

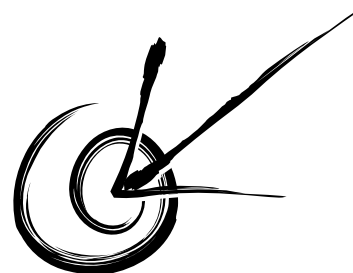


Transport and Greenhouse Gases

Lesson aims

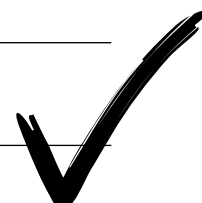
Students will learn that burning fossil fuels causes air pollution and increases greenhouse gas levels leading to health problems and global warming.

They will gain an understanding of the impact that different types of fuel have on the environment. Students will learn about reducing greenhouse gases by being aware of the type of fuel they use, reducing fuel consumption and alternative transportation options.



Learning outcomes

Studies of Society and the Environment	Resources	Use of Resources; Management and enterprise
	Natural and Social systems	Natural systems; Economic Systems
Science	Life and living	Living together; Structure and function; Biodiversity, change and continuity
	Natural and Processed Materials	Materials and their uses; Structure and properties
Mathematics	Chance and Data	Collecting data; Displaying and summarising data; Interpreting data





Background information

The greenhouse effect is a natural process that keeps the Earth's temperature warm enough to support life. The atmosphere consists of a host of gases (predominantly water vapour, nitrogen, argon and oxygen) that form a blanket around the Earth.

Without these gases, heat would escape back into space and Earth's average temperature would be a lot colder. Without the greenhouse effect, the Earth would not be warm enough for humans to live. But if the greenhouse effect becomes stronger, it could make the Earth warmer than usual. Even a little extra warming may cause problems for humans, plants, and animals.

The burning of fossil fuels such as petrol and diesel are major producers of greenhouse gases. Passenger vehicles in Australia produce almost 46 million tonnes of greenhouse gas emissions per annum and are a major contributor to air pollution in urban areas.

There are a number of alternative fuels available such as petrol blended with ethanol and biodiesel that are more environmentally friendly. Ethanol is an alcohol fuel produced from grain, sugarcane, corn or other agricultural waste. Ethanol reduces our dependence on oil, can reduce air pollution and it is a renewable fuel. Biodiesel is a cleaner-burning diesel fuel made from natural, renewable sources such as vegetable oils. Biodiesel is made from domestic renewable resources. It is biodegradable, requires minimal engine modification when used either as a blending component or in its pure form and is potentially cleaner-burning than the diesel it replaces.



Sources & further information

Clean Up Australia has developed a series of fact sheets on the environmental and health issues of a number of fuel alternatives.

www.cleanup.org.au



bp BP Teaching Resources.

Teachers can download educational resources including information about BP service stations and simple, relevant information on climate change.

www.bp.com/

The Department of Climate Change provides a great list of ways you can reduce your greenhouse gas emissions through making wise transportation choices.

www.climatechange.gov.au/

TravelSmart Australia brings together the many community and government based programs that are asking Australians to use alternative forms of transport to travelling in their private car.

www.travelsmart.gov.au



Classroom activities

1. What is the Greenhouse Effect?

- a. Undertake an introductory lesson explaining the greenhouse effect and key terms that students will come across in this unit of work.
- b. Conduct the following science experiment to illustrate what the greenhouse effect is. The following materials will be required to undertake the experiment:
 - 1 x large glass jar (with a lid)
 - 2 x small thermometers
 - 2 x pieces of cardboard slightly larger than the thermometers
 - 2 x rubber bands

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- c. Place one thermometer on a piece of cardboard (like a sausage on bread) and secure it with a rubber band. Repeat this exercise with the second thermometer. It is important the thermometer is fully covered by the cardboard so it can be protected from the sun. Place the thermometer, wrapped in cardboard, inside the jar and put the lid on the jar.
- d. Place the other thermometer outside the jar but facing down so it is also protected from direct sunlight. Place jar and thermometer on a sunny windowsill making sure that the thermometers are shielded from direct sunlight by the cardboard they are attached to.
- e. Record the temperatures of both thermometers every 10 minutes for an hour or daily for a week. Get students to present the data on a graph, table or chart.
- f. Discuss the higher temperature and reason for it, daily variations resulting from different light conditions, and how the glass jar has a similar effect to the greenhouse gases in the Earth's atmosphere.

Greenhouse gases in the atmosphere act like the glass in a greenhouse. They allow sunlight to pass through to the Earth's surface. When sunlight hits the Earth it heats the surface. As heat rises, some of it is trapped by the greenhouse gases. Without the greenhouse gases creating what is called the natural greenhouse effect, the atmosphere and climate on Earth would be too cold to sustain life.

2. Different types of fuels

- a. Divide the class into five groups and ask each group to research one of the following sources of fuel - petrol, diesel, Liquefied Petroleum Gas (LPG), bio-diesel and ethanol. Depending on student ability each group will need to research a number of facts including:
 - How is the fuel produced?

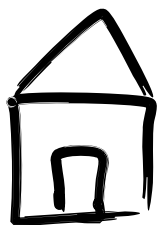
- Is the fuel renewable?
 - What impacts does it have on the environment?
- b. Ask each group to create a poster to present their findings to the class. Depending on students' ability, you could conduct a debate on the different types of fuels and ask each group to make a pitch on the benefits of their fuel.
 - c. Discuss with the class what are the most environmentally friendly fuels.

3. How can you reduce greenhouse gas levels?

- a. Ask students to discuss what they already know about fuel efficiency in cars. Pose the following questions:
 - Which types of cars are the most fuel-efficient? Why?
 - What factors might contribute to a desire for increased fuel efficiency in cars?
- b. Ask students to complete the *Worksheet: How fuel-efficient is your family car?* When students have completed the worksheet explain to them that the more efficient the car, the further it travels using the least amount of fuel. Compare results in the class and work out the following:
 - Which car is the most efficient?
 - Which car is the least efficient?
 - Look at the results of cars that were similar model and compare their results.
 - Did the distance the cars travel affect how efficient they were?
 - Does the age of the car affect efficiency?
 - Depending on students' ability ask them to complete the following maths puzzle: If the average car produces 4.5 tonnes of greenhouse gases per year what amount of greenhouse gases would the average car produce every month? What would the average car produce every day?

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- c. Ask students to complete the *Worksheet: Measure your emissions*. As part of the worksheet you will need to assist students to record the amount of greenhouse emissions the class used when travelling to school. Suggest ways of reducing the number of emissions and set a target the students can aim for if they improve their practices.
- d. Discuss with students how they can reduce their greenhouse emissions:
- Considering alternative transport.
 - Reducing fuel consumption.
 - Choosing the most environmentally friendly type of fuel.



Extension / Home-based activities

Schools can implement a 'walk to school program' or 'walk to school day' and learn about healthier and more sustainable travel options.

New South Wales - Walk Safely to School Day
www.walk.com.au/

Victoria - Walking School Bus
www.vichealth.vic.gov.au

Western Australia - TravelSmart to School
www.dpi.wa.gov.au/

Lower Primary

Plant a tree. Greenhouse gases are absorbed in carbon sinks – growing vegetation absorbs carbon dioxide during photosynthesis.

Students can create a poster advertising the benefits of using cow manure as an alternative fuel.

Middle Primary

Write a jingle for an advertisement that promotes an alternative energy resource.

Students can write a newspaper article comparing ethanol or biodiesel with fossil fuels.

Upper Primary

As a class, design a survey that asks people what they are doing to reduce their greenhouse gas emissions. Decide what questions you will ask, who you will ask, how you will collect the information and how you will present your findings.

Students can research the Kyoto Protocol – What is the Protocol? What are the environmental benefits of the Protocol? How many countries have signed? Is Australia a signatory to the Kyoto Protocol? What factors affected the Australian government decision? What is the Australian government doing to combat climate change?

Make a school greenhouse. Students will construct a greenhouse and grow seeds. They will study the similarities between a gardener's greenhouse and the Earth's atmosphere in the manner in which they operate.

Students can research alternative energy sources for cars and predict which energy sources currently under research today are the most likely to be used in the next 50 years.

Investigate:

www.greenvehicleguide.gov.au/

- Which are the top-rated cars?
- Can you find your family car?
- What conclusions can you draw from looking at some of the characteristics of the "greenest" cars?

Worksheet: How fuel-efficient is your car?

Students need to record the fuel use of their family car over one week. At the start of the week, students need to record the following information with their parents about the family car. Students whose family does not own a car could use a teacher's car.

The make, model and year of the car

How many litres the petrol tank holds

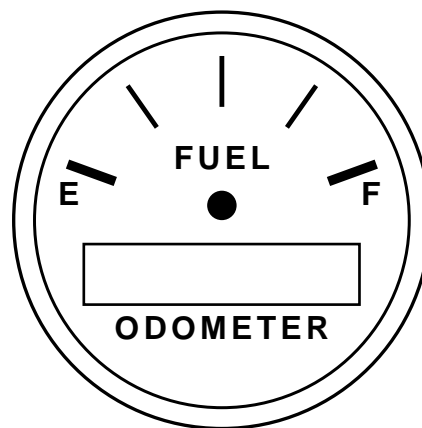
On the diagram at right:

1. Write the number of kilometres recorded on the odometer.
2. Mark how full the petrol tank is.

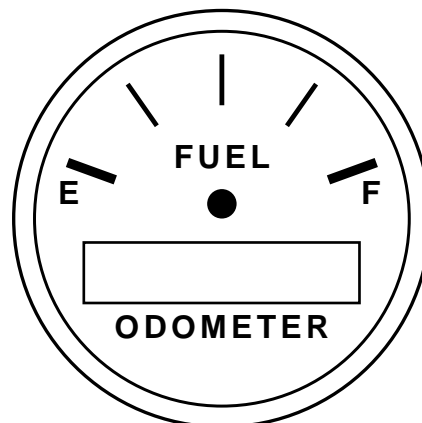
During the week, the primary driver needs to record how many times they fill the car, how many litres they fill the car with, and the fuel they use. Ideally the driver could save any receipts of their fuel purchase.

At the end of the week students should record the odometer and fuel tank readings on the second diagram.

Start of the week readings:



End of the week readings:



Using this information answer the following questions:

What type of fuel does your car use? _____

How much fuel the car started with? _____

How much fuel went into the car? _____

How much fuel was left in the car? _____

Total amount of fuel used during the week? _____

How many kilometres the car travelled? _____

The amount of fuel used for every kilometre travelled? _____