

Science Explorers: Energy lesson #1

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## Title: What is energy, energy conservation, energy conversion

Goal: Encourage the student to start identifying the energy that is around them. Give them a context of thinking about kinetic (“motional energy”) AND potential (“stored”, “hidden”) energy. Emphasize the idea that energy cannot be created or destroyed. But one type of energy can be converted to another type of energy.

Prepwork:

1) Read lesson plan in advance. Each tutor will ideally work with 2 students. Your students should either be in 2nd/3rd OR 4th/5th (i.e. do not mix 2nd/5th...)

2) When you arrive to the class, make sure you have the following supplies for your group.

- markers/crayons (supplied by CDSA)
- 1 pen or pencil/person (supplied by CDSA)
- 1 sheet of scrap paper to rip up/group (supplied by CDSA)
- knowledge of where to find scotch tape when needed (supplied by CDSA)
- 1 rubber band/student
- 1 bouncy ball/student
- 1 pair of scissors/group
- 2 balloons/student (one to take home)
- 2 straws/student (one to take home)
- 1 windmill worksheet/student
- 10-20 ft of kite string/group
- 1 thumbtack/student
- 1 new pencil/student (unsharpened)
- 1 general worksheet/student
- copy of lesson plan

Note: Activities 2 and 3 can be swapped. Feel free to ask the students which one they would like to do first.

### Activity 1: Introduction to energy, kinetic (motional) and potential (stored)

#### **Supplies: worksheet, bouncy balls, rubber band, scrap paper**

Ask the students what they think energy is. Note that this is a tricky question. A quick look on wikipedia yields the following Feynman quote "*It is important to realize that in physics today, we have no knowledge what energy is. We do not have a picture that energy comes in little blobs of a definite amount.*" But let them think about it and talk about it. One could use phrases like "energy is motion or things happening" or the "ability to make them happen".

Next ask the students to name different types of energy. Have them, or help them, write down the types they come up with on their sheet of paper. Help them categorize the energy into motional (me jumping up and down, water flowing over a dam, wind blowing) and stored/hidden (gravity or stuff high up, a battery, food)

Now with your bouncy balls/rubber bands do experiments. Here are some things you can try.

- Have the students hold their ball high but still. Ask them if it has energy. Let them drop it. Ask them if the ball had energy when they let go (hopefully they will say yes). Explain that this means that it had energy when it was still but up high- just the energy was potential/stored/hidden. This energy is gravitational energy.
- One student can hold both balls and drop them from different heights. Which goes faster? Which bounces higher? Why?
- Let them compare dropping a ball and throwing a ball of the ground. Which has more energy? Where does the energy come from?
- Put the ball on floor or table. Give it an initial velocity by knocking it with finger. First, knock it slightly, then hard. See for which time it can go faster. Where does the energy come from?
- Shoot a wad of paper with rubber bands across the room. Again, when the rubber band is stretched but not let do- is their energy? Where? (this is elastic energy).
- To be more quantitative fix one end of the rubber band on the table and pull back the rubber band different amounts to see how far the wad of paper goes.
- If you are ambitious, play with different size wads of paper. Pull the rubber band back the same amount for each. Which goes further? Which had more energy? Hopefully you will see the smaller wad go further. But it did not have more energy! All the energy came from the rubber band which was pulled back the same amount both times.
- Let the student throw the paper. Ask them where they the energy came from. Go as far back as you like. For example: paper moving-> student/muscles contracting ->food ->animal ->plant->sun.

Bonus- can play with basketball/tennis ball experiment if tutors bring them.

[http://www.ap.smu.ca/demos/index.php?option=com\\_content&view=article&id=78](http://www.ap.smu.ca/demos/index.php?option=com_content&view=article&id=78).

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### Activity 2: Making windmills: Energy can come from wind

**Supplies: windmill worksheet, thumbtacks, pencil, markers/crayons, scissors**

1) Look at the picture of a windmill that is attached to their worksheet. Ask questions such as.

- What is this?
- Windmill (expected answer).
- Do you know what is a windmill used for?
- Generating electricity, pumping water for irrigation, milling grain, etc.
- Do you know how does it work?
- With the help of wind.
- Why people use wind?
- Wind is free, low cost. No requirement for fuel. No toxic products. Renewable, etc.
- Do you want to have your own windmill and see how it works?

(A reference website for the knowledge of windmill:

<http://www.windmillgallery.com/applications/applications.html>)

2) Next- make the windmill! If the students would like, they can color the windmill first so it will be more attractive. Instructions are on the worksheet and at <http://www.stem-works.com/external/activity/159>

3) Finally: Ask them how they can make it move. (use breath or touch with finger). Introduce the concept again of converting one kind of energy to another. If they haven't done so, let them add wind to their types of energy worksheet.

### Activity 3: Balloon rockets: Energy can materials that are stretched

**Supplies: general worksheet, balloons, string, tape, straw**

1) Blow up a balloon (or pump it up- I'll try to remember my balloon pump). Hold it still. Ask them if the balloon has energy? Ask them what will happen if you let go. Let them play some with the balloons making observations. (Which balloon has more energy, a small one or a big one? Can you make the balloon go straight? etc.)

2) Make a balloon rocket. One the back of the students take-home worksheet are instructions for the balloon experiment taken from

<http://www.sciencebob.com/experiments/balloonrocket.php>

It will probably be easiest to tie the string to two chairs. Two groups could tie their lines next to each other to do competitions. There are example questions to explore on the worksheet but probably the easiest one would be, how does the distance or speed depend on how much you blow up the balloon? If you have a particularly quantitative kid you could try to make a table (or graph!) with length of balloon v. distance travelled!

### Lesson wrap up:

On the worksheet have the students answer the follow-up questions.

Explain their "homework" which is listed on the sheet..

- 1) Show their windmill to a parent/sibling/friend and explain how it works
- 2) Make a balloon rocket at home! Give them a balloon and straw. Ask them if they need string.