

4.5 Global warmers

Data collected over a period of years shows that there are significant variations among countries in their output of greenhouse gases. Some countries, mainly because of differences in lifestyles and economic activities, are responsible for far more greenhouse gases than others.

As indicated in a previous spread, one significant greenhouse gas is carbon dioxide. The pie graphs opposite compare carbon dioxide emissions in 1995 with emissions predicted for 2035 produced by a number of the world's regions or continents.

The global carbon cycle

The carbon cycle explains how carbon dioxide enters and leaves the atmosphere. The processes of **photosynthesis** and **respiration** result in the exchange of carbon dioxide over land. The Earth's oceans

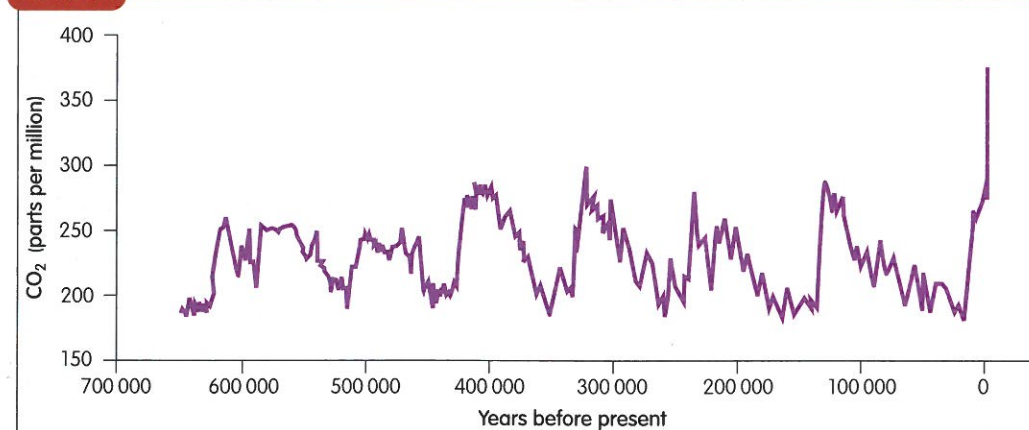
act as **carbon sinks** absorbing carbon dioxide and storing it deep in the ocean floor. Over long periods of time this stored carbon can also be converted into other forms of carbon such as coal, oil and gas.

Rises in the concentrations of carbon dioxide (CO₂) in the atmosphere are the result of an imbalance in the carbon cycle. More carbon is being released into the atmosphere than can be absorbed by plants or stored in carbon sinks. The concentration of CO₂ in the atmosphere has risen

by approximately 30 per cent since the Industrial Revolution.

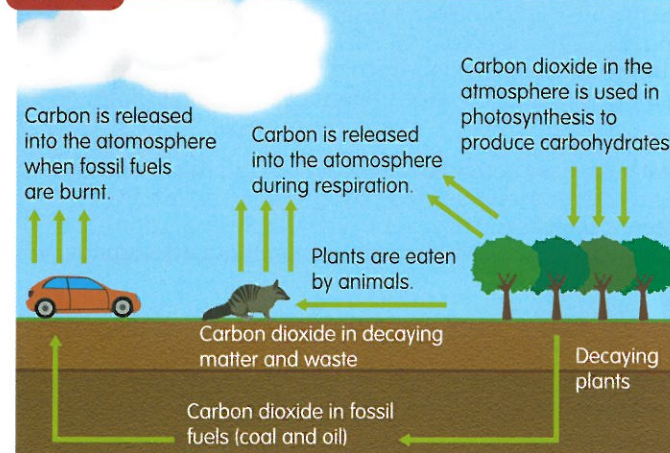
Scientists have learnt a great deal about the changes in the concentration of CO₂ in the atmosphere by studying ice core samples (see page 108). These are long cylinders of ice that are collected by drilling into the ice in Antarctica to depths of 100 metres. Locked within these samples is a record of what was in the atmosphere when the ice was laid down which provides a snapshot of climatic changes over thousands of years.

FIGURE 1



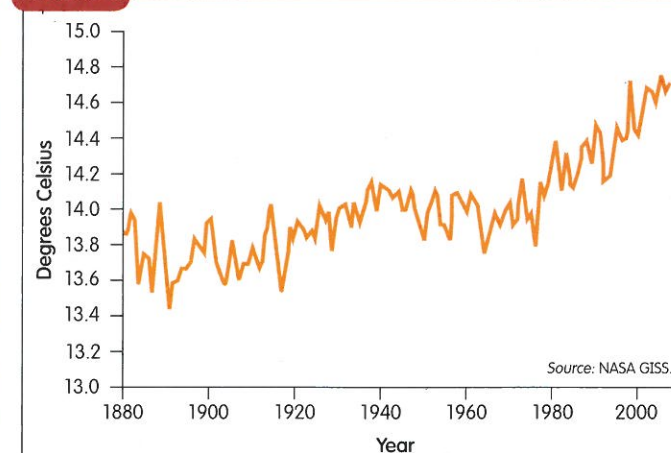
Atmospheric CO₂ concentrations from ice cores over the past 650 000 years

FIGURE 2



The global carbon cycle

FIGURE 3



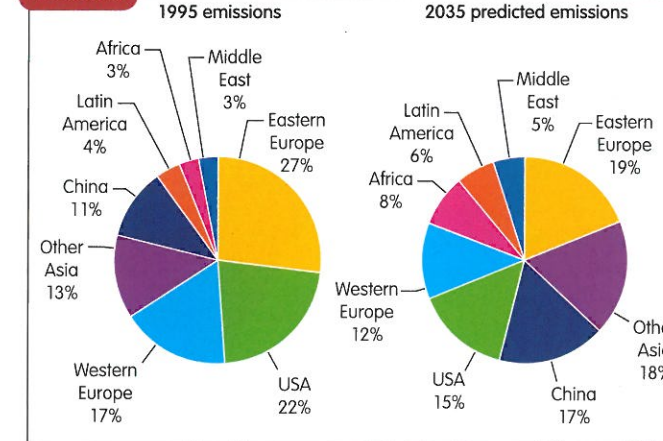
Average global temperatures 1880–2007

FIGURE 4



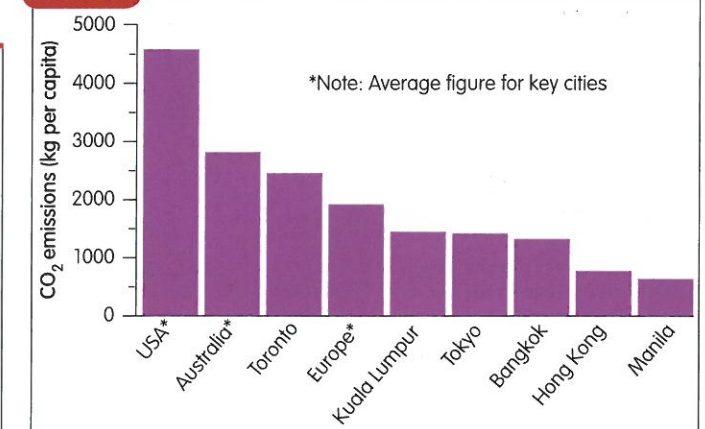
City smog, Los Angeles

FIGURE 5



World CO₂ production 1995 and 2035 (projected)

FIGURE 6



CO₂ transport emissions per person for selected cities (kilograms per person)

carbon sink places or processes that remove and store greenhouse gases such as carbon from the atmosphere
photosynthesis process whereby plants use the energy from sunlight to convert water and carbon dioxide into carbohydrates and oxygen
respiration process whereby organisms use oxygen and release carbon dioxide

Activities

Student worksheet 4.7

THINK

- Refer to figure 5:
 - Which continent or region had the greatest proportion of carbon dioxide emissions in (i) 1995 and in (ii) 2035 (predicted)?
 - Which continent or region, based on these data, is likely to record the greatest change (upwards or downwards) between 1995 and 2035? Suggest possible reasons for this.
- Look at figure 6:
 - What does this graph suggest about Australians?
 - Do the data in this graph surprise you in any way? Explain.
 - Large amounts of carbon dioxide are produced in car exhausts. Imagine you are an environmental lobbyist: explain how you might use the data in this graph to pressure your local council or government member. What might you lobby for?
 - As a class, identify as many groups as you can that might have a vested interest in private car

ownership (e.g. oil companies, but there are many others). In light of this, discuss the problems faced by governments around the world in balancing economic and environmental interests.

- Explain how scientists can use ice core samples to learn about our atmosphere.
 - Examine figure 1. Describe the changes in CO₂ concentrations over the last 650 000 years.
 - Explain the link between increases in CO₂ emissions and changes to global temperatures.

ICT/COMMUNICATE

- Use desktop publishing software to write a newspaper article that explains, in your own words, the operation of the global carbon cycle. In your article include information on how trees can both contribute to and reduce the amount of carbon in the atmosphere, and how the ocean can operate as a carbon sink. Also include information on which parts of the cycle have the highest and lowest concentrations of carbon.