Chapter 8 Dynamics of Climate Change

What You Will Learn

In this chapter, you will learn how to...

- **describe** and **explain** heat transfer in Earth's climate system
- **describe** the natural greenhouse effect and **distinguish** it from the anthropogenic greenhouse effect
- **describe** the principal sources and sinks of greenhouse gases

Why It Matters

Recent climate change has been driven by changes in Earth's atmosphere that have affected how heat is transferred through Earth's atmosphere and oceans. By recognizing how human activities alter these natural processes, we can understand how humans affect climate change and can act to reduce our impact.

Skills You Will Use

In this chapter, you will learn how to...

- **investigate** the effects of heat transfer within Earth's oceans and atmosphere
- **design** and **build** a model of the natural greenhouse effect

Every living thing on Earth is affected by climate, so even cows are becoming part of the solution! Cows and other livestock produce a lot of gas, which affects climate. By attaching tubes to the digestive tracts of cows, researchers hope to reduce the amount of these emissions. In this chapter, you will learn how natural processes transfer heat throughout Earth's surface. Then you will learn how human activities, such as agriculture, alter these natural processes.

Activity 8-1

Modelling Balance in Systems

How do changes in the balance of energy and matter affect climate? In this activity, you will use water to model the flow of matter and energy through a system.

The amount of energy and matter that enters a system usually equals the amount that exits the system.

Safety Precaution

Materials

- basin or tub
- plastic or paper cup
- 1 L of water
- pitcher
- ruler
- tool to make a hole

Procedure

1. Use a tool to poke a hole in the bottom of a plastic or paper cup.
2. Position the cup over a tub or basin.
3. Slowly pour 1 L of water into the cup. Observe what happens to the water, and record your observations.
4. Return the water to the pitcher.
5. Position the cup over the tub or basin again.
6. Pour the water into the cup as quickly as possible. Observe what happens to the water, and record your observations.

Questions

1. In step 3, you modelled a balanced system. How does the amount of energy or matter that enters the system relate to the amount of energy or matter that leaves the system?
2. In step 6, you modeled an unbalanced system. Identify all of the variables that could be changed to restore balance to the system.
3. How do you think changing the composition of the atmosphere could change the climate system?

Study Toolkit

These strategies will help you use this textbook to develop your understanding of science concepts and skills.
To find out more about these and other strategies, refer to the Study Toolkit Overview, which begins on page 560.

Reading Effectively

Making Connections to Visuals

Visuals can clarify or expand on information in the text. Making connections to visuals will help you understand their purpose and meaning. For example, look at the photograph below (shown on page 328), and read the caption. Then think about answers to these questions:

1. What personal connections can I make to the visual, based on my prior knowledge?
2. What can I learn about the visual from the caption and the accompanying text?
3. What does the visual *not* show?

Vehicle exhaust is a direct source of greenhouse gases. It is also an indirect source of ground-level ozone.

Use the Strategy

With a partner, examine **Figure 8.19** on page 331. Discuss your answers to the questions above.

Word Study

Word Parts

To better understand long, unfamiliar words, break the words into parts. Combine the meanings of the parts to infer the definition of the unfamiliar word. For example, the word *interdependent* has the base word *depend* (to rely on), the prefix *inter-* (between or among), and the suffix *-ent* (in a state of). Combining the meanings of these word parts gives you the following definition of *interdependent*: in a state of relying on one another.

Use the Strategy

Break the word *chlorofluorocarbon* into parts. Determine what each word part means. Then combine the meanings of the word parts to infer a definition of the whole word. Use the context in which the word appears to check that your definition makes sense. Confirm your definition by using a dictionary or the Glossary at the end of this textbook.

Organizing Your Learning

Synthesizing

Synthesizing involves processing information from a variety of sources to gain a new understanding of a topic. Use sources such as this textbook, other books, your own prior knowledge, and different opinions (your own and other people's). Then combine all the information you gathered in an original way.

For example, you learned about climate change in Chapter 7. The **flowchart** on the right shows the process you might follow to synthesize your understanding of climate change.

Use the Strategy

Follow the steps in the flowchart to synthesize information about the main topic in Section 8.2.

1. Before reading this chapter, write down what you know or believe about the topic and related issues.
2. During class, record new facts, as well as opinions that are different from your own.
3. Study each section, and summarize the main ideas in each subsection.
4. Watch for news stories about this topic, which may add to your knowledge.
5. Review all the information you have gathered.
6. Synthesize what you have learned by presenting the information in a new form that communicates what you have come to know and understand.