Bushfire and ice • Correlating CO2 levels with average temperature in the Antarctic ice core

**Year 9**

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| **Name:** |  |

### Background

The Earth is surrounded by a number of different gases (carbon dioxide, methane and water) that form the atmosphere. When sunlight travels to the Earth’s surface, the gases in the atmosphere allow the visible light to pass through. Some of this light energy is reflected off clouds, ice and other white surfaces. The rest of the light energy is absorbed by plants for photosynthesis or absorbed by the surface of the Earth. The Earth’s surface then releases infrared radiation, warming the gases in the atmosphere. This process is called the greenhouse effect.

A sample of ice from an ice core can tell us a lot of information about greenhouse gases from the past. The deeper the ice sample, the older the ice. Each ice segment can provide us information on:

* the age of the ice (based on the ratios of radioactive compounds present in the ice).
* the level of carbon dioxide that was in the atmosphere (trapped in air bubbles in the ice).
* an estimate of the temperature at the time the ice was formed (from the level of deuterium in the ice).

### Aim

To determine the relationship between carbon dioxide and Antarctic temperatures over the last 800,000 years.

### Data

**Figure 1**: Ice Core comparison of carbon dioxide levels (upper) and the difference in temperature (lower) from the average over the last 1000 years.

### Discussion

1. Define the greenhouse effect and identify two gases that contribute to this effect.
2. Describe the shape of the graph (Figure 1) of the:
   1. carbon dioxide levels over the last 800,000 years, by:
      1. identifying the highest and lowest levels in ppmv.
      2. identifying the average time (years) between each cycle (by calculating the time between the peaks).
   2. change in temperature in Antarctica over the last 800,000 years, by:
      1. identifying the highest and lowest levels in degrees Celsius.
      2. identifying the average time (years) between each cycle (by calculating the time between the peaks).
3. A student claimed that the increased levels of carbon dioxide levels caused the increased temperatures in the Antarctic. Evaluate their claim by
   1. defining the difference between causation and correlation.
   2. identifying if there is any evidence to support their claim of causation.
   3. providing a counter claim that identifies another possible cause of increased global temperatures.