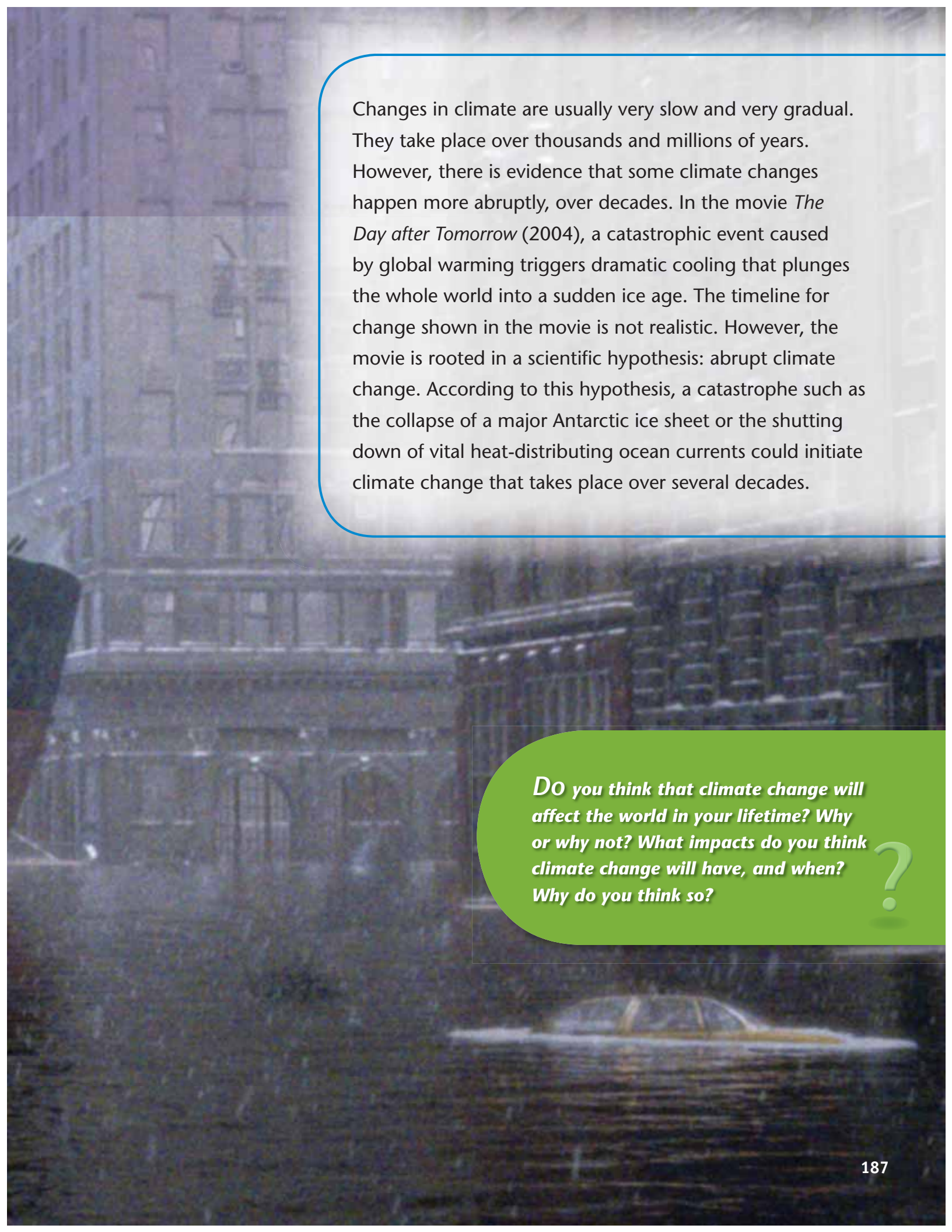


# Unit 3 Earth's Dynamic Climate

## Big Ideas

- Global climate change is affected by both natural and human factors.
- Climate change affects living things and natural systems in a variety of ways.



Changes in climate are usually very slow and very gradual. They take place over thousands and millions of years. However, there is evidence that some climate changes happen more abruptly, over decades. In the movie *The Day after Tomorrow* (2004), a catastrophic event caused by global warming triggers dramatic cooling that plunges the whole world into a sudden ice age. The timeline for change shown in the movie is not realistic. However, the movie is rooted in a scientific hypothesis: abrupt climate change. According to this hypothesis, a catastrophe such as the collapse of a major Antarctic ice sheet or the shutting down of vital heat-distributing ocean currents could initiate climate change that takes place over several decades.

***Do you think that climate change will affect the world in your lifetime? Why or why not? What impacts do you think climate change will have, and when? Why do you think so?***



## Unit 3 At a Glance

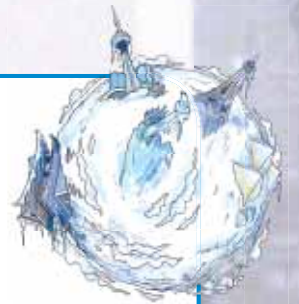
In this unit you will learn about the interacting parts that make up climate and how climate changes over time. You also will investigate the natural and human factors that affect climate and how both contribute to climate change and global warming.

*Think about answers to each question as you work through the topic.*

### Topic 3.1: What is climate, and how has it changed during Earth's history?

#### Key Concepts

- Climate is different from weather, but they are also linked.
- Climate has changed frequently throughout Earth's past.
- Climate is currently changing around the world.



### Topic 3.5: How can we assess present climate change and reduce our impact?

#### Key Concepts

- Studying past climates helps us understand how climate changes over time.
- We use various instruments to collect data to help us assess present climate change.
- We use computer models and projections to estimate future climate change.
- We can use our ingenuity to reduce our impact on climate change.
- We can make personal choices that reduce our impact on climate change.



## Earth's Dynamic Climate

### Topic 3.4: How do human activities affect the natural greenhouse effect?

#### Key Concepts

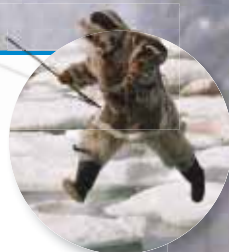
- Human activities produce more greenhouse gases, which enhance the natural greenhouse effect.
- Canadians add to the increase of greenhouse gases in the atmosphere.



### Topic 3.2: Where are the effects of climate change felt, and what is their impact?

#### Key Concepts

- Climate change affects aquatic ecosystems.
- Climate change affects terrestrial ecosystems.
- Both positive and negative impacts of climate change are occurring worldwide.



### Topic 3.3: What natural factors affect climate, and how do they affect it?

#### Key Concepts

- Interactions of the Sun and Earth affect climate.
- The atmosphere affects climate around the world.
- The natural greenhouse effect moderates Earth's temperature, indirectly affecting climate.
- The hydrosphere affects global climate.
- Moving continents have a variety of effects on climate.
- The interaction of all natural factors affects climate in ways that are hard to predict.



### Looking Ahead to the Unit 3 Projects

At the end of this unit, you will have an opportunity to apply what you have learned. In your unit projects, you will compare the reflecting effect of white and black roofs on incoming solar energy, and you will perform a cost-benefit analysis of possible actions to deal with climate change.



# Get Ready for Unit 3

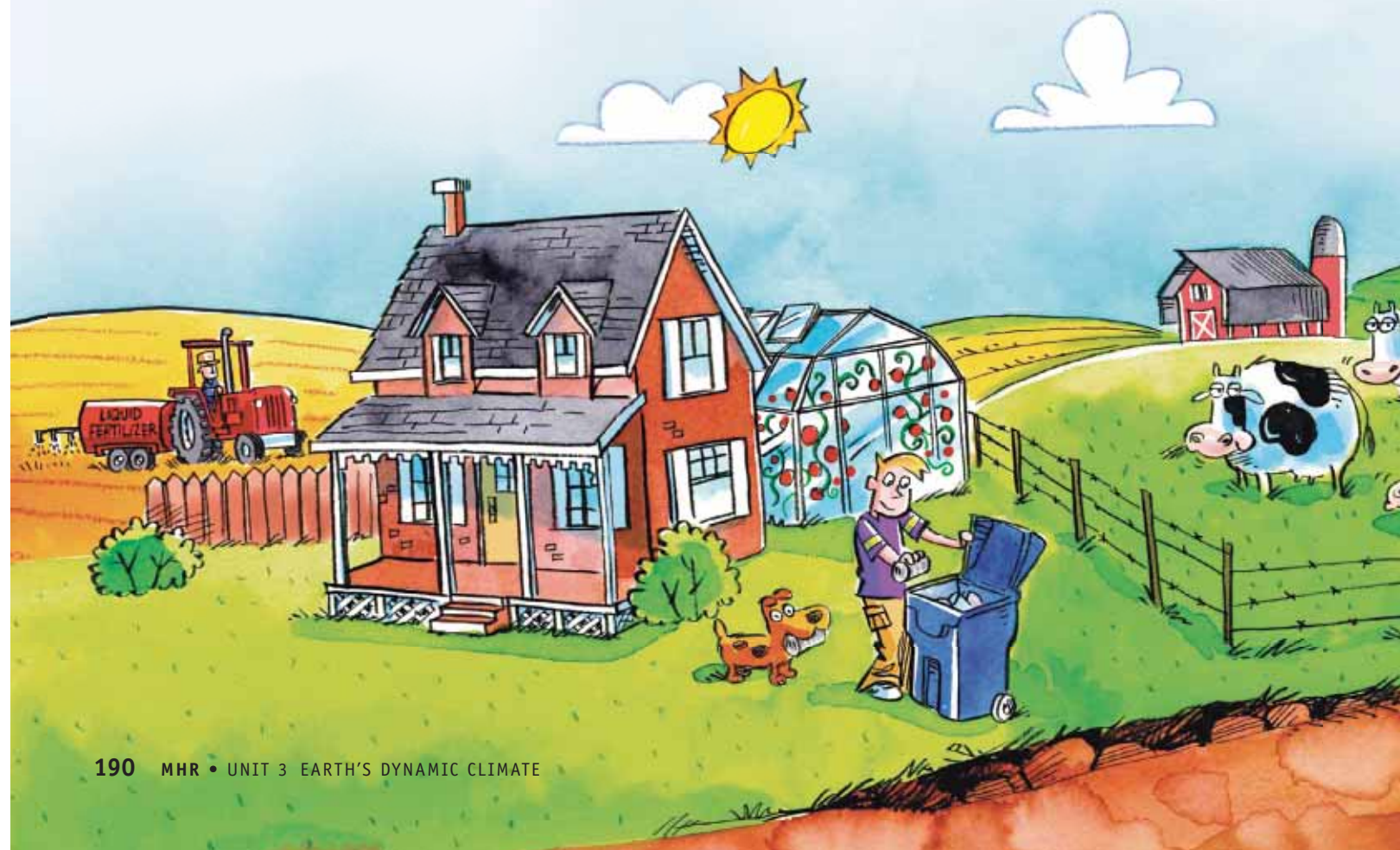
## Concept Check

1. Many human activities have an effect on the climate in a region. List as many climate-changing human activities as you can. Refer to the illustration below, and think about your prior knowledge as well.
2. Categorize each human activity you listed for question 1 as either negative (for example, raises global temperature or increases pollution) or positive (for example, lowers global temperature or reduces pollution). Record your answers in a t-chart. With a partner, brainstorm less-harmful alternatives to the activities you categorized as negative.
3. What do you know about carbon dioxide? In your notebook, create a concept map that illustrates the role carbon dioxide plays in the following processes: photosynthesis, cellular respiration, and global warming. Use linking words and/or explanations to describe the connections among the processes.

4. In your notebook, match each type of heat transfer listed in the box with its definition below.

convection    radiation    conduction

- a) the emission or transmission of energy in the form of waves
  - b) the movement or transmission of energy by direct contact between molecules or substances
  - c) the transfer of energy that occurs as a result of the movement of a fluid that has been warmed or cooled
5. Which types of heat transfer can you identify in the illustration below? Explain your answer, and give three other examples of heat transfer from your own experiences.

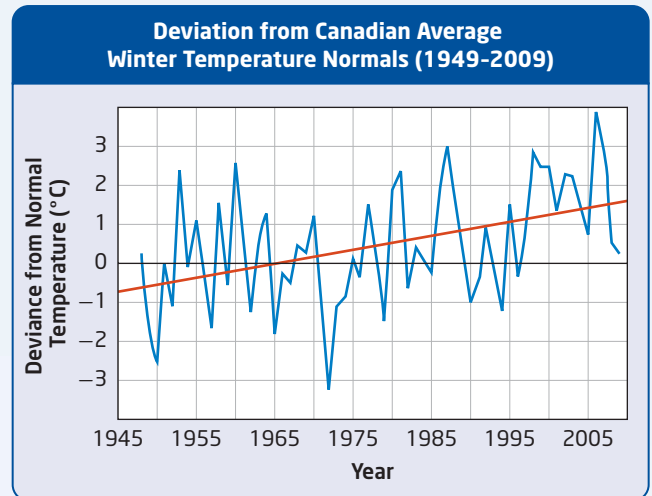


## Inquiry Check

- 6. Analyze and Interpret** The following investigation was conducted by a student attempting to model one aspect of the greenhouse effect—that atmospheric carbon dioxide acts as a heat trap.
- Two identical glass jars were each filled with 500 mL of water that had a temperature of  $2^{\circ}\text{C}$ .
  - Both jars were sealed, and one was wrapped in a clear plastic bag.
  - Both jars were left in the Sun for one hour.
  - After one hour, the jars were opened and the temperature of the water in each glass jar was measured.
- Why did the student use a clear plastic bag? What did the plastic bag represent in terms of the greenhouse effect?
  - What variables did the student control?
  - List safety precautions that would be necessary for this procedure.
  - How would you modify this procedure to more closely model the greenhouse effect?

## Numeracy and Literacy Check

- 7. Analyze** The graph below shows how much winter temperatures deviate from (are different from) their normal values. Use the graph to answer the questions.



- What trend does the graph indicate is occurring in average winter temperatures in Canada?
  - A line of best fit has been drawn in red to show the long-term trend. Using this line, determine the overall change in average temperature from 1950 to 2005.
- 8. Write** Use a Venn diagram to list your ideas about how climate change and global warming are related.