10.0 Getting Started

Figure 10.1 Astronaut Dr. Dave Williams holds the Canadian record for hours spent outside the International Space Station.

Your environment includes the atmosphere — a thick layer of air that protects you from the strong energy of the Sun and other objects in space. To work in space, outside the space shuttle, Canadian astronaut Dr. Dave Williams needed to take his environment with him (Figure 10.1).

An astronaut's spacesuit provides protection from the extreme heat and cold of space. The side of the suit facing the Sun may be heated to a temperature as high as 120°C. The other side, exposed to the darkness of deep space, may get as cold as −160°C.

These extreme temperatures never occur on Earth, where the temperature ranges from about −89°C to about 57°C. The coldest temperature ever recorded in Canada was −63°C in Snag, in Yukon Territory, on February 3, 1947. The hottest day on record in Canada was in Saskatchewan on July 5, 1937; the temperature reached a scorching 45°C.

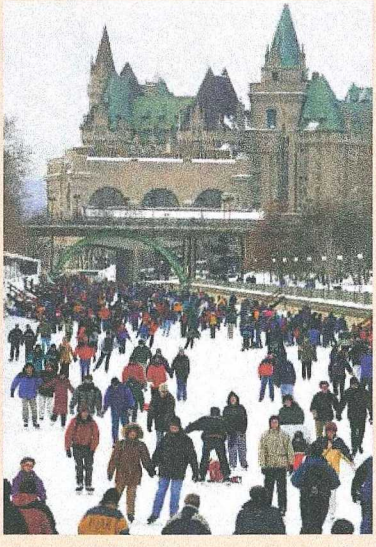


Figure 10.2 Cold temperatures are useful for some outdoor activities.

Canadians often talk about how hot or how cold it is outside, and heat plays many roles in our daily activities (Figures 10.2 and 10.3). At school, at home, in a car, or out shopping, you need to know how to control heat so that you can feel comfortable.

Producing, using, and controlling heat helps people survive around the world. People also use heat in manufacturing and other industries. However, some of the methods used to produce heat can harm plants, animals, and other living things in the environment.

Canadians are working to reduce the harmful effects of heat in the environment. To play your part, you need to understand what heat is and its impact on our planet. In this chapter, you will learn about heat, thermal energy, and temperature.

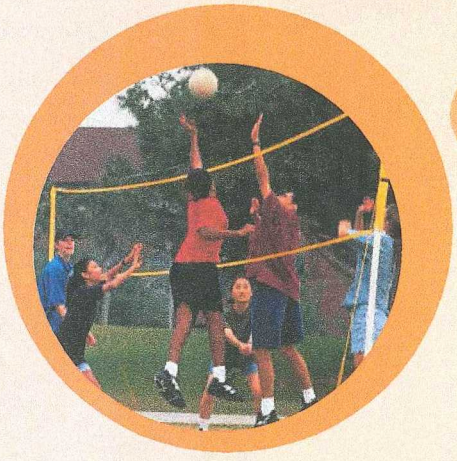


Figure 10.3 A warm, sunny day is a great time to be outside.

D3 Quick Lab

What Is Hot? What Is Not?

Purpose

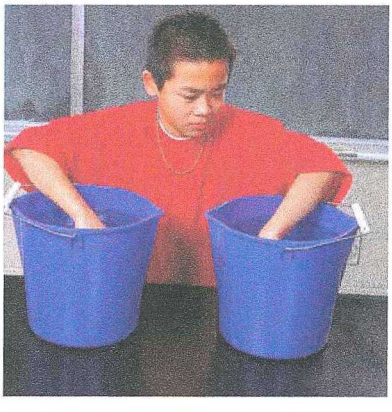
To compare sensations of hot and cold under different conditions

Materials & Equipment

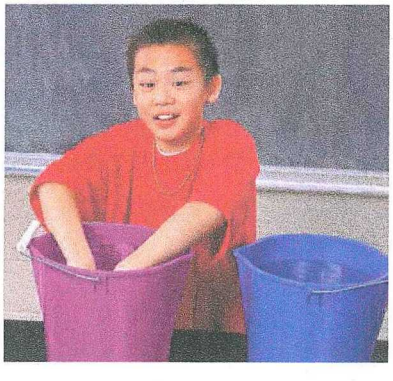
- 3 buckets or other containers
- stopwatch or clock
- water: cold, warm, and room temperature

Procedure

1. At the same time, stick one hand into a container of cold water and the other into a container of warm water (Figure 10.4(a)).
2. Keep your hands submerged for 1 min.
3. During the minute, predict what your hands might feel like when you place them into a third container of water at room temperature. Have a classmate record your prediction.
4. After 1 min, place both hands into a third container of water at room temperature (Figure 10.4(b)).



(a)



(b)

Figure 10.4

Question

5. Was your prediction in step 3 correct? Try to explain what happened and record your explanation.

Forms of Energy

Energy is the ability to make objects move. For example, the energy stored in fuels like gasoline can be used to make a car move. The energy in gasoline is a form of energy called chemical energy. There are 10 forms of energy, as shown in Figure 10.6.

Take It Further

Choose one of the types of energy shown below. Research ways in which people use this type of energy in everyday life. Begin your search at ScienceSource.

Figure 10.6 (a) Thermal energy is the total energy of the moving particles in a solid, a liquid, or a gas.

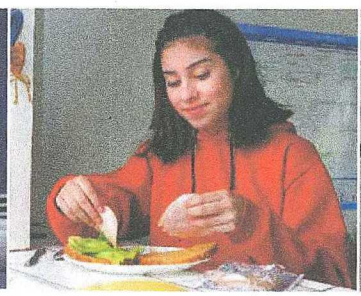


Figure 10.6 (b) Chemical energy is the energy stored in matter such as food, fuels, and clothing.

Figure 10.6 (c) Magnetic energy (magnetism) is the energy that causes some types of metal, such as iron, to attract or push away from certain other metals.

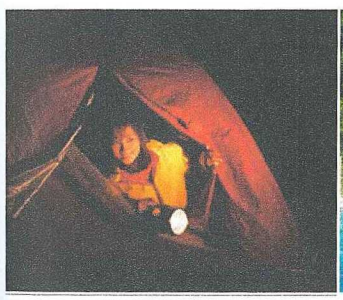


Figure 10.6 (d) Light energy is the form of energy that our eyes can detect.

Figure 10.6 (e) Gravitational energy is the stored energy an object has when it is above Earth's surface.

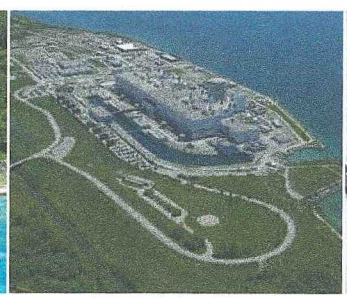


Figure 10.6 (f) Nuclear energy is the stored energy at the centre of particles of matter. Nuclear power plants produce electricity from nuclear energy.

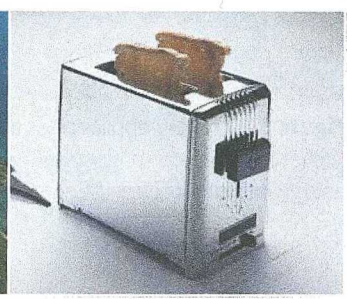


Figure 10.6 (g) Electrical energy (electricity) is the energy of particles moving through a wire or through an electrical device.

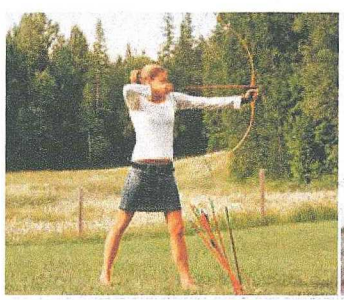


Figure 10.6 (h) Elastic energy is the energy stored in objects that are stretched, compressed, bent, or twisted.

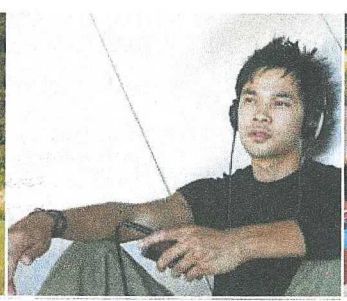


Figure 10.6 (i) Sound energy is the form of energy that we can hear.

Figure 10.6 (j) Mechanical energy is the energy of objects in motion.

D5 Learning Checkpoint

Ten Terrific Forms of Energy

1. Name all 10 forms of energy.
2. Which forms of energy are used and produced when you:
   (a) listen to your MP3 player?
   (b) surf the Internet?
   (c) prepare dinner using a kitchen stove that burns natural gas?
3. Identify the form(s) of energy that are described in the following situations. You may need to list more than one form of energy for some of these.
   (a) playing a violin
   (b) throwing a baseball
   (c) stretching an elastic band

Figure 10.7 Every appliance in this kitchen can transform electrical energy into other forms of energy.

Energy Transformations

An **energy transformation** is a change from one form of energy to another. When you eat a banana, your body breaks down the chemicals in the food. This process releases the stored chemical energy. Your body can transform the chemical energy into thermal energy that keeps you warm and comfortable.

Energy is being transformed around you continuously. The ceiling lights transform electrical energy (electricity) into light. Moving automobiles transform the chemical energy of gasoline into mechanical energy. All of the appliances in Figure 10.7 transform one form of energy into another.

Suggested Activity
D6 Inquiry Activity on page 285

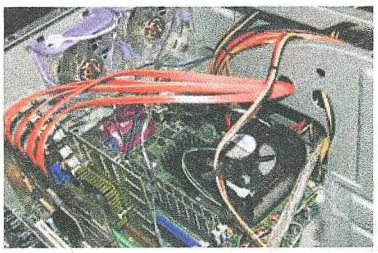


Figure 10.8 The devices inside a computer transform electrical energy into mechanical energy, light energy, magnetic energy, sound energy, and thermal energy.

Hidden Energy

Consider the energy transformations inside a laptop or desktop computer (Figure 10.8). The spinning hard drive transforms electricity into mechanical energy. Some of the mechanical energy produces thermal energy. This is one of the reasons why the outer case of your computer feels warm. The hard drive also transforms electricity into magnetic energy to store your important data. You can hear the whirring of the computer's fan converting electrical energy into mechanical energy and sound. The DVD or CD drive uses the light energy of a small laser to read or burn information. All of these are examples of energy transformations that are hidden.