

The lifespans of structures need to be considered to make responsible decisions.



People buy things, use them for awhile, then discard them. Scrap metal (shown here), aluminum, paper, glass, and plastic are separated from each other and recycled.



What You Will Learn

In this chapter, you will:

- describe factors that make a structure aesthetically appealing
- recognize and describe the lifespan of familiar structures

Skills You Will Use

In this chapter, you will:

- analyze the role of consumers in the manufacture of structures
- make a personal plan of action with respect to lessening your impact on the environment

Why This Is Important

Every decision you make about purchasing something can affect Earth. Many purchases come in some kind of packaging. Sometimes we purchase things we do not really need. Most of our purchases end up as waste. Understanding these issues will help you make responsible decisions.

Before Writing



Question and Answer Pattern

Writers of nonfiction use a variety of organizational patterns to communicate information and ideas. They try to choose a pattern that will give readers what they want or need to know about a topic. Sometimes writers use the pattern of asking and answering questions. Scan Unit B for headings that appear as questions. Do answers directly follow the questions? Why might the writer have chosen this pattern for organizing this topic? Where else have you seen this pattern used?

Key Terms

- consumer
- manufacturer
- market research
- lifespan

6.0 Getting Started



Figure 6.1 Technology allows people to communicate in a wide variety of places and situations.



It is difficult to imagine a time without telephones! In the 1870s, Elisha Gray and Alexander Graham Bell experimented with devices that could transmit speech electronically. Bell was the first to patent the invention. Back then, no one could walk around outside while talking on the phone (Figure 6.1). Early phones were large and bolted to the wall (Figure 6.2).

These days, many families have more than one telephone. There may be an extension in every room. Some families have a cellphone for each member. What happens to all of the old phones? Landfill sites contain many old phones, along with television sets, computers, clothes, and plastic toys (Figure 6.3).

Figure 6.2 The design of telephones has changed over the years. Early in the 20th century, you paid for each call. Your calls would be shorter and mainly to give information. Now, calls are much longer, as people use the phone to “keep in touch.”

Many of these products still worked when they were discarded. Perhaps they were replaced by newer models. Perhaps they outgrew their usefulness to their owner but could have been useful to someone else.

What makes someone buy a new phone? For some people, it is because the old phone broke. For other people, it is because a newer model came along. In this section, you will consider some of these issues.

Some of the ideas in this chapter will generate different points of view. It is important to think about each idea. Discussing ideas openly and respectfully, especially with people who may not agree with you, is a good way to gain insight.



Figure 6.3 Old cellphones end up in landfill sites.

B36 Quick Lab

How Many Phones?

Purpose

To examine the impact of one technology on the environment

Materials & Equipment

- an old telephone
- paper and pencil

Procedure

1. Examine the phone and make a list of the materials you observe in its construction.
2. Write how you think phones are disposed of when they are no longer useful.
3. Estimate the number of phones your family owns at the present time.

Questions

4. How might you estimate the number of phones owned by the families in your class? How might you do this for your entire school?
5. Estimate the number of telephones that are owned by families in Canada.
6. How do you think you could estimate the number of business phones in Canada? Should it be half, the same, double, or more? Imagine a pile of all the phones in Canada. What would it look like?
7. Find out if phones can be recycled when no longer useful.

6.1

Determining Consumer Need

Here is a summary of what you will learn in this section:

- Manufacturers try to determine consumer need in order to make good decisions about products.
- Consumers make purchases based on needs and wants.
- Ergonomics may be a consideration in some purchases.
- Consumers can influence manufacturers to make good products.

You are a **consumer**, a buyer of things (Figure 6.4). Each time you buy something, you have made a decision. Sometimes the decision is small, such as the type of drink you would like with your lunch. At other times, your decision might be bigger, such as an item of clothing or a bicycle. Some day, you may make a decision to buy (or not buy) a car. You may purchase a home. How do people make these decisions, and why are manufacturers so interested in your decision making?

In this section, you will answer these questions and learn about the relationship between manufacturers and consumers.



Figure 6.4 A shopping mall is one place where consumers make decisions about purchases.

B37 Starting Point

Skills **A** **C**



Reading Advertisements

Collect advertisements for jeans from magazines, newspapers, and flyers. If you could pick any one of the pairs of jeans to have for your own, which one would you pick? Why? Discuss the reasons for your choice with a partner.

Manufacturers

Manufacturers are interested in what you think. They want to produce products that you will want to buy. They hope that, even if you are not in charge of buying a particular product, your family will be influenced by what you think.

Manufacturers have to sell their products in order to remain in business (Figure 6.5). However, there are many manufacturers, and each one wants you to choose its product. You, as the consumer, have to make the decisions about how you will spend your money. Manufacturers know that each consumer has a limited amount of money to make purchases, so they compete for “the consumer dollar” through advertising campaigns.

Market Research

Before manufacturers design a new product, they need to be reasonably sure that someone will want to buy it. They do not want to commit a lot of time and resources to manufacturing the product just to find that no one wants it. Shoes are an example. Before designing yet another brand of running shoes, the manufacturer has to gather and evaluate some data. This is called **market research** (Figure 6.6).

You may have been asked to answer questions for a survey at a mall, on the telephone, or on the Internet. Market researchers ask people to give an opinion so that they understand what consumers are thinking. The researchers report to the manufacturer on whether they think that people will buy those shoes.

These days, technology is an important part of gathering market research. Each time a consumer uses a credit, debit, or point collection card, information is entered into an enormous database. This information reveals important trends, such as the popularity of certain brands or colours.

Consumers are becoming increasingly concerned about the environment, so many manufacturers have designed products to meet this demand. Your favourite stores may have switched to reusable shopping bags instead of thin, disposable plastic bags. You can also find clothing made from materials such as seaweed and bamboo.



Figure 6.5 Some manufacturers store products in warehouses like this one.



Figure 6.6 Market researchers often survey shoppers in malls.

Suggested Activity • • • • •

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Advertising

Manufacturers use many different ways to convince you that their product is best. Some advertise on radio or television, in magazines, and on the Internet (Figure 6.7). Some provide incentives such as mail-in rebates to try to convince consumers that they are getting a good deal. Some hire famous people to endorse their products. They think that consumers will feel that products endorsed by celebrities have more status.

Figure 6.7 Internet use has brought new forms of advertising: pop-up ads, banner ads, and hover ads.

B38 During Writing

Thinking
Literacy

Anticipating Readers' Questions

Throughout this chapter, you will consider the impact of choosing “greener options” in your everyday life. Researchers in science and technology have developed many ways to recycle used and discarded products into new, useful materials and products.

Work with a partner to create a list of possible questions and answers you think readers may have about recycled materials and products. You will need to make some decisions about

audience and format before you begin. Will your audience be the other students in your class, parents in the community, or someone else? Will you use a poster, brochure, or other format? The choices you make will help you decide on the questions you will ask. Develop an outline or graphic organizer to record possible questions. As you read more of this chapter, use this organizer to keep track of information and ideas that will help you answer your questions.

Being a Wise Consumer

When consumers are faced with decisions about what to buy, they need to use certain skills in order to make good choices. If you were interested in buying a car, you would probably take the car for a test drive. If the car will be used by your whole family, you may take everyone with you to make sure the car has enough space for car seats or pets.

Even with small purchases, you should take the item for a “test drive.” If you were buying a cellphone, you may hold different phones in your hands to see how they feel. You may dial a few numbers to see if the keypad is easy to use (Figure 6.8). You might call a friend to test the sound quality. All of these tests give you more information so that you can make a wise decision.

WORDS MATTER

“Wise” is an adjective that is related to the noun “wisdom.” Some people say that wisdom is a combination of knowledge plus experience.



Figure 6.8 Some people prefer a large keypad while others prefer a smaller one.

Another part of being a wise consumer is to let manufacturers know if you are unhappy with a purchase. Most manufacturers are eager to improve products if people have problems with them. Perhaps the running shoes you bought came with weak laces that broke the third time you tied them. Maybe you accidentally turn your cellphone off every time you put it into your pocket. You could let the manufacturers know about these issues by phoning, e-mailing, or writing them.

Needs and Wants

Have you ever asked for something by saying “Please, please, I really need it”? Your mom or dad may have disagreed with you about whether you actually “needed” the expensive running shoes or just “wanted” them (Figure 6.9). Sometimes you have to decide whether you need something or just want it.

It is easy to become confused about whether something is a need or a want. People need certain things to stay alive. The basic needs are food, water, oxygen, energy, and a suitable habitat. Where do fancy shoes fit in?



Figure 6.9 Often, it is difficult to tell one brand of shoe from another.

Take It Further

Organizations such as Industry Canada or Consumers Union try to make it easier for consumers to make decisions about buying products. They often test products to see if they live up to their claims or prepare questions for consumers to consider when they are deciding to buy certain items. Find out what one of these organizations (or a similar one) says about cellphones. Begin your search at ScienceSource.

Suggested Activity

B40 Quick Lab on page 160



Figure 6.10 Some people like antique cars because of their aesthetic quality.

Aesthetics

Sometimes it is not the strength or stability of a structure that makes a consumer decide to buy it. Sometimes it is “just something about the way it looks.” You might like the colour. You might like the shape. You might pick it because it has an aesthetic quality that appeals to you. Antique cars, like the one shown in Figure 6.10, appeal to some people, while other people just want a car that will get them from one place to another.

Ergonomics

A well-designed product is a pleasure to use. When scientific research is used in the design of the product, manufacturers often add the label “ergonomically designed” to the packaging. Some consumers consider this very important, especially for products that are used over and over again. Items from pens to seats can be designed to minimize stress on the human body when they are used.



Figure 6.11 Many buildings have ramps leading to the doorways.

Universal Design

Designers have become much more conscious of the concept of universal design. The term “universal design” refers to structures that can be useful to many different users. For example, in the past, people thought that ramps and doors that open at the push of a button were just for people in wheelchairs (Figure 6.11). However, these features are equally useful to older people, people pushing strollers, and people carrying large loads.

- Asking questions
- Reporting results

Surveying the Market

Surveys. You may get them in the mail. Your school might send them home to gather information. You might be sent one by e-mail after visiting a retailer. Manufacturers often survey the general public to find out if a new product will sell.

Question

To develop a survey to collect information that would be useful to a manufacturer who is developing a product to meet a societal need

Materials & Equipment

- pencil
- paper
- access to computer
- examples of surveys

Design and Conduct Your Investigation

1. Look over examples of surveys to see how other people write them.
2. Work with a partner to think of a societal need, such as the need to increase home composting, the need to reduce the use of electricity, the need to prevent injury when using electronic devices, or something else that interests you.
3. Design a survey form that you could use to gather information about whether this need concerns your peers and what product they would require to meet this need.
4. Make a draft of your survey questions, paying attention to the following:
 - (a) Does your form protect people's privacy and encourage honest reflection?
 - (b) Will your questions provide data that you can analyze and graph?
 - (c) Is there a way for people to give you "comments"?
 - (d) Will people be able to complete the survey quickly and accurately?
 - (e) Will you leave the survey with people for them to complete on their own, or will you ask each individual the questions and record the answers yourself?
 - (f) Will you provide an incentive for people to respond to your survey?
 - (g) Can you use a method that does not involve pencil and paper to collect the information?
5. Design a one-page form in an attractive, easy-to-use format. You may use a computer and word processing software.
6. Decide with your teacher who you will ask to fill out your survey. Conduct the research.
7. Examine your completed surveys. Decide on a method to organize your data so it can be analyzed.
8. Complete the data analysis.
9. Write a paragraph that summarizes your findings.
10. Based on your findings, what course of action would you follow in the development of your product?

Wise Choices



Figure 6.12 Advertisements are designed to convince consumers to buy that particular product.

Before you buy a product, you have to decide which brand you want at which price. Picking the right one takes some research.

Purpose

To create a checklist of considerations for purchasing a cellphone

Materials & Equipment

- pencil
- paper
- highlighter

Procedure

1. On a piece of paper, make a list of all of the things you would like your ideal cellphone to do (Figure 6.12). For example, you may want your phone to act as a camera too.
2. On the same piece of paper, make a list of all the physical features you would like your ideal phone to have. For example, you may want your phone to have a durable shell because you may drop it.
3. Highlight each item on your list that is a “need.” For example, you need to be able to make reliable phone calls. However, a cellphone’s ability to play music may not be a need. Although it is a nice feature, it is not essential to the functioning of the phone. Usually, extra features add to the overall cost of an item. However, they may make a product seem more appealing.

Questions

4. Consider your list with a classmate. Do you have similar needs and wants? Why do you think this is?
5. Some cellphones have many features. Could some of these features be neither a need nor a want?
6. Based on your research, would it be better to buy a telephone plan that includes a free phone, or to buy a cellphone and pay a monthly fee? Are there any other things you should consider?

Key Concept Review

1. Explain the concepts of “ergonomics” and “universal design.” How might they affect buying decisions?
2. Describe how each of the following factors relates to being a wise consumer.
 - (a) advertising
 - (b) needs and wants
 - (c) aesthetics
3. What do you think it means when an object is described as “aesthetically pleasing”? Give three examples of objects you find aesthetically pleasing.
5. Think of items your family uses every day, like facial tissues, soap, or bread. Make a list of the items and list the brands your family usually buys next to each item. If you do not always stick to the same brand, note that too. Why does your family make those purchasing decisions?
6. When you read advertisements, it is sometimes useful to maintain “healthy scepticism.” Why might this be the case?

Connect Your Understanding

4. In order for them to be wise consumers, why should people be aware of how manufacturers think?

Practise Your Skills

7. Imagine that you have been hired to do market research for a manufacturer of sun hats. Prepare three questions you would include in your survey.

For more questions, go to ScienceSource.



B41 Thinking about Science, Technology, and Society



Science and Advertising

Advertisers often use so-called “scientific” claims in order to promote their products.

What to Do

1. Recall three advertisements that use scientific claims.
2. Make a three-column chart to summarize these ads. Use the headings Product, Scientific Claim, and Expert Cited.

Consider This

As a class, discuss the following questions.

3. Why might manufacturers use these types of claims in their advertising?
4. When do you think these types of claims are the most effective?
5. When do these claims make you doubtful?
6. How do scientific claims affect your buying decisions?

Here is a summary of what you will learn in this section:

- Every structure has a lifespan.
- Structures are designed with the lifespan in mind.
- Responsible manufacturers and consumers consider the safe disposal of structures in their decision-making.
- Disposal of structures can affect the environment.



Figure 6.13 You often find baby items at a rummage sale.

When you were born, your parents likely purchased a crib, a highchair, a car seat, and several other things. When you grew older, what became of these items? Perhaps your younger brothers and sisters are using them. Maybe the items were sold or given away when they were not needed anymore.

Some items, such as the highchair, serve a function for a set amount of time. Young children need highchairs from the time they can sit up until they can sit at the table on a regular chair. With other items, the decisions on how to dispose of them are not as easy.

People have several ways of disposing of unwanted products. They can sell them at a garage sale, give them to a friend, or give them to a charity rummage sale (Figure 6.13). They can re-use boxes, jars, and other containers. They can compost organic waste or put it in a green bin. They can recycle glass, paper, plastic, and metal. On the other hand, they can just throw everything out with the garbage.

In this section, you will learn about the lifespans of different structures. You will find out how people decide when and how to dispose of those structures when they no longer need them.

B42 Starting Point

Skills **A** **C**



Where Did It Go?

Think back to your favourite thing when you were young. Did you have a special stuffed animal or a special blanket? You may have photographs of you with your favourite thing, or you may still have it. Write down as much about

your favourite thing as you can. When did you get it? How did you use it? Has it changed since you first got it? If you do not have it any more, why not? Share your memories with a partner.



Everything Has a Lifespan

You may be familiar with the term “lifespan.” Perhaps you learned about lifespans when you studied living things in the past. You understand that every living thing is born, lives, and dies. Did you know that structures have lifespans too?

Think about the lifespan of a pencil or your school building. How are they alike? How are they different? Discuss your ideas with a partner. Be prepared to share your thoughts with the class.

The Lifespan of a Product

Every product has a lifespan. This **lifespan** starts as an idea and goes through several steps before it is even available to consumers. More steps in the lifespan take the product through its use to its disposal. Not all products go through every step in the lifespan, however, as illustrated by the windshield wiper example in Table 6.1 on the next page.

Suggested Activity • • • • •

B45 Decision-Making Analysis on page 167

How Long Should a Product Last?

When manufacturers plan a product, they have to answer this question. If a shoe manufacturer made shoes that wore out quickly, consumers would feel that they did not get their money’s worth. If it made shoes that never wore out, the shoes might cost too much and people would not buy them. If people did buy them, the manufacturer might never sell any more shoes!

When a manufacturer deliberately designs a product with a limited lifespan, it is called **planned obsolescence**. The materials and technology used guarantee that the product will not last as long as the consumer might want. Also, fashion often dictates how long a product will be used. Many people have unfashionable clothing in their closets that they don’t wear any more.



Figure 6.14 These windshield wipers are over 50 years old.



Figure 6.15 Modern windshield wipers are stronger than the old ones.

WORDS MATTER

The noun “obsolescence” comes from the adjective “obsolete,” which means discarded or out of date.

Table 6.1 From Idea to Disposal

Step in the Process	Description of Process	Example
Idea	The inventor thinks of a new idea for a product or a modification to an existing product.	In 1902, Mary Anderson was riding a streetcar in New York City during a snowstorm. She watched the streetcar driver try to see by leaving the windshield open and letting the cold weather into the car.
A model	The inventor creates designs to try out to decide which one is best.	Mary Anderson made sketches for a windshield wiper that showed a lever on the inside that was attached to a wiping mechanism on the outside.
Choosing materials	Materials are chosen for the components of the product.	She hired a company to make a model out of wood and rubber strips.
Research	The inventor may need to learn more about materials or how to improve the design of the product.	In 1903, Mary Anderson was awarded a patent for the windshield wiper design.
Improving the design	After research, it might be necessary to change the design so that it lasts longer, is easier or cheaper to make, or uses different materials.	After Anderson's patent expired in 1920, car manufacturers improved the design. Figure 6.14 shows an old car with its windshield wipers.
The prototype	With some products, designers make working models instead of a full-scale version of the final product. This prototype is made to ensure that everything works as planned and that the final product will be easy to manufacture.	There is no record of Anderson's prototypes.
Market research	Information is gathered to find out how much of the item should be produced. Researchers also find out how much people are willing to pay for the item.	Anderson wrote to a large company to sell them her design but they were not interested.
Production	The manufacturer decides where and how the product will be made and starts making it.	Anderson was discouraged and did not develop the idea herself. However, some car companies did use it, and she received royalties for her invention until the patent expired. Today, windshield wipers are installed on every automobile manufactured.
Advertising	The public is informed that there is a new product for them to buy. Sometimes, this step happens months before the product is even available to the public.	Since the windshield wipers come on automobiles, there is not much direct advertising. However, replacement wiper blades are heavily advertised.
Distribution	The product is sent to retailers or directly to the consumer. Figure 6.15 shows windshield wipers on a new car.	Most windshield wipers are manufactured for automobile manufacturers. Replacement wipers and blades are sold to car dealerships and automotive stores.
Consumer's choice	For each product they buy, consumers often have to choose among several different brands.	Some companies advertise specialty wipers for different seasons so that consumers can change them to suit local weather conditions.
Disposal	When the product breaks, wears out, or is no longer needed, it is discarded. It may be composted, re-used, recycled, or sent to a landfill.	When wipers wear out, they are generally sent to landfill.

Something like a game system might be designed to last a few years (Figure 6.16). Manufacturers know that the technology used in the games is always changing. In a few years, the consumer may be ready to buy something new.

Even buildings are not designed to last forever. Home-owners and building maintenance people know that their buildings must be cleaned, maintained, and occasionally renovated to keep them in good shape. The eavestroughs have to be cleaned regularly. The shingles and siding might have to be replaced every 20 years.

Product Disposal

When people make purchasing decisions, they do not always think about what will eventually happen to the product when it breaks or they don't want it anymore.

Many people think that the lifespan of a product ends when the garbage truck picks it up. However, it doesn't actually end until the product breaks down. This can take years, even at a landfill. Recycling, re-using, and composting are often better than a landfill site is.

If you know that a product is recyclable after use, would you choose to buy it instead of a similar item that is not recyclable? Some items can be sold to another owner. Cars, clothing, and toys often get resold instead of thrown out (Figure 6.17). Eventually, however, items wear out and become unusable. Then they end up in landfills or recycled.

Figure 6.17 People often sell bicycles or cars privately.



Figure 6.16 When new game systems come out, people stop using the old ones.



Take It Further

"Manufacturing" means to organize the way something is made. Usually, this is done to make a large number of the same item. Manufacturing might involve the use of machinery or it might involve breaking down the steps of making something into parts that different people can do. Some manufacturing practices are better for the environment than others. Investigate two ways in which a familiar item might be manufactured and report your findings in the form of a T-chart. Begin your search at ScienceSource.

Research a Lifespan



Figure 6.18 Each of these products has a lifespan.

In this section, you have read about the lifespan of windshield wipers. Find out about the lifespan of a product you are interested in. Figure 6.18 might give you some ideas.


Purpose

To research the lifespan of a familiar product

Materials & Equipment

- paper and pencil
- access to the library and/or Internet

Procedure

1. Pick a product from the photographs here or choose your own.
2. Write down the steps in a product's lifespan. (See Table 6.1 for the steps.)
-  3. Fill in the steps you already know. Go to ScienceSource to do some research to fill in the steps you do not know.

Questions

4. Did anything surprise you about the lifespan of your product?
5. Can you think of ways in which the lifespan might be lengthened or shortened?
6. Suggest some ways to lessen the environmental impact of making, using, and disposing of this product.

- Gathering information
- Summarizing information

Altering a Product Lifespan

Issue

Many things affect the lifespan of a structure. One factor you can control is how you care for the structure. Sometimes it is possible to repair a structure rather than purchase a new one.

Background Information

Buildings are designed to have a long lifespan. When a home, school, or factory is built, it is designed to last from many decades to centuries. However, ideas and materials change over time. Many buildings across the country are abandoned; they are no longer being used. Perhaps there is an abandoned building in your neighbourhood. What should be done with these buildings when people want to use the land that they sit on?

Consider these two viewpoints on the issue (Figure 6.19).

- Some people feel that old buildings have historical and architectural value. They feel that the old building should be saved if possible and perhaps incorporated into a new structure.
- Other people feel that it is better to demolish the old building because newer materials are available and safety standards are now higher. It is often quicker and less expensive to demolish a building and start over with new materials than to restore an old building.

Your task is to choose one side of the argument and research the issue. You will present your findings as either a debate or a class presentation. Your teacher will provide more details about how to present your information.

Analyze and Evaluate

Begin your research using the following resources.



1. Go to ScienceSource to begin your search for information.
2. Look in print materials such as magazines, newspapers, and books for information on historical buildings in your neighbourhood.
3. Summarize the information you find in a short report for presentation to your class or for use in a debate. Be sure to include only information that supports your viewpoint and refutes the opposite view.



Figure 6.19 Some people would preserve the old school while others would tear it down and build a modern school.

Key Concept Review


1. Every product has a lifespan. Is this statement true? Explain your answer.
2. Describe the concept of planned obsolescence. How might this affect the planning and design of a product?
3. Think of a three-ring binder. Describe each of these stages in the product-planning process.
 - (a) choosing materials
 - (b) improving the design
 - (c) advertising
 - (d) disposal
4. Why should product disposal be considered when you make buying decisions?

Connect Your Understanding

5. Compare the design of a product whose lifespan is purposely short (for example, a paper cup) with the design of a similar structure with a longer lifespan (for example, a china mug). What decisions would the designers of each item make?
6. Think about the oldest thing your family owns, perhaps a memento from an ancestor or something that travelled with your family from another country. Describe the item. What steps does your family take to extend the lifespan of this item?

Practise Your Skills

7. Think of a product you use every day, such as an item of clothing, a bicycle, or a computer. Write a paragraph or draw a labelled diagram to describe the steps in planning this product from idea to disposal.

For more questions, go to ScienceSource. 

B46

Thinking about Science, Technology, Society, and the Environment



Product Disposal

When you discard a product, you decide whether to put it into a compost collector, a recycling container, or a garbage can. However, not all of these containers are always available.

Consider This

With a classmate or as a whole class, discuss the following questions.

1. Where are the waste containers in your school?
2. How do the waste containers vary in form when their function is different?
3. Are all three types of containers present at each waste collection site?
4. What happens to people's waste when one or more of the containers are missing?

Here is a summary of what you will learn in this section:

- Minimizing impact on the environment should be a key consideration in purchasing decisions.
- Buying products that are locally made and need less energy to produce can help the environment.
- Recycling or composting products that are no longer useful means less garbage in the landfill.
- Consumer demand has encouraged manufacturers to explore greener options.

When you decide to buy a scoop of ice cream, you still have a few other decisions to make. You decide on the flavour, then the server asks, “Is that in a cone or a cup?”

This simple decision can have an impact on the environment. Ice cream in a cone is completely edible (Figure 6.20). If you choose a cup, you get a disposable container and a plastic disposable spoon that often cannot be recycled. Even though it is just one little container and one little spoon, think of the number of people who each get a container and a spoon. The amount of garbage produced in this way has started to concern many consumers. This has encouraged some manufacturers to design biodegradable containers and utensils.

In this section, you will look at how the structures we purchase and dispose of affect the environment. Writing a personal action plan will help you make some important decisions.



Figure 6.20 Canadians do like their ice cream!

Suggested Activity •
B49 Quick Lab on page 172

B47 Starting Point

Skills **A** **C**



Take Stock

Think about your family's fast food habits and the types of fast food your family eats.

1. What is your family's favourite fast food?
How is it packaged?
2. How might this type of packaging affect the environment?
3. Can you do something to lessen its impact on the environment? Discuss your ideas with a classmate.

How Structures Affect the Environment

Humans will always need and want things. However, the things we need and want can have an impact on the environment. As responsible citizens, we need to examine our decisions and try to lessen our impact on Earth and its resources.

Every product you buy requires raw materials and energy to manufacture. Fuel is needed when the product is transported. And the product will need to be disposed of when you no longer need it.

If you choose products made from renewable materials, and then recycle or compost them, you are lessening your impact on Earth. Using renewable resources, such as the plants shown in Figure 6.21, means that others in the future will be able to enjoy the same things you have now. By recycling or composting, you send fewer items to the landfill.

Using Less Energy

If you choose products that need less energy to manufacture, you are lessening your impact on Earth. Generating energy (electricity, heat, etc.) is expensive and can release pollutants. If the products you choose need less energy to manufacture, you reduce the cost and the amount of pollution produced.

If you purchase structures that operate on less energy than similar structures, you are lessening your impact on Earth. Figure 6.22 shows two flashlights. One uses batteries, which are an expensive and wasteful source of energy. The other uses a hand crank, which is a renewable source of energy as long as you eat your meals!

If you buy locally produced items, you are lessening your impact on Earth. Since locally produced items don't have to be transported long distances, this saves on energy and minimizes pollutants. Many people eat locally produced food, and some purchase that food at roadside stands (Figure 6.23).



Figure 6.21 Clothing made from cotton or bamboo is recyclable. Nylon and rayon are not recyclable.



Figure 6.22 Both of these flashlights use energy to produce light. One uses batteries for energy. The other uses your energy when you turn the crank.



Figure 6.23 When you buy food from the farmers, it has not travelled very far.

If you change your behaviour in order to conserve energy, you are lessening your impact as well. For example, you could turn the heat down a degree or two in your home in winter. If you put on warmer clothing, your family will save money and help reduce the total amount of energy it uses.

Consumers are also growing more conscious of the need to think about the products they buy. They consider:

- how raw materials are managed
- the working conditions of people who make the products
- the consequences of buying goods intended to last only a short time

As consumers make these concerns known to manufacturers, changes are being made. You may have noticed labels like “organic,” “fair trade,” or “produced from materials in a sustainable way.” Sometimes products that bear these labels cost more than products that do not. Would you be willing to pay more for something, like a T-shirt, made in an environmentally responsible way?

Suggested Activity •••••

B50 Decision-Making Analysis on page 173

Take It Further

You may live in an apartment or a house. Your home is most likely made out of wood, concrete, and/or brick. These are traditional building materials for homes in Canada.

However, some interesting housing materials may have less impact on the environment. Some people are building houses out of old cans and tires. Others are using straw bales. Investigate an alternative housing method and report back to your class. Begin your search at ScienceSource.

B48 During Writing

Thinking Literacy

Reorganizing Ideas: ARMS

Writers revisit their work to add, change, or delete ideas and information. One strategy they use to help reorganize is called “ARMS” (add, remove, move, substitute).

Revisit your “Question and Answer” organizer on recycled materials and products and think

about changes you want to make. Is there a question you would like to add or remove? Are there better words you can substitute in a question or answer? Now, write your draft.

Personal Action Plan

Throughout this unit, you have learned about structures, their classification, and the forces that act upon them. You have thought about consumer needs and wants. You understand that every purchasing decision has an impact on Earth. It is time for you to put what you have learned into action in your own life (Figure 6.24). You may not make all of the decisions about what to buy for your family, but you do have influence. You also make choices for your own purchases.

Purpose

To prepare a personal plan of action for making wiser consumer decisions

Materials & Equipment

- pencil and paper

Procedure

1. Make a list of the purchasing decisions you make for yourself or have influence over. You may pick your own clothes. You may have a say in what your family buys at the grocery store. You might buy your own batteries for your electronic gear.



Figure 6.24 Each person’s decisions make an impact.

2. Consider products and practices. What are the different ways to lessen your impact on Earth? For each item on your list, propose a way to make it more environmentally responsible. You might organize your list in a chart like the one in Table 6.2.

Table 6.2 Personal Action Plan

Purchasing Decision	Proposed Change	Change Immediately, Discuss, Find Out More?

3. For each decision, decide whether it is something you can change immediately or discuss with your family, friends, and classmates, or whether you need more information.
- Questions
4. Look over your list and make sure there is at least one change you can make immediately. Why will this action lessen your impact on Earth?
 5. Consider the items you need to discuss with your family. What information do you think your family will want to consider before they make a decision?
 6. Consider all of the items you want to find out more about. How will you get your information?
 7. Write a letter to yourself outlining your personal action plan. This personal action plan is a commitment you are making to yourself and Earth.

- Selecting and recording information
- Reporting results

How Green Can We Be?



Figure 6.25 It's lunch time!

Issue

Every school also makes an impact on the environment. Students and staff spend a lot of time at schools and need the school to be safe and comfortable. The issue is: what changes can be made at school to lessen its impact on the environment?

Background Information

Energy is used to heat, cool, and light a school. Many school activities generate waste products. In order to reduce the school's impact on the environment, some of these activities and some of the energy use can be changed.

Some changes can be made with little or no cost. For example, asking students to bring litterless lunches, such as the lunch shown in Figure 6.25, costs no money but reduces the amount of waste produced at the school. Other changes, such as installing energy-efficient windows or switching to solar-powered water heating, will cost money.

Consider these two viewpoints on this issue.

- Some people feel that it is enough to make inexpensive changes to lessen the impact on the environment. Changes in behaviours such as turning off the lights when not needed and keeping the building at a moderate temperature do not cost much money.
- Others feel that changes in behaviour are just the start. Changes in infrastructure, such as increased insulation and the use of low-wattage light bulbs, must be made in order to be more environmentally responsible.

Your task is to choose one side of the argument and research the issue. You will present your findings as either a debate or a class presentation. Your teacher will provide more details about how to present your information.

Analyze and Evaluate

Begin your research using the following resources.



1. Go to ScienceSource to begin your search for information.
2. Look in print materials, such as magazines, newspapers, and books, for information on reducing your impact on the environment.
3. Summarize the information you find in a short report for presentation to your class or for use in a debate. Be sure to include only information that supports your viewpoint and/or refutes the opposite view.

Key Concept Review

1. Describe how every buying decision can affect the environment.
2. Describe how modifying your buying decisions can lessen your impact on Earth.
3. For each of the items below, describe the buying decisions that would have the least impact on the environment.
 - (a) cleaning supplies
 - (b) fresh fruit and vegetables
 - (c) clothing


Connect Your Understanding

4. Describe why it is important to consider greener options every day, even when making “small” decisions such as buying ice cream.

5. Why is it considered better to reduce or re-use than to recycle?
6. Noted environmentalist David Suzuki has warned against “green-washing,” a trend that businesses have adopted to convince consumers that their practices are more environmentally responsible than their competitors’ practices. Why do you think he might be concerned?

Practise Your Skills

7. To make the greenest possible purchase decisions at your local grocery store, you might ask questions such as “How far has this food been transported to get it here?” Make a two-column table that lists this question and four others you could ask. Explain the kind of answer you are looking for in each case.

For more questions, go to ScienceSource. 

B51

Thinking about Science, Technology, Society, and the Environment



Re-structures

Science and technology have discovered many ways to use recycled items. For example, polyester fleece is made from recycled plastic bottles. Think of the future of one recycled material, such as aluminum, paper, plastic, or glass.

Within a group, choose one recycled material and answer the following questions.

1. What products is that recycled material made into?
2. What are the benefits of choosing those products?
3. What are the drawbacks of choosing those products?



A Changing Centre of Gravity

Where is your centre of gravity? In this unit, you learned that it is the point within a structure that gravity seems to act on. So if you are balanced on the tip of one toe, your centre of gravity is directly over that toe. Otherwise you would fall over, pulled to one side or the other by gravity. But how high up is it? Probably just about in the middle, where there's as much of you above it as there is below.

The thing is, your centre of gravity can move, sometimes even outside your body! When you crouch down and wrap your arms around your knees, your centre of gravity drops down with you. It may actually leave your body to float somewhere in the space between your arms, legs, and head.

In the 1960s, an Olympic high jumper named Dick Fosbury became famous for shifting his centre of gravity (Figure 6.26). Up to that time, high jumpers ran parallel to the bar, then kicked one leg up and rolled over the bar (trying

not to touch it), dragging the other leg behind. Some people were really good at this, and could clear a bar that was well over 2 m high.

Fosbury used a completely different technique that became known as the "Fosbury Flop." He ran at the bar, then at the last minute turned his back and jumped head first and backward over the bar. At the very last second, he kicked both legs up and over. Fosbury won the high jump at the 1968 Olympics in Mexico City in this way. He jumped 2.24 m.

Today almost every high jumper uses the Fosbury Flop because it is so effective. With other techniques, jumpers have to get their centre of gravity over the bar. But Fosbury was able to sneak his centre of gravity under the bar, even though he was going over it. Picture him flopping: at first, only his head was over the bar, then only his torso (with his arms and legs under) and finally, only his legs were over. At no time was most of his body over the bar; his centre of gravity stayed under the whole time.



Figure 6.26 Dick Fosbury changing his centre of gravity

After Writing

Thinking
Literacy**Reflect and Evaluate**

Exchange your “Question and Answer” writing piece with another pair. Read their work carefully. Provide each other with some feedback, for example: What two things did they do well? Is there another question you would have liked answered? Did you learn something new about recycled materials? Finally, share tips for writing a good “Question and Answer” writing piece with the class.

Key Concept Review

1. Describe the relationship between manufacturers and consumers. **k**
2. Use the basic steps in the lifespan of a product to trace the development of a new type of water bottle. **k**
3. Why do manufacturers take consumer preferences seriously? **k**
4. Write a short paragraph that shows how these words relate to one another: consumer, market research, advertising. **k**
5. Which of the following statements are true and which are false? Rewrite the false statements to make them true. **k**
 - (a) Many products are sent to the landfill, even when they are in usable condition.
 - (b) Technology is never used when gathering market research.
 - (c) A well-designed product is unpleasant to use.
 - (d) Eventually, all products end up in landfills or are recycled into other products.
 - (e) If you choose products that need less energy to manufacture, you are increasing your impact on Earth.

Connect Your Understanding

6. The lifespan of similar products can vary greatly. Some items, such as a special piece of furniture or china, have been handed down for generations, while similar items last only a short time. Why might this be? **t**
7. Why should consumers consider the lifespan of structures in order to make responsible decisions? Give an example of a time you have considered (or would consider) the lifespan of a structure before making a purchasing decision. **t**
8. How can the desire to minimize the impact on the environment influence buying decisions? **t**
9. What role(s) can consumers play in ensuring that green choices are available? **t**

10. Sometimes the “greener option” is not always obvious. What would you need to think about when deciding if it is better to: **a**
- (a) use cloth or disposable diapers?
 - (b) buy plastic or cardboard containers for storing items?
 - (c) use a product that lasts several years and then has to be sent to the landfill or a similar product that lasts half the time but can be composted or recycled?
11. (a) What do you think consumers can do to encourage manufacturers to produce “greener” products? **t**
- (b) Some would say that this is only part of the solution and that consumers need to learn to live less materialistically. What do you think? **t**
12. A family you know is thinking about buying a new washing machine. Suggest three questions they should ask to ensure that they make a wise choice. **a**

Practise Your Skills

13. If you could modify a pen to be sold to students your age, what modifications would you make and why? Draw a labelled diagram to show these changes. What key points would you emphasize in an advertisement? **a**

Unit Project Link

When you want to improve the energy efficiency of an everyday task, you may have difficult choices to make. Sometimes, replacing an existing structure with one that is more energy efficient can be costly. For example, front-loading washing machines use less electricity, water, and detergent to do the same job as conventional washing machines. Thus, they cost less money per load. However, a front-loading washing machine can cost more to purchase than a conventional washing machine. Which would you buy? Discuss the thinking you would use to make this decision.

B52

Thinking about Science, Technology, Society, and the Environment



What's in a Bag?

These days, many purchases are carried home in plastic bags. However, plastic bags take a big toll on the environment. They take a long time to break down and can also harm animals that try to eat them.

What to Do

1. Estimate the number of plastic bags your family takes home in a week.

Consider This

With a classmate or as a whole class, discuss the following questions.

2. When you are shopping, when do you need to use a plastic bag? When could you make do without one?
3. What alternatives to plastic bags are being offered? Who is offering these alternatives?
4. What are the drawbacks to using plastic bag alternatives? Suggest solutions to these drawbacks.
5. Challenge your family to reduce the number of plastic bags it uses by considering other alternatives.

UNIT *B* Summary

4.0 Designers consider the form and the function of a structure and the forces that act on it.

KEY CONCEPTS

- Every structure can be described and classified.
- Forces act on structures.
- Structures need to be designed with safety in mind.

CHAPTER SUMMARY

- Structures can be classified by their function.
- Structures can be classified by their form as solid, frame, or shell structures.
- Internal and external forces act on structures.
- Designing a structure requires an understanding of the forces and loads that act on it.

5.0 Good design, materials, and construction make structures stable and strong.

KEY CONCEPTS

- Structural strength is affected by many factors.
- Good design involves many elements.

CHAPTER SUMMARY

- Structural shapes, structural components, and structural materials are the main things to consider for structural strength.
- The centre of gravity of a structure affects its stability.
- Structural stress, fatigue, and failure affect structures.
- Designers must ask themselves questions about the elements of design throughout the design process.
- Some of the questions have definite answers. Others are a matter of personal taste.

6.0 The lifespans of structures need to be considered in order to make responsible decisions.

KEY CONCEPTS

- Manufacturers and consumers have responsibilities.
- The lifespan of a product can be traced.
- Decisions made about structures can affect the environment.

CHAPTER SUMMARY

- Manufacturers determine consumer need by using market research, and try to influence consumer thinking with advertising.
- Being a wise consumer involves identifying personal needs and wants.
- The lifespan of a product might include planned obsolescence.
- Product disposal should be a factor in buying decisions.
- Conserving energy in each phase of the lifespan of a product, from idea to disposal, affects Earth positively.
- Modifying their personal behaviour to reduce their impact on Earth is the responsibility of every citizen.

Everything Old Can Be New Again

Getting Started

Many of our buildings — our homes, schools, and offices — are getting older. When they were constructed, the cost of energy was not a concern. Designers chose the technology and materials based upon how the building should look, not how it should conserve energy. Many older buildings are poorly insulated or have inefficient electrical systems.

However, in today's world, energy conservation is crucial. Can we make our older buildings more energy efficient? Creative ways to renovate aging buildings will lessen their impact upon the environment.

Your Goal

You will design and build a prototype (or a model) of a structure that could lessen the environmental impact of your home or school. Choose one of the following three options.

- Modify an existing structure to make it work more efficiently.
- Invent the next great “green” invention!
- Do research and build a model of a recent innovation that is not yet used widely.

What You Need to Know

Consider your own home, apartment building, or school. Think of how you could lessen its environmental impact. Think of some things you might design and build, or some things you might modify, to achieve your goal of greener living.

Steps to Success

1. With a small group, tour a home or your school. Outside, examine the architecture, the materials, and the surrounding property. Inside, look in the rooms, hallways, and other features. Make a list of any ideas you have to improve the energy

efficiency of the building. This is the brainstorming stage, so the more ideas, the better!

2. With your group, pick one idea that you think would efficiently lessen the environmental impact of the building.
3. Talk about the materials you will choose. Will you build a model or a working prototype?
4. Construct your prototype or model. Follow the safety rules you have learned in this unit.
5. Test and evaluate your final product.

How Did It Go?

6. Are there any safety concerns related to either the construction or the testing of your structure?
7. How could you improve upon your model or prototype? What materials would you use if money were not an issue?
8. If you were designing for an actual structure, who might be opposed to the use of your idea? Why might they be concerned?
9. How environmentally friendly are the building materials?
10. Consider the lifespan of your product. Will this be a long-term investment?
11. In your whole class, combine all ideas that are best suited to homes. Form a committee to write a report that lists and explains each structure. Include digital pictures of each structure. Predict what the total energy savings might be if all of the innovations were installed in a single home.
12. Form a second committee to write a report related to the structures that are best suited to your school. Present this report to the principal and custodian of your school. Have all of the structures available for viewing. Record their feedback in a report response.

UNIT *B* Review

Key Terms Review

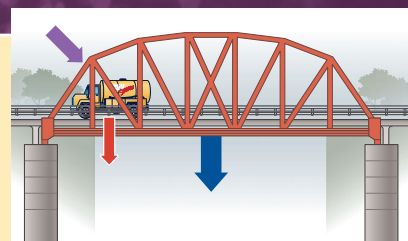
- Create a word web that illustrates your understanding of the following terms. **K**
 - centre of gravity
 - consumer
 - failure
 - fatigue
 - force
 - frame
 - function
 - lifespan
 - load
 - magnitude
 - manufacturer
 - market research
 - product recall
 - prototype
 - shell
 - solid
 - stress
 - structural components
 - structure
 - symmetry

Key Concept Review

4.0

- Explain how you find structures all around you by making a list of eight indoor structures and eight outdoor structures. Describe the form and function of each. **K**
- Describe the types of forces that can affect structures. Explain how designers consider these effects in their designs. **K**
- Describe how designers minimize the risk of failure in structures. **K**
- Some structures are designed to support small loads, and other structures are designed to support large loads. How are these types of structures similar, and how are they different? **K**
- Why might structures that serve the same function have very different forms? **K**

- Sketch the illustration in your notebook and label the dynamic load(s) and the static load(s). **K**



Question 7

- Using mainly diagrams, describe three different types of internal forces. **K**
- No structure can be designed to be 100% failure proof. How might a designer decide that a structure is “safe enough”? **C**

5.0

- Describe and then relate the terms “centre of gravity” and “stability.” **K**
- Why do manufacturers issue product recalls, even when they know that they can cost their business millions of dollars? **K**

- List the structural components that you see in the photograph. **K**



Question 12

- Describe three structures that include triangular shapes in their design. Why did the designers use triangles rather than rectangles? **A**
- Explain how each of the following contributes to structural strength. Describe how all of these factors relate to the design and construction of a bridge. **K**
 - structural shapes
 - structural components
 - structural materials

- 15.** Which of the following statements are true and which are false? Rewrite the false statements to make them true. **k**
- (a) The design for a structure is related to its function.
 - (b) Good structures consider the dynamic loads only.
 - (c) All materials are the same when it comes to cutting and joining them.
 - (d) Ergonomics can be thought of as the science of people-structure relationships.
 - (e) A prototype is the last product to be manufactured.
- 16.** Explain why the concept of aesthetics in design is a personal one. **k**
- 17.** Symmetry can add to structural stability. Explain why this is so. When might this be desirable? When would it not be desirable? **t**
- 18.** Think about each element of good design. Make a chart with the headings “Element” and “Connection to Stability or Strength.” For each element, describe how strength and stability might factor into the designer’s thinking. **k**

6.0

- 19.** Compare the thinking of a wise consumer with one who is not so wise. **k**
- 20.** Why is it difficult to design and build a structure that will last forever? **k**
- 21.** How are designing, building, buying, and disposing of structures related to the use of energy? **a**
- 22.** In order to make responsible decisions, why should you consider the lifespan of structures? **k**
- 23.** Describe the reasons to conduct market research. **k**
- 24.** Describe a building in which you have observed the principles of universal design in use. **a**
- (a) What was the form of the design?
 - (b) How did the form affect the function of the building?
- 25.** What are the pros and cons of “planned obsolescence”? **k**
- 26.** List three choices you have made in the past week that reflected a “greener option.” **k**
- 27.** How could you be encouraged to make even more “greener options”? **a**

Connect Your Understanding

- 28.** Describe which parts of the following “combination structures” are solid, frames, and shells. **a**
- (a) MP3 player
 - (b) umbrella
 - (c) car
 - (d) house
 - (e) canoe
 - (f) human body
- 29.** Consider the items listed in question 28 (a) to (c). How is each structure designed for safety? **a**

UNIT **B** Review (continued)

- 30.** Compare the different chairs you sit on at school (lab stool, chair, gym bench) in terms of centre of gravity and stability. **a**
- 31.** List the different types of material that clothing and shoes can be made from. What are the trends in the relationship between the type of material and the type of clothing or shoe? **a**
- 32.** Think of something you are using right now. It could be this textbook, your binder, or your pen. How could you extend the lifespan of this product? **t**
- 33.** What products that you use have the shortest and longest lifespans? How might these lifespans be altered in length? **t**
- 34.** Using your knowledge of the concepts in this unit, what do you think is the best type of structure to do the following tasks? Explain why for each one. **a**
- (a) hold up a large mass
 - (b) span a gap
 - (c) act as a container
- 35.** You have been asked to design a riding toy for a small child. How would you decide what materials and methods of construction to use? How might you modify the design to make it more suitable for an adult? Use diagrams to show your ideas. **a**
- 37.** Pick one of the building activities you did in this unit and re-do the activity with different materials, different shapes, or different structural components to increase the structure's efficiency. **t**
- 38.** Consider how manufacturers listen to consumers. Write a letter to the manufacturer of a product that you think could be improved to lessen its impact on Earth. **a**
- 39.** Your class is going to have a building competition to see who can build the strongest bridge out of craft sticks and glue. Prepare a handout sheet with instructions and criteria for success for this competition. **t**
- 40.** The environmental club at your school has been given funding to build some seating in the yard for an outdoor classroom. You can use concrete or wood to build the seating. Create a chart that demonstrates the strengths and weaknesses of each choice. How would you make the final decision? **t**

Revisit the Big Ideas

- 41.** Give possible functions for each of these descriptions of form. **a**
- (a) a large piece of glass in the shape of cylinder with a bottom but no top **a**
 - (b) a soft piece of foam covered in fabric
 - (c) a hard, heavy hunk of metal in the shape of a dog
 - (d) a reflective piece of material in a flat, rectangular shape

Practise Your Skills

- 36.** If you had to redesign something in your home to increase its safety, what would it be? Why do you think it needs to be improved? How would you redesign it? **t**

42. Make up four more descriptions of form to share with a partner. **a**

43. The form of a structure depends on its function. Study the photographs and explain how you think the forms of these buildings relate to their functions. **t**



Question 43 Left: The addition to the Royal Ontario Museum was built to house artifacts. Right: The Ontario College of Art and Design is a school for future artists and designers.

44. You have installed a new bookshelf in your room. How might you monitor it to make sure that the structure is standing up to the forces it experiences? **a**

45. As you walk down the street, you notice a small crack in the sidewalk. How might the crack change if it were left over a long period of time? Would the season make any difference to your answer? **t**

46. In what types of structures (if any) would you consider: **t**

(a) form more important than function?

(b) function more important than form?

47. Building and maintaining structures such as roads and bridges is a continuous task. Discuss why this statement is true using the terms “forces,” “structures,” and “interactions.” **t**

B53

Thinking about Science, Technology, Society, and the Environment



Structures and You

When you design, modify, choose to buy, and dispose of structures, you are using science and technology. Your decisions about these issues can impact society and the environment.

What to Do

1. Pick a structure you use every day.
2. Think of a way to reduce your impact on society and the environment by changing how this structure was designed and

modified, and how you choose it and dispose of it.

Consider This

3. Share your plan with a classmate.
4. Make a plan to meet in the near future and a little farther in the future to check on each other's progress.
5. Meet to celebrate your success or modify your plans as necessary.