

# Unit 3

## Unit 3 Earth’s Dynamic Climate

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# 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.

### Overall Expectations

- **D1** analyse effects of human activity on climate change, and effects of climate change on living things and natural systems
- **D2** investigate various natural and human factors that have an impact on climate change and global warming
- **D3** demonstrate an understanding of various natural and human factors that contribute to climate change and global warming

### Materials

Please see page TR-32 to TR-37 for a list of the materials required for this unit and other units.

### Overview

In this unit, students will learn about the processes of climate change and global warming, both natural and human-made, the impact of greenhouse gases on Earth, and how we can make choices that affect Earth's climate in both positive and negative ways. Students will also learn about methods that scientists use to measure these changes in the past and in the present, such as tree rings, ice cores, and satellites that help them predict what may happen in the future.

### Using the Unit Opener (Student textbook pages 186–189)

- Distribute **BLM 3-1 Unit 3 Anticipation Guide** to encourage students to determine what they know about climate change and global warming.
- As a class, read through the unit opener. Ask students if they have seen the movie *The Day after Tomorrow*. If some students have seen the film, ask them to describe what happened to the climate as depicted in the film. Use the chalkboard or large chart paper to make jot notes as the students explain.
- Have students refer to the opener photograph. Have them study the image and, as a class, make notes on what they observe. For example: car under water/ice, freighter ship in the middle of the street, heavy precipitation, and no people.
- Have students work with a partner or in small groups. Have them create a cause-and-effect map, listing the notes on what they observe in the image and what their classmates described as the effects. Then, have them fill in what they think the causes of these changes might have been.
- **ELL** Have English language learners use **BLM 3-39 Cause-and-Effect Map** for this activity.
- As a class, read the questions on page 187. Conduct a class discussion on what students think. After the discussion, have students record their thoughts on these questions in their notebooks. After they have completed the unit, have them revisit these questions and see if their opinions are still the same.
- English language learners may benefit from using **BLM G-44 K-W-L Chart** for this activity.
- As a class, read the text in the green box on page 188. Walk students through the topic descriptions. Answer any questions they may have before proceeding. This is also a good time to address any misconceptions students may have about climate change in general.
- Students can use **BLM 3-3 Key Terms in Unit 3** to review the meanings of Key Terms.

### Preparing for the Unit Projects

- Read Looking Ahead to the Unit 3 Projects, on page 189, to the class. Then allow students to read the projects themselves, on pages 264 and 265, including the assessment checklists.
- Provide instructions on how you would like students to set up their project planning folder(s).
- Have students write an “action plan” or “to-do list” of the tasks they will need to accomplish to be successful with their project(s). You may want to provide them with **BLM A-51 Unit 3 Inquiry Project Rubric** and **BLM A-52 Unit 3 An Issue to Analyze Rubric** at this planning stage so they understand what is expected of them.
- For the Inquiry Project, students should read pages 214 to 217, which explain how solar energy from the Sun is absorbed and how it affects Earth's climate. This is the foundation of

knowledge for the Inquiry Project. Investigation 3A (page 226) and Investigation 3B (page 227) also provide background information on how solar energy is reflected or absorbed.

- Page 251 introduces the idea of white roofs playing a role in reducing global warming. Ensure that the connection to the Inquiry Project is noted when the subject is discussed.
- For An Issue to Analyze (pages 233 and 234), discuss human activities that affect the production of greenhouse gases. This is useful background information on what human activities are involved in the climate change issue and where there might be opportunities to make changes.
- Pages 234 and 235 discuss activities that Canadians, in particular, do that are major contributors to the production of greenhouse gases.
- Investigation 3C (pages 236 and 237) provides additional research information on Canadian activities that are greenhouse gas contributors.
- The Case Study Investigation on page 238 provides one possible alternative for students to consider when they begin researching issues and experience with dealing with complex issues.
- Topic 3.5 (pages 242 to 259) and Science at Work (pages 260 and 261) discuss making choices and the different ways some Canadians have found to reduce climate change. These are good starting points for students to consider.

**Get Ready** (Student textbook pages 190-191)

### Concepts

- Students should determine the positive or negative points of each activity listed for question 1 (question 2).
- Students should write about the role carbon dioxide in relation to photosynthesis, cellular respiration, and global warming (question 3).
- Students should be able to identify examples of convection, radiation, and conduction (question 4).
- Students should analyze an experiment, determine the role of materials, identify different variables, list safety procedures to implement, and suggest modifications (question 6).
- Students should be able to describe how climate change and global warming are related (question 8).

### Skills

- Students should list the human activities that impact climate change by examining diagrams and using prior knowledge (question 1).
- Students should identify examples of heat transfer in diagrams (question 5).
- Students should be able to analyze a graph and make conclusions based the data (question 7).

Students can review some of these skills using **BLM 3-2 Skills for Unit 3**.

### Get Ready Answers

1. Answers may vary. For example: use fertilizer in farming, use gas/diesel powered farm equipment, raise cattle, grow hay to feed the cattle, use black roofing materials, clear trees for agricultural land, plant trees, grow plants in greenhouses, use plastic materials (the recycling bin), recycle, use paints used in the fence, barn, and house, use hybrid or electric vehicles, install white or green roofs, use wind turbines or solar panels to generate electricity, use energy efficient appliances, use a clothesline to dry clothes, eat more vegetables.

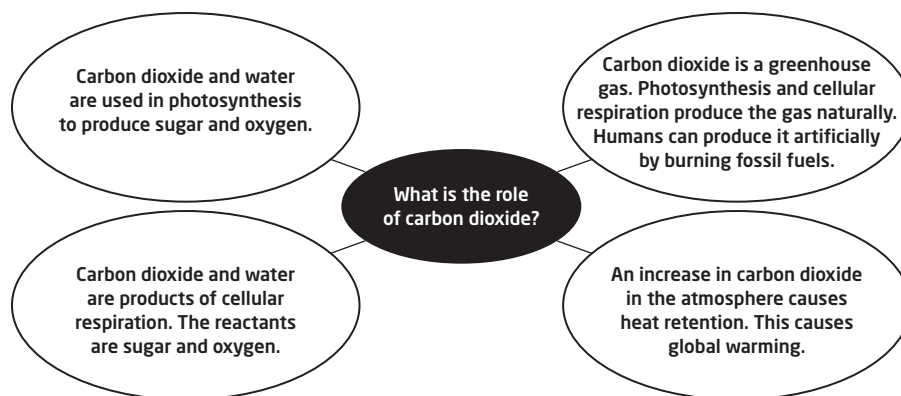
2. Answers may vary. For example:

Positives	Negatives
<ul style="list-style-type: none"> <li>• plant trees</li> <li>• grow plants in greenhouses</li> <li>• recycle</li> <li>• use hybrid or electric vehicles</li> <li>• install white or green roofs</li> <li>• use wind turbines or solar panels to generate electricity</li> <li>• use energy efficient appliances</li> <li>• use a clothesline to dry clothes</li> </ul>	<ul style="list-style-type: none"> <li>• use fertilizer in farming</li> <li>• use gas/diesel powered farm equipment</li> <li>• raise cattle</li> <li>• grow hay to feed the cattle</li> <li>• use black roofing materials</li> <li>• clear trees for agricultural land</li> <li>• use plastic materials, as in the recycling bin</li> <li>• use paints used in the fence, barn, and house</li> </ul>

Alternatives to negatives:

- use organic fertilizers or natural compost
- use electric powered or manual powered farm equipment
- raise less cattle
- reduce land needs for raising cattle
- use light reflecting roof materials or materials not made from petroleum
- plant more trees
- recycle plastics and other reusable materials
- use low VOC paints or paints that do not contain halocarbons

3.



4. a) radiation      b) conduction      c) convection

5. Answers may vary. For example:

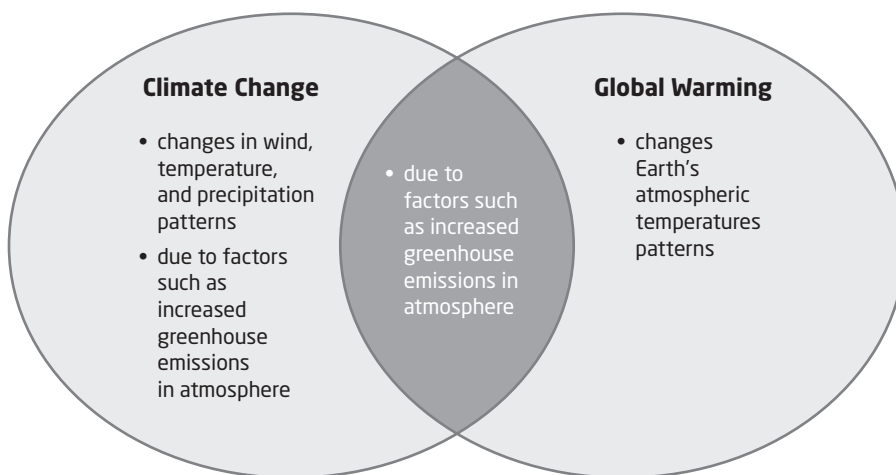
Examples in the illustration: radiation sunlight from the Sun, convection heat within the greenhouse.

Everyday examples: radiation heat from a fire, convection heat from heating water in a pot, conduction heat from the handle on a metal pot being heated on a stove.

6. a) The clear plastic bag was used to allow Sun to penetrate the glass jar but also to insulate it so heat would not get conducted out of the jar.  
 b) The amount of heat escaping from the jar as the water was heated.  
 c) Wear protective goggles in case of glass breakage. Make sure a clean-up station is nearby. Wear protective gloves when cleaning up broken glass. Dispose of glass safely in a designated disposal area and container.  
 d) Answers may vary. For example: Add a small, equal-sized piece of dry carbon dioxide to each jar.
7. a) The average winter temperatures are increasing over time and rising above 0°C.  
 b) Answers will vary. For example:

$$\begin{aligned} \text{Slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{11.3^{\circ}\text{C} - 0.5^{\circ}\text{C}}{2005 - 1950} = \frac{0.8^{\circ}\text{C}}{55} \doteq 0.02^{\circ}\text{C} \end{aligned}$$

8. Diagrams may vary. For example:



Assessment OF Learning for Unit 3		
Activity	Evidence of Learning	Supporting Learners
Unit 3 Inquiry Investigation, page 264	Students follow the scientific inquiry process to design an investigation about the effectiveness of white roofs in reducing heat absorption, create a data table, and graph the data as part of their summary.	<ul style="list-style-type: none"> <li>Refer students to Science Toolkit 2, Scientific Inquiry on pages 371 to 375.</li> <li><b>ELL</b> Provide <b>BLM 3-4 Unit Inquiry Investigation</b> to English language learners and other students to help scaffold the activity, if needed.</li> <li>Students can review drawing line graphs using <b>BLM G-34 Constructing Line Graphs</b>.</li> <li><b>ELL</b> English language learners may benefit from using <b>BLM G-33 Organizing and Communicating Scientific Results with Graphs</b>.</li> </ul>
Unit 3 An Issue to Analyze Project, page 265	Students write an action plan for climate change that includes the costs and benefits for each proposed action.	<ul style="list-style-type: none"> <li>Refer students to Topic 3.4 and Topic 3.5 on pages 230 to 259.</li> <li><b>ELL</b> Provide <b>BLM 3-5 Cost-Benefit Matrix</b> to English language learners and other students, if needed.</li> </ul>

Assessment FOR Learning for Unit 3		
Tool	Evidence of Learning	Supporting Learners
Get Ready, questions 1 and 2, page 190	Students recognize examples of activities that affect climate change. Students can list examples from their own experiences.	<ul style="list-style-type: none"> <li>Have students work in pairs to list the examples and to create the t-chart.</li> </ul>
Get Ready, question 3, page 190	Students link carbon dioxide production to photosynthesis, cellular respiration, and global warming.	<ul style="list-style-type: none"> <li>Provide students with <b>BLM G-45 Main Idea Web</b>.</li> </ul>
Get Ready, question 4 and 5, page 190	Students differentiate and recognize three types of heat transfer that are involved in global warming.	<ul style="list-style-type: none"> <li>Students could work in pairs to answer these questions.</li> </ul>
Get Ready, question 6, page 191	Students identify and use each step in the Scientific Inquiry Process.	<ul style="list-style-type: none"> <li>Students should work in groups of three or four to brainstorm ideas. Provide <b>BLM G-25 Testing Scientific Ideas</b>, if needed.</li> </ul>
Get Ready, question 7, page 191	Students analyze and interpret a graph. Students use the slope of the red line to determine the temperature change.	<ul style="list-style-type: none"> <li>Students' answers will vary. Provide an acceptable range of answers. Remind students what slope means (rise over run) to help them get started.</li> </ul>
Get Ready, question 8, page 191	Students use a Venn diagram to show how climate change and global warming are related.	<ul style="list-style-type: none"> <li>Provide <b>BLM G-49 Venn Diagram</b>, if needed.</li> </ul>