

EcoSchools Multimedia Presentation: *The Science of Climate Change*

This answer key corresponds to the student question sheet for the EcoSchools multimedia presentation, *The Science of Climate Change*. Video clips are linked to some of the slides. These provide additional information about the science of climate change. Answers to the questions are found in both the slides and the video clips.

The student question sheet is designed to help focus the attention of the class as the teacher is delivering the multimedia presentation. This answer key/extension suggestions resource is meant to support the delivery of the presentation. Many of the questions link to the Big Ideas found in the Focus Questions—Connections to Climate Change sections of the EcoSchools curriculum document *Climate Change in Grade 10 Science (Academic or Applied)*. *The Science of Climate Change* multimedia presentation complements this curriculum document.

The presentation can be viewed over a number of periods. Below is a suggested schedule, based on 40 minute periods:

Period 1: Introduction to climate change and Energy Balance Slides 1 – 16

Period 2: Carbon is crucial and Weathering the storm Slides 17 - 37

Period 3: Science and Technology: Problems and Solutions Slides 38 - 56

Answer Key

The numbered questions below correspond to the questions found on the student question sheet. The student questions appear in regular type; *answers appear in italics*.

Extensions for Teachers

Opportunities to engage in class discussion and extend students' learning as the presentation is being made are identified in the text below as:

- ▶ **Making Connections:** Here is a chance to make links to other subject areas. You may want to use these to illustrate to students how climate change affects many areas of our lives. Climate change is a complex issue that requires multidisciplinary study and numerous solutions.
- ▶ **Skills Building:** activities or questions that can be used during or after the presentation that help to build skills listed in the curriculum.

Introduction: Slides 1-16

- ▶ **Making Connections:** Ask students if they have heard of the terms climate change or global warming.

1. What is climate?

Climate is the characteristic pattern or course of weather that an area has over a long period of time.

2. What are the 5 main components of the global climate system?

- *Atmosphere (air)*
- *Hydrosphere (water)*
- *Cryosphere (ice/snow)*
- *Land surface*
- *Biosphere (living things)*

3. Describe the greenhouse effect. Draw a diagram showing the greenhouse effect.

Heat and light energy (radiation) from the sun is either reflected back into space by the atmosphere or passes through the atmosphere and warms the Earth's surface. Some of this energy is radiated back out from Earth. Some gases in the atmosphere absorb or "trap" some of the radiation, increasing the temperature of the Earth's surface. Thus, the gases are said to act like a greenhouse. (see slide 7 for diagram.)

4. What key outside factor affects the global climate system?

Energy from the sun.

5. Complete this equation:

When energy in = energy out, we have *a balanced* climate system

- ▶ **Making Connections:** Discuss the fact that energy can be converted but not destroyed. Brainstorm some energy conversions that take place in student's lives everyday.

6. Looking at the diagram on slide 14, in what form does energy *reach* the earth's climate system?

In what forms does energy *leave* the earth's climate system?

Into the system:

- *Solar radiation*

Leaving the system:

- *Reflected solar radiation (atmosphere and surface)*
- *Long-wave (heat) radiation*

7. Describe the *enhanced* greenhouse effect.

When the concentration of CO₂ and other greenhouse gases in the atmosphere increases, the amount of heat escaping from the earth is reduced. The heat energy is absorbed by GHGs and the climate system achieves equilibrium through changes in some of its parts. These changes in the climate system are the impacts of climate change.

8. What are 3 major climatic responses to the enhanced greenhouse effect observed by IPCC scientists?

- *Increase in global average surface temperature*
- *Snow and ice cover have decreased*
- *Sea level has risen and ocean heat content has increased*

- ▶ **Making Connections:** Brainstorm human activities that contribute to climate change

9. What happened to create the enhanced greenhouse effect and change the balance in the climate system?

Since the Industrial Revolution the concentration of greenhouse gases has increased, specifically carbon dioxide (CO₂).

Carbon is crucial, and Weathering the Storm: Slides 17 - 37

10. How is carbon released? What are the natural sources of carbon in the global climate system?

- *Oceans (through direct exchange with the atmosphere)*
- *Decomposition and respiration by plants and animals*
- *Volcanic eruptions*

11. What are the natural sinks (absorbers) of carbon?

Oceans, wetlands, forests

12. What is the main form of carbon linked to the enhanced greenhouse effect?

Carbon dioxide (CO₂) is the carbon-containing gas compound that is released during cellular respiration, absorbed by plants during photosynthesis and dissolved and released from oceans.

13. What human processes release carbon into the atmosphere at a rate faster than the natural system can absorb?

Burning of fossil fuels is the major human-related source of carbon dioxide.

14. What other human activities have contributed to the reduction in carbon absorption?

Destruction of forest, wetlands and other natural habitats has reduced the effectiveness of the earth's carbon sinks.

- **Building Skills:** Reading Graphs (Use the graph link icon) Discuss the Industrial Revolution and the corresponding predicted increase in the Earth's average temperature.

15. List the types of weather changes associated with climate change.

Increased precipitation, drought and temperatures.

16. The density of seawater drives the flow of ocean currents. What 2 key physical characteristics determine the density of seawater?

Temperature (thermo) and salinity (haline).

17. Why is thermohaline circulation important to the climate and ecosystems around the world?

Warm and cold waters are mixed, affecting climate. Currents move water and nutrients around the world. Currents affect coastal and marine ecosystems.

18. What are some of the problems that plants and animals face with rapid changes in climate?

Most plants and animals have evolved over centuries to live in a specific habitat in a specific ecosystem. Rapid changes to parts of the ecosystem (e.g., climate and weather) may change the biotic (living) and abiotic (non-living) conditions of an area more quickly than plants and animals can adapt. Animal and plants already under pressure from other environmental factors (pollution, habitat loss, etc.) will not survive the added threat of climate change.

Science and Technology: Problems and Solutions Slides 38 – 56

19. What types of technology assist scientists in studying climate change?

Weather satellites and computer modeling are two essential technologies to the study of climate change.

20. List 3 emission-free energy sources.

- *Solar power*
- *Wind Power*
- *Micro-hydro power*

21. List 3 transportation technologies that reduce the emission of greenhouse gases.

- *Hybrid vehicles*
- *Fuel Cells*
- *Hydrogen power systems*

22. What is the Kyoto Protocol?

- *In 1997, representatives of over 160 countries gathered in Kyoto, Japan to draw up the Kyoto Protocol, an international agreement that seeks to reduce greenhouse gas emissions to below 1990 levels by 2008-2012.*
- *Canada ratified, or committed to, the Protocol in 2002*
- *In Canada, implementing Kyoto means reducing our greenhouse gas emissions by 20% below today's levels, or 6% below 1990 levels.*