

FORMS OF ENERGY – LESSON PLAN 2.3

Mechanical 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 mechanical energy.
- Explain the difference between potential mechanical energy and kinetic mechanical energy.

Public School System Teaching Standards Covered

State Science Standards

- AL 3.4.1 3rd
- AL 3.4.2 3rd
- AL 4.1.1 4th
- AL 5.4.1 5th
- GA SC5 4th
- KY 3 PS2.B 3rd
- NC 3.P.1 and 3 3rd
- NC 5.P.1 5th
- TN GLE 0307.INQ.1 and 3 3rd
- TN GLE0407.11.1 4th
- TN GLE 0407.INQ.1 and 3 4th
- TN GLE 0507.INQ.1 and 3 5th
- VA S.4.2 4th
- VA S.4.3 4th

Common Core Language Arts/Reading

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

I. Anticipatory Set (Attention Grabber)

? Essential Question

What is mechanical energy?

📺 Videos

Explaining the Three Types of Energy Video: http://www.youtube.com/watch?v=XU_rMVd6DkU

II. Modeling (Concepts to Teach)

Additional Information

<http://www.physicsclassroom.com/class/energy/Lesson-1/Mechanical-Energy>

The object that provides the force in order to do work (Remember: work equals force times distance) needs some source of energy. For example, if a person wants to do work on a set of dumbbell weights at the gym, then he/she needs to provide his/her body with food, which is chemical potential energy. It is the food that is eaten that provides the energy for the force exerted on the weights. The chemical potential energy stored in food or fuel is transformed into work. In the process of doing work, the object that is doing the work exchanges energy with the object upon which the work is done. When the work is done upon the object, that object gains energy. The energy acquired by the objects upon which work is done is known as **mechanical energy**.

Mechanical Energy can be classified as either Potential (1) or Kinetic (2):

An object that possesses mechanical energy is able to do work. In fact, mechanical energy is often defined as the ability to do work. Any object that possesses mechanical energy – whether it is in the form of potential energy or kinetic energy – is able to do work. That is, its mechanical energy enables that object to apply a force to another object in order to cause it to be displaced.

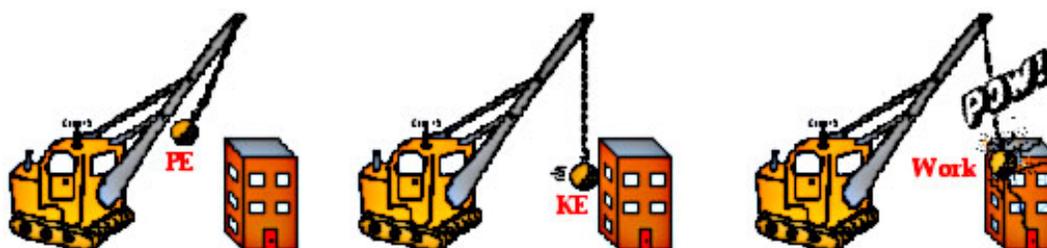
1. Potential Mechanical Energy

Sometimes mechanical energy is **stored** in objects. Tension is an example of stored mechanical energy and is **Potential Energy**. Compressed springs and stretched rubber bands are examples of this stored mechanical energy. For example, a bow is provided with stored mechanical energy that is provided by the archer when he or she pulls back on the string, putting tension on it. When the string is released, the arrow is sent flying through the air. Work is done on the arrow.

2. Kinetic Mechanical Energy

Sometimes mechanical energy is a **moving** object. A hammer pounding a nail is a good example of moving mechanical energy. A person gives energy to the hammer and then the hammer has the moving mechanical energy to do work on a nail. When the hammer moves into the nail, it pushes it into the board. Work is done on the nail. In addition, moving air (wind) exhibits moving mechanical energy when it does work on the blades of a turbine. As the blades spin, their energy is then converted to electrical potential energy.

In the diagram below, mechanical energy can be seen in both of its forms-potential and kinetic.



The massive ball of a demolition machine possesses mechanical energy – the ability to do work. When held at a height, it possesses mechanical energy in the form of potential energy. As it falls, it exhibits mechanical energy in the form of kinetic energy. As it strikes the structure to be demolished, it applies a force to displace the structure – i.e., it does work upon the structure.

III. Checking for Understanding

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

REMEMBER	Define mechanical energy. (Class discussion)
APPLY	Give an example of an object with POTENTIAL mechanical energy; Give an example of an object with KINETIC mechanical energy. (Class discussion)
ANALYZE	Compare and contrast potential mechanical energy and kinetic mechanical energy. (Class discussion)
CREATE	Create a drawing of mechanical energy changing from potential (stored) to kinetic (moving). (Teachers can ask students to draw their pictures on a sheet of paper. Ex: a hammer in the air and then falling to hit a nail.)

IV. Guided Practice Ideas

Recommended Items

Conversion to Mechanical Energy Experiment (see below)

Experiments

- **Conversion to Mechanical Energy:** <http://www.evilmadscientist.com/2006/how-to-make-the-simplest-electric-motor/>
- Mechanical Energy: <http://education-portal.com/academy/lesson/what-are-the-types-of-energy.html-lesson>
- Lift Light Weights: Showing biceps' potential energy converting to mechanical energy on weights. Teachers can ask students to lift a light weight, such as a book, and observe potential energy converting to mechanical.
- Wind Mill Experiment: Converting wind energy (breath) to mechanical energy (spinning wind mill). Teachers can ask students to stand and swing arms in windmill and observe potential energy converting to mechanical.
- Examples of conversion to mechanical energy: http://www.ehow.com/info_10067494_experiments-mechanical-energy-kids.html

V. Independent Practice Ideas

Recommended Item: At-home Scavenger Hunt

- **At-home Scavenger Hunt:** Students find three objects in their home that convert potential energy to kinetic mechanical energy (Ex. ink pen, bicycle, etc.) and list them on a piece of paper.
- 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: Explain the difference between potential mechanical energy and kinetic mechanical energy.
- Venn diagram: Teacher asks students to compare potential mechanical energy to kinetic mechanical energy using a Venn diagram. (Ex. Draw two large intersecting circles. Label one circle potential mechanical energy and the other circle kinetic mechanical energy).
http://www.learninggamesforkids.com/graphic_organizers/writing/venn-diagram.html
- At-home Activity: Teachers ask students to create something from household materials that stores mechanical energy and then goes into motion. (Ex. spring, windmill, mousetrap, etc.)

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.

- Journal (if completed as Independent Practice, as shown above)
- Venn diagram (if completed as Independent Practice, as shown above)
- This lesson plan doesn't include a worksheet.



VII. Materials Needed

The following materials are needed for the **Conversion to Mechanical Energy Experiment** in “Recommended Items” in Guided Practice.

- 1 drywall screw
- 1 1.5V alkaline cell
- 6 inches of plain copper wire
- 1 small neodymium disk magnet

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

What is mechanical energy?