

ENERGY

GRADE 6

ASSESSMENT PACKET

Energy is the mover and shaker of the universe. Heat from the sun, sounds from your radio, riding a bike and watching a movie are all expressions of different forms of energy. We're going to focus on simple machines (pulleys, levers, and pendulums) that make use of mechanical advantage as well as studying several methods of finding, converting, storing and using alternative energy.



Created by Aurora Lipper, Supercharged Science

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

Educational Goals

Energy is the mover and shaker of the universe. Heat from the sun, sounds from your radio, riding a bike and watching a movie are all expressions of different forms of energy. As you sit there reading this, there is energy flowing all around you in the form of light waves, sound waves, radio waves, heat and more. You are constantly being bombarded by energy. Energy is everywhere, all the time. We're going to focus on simple machines (pulleys, levers, and pendulums) that make use of mechanical advantage as well as studying several methods of finding, converting, storing and using alternative energy.

Here are the scientific concepts:

- Energy can be carried from one place to another by heat flow, or by waves including water waves, light and sound, or by moving objects.
- When fuel is consumed, most of the energy released becomes heat energy.
- Heat flows in solids by conduction (which involves no flow of matter) and in fluids by conduction and also by convection (which involves flow of matter).
- Heat energy is also transferred between objects by radiation; radiation can travel through space.
- The sun is the major source of energy for phenomena on the Earth's surface, powering winds, ocean currents, and the water cycle.
- Solar energy reaches Earth through radiation, mostly in the form of visible light.
- Heat from Earth's interior reaches the surface primarily through convection.
- Convection currents distribute heat in the atmosphere and oceans.
- Differences in pressure, heat, air movement, and humidity result in changes of weather.
- The utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.
- Different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and classify them as renewable or nonrenewable.
- Natural origin of the materials used to make common objects.
- Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.
- A system of objects may also contain stored (potential) energy, depending on their relative positions.
- Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.
- When the motion energy of an object changes, there is inevitably some other change in energy at the same time.
- The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.
- Energy is spontaneously transferred out of hotter regions or objects and into colder ones.
- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.

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

- Know how to demonstrate how solar energy reaches Earth through radiation, mostly in the form of visible light.
- Understand how to determine that energy can be carried from one place to another by waves, such as water waves and sound, by electric current, and by moving objects.
- 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 6 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.
- Heat moves in a predictable flow from warmer objects to cooler objects until all objects are at the same temperature.
- Energy can be carried from one place to another by heat flow, or by waves including water waves, light and sound, or by moving objects.
- When fuel is consumed, most of the energy released becomes heat energy.
- Heat flows in solids by conduction (which involves no flow of matter) and in fluids by conduction and also by convection (which involves flow of matter).
- The sun is the major source of energy for phenomena on the Earth's surface, powering winds, ocean currents, and the water cycle.
- Solar energy reaches Earth through radiation, mostly in the form of visible light.
- The utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.

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)
- Something that weighs 100 grams (like an apple)
- A meter stick
- A calculator
- Scale

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.

Students will also demonstrate individually that they know how to measure energy output and work with the specific unit of Joules. 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 6 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.

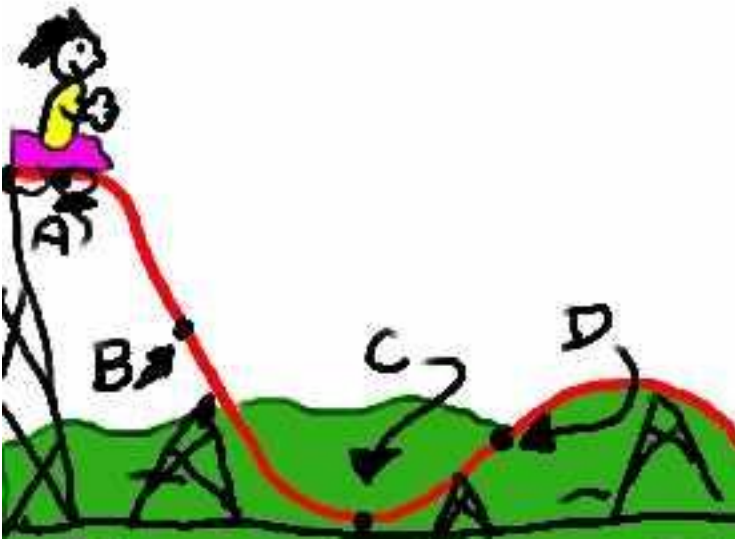
Lab Test & Homework

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 6 Quiz

Teacher's Answer Key

1. Fill in the blank: A battery produces _____ energy from _____ energy. (electrical, chemical)
2. Name two ways energy is transferred: (heat, sound, radiation, etc.)
3. What is one way to describe energy? (the ability to do work)
4. Work is when something moves when: (Energy is used over a distance.)
5. Name two simple machines: (lever, pulley, inclined plane)
6. A lever has three parts. Circle all that apply: (fulcrum, load, effort)



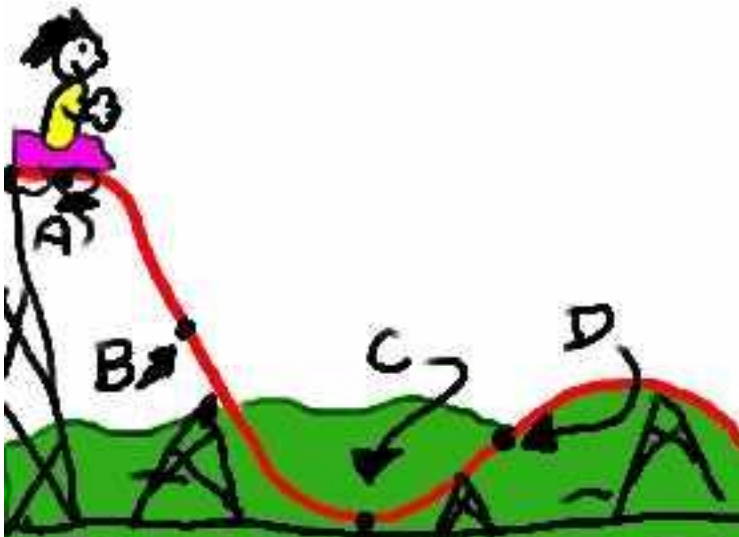
7. Where is the potential energy greatest in the above image? (A)
8. What units do we use to measure energy? (Joules)
9. True or False: Water is poor at absorbing heat energy. (false)
10. True or False: A molecule that heats up will move faster. (true)
11. True or False: A material will be less dense at lower temperatures. (false)
12. If something has a weight of 2 Newtons and is moved half a meter, how many Joules of energy are used? (1 Joule)
13. What is work? (force times distance)
14. What is power? (work over time)

Energy Grade 6 Quiz

Student Quiz Sheet

Name _____

1. Fill in the blank: A battery produces _____ energy from _____ energy.
2. Name two ways energy is transferred:
 - a.
 - b.
3. 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
4. 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
5. Name two simple machines:
 - a.
 - b.
6. A lever has three parts. Circle all that apply:
 - a. Fulcrum
 - b. Weight
 - c. Load
 - d. Effort



7. Where is the potential energy greatest in the above image?
8. What units do we use to measure energy?
 - a. Kilowatts
 - b. Joules
 - c. Newtons
 - d. Kilowatt-hours
9. True or False: Water is poor at absorbing heat energy.
 - a. True
 - b. False

10. True or False: A molecule that heats up will move faster.

- a. True
- b. False

11. True or False: A material will be less dense at lower temperatures.

- a. True
- b. False

12. If something has a weight of 2 Newtons and is moved half a meter, how many Joules of energy are used?
Show your work.

13. What is work?

- a. Force divided by distance
- b. Force times distance
- c. Energy required for power
- d. Kinetic and potential energy

14. What is power?

- a. Work divided by time
- b. Work multiplied by time
- c. Energy used in an exercise
- d. Calories over time

Energy Grade 6 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)
- Something that weighs 100 grams (like an apple)
- A meter stick
- A calculator
- Scale

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

1. 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.
2. 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!*

You will demonstrate that you know how energy is measured and how work is done using the materials.

3. In your own words describe what work is. *Work happens when something moves a distance against a force. Do you ever climb stairs, walk, ride a bicycle, or lift a fork to your mouth to eat? Of course you do. Each one of those things requires you to move something a distance against a force.*
4. Measure the weight of the object in grams. Record your measurement here: *Answers vary.*
5. Move the object one meter 5 times. How much work did you do? Record your data here: *Answers vary, but here's a sample:*

$$\text{Mass} = 100 \text{ g} = 0.1 \text{ kg, so Weight} = \text{mass} \times \text{gravity} = 0.1 \text{ kg} \times 9.81 \text{ m/s}^2 = 0.981 \text{ N}$$

$$\text{Work} = \text{Force} \times \text{Distance} = 0.981 \text{ N} \times 1 \text{ meter} \times 5 = \underline{4.9 \text{ Joules}}$$

Energy Grade 6 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)
- Something that weighs 100 grams (like an apple)
- A meter stick
- A calculator
- Scale

Lab Practical:

1. 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?

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

You will demonstrate that you know how energy is measured and how work is done using the materials.

3. In your own words describe what work is.

4. Measure the weight of the object in grams. Record your measurement here:

Move the object one meter 5 times. How much work did you do? Record your data on the reverse side.