enough kinetic energy to climb the next one. **However, some of the energy turns into heat in overcoming friction.** For this reason, each hill in the ride is a little smaller than the one before it.



When scientists measure energy changes in a system such as a roller coaster, they find that when energy disappears in one form, an equal amount appears in another form. In other words, energy is neither created nor destroyed. It only changes form. This basic law of nature is called the law of conservation of energy.

Examples of energy transformations where energy is conserved:


<http://examples.yourdictionary.com/law-of-conservation-of-energy-examples.html>

- Water can produce electricity. Water falls from the sky, converting potential energy to kinetic energy. This energy is then used to rotate the turbine of a generator to produce electricity. In this process, the potential energy of water in a dam can be turned into kinetic energy, which can then become electric energy. Some of the potential energy is also converted into heat energy, due to friction and perhaps some sound energy, too.
- When playing pool, the cue ball is shot at a stationary 8 ball. The cue ball has energy. When the cue ball hits the 8 ball, the energy transfers from the cue ball to the 8 ball, sending the 8 ball into motion. The cue ball loses energy because the energy it had has been transferred to the 8 ball, so the cue ball slows down. Some of the kinetic energy is also transformed into heat energy due to friction and sound energy, too.
- Kelly ran across the room and bumped into her brother, pushing him to the floor. The kinetic energy she possessed because of her movement was transferred to her brother, causing him to move.
- When a moving car hits a parked car and causes the parked car to move, energy is transferred from the moving car to the parked car.
- When playing the lawn game bocce ball, a small ball is thrown with the intention of hitting larger balls and causing them to move. When a larger ball moves because it was hit by the small ball, energy is transferred from the small ball to the larger one.
- When Joe pushes a book across the table, the energy from his moving arm is transferred from his body to the book, causing the book to move.
- A cat sitting on the highest branch of a tree has what is known as potential energy. If he falls off the branch and falls to the ground, his potential energy is now being converted into kinetic energy.
- When kicking a football that is sitting on the ground, energy is transferred from the kicker's body to the ball, setting it in motion.
- Sam was rearranging furniture, and needed help to push the heavy sofa. His brother came over, and together they were able to lift the sofa onto sliders. This made it easy to push the sofa across the room. When Sam and his brother pushed the sofa and it slid across the wood floor, energy was transferred from the men to the piece of furniture.
- A fly ball hits a window in a house, shattering the glass. The energy from the ball was transferred to the glass, making it shatter into pieces and fly in various directions.
- Two football players collided on the field, and both went flying backwards. Energy was transferred from each player to the other, sending them in the opposite direction from which they had been running.
- Claire threw the ball and it hit her mother's vase, knocking it over. Energy was transferred from the moving ball to the stationary vase, causing the vase to move.
- Fingers hitting piano keys transfer energy from the player's hand to the keys.
- Billy hit the punching bag, transferring energy from his arm to the stationary bag.

- The dog ran into the decorative plant and knocked it over. Energy was transferred from the moving dog to the stationary plant, causing the plant to move.
- When the car hit the road sign, the sign fell over. Energy was transferred from the moving car to the stationary sign, causing the sign to move.
- Potential energy of oil or gas is changed into energy to heat a building.
- When a bowling ball knocks over pins that had been standing still, energy is transferred from the ball to the pins.
- Beth hit the wall so hard that she put a hole in it. Energy was transferred from Beth's body to the drywall, causing it to move.

III. Checking for Understanding

Teachers can ask students these questions to determine understanding of concepts.

REMEMBER	Is energy created? Is energy destroyed? (Class discussion) List the forms of energy that potential energy can be transformed into. (Teachers can list these on the board with help from students. Ex. mechanical, light, etc.)
UNDERSTAND	How does energy change from stored energy to motion? (Class discussion)
APPLY	<p>On this roller coaster, show where the cars have potential energy and where it is converted to kinetic energy. (Teacher can draw on board and discuss with class. For more information: http://www.pbslearningmedia.org/asset/mck05_int_rollercoaster/)</p> 
ANALYZE	Explain why it seems like some energy is lost when in reality it is just being converted into different forms of energy. (Class discussion. Answer: Besides the energy changing into visible motion, some energy is converted into heat, sound, light, chemical, or mechanical energy.)
CREATE	Come up with some examples of energy being transferred from potential to kinetic energy. (Class discussion)

IV. Guided Practice Ideas

Recommended Items

Build a Roller Coaster

Experiments

- **Build a Roller Coaster:** <http://www.msichicago.org/online-science/activities/activity-detail/activities/build-a-roller-coaster> OR <http://www.miamisci.org/af/sln/mummy/raceways.html>
- **Transfer of Energy:** <http://frugalfun4boys.com/2012/11/14/transfer-of-energy-science-experiment/>
- **Dominos chain reaction** (potential → kinetic energy):
<http://www.cpalms.org/Public/PreviewResource/Preview/45896>

V. Independent Practice Ideas

Recommended Item: Energy Conservation Worksheet and Answer Key provided

- Energy Conservation Worksheet and Answer Key provided
- Transformation of Energy Worksheet and Answer Key provided
- Journal (if the students have a journal). Teachers write the following question on the board and ask students to copy and answer the question in their journals: Come up with an example from your everyday life of energy being converted from one form to another.
- Draw and explain: Teachers ask students to draw an object with potential energy OR kinetic energy and explain which type of energy is pictured.
- Create a story or skit: Teachers ask students to write a story on a sheet of paper or create a skit in the classroom of how energy changes forms to be utilized.

VI. Assessment

These items provide a check for understanding so teachers can easily determine whether concepts need to be reinforced. These items can be graded, if desired.

- Energy Conservation Worksheet and Answer Key provided
- Transformation of Energy Worksheet and Answer Key provided
- Roller Coaster creation and labels (if completed **Build a Roller Coaster Experiment** in Guided Practice, as shown above).
- Journal (if completed as Independent Practice, as shown above).

VII. Materials Needed

The following materials are needed for the **Build a Roller Coaster Experiment** in “Recommended Items” in Guided Practice.

- Marbles or small balls
- About 6 feet of flexible tubing, such as ¾-inch foam pipe insulation
- Masking tape
- Plastic cup
- Scissors
- Various supports, such as boxes, paper towel tubes or books

VIII. Closing the Lesson

In addition to the Essential Question shown below, teachers can reference Performance Objectives at the top of the Lesson Plan.

Essential Question

How is energy used?

WORKSHEET FOR THE LAW OF CONSERVATION OF ENERGY LESSON 2.2

Energy Conservation

NAME: _____

Objective: Students will be able to identify when energy is converted, list the different forms of energy, restate The Law of Conservation of Energy, and provide examples of energy conservation.

1. Give an example of energy changing form.

2. How can energy be converted to make electricity?

3. Draw three stages of energy being transferred to set a car in motion.

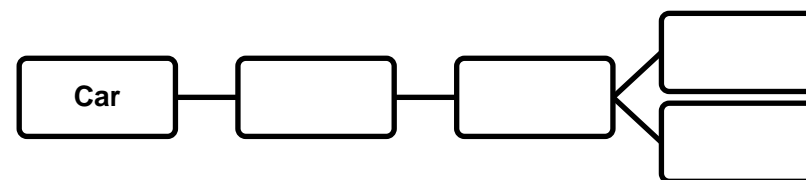
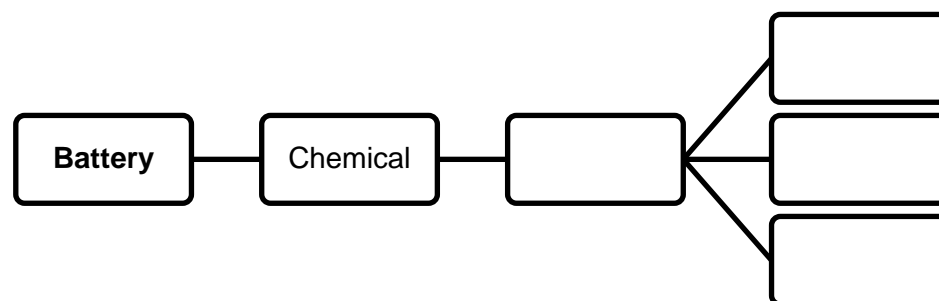
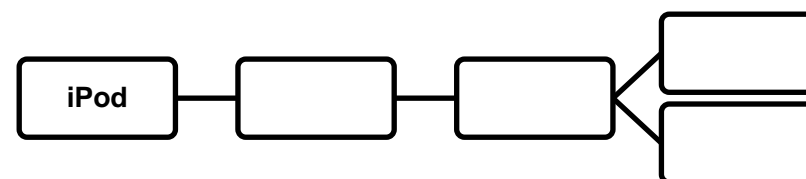
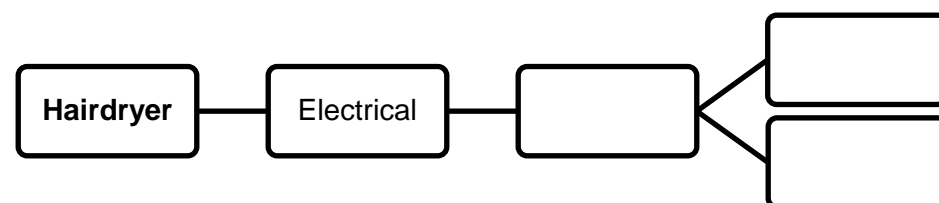
4. Restate The Law of Conservation of Energy.

WORKSHEET FOR THE LAW OF CONSERVATION OF ENERGY LESSON 2.2

NAME: _____

Transformation of Energy

Objective: Students will be able to identify when energy is converted, list the different forms of energy, explain why there is no loss of energy, and provide examples of energy conservation.



Identify which type of energy is used in each phase of energy transformation.

Answer Keys

ANSWER KEY FOR WORKSHEET: ENERGY CONSERVATION

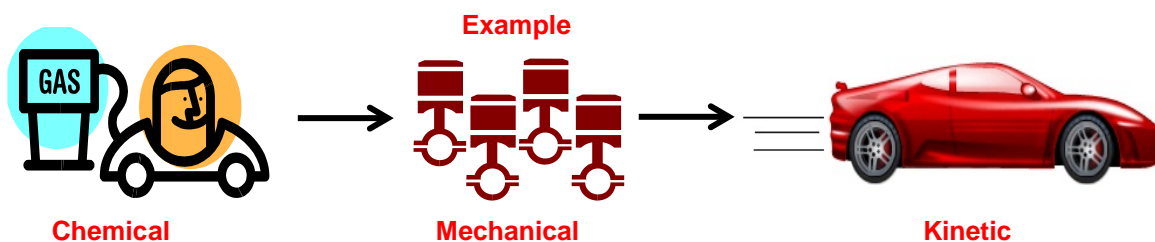
1. Give an example of energy changing form.

Ex. Car fuel being transferred into mechanical energy, mechanical energy from the engine being transferred into kinetic energy, thereby moving the car.

2. How can energy be converted to make electricity?

Ex. Water or wind can be used to turn turbines of a generator to create electricity.

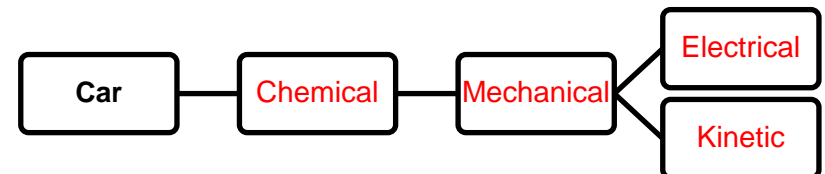
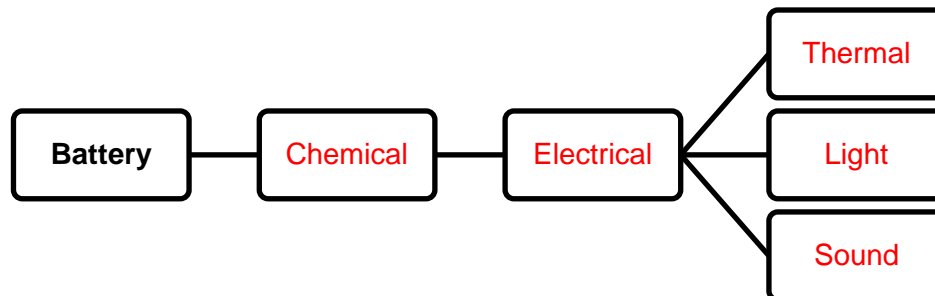
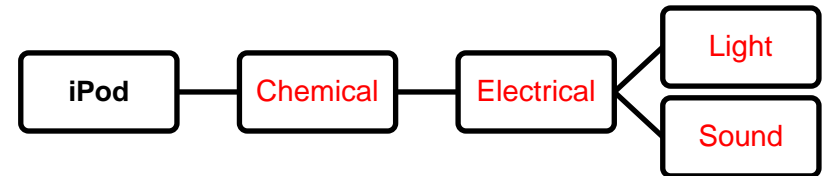
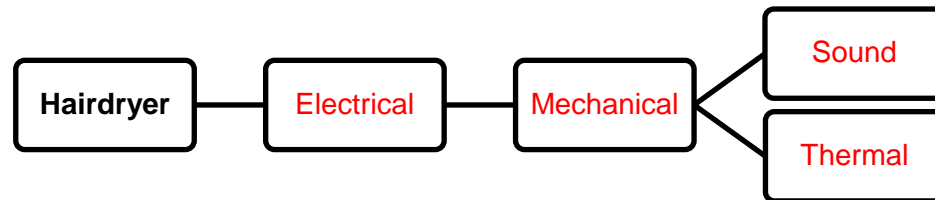
3. Draw three stages of energy being transferred to set a car in motion.



5. Restate The Law of Conservation of Energy.

Ex. The Law of Conservation of Energy states that energy is never created nor destroyed, but it is transformed from one type to another.

ANSWER KEY FOR WORKSHEET: TRANSFORMATION OF ENERGY



Identify which type of energy is used in each phase of energy transformation.