Name Date

Answers

Science Links 10 Workbook Answers
Unit 3 Earth's Dynamic Climate

Using Your Appendices, page 72

1. Three potential sources of information should be listed, for example, science magazines or journals, the Internet, and environmental organizations.
2. Only information that is presented fairly can be trusted. Information not presented in a fair way may be incomplete, misleading, or incorrect.
3. Students should identify pros, such as reduction in greenhouse gases, lower food prices, and health benefits; as well as cons, such as reduced taste and nutrition in produce and farmers being deprived of their livelihood. Any bias should be declared.
4. **a)** The car manufacturer wants people to continue buying cars, and may base his or her claim on that, instead of on scientific data.
   b) You could analyze the evidence presented for the claim, and research to see if a similar claim has been made by other, unbiased, sources.

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

Comprehension, page 75

1. It was warmer than it is now. Dinosaurs lived in warm areas.
2. Climate change is much faster now than it has been in the past.
3. Answers may vary. For example, Climate change causes flooding, desertification, and melting permafrost.
4. Climate change includes long term warming and cooling, as well as changes in precipitation and winds in a particular area. Global warming describes a general trend of warmer average temperatures.
5. Weather. The conditions at any given time are weather. The average conditions over a long time are climate.
6. Answers may vary. This is generally considered to be a description of weather, since it addresses a relatively short time, in terms of Earth's history.
7. Global warming. Earth's atmosphere warming gradually is causing polar ice to melt, and sea levels to rise.

Analyze the Information, page 76

1. For example, Average Temperature on Earth.
2. warmer
3. approximately 1400 to 1800

4. Predictions will vary. Most will show a gradual warming trend over the student's lifetime.
5. Evidence should support the prediction in question 4. For example, humans will continue to cause some global warming, but will learn to be more environmentally friendly, so the warming will be gradual.

Assessment, page 77

1. D
2. E
3. B
4. A
5. C
6. Answers will vary. For example: The average temperature is increasing, some areas area experiencing drought and desertification, and on average tropical storms are becoming more severe.
7. The effects of human activities are now influencing Earth's climate.
8. No, the average temperature of Earth's atmosphere is increasing, but some areas are getting cooler, depending on currents and winds.

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

Reading Check, page 78

1. Climate change is disrupting food chains, causing currents to change, and raising sea levels.
2. Answers should include three of the following: Climate change is causing migratory birds to change their habits, melting permafrost, causing desertification, and allowing disease carrying organisms to live in new areas.

Applying Knowledge, page 80

Climate Change		
Effects of climate change	**Organisms that are affected**	**Additional information**
Melting sea ice	• polar bears • humans	• disrupts traditional Inuit way of life • polar bears can no longer hunt on the ice
New food chains	• krill and organisms that eat krill • salmon	• krill are at bottom of food chain • reduces diversity • salmon move north, affecting food chains in their new habitat, and in the one they left
Warmer oceans	• coral • algae • other organisms that live near coral reefs	• also slows down ocean currents, affecting land masses
Rising sea levels	• organisms that live in low-lying coastal areas	• caused by melting ice and warmer water • causes humans and other animals in coastal areas to find new homes
More violent storms	• organisms in the path of tropical storms	• warmer air above oceans is less stable

Cloze Activity, page 81

1. desertification
2. disease
3. Migration
4. permafrost
5. Climate change
6. sea
7. tropical storms
8. mosquitoes
9. global

Comprehension, page 82

1. Melting sea ice in Canadian Arctic waters have made new oil and gas reserves available. Milder winters and a longer growing season are increasing Canada's production of maple syrup. Increased rainfall in parts of Africa may lead to increased crop growth, and less risk of famine.
2. Algae give corals their colour. These algae provide food for the corals. When the corals become white, it means the algae are no longer present, and the corals die. Coral reefs act as nurseries and shelters for a wide variety of organisms in their aquatic ecosystem. When the corals die, these organisms must move elsewhere or die as well.
3. Traditional Inuit ways of life include travel over sea ice, often to hunt. If the sea ice melts, Inuit hunting and travelling are disrupted.
4. Houses built on the permafrost will become unsafe. Trees on the permafrost may topple and die.
5. Mosquitoes that carry disease thrive in wet conditions. Floods can cause mosquito populations to rise, and increase the spread of diseases such as malaria and West Nile virus.
6. Answers will vary. Areas near coasts may be more affected because they are affected by temperature changes as well as sea level changes and current changes. Areas near the poles may be more affected because warmer temperatures will cause ice to melt, changing their climate, landscape, and ecosystems.

Assessment, page 83

1. C
2. D
3. E
4. B
5. A
6. Climate change can cause aquatic organisms to die, or to move to warmer or cooler water. This removes a link from the food chain, and disrupts the whole chain.
7. When average temperatures stay below the freezing point, the ground stays permanently frozen, and solid. As average temperatures rise above the freezing point, the permafrost thaws, becoming wet and soft.
8. Higher temperatures create drought, and also create storms and higher sea levels, which cause flooding.

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

Reading Check, page 85

1. More solar energy strikes Earth at the equator.
2. water vapour, carbon dioxide, methane, and nitrous oxide
3. It takes more heat to warm water than it does to warm air.
4. Mountains cause air to rise, which makes it cool. Mountains also affect the path of moisture-carrying winds.

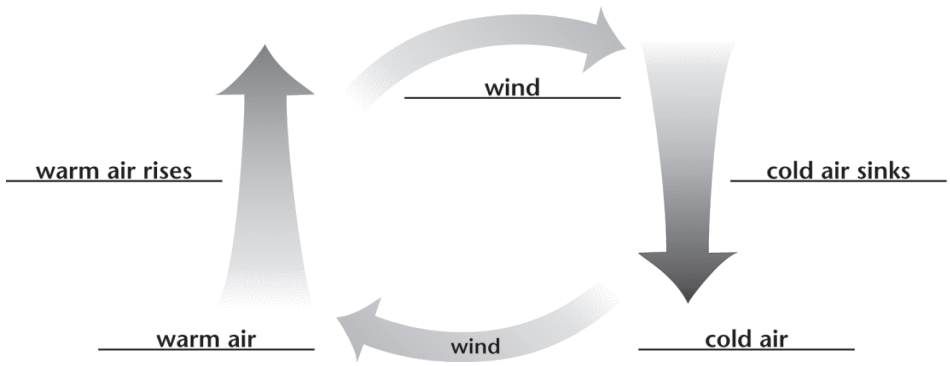
Applying Knowledge, page 88

Type of greenhouse gas	Natural sources	Other details
Water vapour	• evaporation • given off by plants, animals, and other organisms	• most abundant greenhouse gas • accounts for about 70% of greenhouse effect • amount in atmosphere varies with temperature • produced during cellular respiration
Carbon dioxide	• living organisms • volcanoes, forest fires, decaying organisms, released from oceans	• second-most abundant greenhouse gas • produced during cellular respiration
Methane	• some bacteria and other organisms that live in wetlands • bacteria that live in gut of cows and termites • vents in Earth's crust	• produced during extraction of energy from food in absence of oxygen
Nitrous oxide	• bacteria that live in oceans and tropical soils	• produced when bacteria break down nitrogen-rich compounds for food

Comprehension, page 89

1. Areas near the equator receive energy from the Sun from overhead, which transfers more energy to the Earth. Areas near the poles receive energy at more of an angle, which spreads it out, resulting in less energy transfer.

2.



3. The greenhouse effect is a process in which certain gases in Earth's atmosphere absorb heat from the Sun and heat radiated from Earth's surface.

4. The greenhouse effect helps to keep Earth's temperature moderate. Without the greenhouse effect, temperatures would be extreme.

5. Many factors affect climate, and it can be difficult to predict their combined effects. For example, an erupting volcano can affect Earth's climate systems in unpredictable ways.

Applying Knowledge, page 90

Atmosphere: winds transfer heat around the world
Hydrosphere: currents transfer heat around the world, stores and releases carbon dioxide to keep Earth from getting too warm or too cool
Both: moderate Earth's temperature, transfer heat

Assessment, page 91

1. D

2. C

3. F

4. A

5. E

6. B

7. When the northern hemisphere is tilted toward the Sun, more intense solar energy reaches it and it experiences warmer temperatures (summer). When it is tilted away from the Sun, less intense solar energy reaches it and it experiences colder temperatures (winter).

8. As Earth orbits the Sun every year, different parts of the Earth are tilted toward the Sun at different parts of the orbit. This results in the regular patterns of seasons that we experience.

9. In a greenhouse, energy from the Sun is trapped inside by the glass. Greenhouse gases in Earth's atmosphere also trap the Sun's energy, moderating Earth's temperature.

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

Reading Check, page 93

1. Anthropogenic means "human-caused".

Cloze Activity, page 94

1. humans
2. halocarbons
3. Fossil fuels
4. methane
5. Landfills
6. Nitrous oxide
7. oil sands
8. industrial revolution
9. Urbanization
10. coal

Applying Knowledge, page 95

1. Canadians need to heat their homes for many months of the year. We use fossil fuels for much of this heating. We would produce less greenhouse gases if our climate were warmer and if we did not need to heat our homes as much.
2. Methane is produced when bacteria break down vegetation without oxygen. This happens in rice fields and hydroelectric dams, where bacteria break down vegetation under water, and in landfills, where bacteria break down vegetation buried in piles of garbage.
3. Trees use carbon dioxide in the process of photosynthesis. This carbon dioxide is removed from the atmosphere. When a tree is cut down, it will stop using carbon dioxide. Also, if the tree is burned, or left to decompose, it will release carbon dioxide into the atmosphere.
4. Methane absorbs 25 times more heat than carbon dioxide does. This makes it a stronger, or more potent, greenhouse gas.
5. Animals on farms, such as cows, goats, and sheep, have bacteria in their guts that produce methane. Farm machines produce greenhouse gases by burning fossil fuels. Farming produces nitrous oxide, and clearing forests for farming increases levels of carbon dioxide in the atmosphere. Students should list two of these processes.

6. During the industrial revolution more coal-fuelled factories were built, increasing the levels of carbon dioxide in the atmosphere. People moved to cities to work in these factories. As the size of cities increased, more land was cleared, also increasing the levels of carbon dioxide in the atmosphere.

Analyze the Information, page 96

Students' graphic organizers should include the following information:

Hydroelectric Plants:
- Dams flood land, causing the production of methane.
- Hydroelectric dams also produce some carbon dioxide.

Coal-fired Plants:
- Coal contains carbon, and releases large amounts of carbon dioxide as it burns.

Assessment, page 97

1. B
2. E
3. C
4. D
5. A
6. The anthropogenic greenhouse effect is the enhanced accumulation of greenhouse gases in Earth's atmosphere, caused by human activities.
7. During the industrial revolution, more factories were built in cities. People moved to the cities to work in the factories. The cities then needed to become larger and larger, expanding onto rural land.
8. Farming and travel (land and air).
9. Canada's location away from the equator means we need to use a lot of fossil fuels to heat our homes, and other buildings. So we produce more greenhouse gases than we would if we lived in a warmer climate.

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

Reading Check, page 99

1. Three sources of information about Earth's past climate are tree rings, ice cores, and fossils.
2. Scientists use weather balloons, radar, and satellites to collect data on climate change today.
3. A global climate model is a set of mathematical equations that helps us understand and predict changes in Earth's climate.

4. A carbon footprint is the total amount of greenhouse gas emissions caused by an individual, a company, or an organization.

Applying Knowledge, page 102

Cause and effect maps will vary. For example, purchasing a bicycle can affect climate change in these ways:

- reduces greenhouse gas production because you do not need to drive or be driven in a car as often, so will not use as much fuel
- reduces greenhouse gas production by using the bicycle as recreation instead of activities that require electricity
- reduces other people's greenhouse gas production by setting a good example
- produces some greenhouse gases through the manufacturing and shipping of the bicycle, helmet, and other bicycle accessories

Comprehension, page 103

Tool	Type(s) of data collected	Other information
Tree rings	• data about droughts, floods, and fires	• sizes and shapes of rings vary depending on conditions
Ice cores	• dust and ash trapped in ice indicate volcanic eruptions or forest fires • plant pollen tells about species of plants that were alive at that time • air bubbles show composition of air when the ice formed	• oldest ice is about 1 000 000 years old • special drills are used
Fossils	• data about organisms and climate in an area millions of years ago	• many fossils are much older than the oldest ice
Weather balloons	• temperature, air pressure, humidity	• carry mini weather stations that relay data to Earth by a radio transmitter
Radar	• precipitation and storms	• microwaves bounce off water droplets or ice crystals
Satellites	• conditions on land, in atmosphere, and in oceans	• many countries cooperate to gather data with satellites

Cloze Activity, page 104

1. tree rings
2. Radar
3. global climate model
4. clotheslines, white roofs
5. ice cores
6. Satellites

7. Artificial trees
8. bioclimate profile
9. humans
10. energy

Assessment, page 105

1. C
2. D
3. B
4. E
5. A
6. Answers will vary. For example, you can walk to school instead of getting a ride, purchase things that were made or grown locally, eat less meat, use a clothesline instead of a dryer, and turn down the thermostat.
7. Scientists can learn what organisms lived in an area, and what the climate must have been like for those types of organisms to survive.
8. Weather balloons measure temperature, air pressure, and humidity.
9. A light-coloured ring represents spring growth, so a wide light-coloured ring might mean that there was enough moisture and light for the tree to grow a lot that spring.
10. Since the climate in every part of the world is connected, no country can solve the climate-change problem on its own. In addition, our activities in Canada affect people's activities in other countries. Countries must cooperate to solve the climate issues that affect the Earth.

Literacy Test Preparation, page 106

1. D
2. C
3. A
4. C
5. Summaries will vary. They should include a main idea and at least one point to support it. For example, polar bears are threatened by global warming. Polar bears have a thick layer of fat to help them survive in cold winters, and can overheat if the weather gets too warm. Sea ice is melting, making it more difficult for them to reach their prey. Sometimes they drown trying to swim to sea ice. Polar bears also need sea ice for breeding and shelter.