

ENERGY

GRADE 4

ASSESSMENT PACKET

Explore several different energy concepts, including the dynamics behind sound waves and the energy that allows a bobsled or roller coaster to slide down a hill as we play with kinetic and potential energy. You'll soon discover how energy is converted into one form or another, and that energy is not created or destroyed, but rather it changes forms.



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This curriculum is aligned with the National State Standards and STEM for Science.

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Educational Goals

Energy is the ability to do work. What is work? To understand the answers to these important questions we dive into the territory of classic physics, especially those of the “Golden Age” when Galileo, Newton, and other geniuses were finding out all kinds of amazing things about the world around us. If we have a firm grasp on these concepts, you’ll be very well prepared to tackle the toughest physics classes out there.

Students will start their energy studies by exploring some common ways that energy is converted into usable forms and transferred. To understand this, we’ll look at the chemicals and the ability they have to direct electrons to and fro. When electrons move around like this, it creates a current, and we have electricity! More importantly, we’ll explore some more advanced applications of chemical energy because they are the basis for our modern interest in solar energy.

We have many creative ways to harness energy today due to the increasing demand for resources and an increasing population with all kinds of energy needs. All our planet’s energy needs come from the sun, including wind energy (weather is driven by the sun).

We will explore several different energy concepts, including the dynamics behind sound waves and the energy that allows a bobsled or roller coaster to slide down a hill as we play with kinetic and potential energy. You’ll soon discover how energy is converted into one form or another, and that energy is not created or destroyed, but rather it changes forms.

Here are the scientific concepts:

- Energy comes from the sun to the Earth in the form of light.
- Sources of stored energy take many forms, such as food, fuel, and batteries.
- Machines and living things convert stored energy to motion and heat.
- The faster an object is moving, the more energy it has.
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.
- Energy is present whenever there are moving objects, sound, light or heat.
- When objects collide, energy can be transferred from one object to another, changing their motion.
- Light also transfers energy from place to place.
- Energy can be transferred by electric currents, which can be used locally to produce motion, sound, heat or light. The currents may have been produced to begin with by transferring the energy of motion into electrical energy.
- When objects collide, the contact forces transfer energy so as to change the object’s motion.
- Energy and fuels that humans use come from natural sources, and their use effects the environment in many different ways. Some resources are renewable over time, and others are not.
- “Produce energy” refers to the conversion of stored energy into a form for practical use.
- Waves of the same type can differ in amplitude and wavelength.

By the end of the labs in this unit, students will be able to:

- Design and build an experiment that shows how the speed and energy of an object are related.
- Make observations to show that energy can be transferred by either sound, heat, light, or electric currents.
- predict the outcome when two objects collide.
- Design an experiment that converts energy from one form to another.
- Understand how energy and fuels are made from natural resources, and how those resources affect the environment.
- Design and build experiments that demonstrate that sources of stored energy take many forms, such as food, fuel, and batteries.
- Construct an experiment that shown the patterns of waves in terms of amplitude and wavelength, and how these waves can cause objects to move.
- Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
- Measure and estimate the weight, length and volume of objects.
- Formulate and justify predictions based on cause-and-effect relationships.
- Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.
- Construct and interpret graphs from measurements.
- Follow a set of written instructions for a scientific investigation.

Energy Grade 4 Evaluation

Teacher Section

Overview: Kids will demonstrate how well they understand important key concepts from this section.

Suggested Time: 45-60 minutes

Objectives: Students will be tested on the key concepts:

- Energy and matter have multiple forms and can be changed from one form to another.
- Energy comes from the sun to the Earth in the form of light.
- Sources of stored energy take many forms, such as food, fuel, and batteries.
- Machines and living things convert stored energy to motion and heat.
- Energy can be carried from one place to another by waves, such as water waves and sound, by electric current, and by moving objects.

Students will also demonstrate these principles:

1. Collecting and interpreting data from an experiment
2. Making valid observations based on their actions in lab
3. Energy is not completely used up, but only takes different forms.

Materials (one set for entire class)

- Weight (like a rock)
- Dowel or yardstick
- Tape (to keep the rock on the yardstick)

Lab Preparation

1. Print out copies of the student worksheets, lab practical, and quiz.
2. Have a tub of the materials in front of you at your desk. Kids will come up when called and demonstrate their knowledge using these materials.

Lesson

The students are taking two tests today: the quiz and the lab practical. The quiz takes about 20 minutes, and you'll find the answer key to make it easy to grade.

Lab Practical

Students will demonstrate individually that they know how to create a simple machine that could theoretically help them do work. While other kids are waiting for their turn, they will get started on their homework assignment. You get to decide whether they do their assignment individually or as a group.

Energy Grade 4 Evaluation

Student Worksheet

Overview: Today you're going to take two different tests: the quiz and the lab practical. You're going to take the written quiz first, and the lab practical at the end of this lab. The lab practical isn't a paper test – it's where you get to show your teacher that you know how to do something.

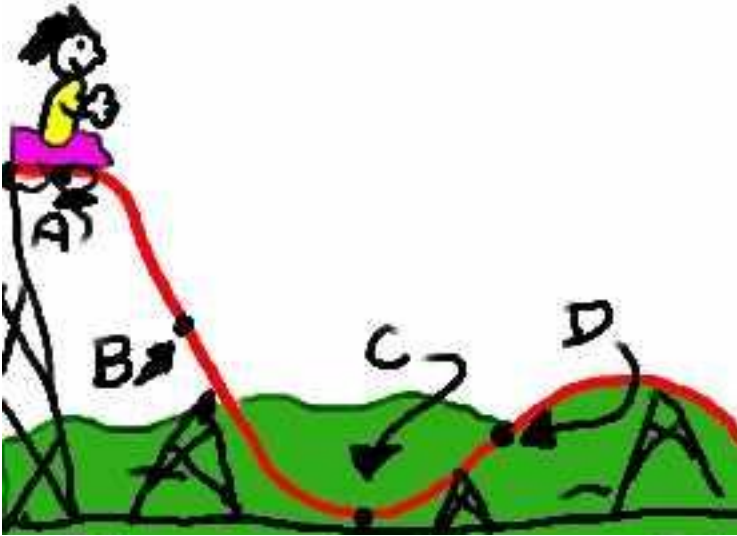
Lab Test & Homework

1. Your teacher will call you up so you can share how much you understand about energy and how it works. Since science is so much more than just reading a book or circling the right answer, this is an important part of the test to find out what you really understand.
2. While you are waiting for your turn to show your teacher how much of this stuff you already know, you get to get started on your homework assignment. The assignment is due next week, and half the credit is for creativity and the other half is for content, so really let your imagination fly as you work through it. Choose one:
 - a. Write a short story or skit about inventing a machine that uses simple machines from the perspective of the machine (like a pulley, wedge, screw, ramp, lever, or wheel and axle). You'll read this aloud to your class.
 - b. Make a poster that teaches the main concepts of simple machines. When you're finished, you'll use it to teach to a class in the younger grades and demonstrate each of the principles that you've learned, and give examples of a perpetual machine and why it won't work ... ever.
 - c. Write and perform a poem or song about simple machines. This will be performed for your class.

Energy Grade 4 Quiz

Teacher's Answer Key

1. Fill in the blank: A battery produces _____ energy from _____ energy. (electrical, chemical)
2. Another name for a battery is: (voltaic cell)
3. As one chemical in a battery loses electrons, what happens to the other chemical? (gains electrons)
4. What type of energy source is the solar panel most closely related to? (chemical battery)
1. Electricity is another name for the free flow of: (electrons)
2. Which of the following best describes how sound gets to us? (vibrating molecules)
3. Name two ways energy is transferred: (heat, sound, radiation, etc.)
4. True or false: A loud noise represents molecules that vibrate violently. (true)
5. What is one way to describe energy? (the ability to do work)
6. Work is when something moves when: (Energy is used over a distance.)
7. Name two simple machines: (lever, pulley, inclined plane)
8. A lever has three parts. Circle all that apply: (fulcrum, load, effort)



9. Where is the potential energy greatest? (A)

Energy Grade 4 Quiz

Name _____

1. Fill in the blank: A battery produces _____ energy from _____ energy.
2. Another name for a battery is:
 - a. Solar array
 - b. Voltaic cell
 - c. Nuclear reactor
 - d. Fusion cell
3. As one chemical in a battery loses electrons, what happens to the other chemical?
 - a. It loses electrons
 - b. It gains electrons
 - c. Nothing
 - d. It decomposes
4. What type of energy source is the solar panel most closely related to?
 - a. Biofuel
 - b. Chemical battery
 - c. Nuclear reactor
 - d. Plant energy
5. Electricity is another name for the free flow of:
 - a. Protons
 - b. Quarks
 - c. Electrodes
 - d. Electrons
6. Which of the following best describes how sound gets to us?
 - a. Chemical electricity
 - b. Solar radiation
 - c. Heat conduction
 - d. Vibrating molecules
7. Name two ways energy is transferred:
 - a.
 - b.
8. True or false: A loud noise represents molecules that vibrate violently.
 - a. True
 - b. False
9. What is one way to describe energy?
 - a. The amount of atoms moving around at any given moment

- b. Electrons flowing from one area to another
- c. The ability to do work
- d. The square root of the speed of an electron

10. Work is when something moves when:

- a. Force is applied
- b. Energy is used
- c. Electrons are lost or gained
- d. A group of atoms vibrate

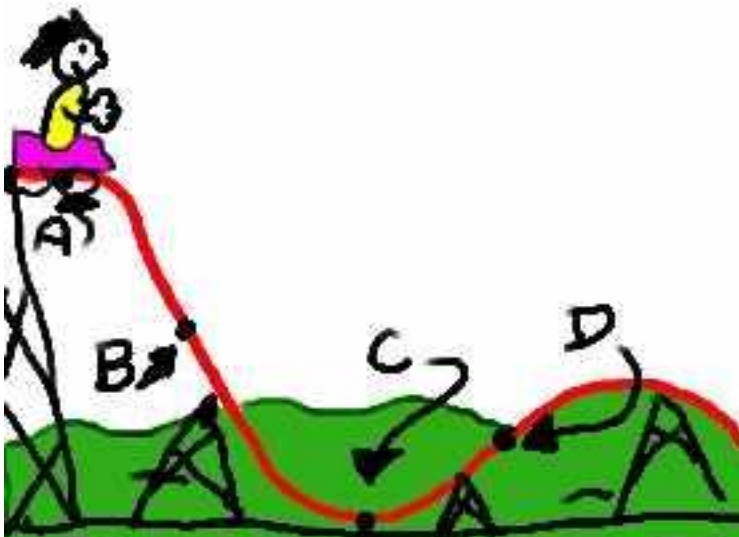
11. Name two simple machines:

a.

b.

12. A lever has three parts. Circle all that apply:

- a. Fulcrum
- b. Weight
- c. Load
- d. Effort



13. Where is the potential energy greatest?

Energy Grade 4 Lab Practical

Teacher's Answer Key

This is your chance to see how well your students have picked up on important key concepts, and if there are any holes. Your students also will be working on their homework assignment as you do this test individually with the students.

Materials:

- Weight (like a rock)
- Dowel or yardstick
- Tape (to keep the rock on the yardstick)

Lab Practical: Ask the student *Note: Answers given in italics!*

- You will make a simple machine out of only these materials. Pretend the boulder weights four times your weight. How can you move the boulder with only a long plank of wood (the yardstick) and you? *The student will place the boulder on the end of the yardstick, and put a fulcrum, like their hand, close to the boulder. They will then push down on the other end of the yardstick and the rock moves up one fourth the distance that their hand pushes down on the yardstick end.*
- Give three examples of simple machines you use every day. *Scissors, screws, jam jar lids, ramps, a wedge in the door to hold it open, pliers, pulleys, and more!*

Energy Grade 4 Lab Practical

Student Worksheet

This is your chance to show how much you have picked up on important key concepts, and if there are any holes. You also will be working on a homework assignment as you do this test individually with a teacher.

Materials:

- Weight (like a rock)
- Dowel or yardstick
- Tape (to keep the rock on the yardstick)

Lab Practical:

- You will make a simple machine out of only these materials. Pretend the boulder weighs four times your weight. How can you move the boulder with only a long plank of wood (the yardstick) and you?

- Give three examples of simple machines you use every day.