# TAKING A HEALTHY BITE OUT OF CLIMATE CHANGE

| **Session #2: What's "Up" With Climate Change?** | **Date:** |
|---|---|

**Teaching Point & Strategy:**
The goal of this session is to help students discover that the greenhouse effect is a natural process needed for life on Earth but that human activity (including the transportation and processing of food) increases greenhouse gas concentration and therefore, the contributes to climate change. A graphing exercise demonstrates recent increase of $CO_2$ in the atmosphere.

**Resources:**
- Greenhouse Effect Diagram (posted and as handout for each student)
- Chart of Increased $CO_2$ in atmosphere in parts per million past 2000 years, plus *Atmospheric $CO_2$* chart
- Student Handout - Line Graph Template to Complete for Atmospheric Carbon Graph
- World Map
- Map of Southwestern Ontario with 200km and 20km circles

**BEFORE**

1) In a math lesson, introduce students to line graphs so that they are familiar with the concept.

2) (If done) Review results of students' visit to supermarket.

**DURING**

INTRO - 15 min:
- Review Greenhouse Effect by following colouring instructions with students (*see "Colouring Instructions" in Teacher Support below*).
- Orient students to graph by explaining units parts per million.

MAIN LESSON - 30 min:
1) Have students plot points and connect line to create their own version of the Atmospheric Carbon Curve.
2) Discuss the trend that they see.
3) Extend the line into the future (to 2030) with 3 possible scenarios
   - line continues, business as usual
   - line gets steeper, more fossil fuel use
   - line levels off, people take action
4) With a series of horizontal lines, have students add benchmark numbers. (listed in Teacher Reference below)

WRAP-UP:
Discuss how the shipping and processing of food contributes to GHG levels in the atmosphere. Review from Session #1 about greenhouse gases and carbon footprint of food.

**AFTER**

After having completed the colouring exercise with the Greenhouse Effect diagram, have students turn to the person next to them and take turns explaining what is happening in the diagram in their own words.

**New Vocabulary:**
- parts per million
- local vs. imported food

**Ontario Curriculum Expectations:**

Mathematics - Data Management & Probability
- collect and organize discrete or continuous primary data and secondary data and display the data in charts,tables,and graphs (including broken-line graphs) that have appropriate titles,labels (e.g.,appropriate units marked on the axes),and scales that suit the range and distribution of the data, using a variety of tools (e.g.,graph paper,simple spreadsheets, dynamic statistical software);
- read,interpret,and draw conclusions from primary data (e.g.,survey results, measurements, observations) and from secondary data, presented in charts, tables,and graphs

Health & Physical Education- Healthy Eating
C3.1 Describe how advertising and media influences affect food choices (e.g., TV commercials, product packaging,), and explain how these influences can be evaluated to make healthier choices (e.g., asking for information about product ingredients and nutrients)

Media Literacy (optional extension) - Producing Media Texts
3.4 Produce a variety of media texts for specific purposes and audiences, using appropriate forms, conventions, and techniques (e.g. a pamphlet on a socially relevant topic they have studied this year, a news broadcast about a topic from a cross-curricular unit of study

**Teacher Assessment / Evaluation:**
- Collect graphs for assessment.
- Students' ability to recount/explain the Greenhouse Effect.

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**Optional Extension Activities:**
1) To illustrate the greenhouse effect, ask one student to come to the front of the room and add layer after layer of clothing (jackets, hats, mitts, scarves, another jacket, etc.) until they feel quite warm - heat is trapped in the same way as in the atmosphere!
2) Use new vocabulary words to practice proper spelling.
3) On the map, ask each student to find two places inside the circle that you know and two places outside the circle that you know (contextualizes the distance)
4) Drawing activity: Show their own representation of the Greenhouse Effect (natural and enhanced).
5) Design and create an information poster about how our food choices impact climate change - to be posted in the school hallway.

## TEACHER SUPPORT / REFERENCE:

Colouring Instructions for Greenhouse Effect Diagram

| Explanation (Read Before Colouring) | Colouring Instruction |
|---|---|
| 1) The Earth is surrounded by a mixture of gases that make up the atmosphere and act as a blanket, warming the Earth. | 1) Colour (BLUE) the line that represents the atmosphere . |
| 2 a) As the Sun radiates energy onto the Earth,<br>b) some of the energy is reflected back out into space before reaching the Earth,<br>c) some of the energy passes through the atmosphere and reaches the Earth, and<br>d) some is reflected by the Earth back to the atmosphere. | a) Colour (YELLOW) the arrow coming from the Sun to the Earth .<br>b) Colour (YELLOW) the small arrow that reflects off the atmosphere .<br>c) Colour (YELLOW) the arrow that reaches the Earth .<br>d) Colour (ORANGE) the wavy arrow coming from the Earth. |
| 3 a) Some of this energy goes through the atmosphere and back out to space, but<br>b) some is absorbed by gases in the atmosphere and return to the Earth.<br>The process of the Earth being warmed by the heat that is trapped in the atmosphere is called the “Greenhouse Effect” and the gases in the atmosphere that trap heat are called “Greenhouse Gases”. The Greenhouse Effect is a natural process and it is what makes it possible for life on Earth. Without greenhouse gases in the atmosphere, all of the heat from the sun would go back out into space and the Earth would be very cold! | e) Colour (ORANGE) the wavy arrow going to space.<br>f) Colour (ORANGE) the wavy arrow pointing back to the Earth. |
| 4) Over the last 200 years, burning fossil fuels to drive cars, produce electricity and grow and process food has produced greenhouse gases (GHGs). The amount of GHGs in the atmosphere has increased and so have the average temperatures on Earth. The added GHGs act as an additional blanket on Earth. This is called the Enhanced Greenhouse Effect. The three major greenhouse gases are carbon dioxide, methane, nitrous oxide. | 6) Colour (RED) the thicker atmosphere. Colour the arrows, using the same colours as you did in the Natural Greenhouse Effect, follow the flow of the sun’s energy in the Enhanced Greenhouse Effect. Notice that more greenhouse gases in the atmosphere trap more heat. |

Benchmark Carbon Dioxide Concentrations in the Atmosphere
- **280** parts per million – ppm – of CO2 in the atmosphere at the start of the Industrial Revolution
- **350** ppm – what is considered safe for life on Earth
- **392** ppm – where we are now (February 2011) reference: http://co2now.org/
- **450** ppm – what many countries including Canada think is okay for Earth = 2 degrees C increase. This is a very dangerous level - much like a human with a temperature (fever), a slight increase can make a HUGE difference.

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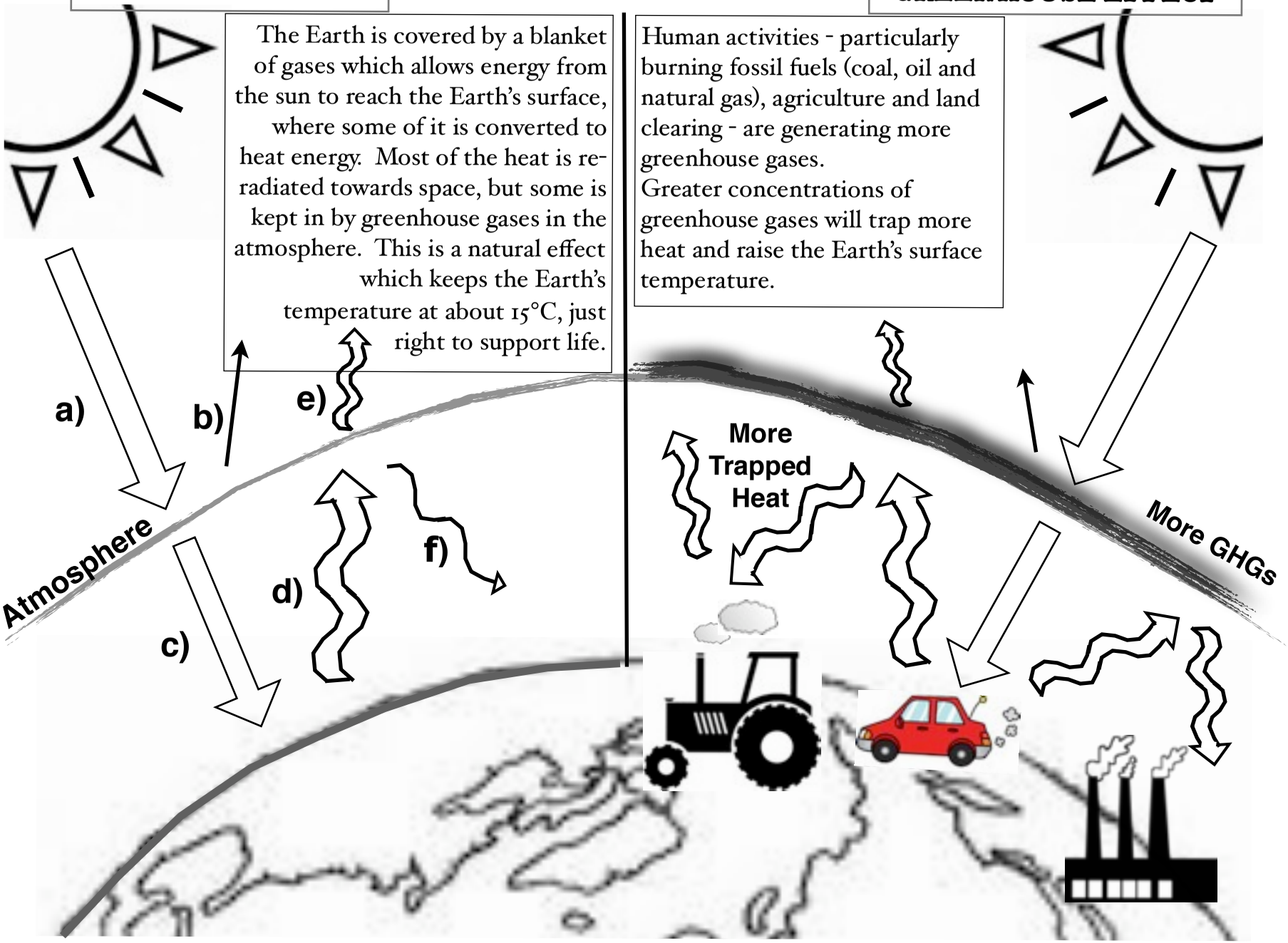
# Colour Me!

## NATURAL GREENHOUSE EFFECT

The Earth is covered by a blanket of gases which allows energy from the sun to reach the Earth's surface, where some of it is converted to heat energy. Most of the heat is re-radiated towards space, but some is kept in by greenhouse gases in the atmosphere. This is a natural effect which keeps the Earth's temperature at about 15°C, just right to support life.

## ENHANCED GREENHOUSE EFFECT

Human activities - particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing - are generating more greenhouse gases.
Greater concentrations of greenhouse gases will trap more heat and raise the Earth's surface temperature.



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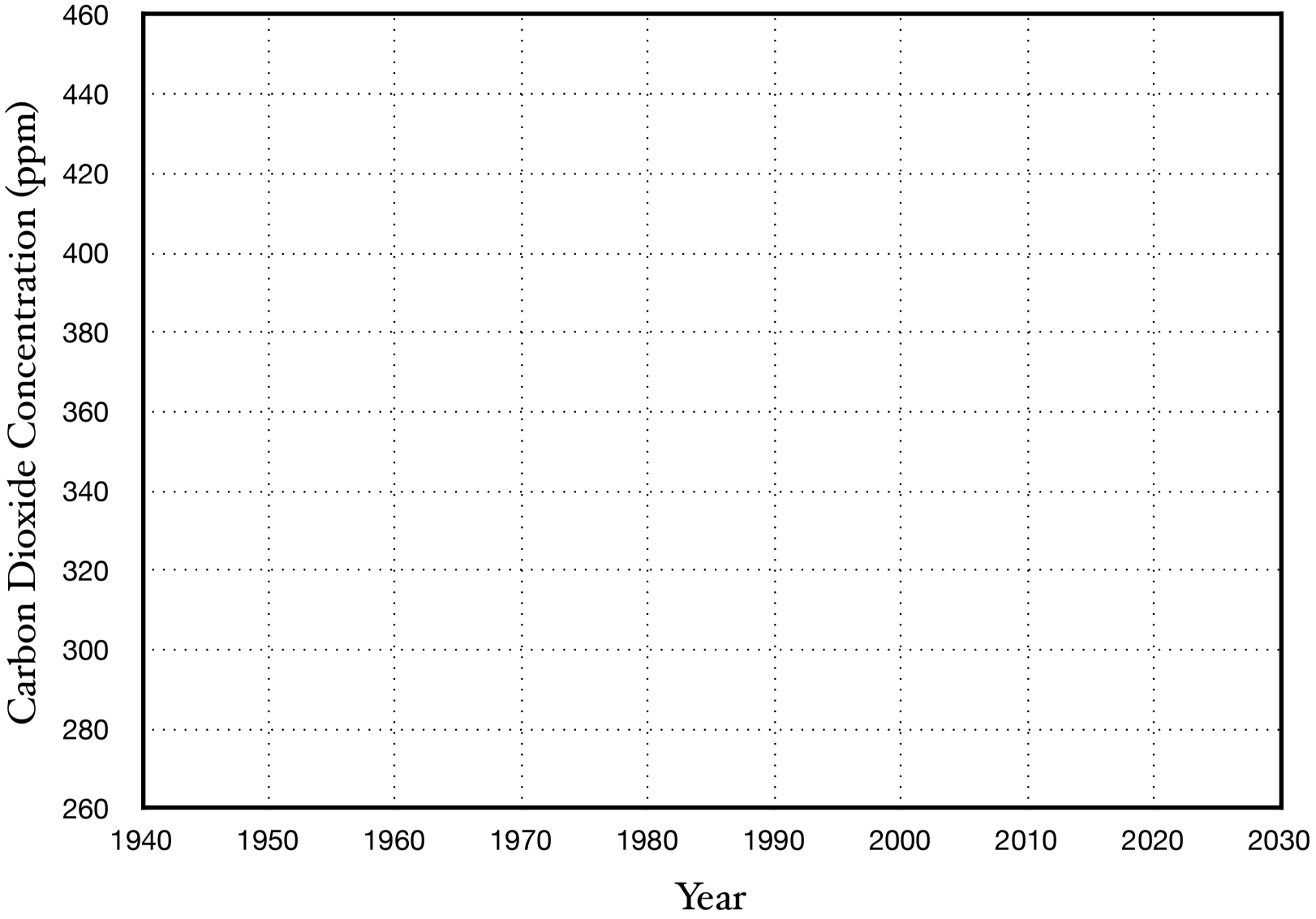
## ATMOSPHERIC CARBON DIOXIDE MEASURED AT MAUNA LOA, HAWAII



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**Atmospheric Carbon Dioxide Measured at Mauna Loa, Hawaii**

| Year | Carbon Dioxide Concentration (ppm) |
|---|---|
| 1960 | 315 |
| 1970 | 325 |
| 1980 | 337 |
| 1990 | 353 |
| 2000 | 368 |
| 2010 | 390 |

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