

Card A1: Thinking about Climate Change

Global Warming

Questions

1. Find a card showing the Earth getting hotter!
2. The gradual increase of the air temperature in the Earth's lower atmosphere is referred to as global warming – find a picture representing this.

Educator's Notes

Global warming describes the gradual increase of the air temperature in the Earth's lower atmosphere. This is caused by an increase in greenhouse gas concentrations through natural and human activity. If current pollution trends continue, some scientists estimate that the Earth could be about 1°C warmer by 2025 and 3°C warmer by 2100.

Topics to debate

- What do you think the effects of global warming could be?
- Do you think our everyday actions, like bathing, getting to school in a bus or car, have an effect on global warming? How?



Card A2: Thinking about Climate Change

The Sun's Energy

Questions

1. Where does our planet, Earth, get its light and warmth from?
2. What energy source heats our Earth and enables plants to grow?

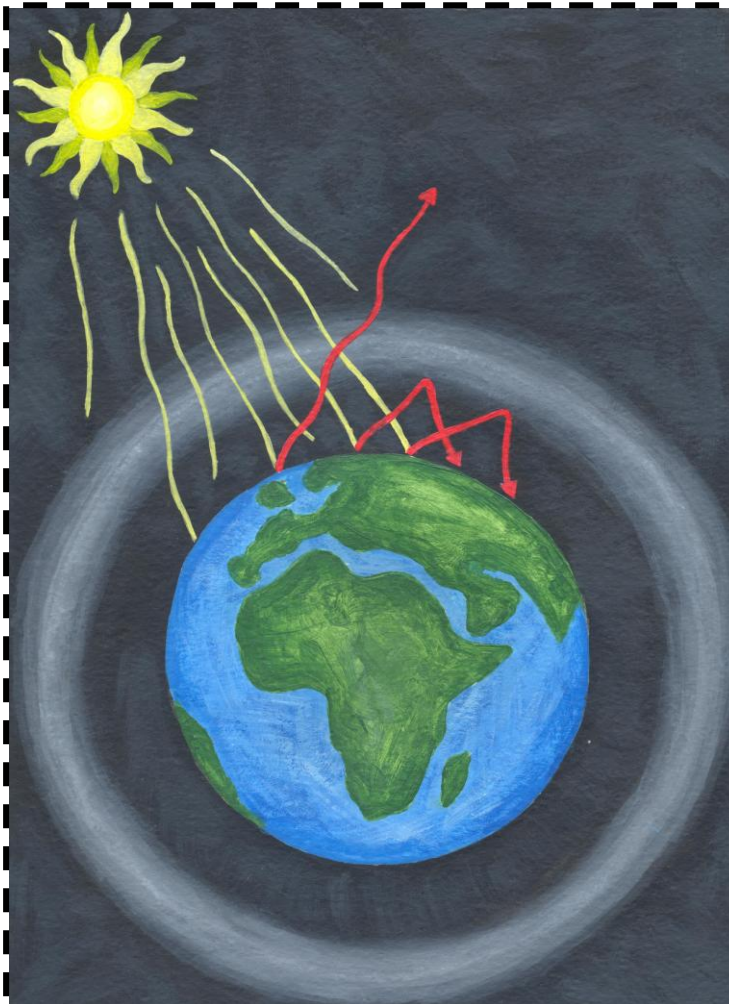
Educator's Notes

The Sun (Latin: Sol) is the star at the centre of our Solar System. The Earth and other matter (including planets, asteroids, meteoroids, comets, and dust) orbit the Sun, which makes up about 99.8% of the Solar System's mass. Energy from the Sun, in the form of sunlight and heat, supports almost all life on Earth through photosynthesis, and drives the Earth's climate and weather.

Topics to debate

- What would happen if the Sun burnt itself out and the Earth received no light?
- South Africa's average number of sunshine hours each day is amongst the highest in the world – 8.5 hours. What are the advantages and disadvantages of using solar technology?





Card A3: Thinking about Climate Change The Greenhouse Effect

Questions

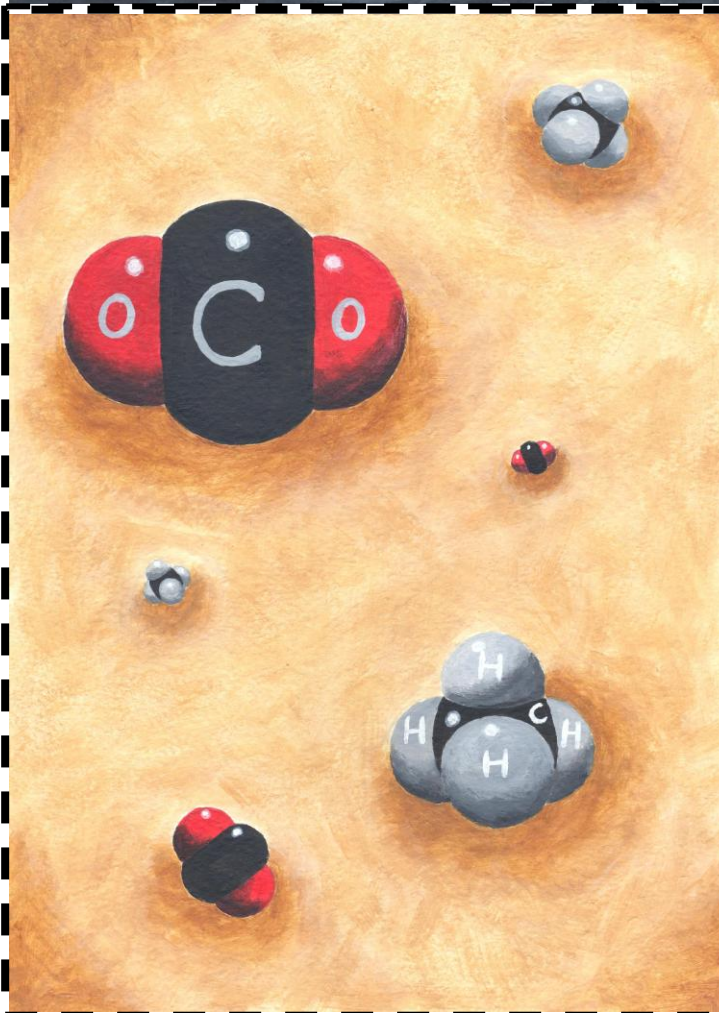
1. Can you find a picture representing the Earth's greenhouse effect?
2. Find a picture showing shortwave (or solar/incoming) radiation and outgoing longwave radiation.

Educator's Notes

The term "greenhouse effect" is used to describe the warming effect that certain gases have on the temperature of the Earth's atmosphere under normal conditions. Sunlight (shortwave radiation) passes easily through the Earth's atmosphere. Once it strikes and warms the Earth's surface, longwave radiation is given off and goes back into the atmosphere. Some of this longwave radiation is reflected back to Earth, absorbed or held by carbon dioxide and other gases that exist in small quantities in the atmosphere. Thus these greenhouse gases keep the Earth at an average of 33°C warmer than it would be if this greenhouse effect did not occur.

Topic for debate

- What would happen if there was no 'greenhouse effect' on our planet?



Card A4: Thinking about Climate Change Greenhouse Gases

Questions

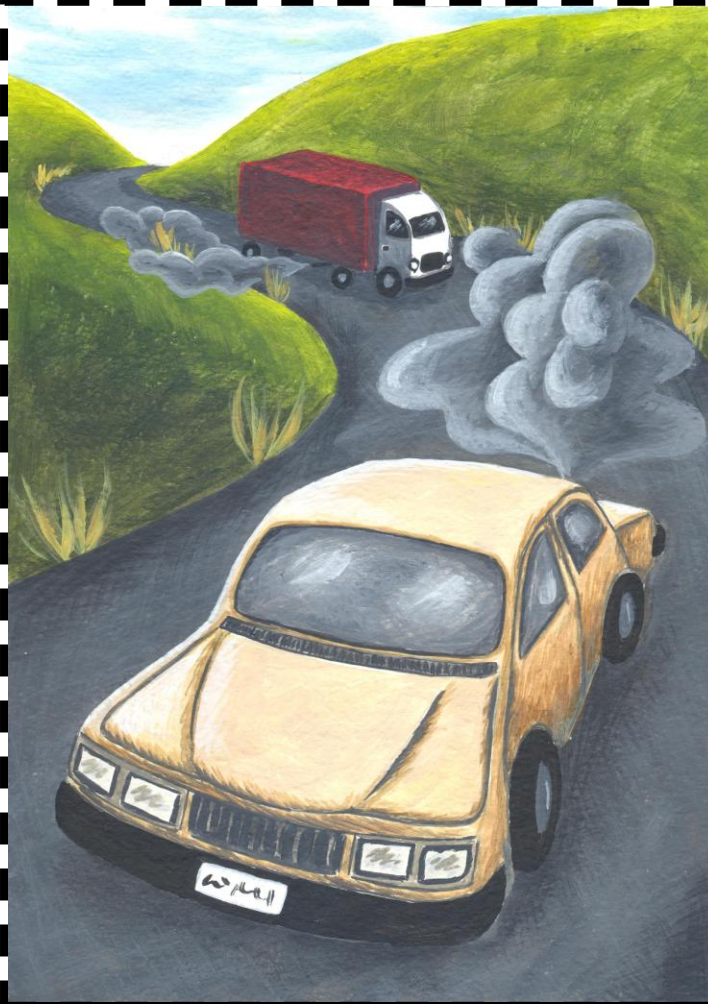
1. Can you find a picture representing the molecule, carbon dioxide, CO₂?
2. What is generated as a by-product of the combustion of fossil fuels or the burning of vegetable matter?

Educator's Notes

Greenhouse gases are gases in the atmosphere that absorb and emit radiation within the thermal infrared range. The main greenhouse gases in the Earth's atmosphere are water vapour, CO₂, methane, nitrous oxide, and ozone. Due to people's activities, the amount of CO₂ released into the atmosphere has been rising during the last 150 years. As a result, it has exceeded the amount sequestered (carbon sequestration means to capture carbon from the atmosphere and store it) in biomass, the oceans, and other "sinks".

Topic for debate

- Do you think people's everyday activities contribute to the greenhouse gas layer? How?



Card B1: Causes of Climate Change

Pollution from vehicles

Questions

1. Find common forms of road transport that generate carbon monoxide?
2. Carbon monoxide (CO) is a weak greenhouse gas but has important indirect effects on global warming.

Educator's Notes

Today's settlements have been strongly influenced by the motor car. Out-of-town shopping centres are becoming more popular and overtaking the traditional town-centred shopping districts, which means that one may have to drive long distances to get to these centres. This leads to an increase in our consumption of petrol and CO emissions.

What can we do? Bicycle or walk where you can; start using lift clubs to and from work and school and use taxis; cars should be serviced regularly as an inefficient, poorly maintained engine can reduce your car's fuel efficiency by 10% or more.

Topics for debate

- How can we reduce the number of vehicles, both passenger and commercial vehicles, on our roads?
- Try to list carbon-free modes of transport.



Card B2: Causes of Climate Change

Pollution from Aeroplanes

Questions

1. Find the mode of transport that is becoming the fastest growing transport sector.
2. Local holidays are better for the planet than overseas trips. Find the card that illustrates the reason why.

Educator's Notes

Air travel is one of the world's fastest growing sources of greenhouse gas emissions. The world's commercial jet aircraft currently generate more than 600 million tons of carbon dioxide (CO₂) per annum, this represents 3.5% of the entire world's emissions. And, according to the Intergovernmental Panel on Climate Change, 'by 2050 emissions from aircraft could be responsible for up to 15% of total global warming produced by human activities'.

Topics for debate

- Why do people feel that it is necessary to fly in aeroplanes? Are there other options which are not as damaging to the environment?
- Do you think that 'paying' for your carbon emissions is an answer to flying?

Card B3: Causes of Climate Change

Deforestation

Questions

1. What do people use to warm themselves and cook their food?
2. Forests are our planet's lungs – trees absorb CO₂, banking it away in their woody parts and roots. Can you find a picture showing deforestation?

Educator's Notes

Tropical forests hold nearly half of the carbon present in vegetation around the world. Trees also absorb CO₂ and release oxygen to clean the air. However, when they are burned to clear land, the trees, soils and undergrowth release the stored CO₂. Rainforests also cool the climate on a more local level, their canopy helps to trap moisture and allow it to slowly evaporate, providing a natural air-conditioning effect.

Topics for debate

- Why do people chop down trees?
- What are the benefits of looking after our existing indigenous forests, rather than removing them for other purposes?



Card B4: Causes of Climate Change

Pollution from factories

Questions

1. These places produce gases that contribute to global warming.
2. Find a place where the energy from fossil fuels is used to create consumer goods.

Educator's Notes

During the Industrial Revolution (about 150 years ago), people began altering the climate and environment through agricultural and industrial practices. We began using machines to make life easier. Before the Industrial Revolution, our activities released few gases into the atmosphere, but through population growth, fossil fuel burning, and deforestation, we are affecting the mix of gases in the atmosphere. The need for fossil fuel based energy to run machines has steadily increased and contributes to 40% of global emissions.

Topics for debate

- What does 'sustainable development' mean?
- How is it possible to meet the needs of South Africans through "development" and yet still live sustainably?



Card C1: Impacts of Climate Change

Change in Weather

Questions

1. In some places storms may become stronger due to climate change.
2. Find a card showing severe weather patterns predicted as a result of climate change.

Educator's Notes

Predicting seasonal rainfall with respect to climate change can be problematic, but most climatologists agree that, by 2050, the north and the interior of southern Africa may see a decrease in rainfall during the growing season. The east of the region, however, will become wetter and the west drier. It is also predicted that in the wetter east, incidents of flooding will increase due to heavy rainfall.

Topics to debate

- Will climate change cause the Earth to get hotter in all places?
- What will be the effect of climate change on agriculture and other farming practices in South Africa?



Card C2: Impacts of Climate Change

Loss of Biodiversity

Questions

1. Rapid changes in climate endanger many plants and animals. Find a picture with birds and butterflies.
2. Some of South Africa's fauna and flora are threatened with extinction. Find a picture showing fauna and flora.

Educator's Notes

Climate change may alter the world's habitats and ecosystems. Many of these places depend on a delicate balance of rainfall, temperature, and soil type. When climate changes occur slowly, plants and animals may be able to adapt to the new environment or move somewhere else. However, if future climate changes occur as rapidly as some scientists predict, plants and animals may not be able to react quickly enough to survive.

Topic to debate

- Does it really matter if some plant and animal species become extinct? Why?





Card C3: Impacts of Climate Change Rising Sea Levels

Questions

1. If water levels rise, coastal cities will flood.
2. Phytoplankton form one of the most important "carbon sinks" on Earth.

Educator's Notes

Oceans cover about 70% of the Earth's surface. Over the last 100 years, global sea levels have risen by between 100-250mm. Scientists think the sea has risen partly because of melting glaciers and land-based ice. Warmer temperatures also make water expand. When water expands, it takes up more space and the sea level rises. One effect we can expect of rising sea levels is an increase in coastal flooding around the world.

Topics to debate

- What will be the major impacts to people living in low lying or coastal areas if the sea levels rise?
- What is a "carbon sink"?

Card C4: Impacts of Climate Change Increased disease

Questions

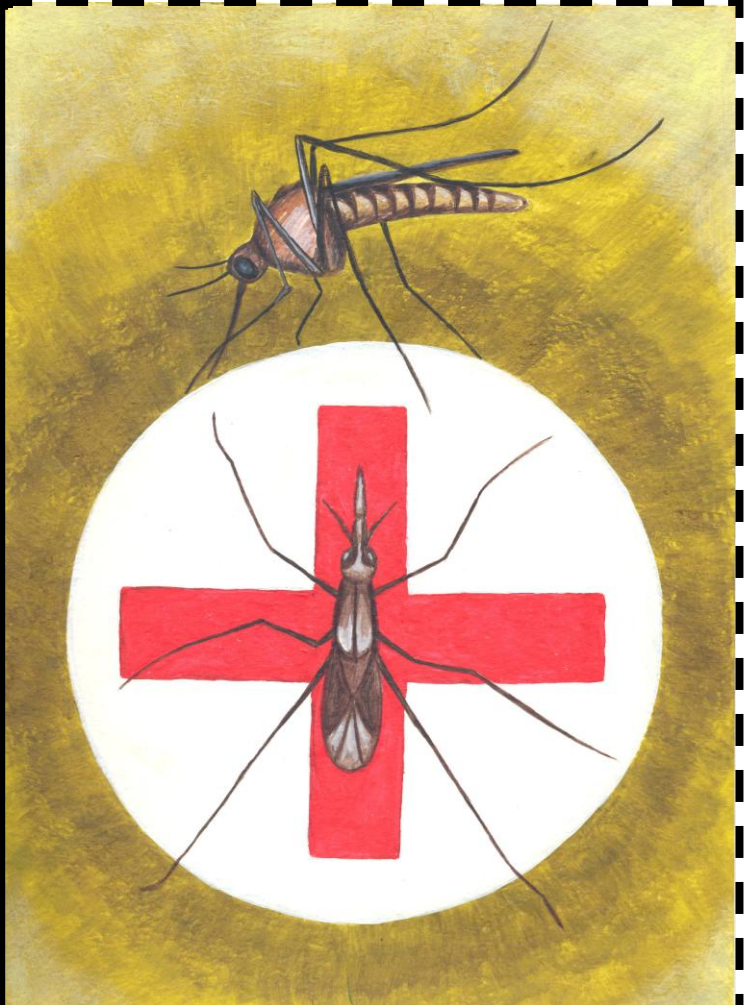
1. Find a card that shows an insect that could spread malaria.
2. It is predicted that diseases like malaria will spread with climate change.

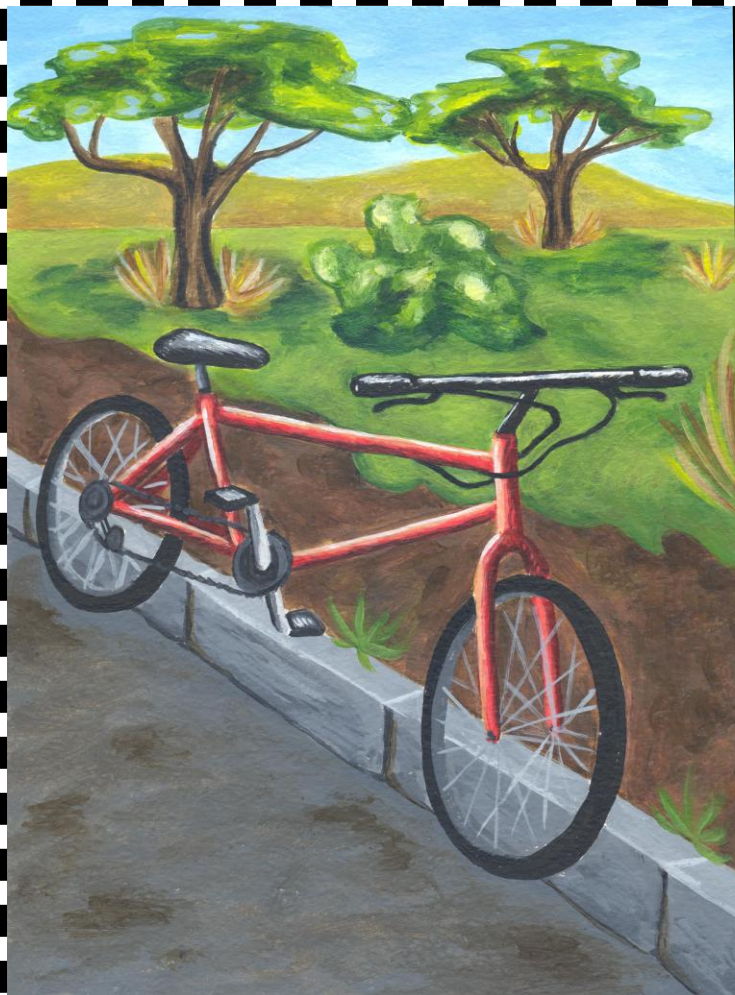
Educator's Notes

Throughout the world, the prevalence of some diseases and other threats to human health depend largely on local climate. It is predicated that, as climate change occurs, some diseases such as malaria may spread to places where malaria did not occur in the past. Warmer conditions may allow the malaria-carrying mosquito to survive in places where it used to be too cold.

Topics to debate

- Diseases, such as malaria in humans and sleeping sickness in cattle, are restricted by temperatures. As temperatures increase, these diseases spread. Why do you think this happens?
- What would be the consequences of malaria-carrying mosquitoes moving to cities such as Durban and Johannesburg?





Card D1: What can we do?

Ride a bicycle instead of using a car

Questions

1. What type of transport can we use that is virtually carbon neutral?
2. Emissions from vehicle exhausts are expected to rise by 44% between 2002 and 2011. Find an environmentally friendly form of transport.

Educator's Notes

Did you know?

- Bicycles were introduced in the 19th century and now number about one billion worldwide, twice as many as motor cars. They are the main means of transportation in many countries.
- The energy and resources needed to build one medium-sized car could produce 100 bicycles!

Topics for debate

- In South Africa, what problems can you foresee in using bicycles to get to and from work?
- What are other ideas for carbon-free transport?

Card D2: What can we do?

Recycle your waste

Questions

1. What can we do with the waste that we produce?
2. Waste prevention and recycling can help reduce greenhouse gas emissions.

Educator's Notes

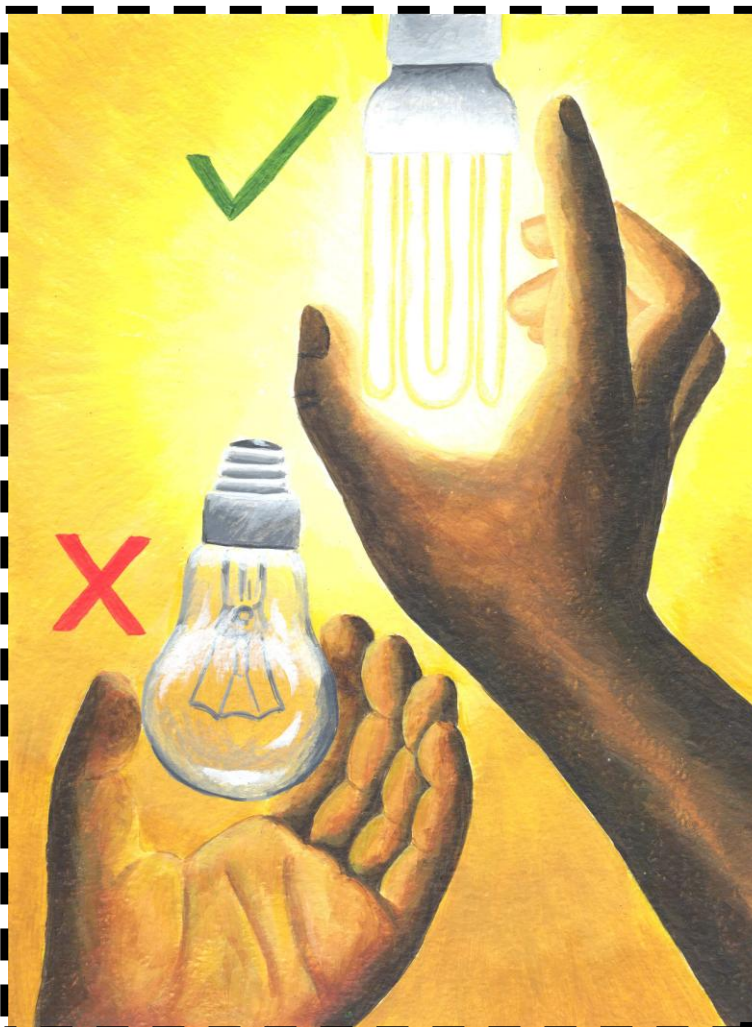
Waste prevention and recycling can help reduce greenhouse gas emissions by:

- diverting organic waste from landfills, avoiding the production of methane which is released when organic matter decomposes anaerobically (without oxygen); and,
- most CO₂ is produced during the manufacture of the items we throw away as waste. We therefore need to cut down on the amount we buy and then throw away.

Topics for debate

- Why is reusing better than recycling?
- How does consumerism contribute to litter and waste?
- Should manufacturing companies be responsible for the waste resulting from their packaging or is it the consumer's responsibility?





Card D3: What can we do?

Save electricity

Questions

1. After the geyser, lighting is usually the largest consumer of our household electricity!
2. By using less electricity, you can reduce your carbon footprint and save money.

Educator's Notes

About 80% of the energy used to create light in incandescent (old type/standard) bulbs escapes in the form of heat. Compact Fluorescent Lamps (CFLs) or Light-Emitting Diodes (LEDs) use less energy thereby saving money and electricity. Energy saving light bulbs also last longer and do not have to be replaced as often as incandescent bulbs.

Topics for debate

- CFLs still rely on electricity. What types of lighting are carbon neutral?
- Find out how much carbon is emitted by an old type 100W light bulb in one hour and compare it with how much carbon is emitted by a CFL light bulb of 11W in one hour.

Card D4: What can we do?

Plant a Tree

Questions

1. What do many people do for National Arbor Week?
2. CO₂ is 'banked' in their woody parts and roots – what are they?

Educator's Notes

Trees act as a major carbon store or 'sink'. They take up carbon dioxide (CO₂) from the atmosphere and use it to produce the carbohydrates that make up the tree. South Africa's climate is such that less than 0,56% of its surface area is covered with indigenous forest – great care should be taken to conserve the little we have.

Topics for debate

- Many countries get lots of money by harvesting trees and so are inclined to remove indigenous forests and grasslands to make way for exotic tree plantations that grow quickly. What are the dangers of this practice?
- Debate the issue around planting trees to offset carbon emissions.

