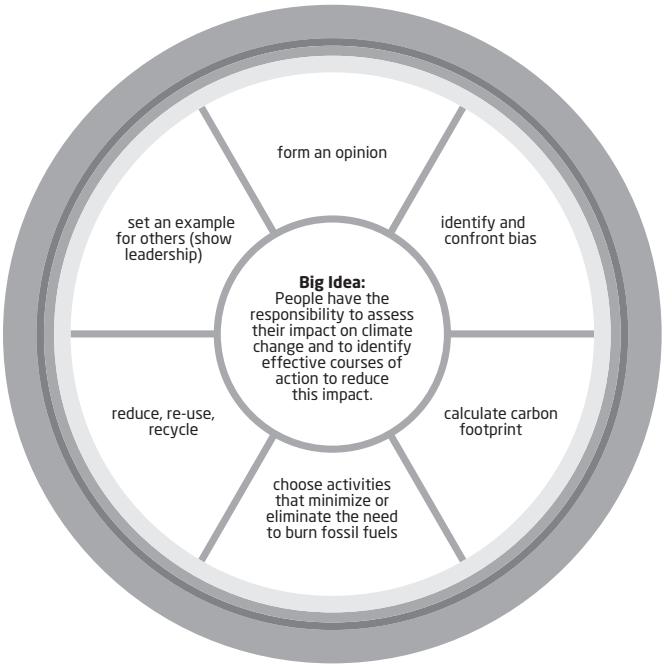
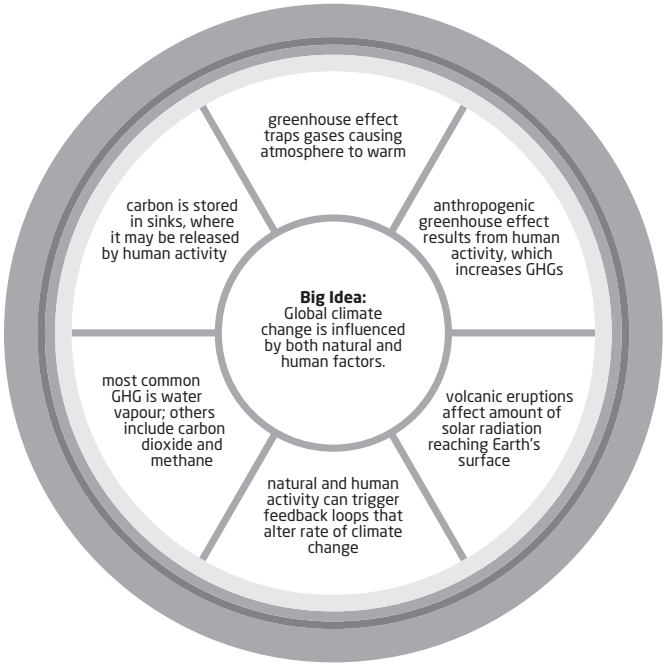
Unit 3 Review Answers (Student textbook pages 392 to 395)

Connect to the Big Ideas

Connect to the Big Ideas answers are also available as a Blackline master on the accompanying CD.





Knowledge and Understanding

1. d.

2. a.

3. b.

4. c.

5. c.

6. Example: In this positive feedback loop, increased CO_2 in the air increases global air temperatures, which increases water vapour in the air, which increases greenhouse warming, which continues to increase global air temperatures, continuing the loop.

7. Example: The area available for cultivation will expand farther north and the length of the growing season will increase. On the other hand, global warming is expected to reduce water available for agriculture, which will limit what crops can be grown.

8. Example: In a positive feedback loop, a small initial change is magnified and results in a large overall change in the system. In a negative feedback loop, the initial change is counteracted by another process and the overall result is a return the original condition.

9. The more carbon dioxide there is in the atmosphere, the more acid rain will form, which in turn makes the oceans more acidic.

10. Because these organisms currently live only in warm, wet environments, scientists can conclude that the climate of the high Arctic was once like that.

11. Large bodies of water tend to moderate the local and regional climate because they change temperature more slowly than the surrounding land.

12. Example: The *pace* of change is unusually fast, faster than the ability of biomes (and animals in them, including humans) to adapt.

13. Roads and buildings absorb a lot of heat, radiating it into the area. Development also reduces tree (and grass and wetland) cover, decreasing the size of carbon sinks.

14. Scientists can test the accuracy of climate models by substituting data from past climates and seeing how well they re-create those climates. They also compare several different models using different ways of solving the equations for climate to see how well the models can reproduce each others' results. Any models that are significantly different are examined to identify why they disagree.

15. Example: Cap-and-trade is a good solution for large industrial emitters; however, it does not cover other sources such as transportation fuels. The carbon tax can cover many sectors that would be missed with a cap-and-trade system. Both have costs that are passed down to the consumer, although the carbon tax is more direct, as the consumer would pay it at the gas pump.

Thinking and Investigating

16. By examining records of past environments, scientists can see what Earth was like before being influenced by human activities. Any deviation from the past that cannot be explained by natural processes will likely be from human activities.

17. Plausible myths include: that climate change is not occurring; that the Earth is entering into an ice age; that carbon dioxide is not a factor in climate change; that human activity has no impact on global warming; that the ocean levels are not rising; and that the polar ice caps are not melting.

18. Example: Although carbon dioxide and other greenhouse gases are only trace elements in the atmosphere, these gases absorb thermal energy, which results in the greenhouse effect. Because humans have increased the concentration of greenhouse gases in the atmosphere by significant amounts, it is reasonable to conclude that we have increased the amount of thermal energy absorbed and retained by Earth's atmosphere.

19. Tropical storms and hurricanes form over warm oceans. More frequent storms indicate that the ocean surface temperature is higher.

20. Example: While we cannot predict with certainty on which days it will snow (weather) we can predict that it will snow in winter (climate). Being that climate is the long-term pattern of weather conditions, predicting it is much more reliable than predicting individual weather.

21. Students could start their research at **www.scienceontario.ca**.

22. Because it concerns a long-term pattern, this describes a change in climate.

23. Biases in weather records include: changing instrumentation, urban heat islands that grew around weather stations, and by the limited location and availability of records in some areas such as the middle of the ocean. Corrective steps include accounting for known biases and extrapolating weather models to what the weather and climate might have been in unmonitored locations.

Communication

24. Potential biases include: it presents the flow as a closed loop, implying that all CO_2 released is reused by photosynthesis, with no excess in the atmosphere. Questions could include: Is the source crop diverted from the food supply? Does the processing pollute? Where does the heat come from for the process? Is the heating process efficient or self-sufficient (i.e., what is the net energy output)?

25. Example: polar bears or coral affected by acidic oceans

26. Students could start their research at **www.scienceontario.ca**.

27. Example:

Sources	Sinks
respiration combustion of fossil fuels	forests phytoplankton in oceans

28. **a.–f.** Paragraphs should reflect incorporation of unit content to support conclusions, and evidence of personal growth as well as critical thinking.

Application

29. No, ice cores are just one of many ways in which scientists reconstruct past climates.

30. Because the polar regions do not get as much direct radiation from the Sun, heat absorbed by and distributed through the atmosphere would be more significant in those regions.

31. We will need less heating in the winter, but more air conditioning in the summer; improved insulation will help. Warmer temperatures will increase evaporation, drying up some land and waterways. This could prevent shipping, irrigation, access to drinking water, and the ability to produce electricity from hydroelectric dams. New plants and animals might move to Canada displacing native species, and native species may not adapt to the warmer weather.

32. A farmer can change crops every year, but trees take decades or centuries to grow, so forestry will take longer to adapt to changing climate that might destroy the crop or prevent its regrowth.

33. Earth's axial tilt may have been different, and the Sun's output might have been lower, so a greater greenhouse effect was needed to maintain temperature levels comparable to what they are today.

34. Both the period of data and the region for which it was collected is too small to represent climate.

Literacy Test Prep

Multiple Choice

35. c.

36. c.

37. b.

Written Answer

38. Example: While the movement of tectonic plates affects the size, shape, and distribution of continents, it occurs so slowly that it is unlikely to have greatly affected measurement of climate change in the past 200 years. However, rebound (the expansion of the tectonic plates after being compressed by ice during the last ice age) may be affecting the measured climate change by distorting how much the ocean levels have risen. Tectonic plates may impact measured sea level rise; however, many other measurements, including global atmospheric temperatures, ocean currents, and changes in weather patterns, are not associated with tectonic plates.