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# Introduction

Energy. It is a basic, intrinsic part of our lives. It surrounds us, permeates our every effort. Yet how often do we recognise its existence, its importance, in our lives? It seems to take an oil crisis or a personal illness for us to appreciate the energy we routinely use. Even then we are only partially aware of what it is we are missing. A thorough understanding of energy is crucial to our understanding of world issues such as global warming, energy sources and their impact on our environment, and the economic competitiveness of nations. An understanding of energy also applies to personal issues such as how we take care of and express ourselves.

Instead of waiting until high school or university physics to introduce students to energy, this unit introduces energy to younger students. The intent is to acquaint your students with the ideas and vocabulary associated with energy without inundating them with details and precision measurements. In this way, they are more apt to take the high school or university courses where they can learn the details.

The interdisciplinary nature of these units addresses the broad impact of energy on our lives. It is aimed at teachers who plan or teach as part of an interdisciplinary team. Each unit is centred around a science experiment which is reinforced through a set of related lessons in the areas of maths, social studies, and English. These lessons are intended to supplement the information normally taught in these subjects, not teach specific skills. For example, English lesson five is a research and writing exercise but does not attempt to teach specific library research or writing skills.

## Subject Notes

### Science

The science lessons require quite a few materials not normally found around schools. Therefore, great care was taken to choose inexpensive materials. A list of these materials can be found in Appendix A.

### Maths

In order to cover a wide range of abilities, most worksheets have problems that range in complexity, starting with the simplest and progressing to the most complex. You, the teacher, should review the questions and select the range appropriate for your students' abilities. Specifically, the problems are aimed at problem solving and higher-order thinking rather than drill and practice. Many of the problems are presented as story problems. Finally, since the maths lessons build on the concrete experiences of the science lessons, it is important that the children receive the science lesson before the corresponding maths lesson.

### English

Lesson eight requires a prerecorded commercial be played for your students.

### Social Studies

Lesson eight recommends obtaining a copy of *The War of the Worlds* prior to class. Lesson nine requires homework be assigned and completed before the lesson is taught.

 

# Introduction to Potential and Kinetic Energy: Part 1

**Knowledge Objective:**

Students will understand the fundamental differences between potential and kinetic energy, as well as their relationship to each other.

**Materials Needed:**

- 1 inanimate object, such as a ball

enough of the following for each group of students:

- tape measures
- toy cars
- pieces of track
- Science Worksheet 1.1

## Activity

### Management Tips

The potential to kinetic energy transfer experiment requires enough room to allow the cars to stop and their distance to be measured without interference from neighbouring groups.

### Introduction

Ask your students their opinions on what energy is. Have them give examples of things with energy. Record this list on butcher's paper or the whiteboard. Ask them why they think the things on the list have energy while others do not. It should be apparent that things that move or get hot have energy.

### Motivation

Hold some inanimate object up in front of your class, such as a ball. Solicit opinions on whether it has energy. Drop the object and state that it just did something. It moved. For the object to have moved, it must have had energy. Where did the energy come from? The person who dropped the object simply released it and did not throw it.

### Body

In this lesson the concept of transferring energy from one source to another is not necessary. Although your students may guess the object's energy came from the person picking up the object, the focus should be on the two categories of energy: potential and kinetic.

While holding the object up about waist high, get your class to agree it does have energy. The object has the potential to do something. This "potential to do something" is termed potential energy. Drop the object and observe what happens. It does something for some time, then stops. (Gloss over the idea that external forces, such as friction, dissipated the kinetic energy and caused it to stop.) Does it have potential energy now? Where did the potential energy go?

# FYI: Potential and Kinetic Energy

The word energy is from the Greek word *energia* which means "in-work." Energy is the ability to do work. Energy manifests itself in many ways.

- Chemical energy in petrol
- Electrical energy available in our homes
- Nuclear energy within atoms
- Physical energy in the water behind a dam
- Magnetic energy in magnets

In each of these examples there is an ability to do work, which we call energy. Notice that energy is simply the ability to do work. Depending on whether or not work is being performed, energy is classified into two categories.

If work is not presently being performed, we call the energy potential energy. (Potential is from the Latin word *potens*, to be powerful or able.)

If work is being performed, we call the energy kinetic energy. (Kinetic is from the Greek word *kinetos*, which means moving.)

For example, water behind a dam is considered potential energy until it is released. Potential energy is often called energy at rest.

As the water falls over the spillway, we call the ability of the falling water to do work kinetic energy. Kinetic energy is often called the energy of motion.

 