Unit 3 Climate Change

Chapter 7 Earth's Climate System

Chapter 8 Dynamics of Climate Change

Chapter 9 Addressing Climate Change

Unit 3 Climate Change

BIG IDEAS

- People have the responsibility to assess their impact on climate change and to identify effective courses of action to reduce this impact.
- Earth's climate is dynamic and is the result of interacting systems and processes.
- Global climate change is influenced by both natural and human factors.
- Climate change affects living things and natural systems in a variety of ways.

Overall Expectations

- **D1** analyse some of the effects of climate change around the world, and assess the effectiveness of initiatives that attempt to address the issue of climate change
- **D2** investigate various natural and human factors that influence Earth's climate and climate change
- **D3** demonstrate an understanding of natural and human factors, including the greenhouse effect, that influence Earth's climate and contribute to climate change

Materials

- Please see page TR-31 for a list of the materials required for this unit and other units.

In this unit, students learn about climate change and its indicators, such as global warming. Students begin by learning about the Earth's complex climate system and how different climates are classified. They learn about both natural and artificial causes of climate change. Students distinguish between the natural and the anthropogenic greenhouse effect and learn about the principle sources and sinks of greenhouse gases. Finally, students learn how climate is studied, how future climates are predicted, and how Canada is acting to prevent further climate change.

Using the Unit Opener (Student textbook pages 262 to 263)

- Have a class discussion about Earth's polar regions to gauge students existing knowledge or misunderstanding regarding what kinds of animals live there, where any people live, average temperatures, and the size of icepacks. Begin compiling information about these regions in a "graffiti poster," adding examples and details as the unit progresses. Student should then consider how global warming will change these regions. Focus conversation on how changes in polar regions might affect other parts of the globe. Have students consider what will happen to the water that is currently frozen in the ice. Also, have them consider the animals, such as penguins and polar bears, that live in these regions.
- Use a jigsaw format to initiate discussion on the big ideas. Then, redistribute these experts to share their ideas in groups of four.
- Create a display in the classroom (or discussion group online) with the heading "What strategies can individuals, communities, and governments use to address climate change?" Have students add ideas, examples, images, and clippings as the unit progresses.
- Check what students know and believe already about light and optics using **BLM 7-1 Unit 3 Anticipation Guide.** Then, when they have completed the unit, have students reflect on how and why their understandings and attitudes may have changed.
- Reactivate learning by having students answer the Get Ready questions on pages 264 to 265 of the student textbook. **BLM 7-2 Get Ready (Extra Practice)** can be used for students who would benefit from remediation.

Assessment OF Learning for Unit 3

Tool	Evidence of Student Understanding	Supporting Learners
Inquiry Project	Students select a materials to test that represent range of albedo values.	Have students review their results from Investigation 7-A Albedo and Colour. **BLM A-30 Fair Testing Rubric** may help them with their design.
An Issue to Analyze	Students identify eight initiatives described in the unit and summarize the costs and benefits of each. Students support their opinions with facts.	Organize students into "expert groups" to support each other in the research phase, then have each group present their findings to the class.

Get Ready (Student textbook pages 264 and 265)

Prerequisite Learning

Students would benefit from understanding

- positive and negative human impacts on ecosystems and climate (questions 1 and 2)
- the carbon cycle (question 3)
- thermodynamics and heat transfer (questions 4 and 5)

Prerequisite Skills

Students need to be able to

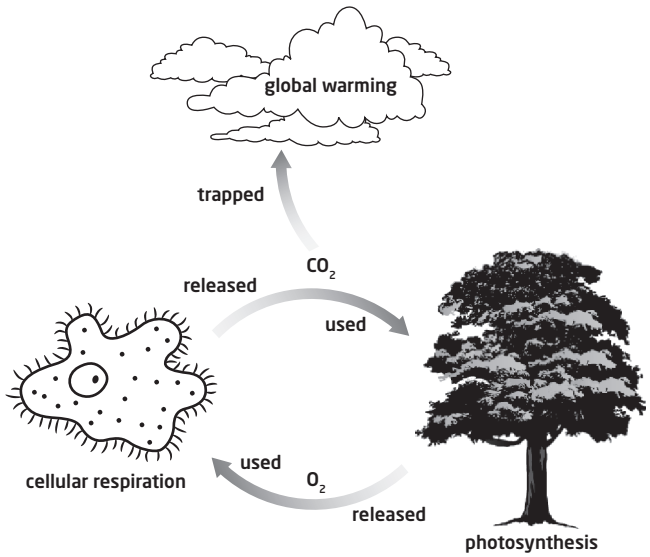
- communicate in writing, verbally, and using a variety of different media with different audiences for a variety of purposes (questions 6, 7, and 8)
- interpret a variety of literary, graphic, and informational text (questions 6 and 7)
- record and organize data using standard measurements in tables, graphs, or charts (question 7)
- represent the steps and results of an experimental procedure (questions 6 and 7)
- state a conclusion based on information gathered (questions 6 and 7)
- proofread and edit work to correct errors and refine their expression (questions 6 and 8)

Answers

Concept Check

1.–2. Example:
Positive—recycling, growing plants
Negative—driving, livestock, defoliating for farm land, lack of shade trees increases need for air conditioning and lowers albedo, fertilizer increases plant growth in waterways

3. Example:



4. **a.** radiation
b. conduction
c. convection

5. Example: radiation from the Sun, convection in the air/wind, and conduction from the shingles to the house

Inquiry Check

6. a. atmosphere

b. size and contents of glass jars, time exposed to Sun

c. Example: thermal protection when handling heated jars

d. Example: fill the jars with soil

Numeracy and Literacy Check

7. a. The average deviation from normal is steadily increasing.

b. +2°C

8. Example: Possible effects of climate change

Positive	Negative
• more agricultural land in north • enlarged habitat range • narrowed temperature extremes	• loss of agricultural land in south • loss of ice-snow habitat • desertification • increased severe weather

Introducing the Unit 3 Projects (Student textbook pages 390 and 391)

One of the challenges of climate change is finding ways to feel that climate change can be stopped and that individuals can play a positive role in dealing with this threat. Both of these projects require students to use "big picture" thinking and encourage students to explore positive outcomes for the changing climate. The Inquiry Project may be preferable to ELL as it is less linguistically challenging.

Have students begin preparing for these projects early in the Unit as much of the unit content can be used. You may wish to lay out the timelines and expectations for the projects early on, and continue to reinforce them as the unit progresses. This way, students can seek extra help, or you can organize groups that will support each other's learning before it is too late. As a class, brainstorm meanings of "ground cover." The image implies that the colour of a roof could be considered as well as the difference between pavement and grass.

Assessment FOR Learning		
Tool	**Evidence of Student Understanding**	**Supporting Learners**
Concept Check	Students identify and categorize human activities that affect climate as either positive or negative. Students recall the carbon cycle and are able to link it to global warming. Students identify types of heat transfer.	As a class, evaluate each activity (or land use) in the illustration as it affects climate. Have students start a think-pair-share activity by creating a spider map of what they already know about the topics, building on the map in pairs, to eventually include in a class summary.
Inquiry Check	Students link procedures and methods in the investigation to factors in climate change and modify the procedure to more closely model the greenhouse effect.	Refer students to Science Skills Toolkit 2 on pages 532 to 535 of the student textbook. Especially, the section of Controlling Variables for a Fair Test on page 534. They may also find **BLM G-32 Experiment Checklist** useful.
Numeracy and Literacy Check	Students interpret the graph, describing the trend and drawing the line of best fit.	Refer students to Study Toolkit Overview on page 560 of the student textbook, especially the section on Reading Graphic Text, and the Drawing a Line Graph section of Math Skills Toolkit 3 on page 556, which describes how to draw a line of best fit.

Using Making a Difference (Student textbook pages 292, 328 and 380)

Students are inundated with information about climate change, much of it both scary and confusing. The size of the problem, the difficulty actually seeing effects in our part of the world, and the contradictory information that is regularly shown on the news may have students feeling helpless and unsure of their role, or even whether they have a role. BJ, Jasmeet, and P.J. all are making a difference; doing activities that began small and grew. Each of these examples of student activism can be used to reaffirm that firstly, it is not too late to act, and secondly, everyone can play a role by doing something that interests them and that they feel is important.

Using Science at Work (Student textbook pages 388 to 389)

Sheila Watt-Cloutier has been motivated to communicate her concerns about climate change because the effects are so drastic and negative on her people, their traditional land, and their very way of life. Have students read this and then re-read the unit opener and the Chapter 7 opener. As a class, discuss why the changes are so severe in the northern regions compared to more temperate regions in southern Canada.

Have students brainstorm a list of careers that overlap with climate change in some way. They may be surprised by the far-reaching impact, affecting almost all sectors. Challenge students to pick a career and see if they can identify a related angle related to climate change.

Using the Case Studies

Chapter 7 (Student textbook pages 294 to 295)

Have students discuss where their drinking water comes from and how it might be protected. Students may recall doing a pond water study in previous ecology units, seeing the micro-organisms. Have student connect the idea that micro-organisms, some of which are harmful, have the potential to infiltrate water systems.

Have students read the bullets describing changes as global warming increases. Then, create a flowchart showing the relationship between the weather and the potential for serious illness.

Have students deliver a PSA to the class or make a display for the whole school.

Chapter 8 (Student textbook pages 312 to 313)

Before reading the case study, have students consider the title and predict the topic. They can keep this to themselves or share it. After reading, have student pairs discuss what they originally thought and if their thinking changed.

Draw a circle at the front of the class and challenge the students to label the cycle that global warming is influencing with respect to phytoplankton. Students should note that this is a positive feedback loop.

Divide the students into groups to work on their research. They can create a visual display showing before and after food webs, with respect to the phytoplankton.

Chapter 9 (Student textbook pages 378 to 379)

As a class, do a rough estimate of how many large items have been purchased and/or replaced in their homes over the years. Include microwaves, air conditioners, fridges, washers, dryers, and computers. Now have students expand the estimate to reflect the whole school's population. Continue to build the estimate by levels. Then, discuss what happens to all of the waste.

Many recycling programs exist for appliances and electronics. Have students research what they can recycle locally. Perhaps their car, phones, or toilets? Consider having students design a promotional campaign for these programs.

Have students check appliances at home for ENERGY STAR ratings. Whether they do or not, have them draft a letter explaining why such a designation is desirable.