

9

SCIENCE

SAMPLE RESPONSES



Climate change

This booklet is designed to help teachers make overall, on-balance judgments by providing examples of student responses. The responses are not an exhaustive set.

D samples

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D sample: Response 1

Guide to making judgments — Year 9 Science

Student

Purpose: To use evidence and scientific argument to draw conclusions and to inform an opinion about climate change and its effects.

Investigating	Knowledge and understanding	Investigating	Communicating
<p>Draws conclusions and makes predictions consistent with data evidence.</p> <p>Questions 1, 2, 3, 4, 5, 11, 13</p>	<p>Changes</p> <p>Knowledge and understanding</p> <p>Partially completed a word equation.</p> <p>Chose some correct chemical symbols and wrote some chemical formulas with correct ratios. Energy diagrams did not illustrate energy forms or transfers.</p>	<p>Uses data, evidence and scientific argument to evaluate and propose hypotheses and to inform an opinion.</p> <p>Questions 6, 7, 14, 15</p>	<p>Uses scientific terminology in conclusions, predictions and arguments.</p> <p>Communicating</p> <p>Wrote a chemical equation using accepted formats.</p> <p>Energy diagrams conveyed little meaning. Made some use of scientific terminology.</p>
<p>Investigating</p> <p>Made valid predictions in Question 1, based on experimental evidence.</p>	<p>Investigating</p> <p>Offered an opinion based on minimal consideration of the evidence.</p>	<p>Investigating</p> <p>Provides accurate and insightful change and its effects based on an incomplete analysis of the evidence. Uses evidence to evaluate or propose a credible hypothesis.</p> <p>Offers an opinion based on a minimal consideration of the evidence, with some confusion of concepts or misinterpretation of evidence.</p> <p>Provides an opinion or hypothesis based on preconceptions.</p>	<p>Communicating</p> <p>Terminology when drawing conclusions, making predictions and constructing arguments. Writes formulas and equations with variable use of accepted formats. Draws energy diagrams which adequately convey meaning.</p> <p>Makes minimal use of scientific terminology and formats.</p>
A	B	C	D
			E

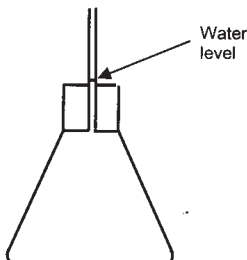
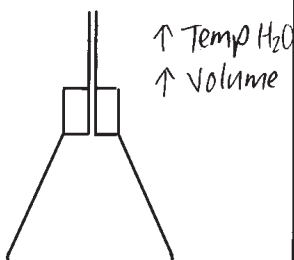
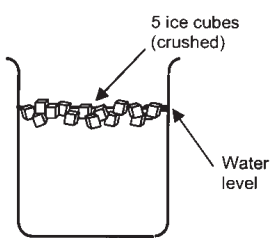
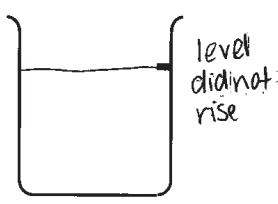
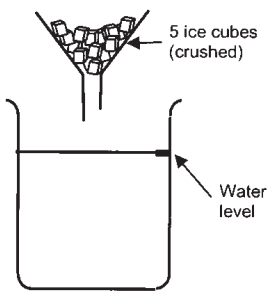
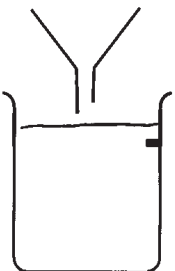
Overall grade
As this response demonstrates a limited level of Knowledge and understanding, Investigating and Communicating, it is judged to be an overall D.

Feedback

D sample: Response 1

Recording sheet

Modelling the effect of global warming on sea levels

		Observations Draw the water level after warming or melting
Experiment 1: Warming of the oceans Modelled by warming water in a flask.	Before warming 	After warming 
Experiment 2: Warming of floating sea ice Modelled by melting ice floating in a beaker of water.	Before warming 	After warming 
Experiment 3: Warming of ice on land Modelled by melting ice above a beaker of water.	Before warming 	After warming 

D sample: Response 1

Section 1: Interpreting evidence

1. Use your recorded observations from *Modelling the effect of global warming on sea levels* to complete Table 1.

Table 1

Global warming event	Effect on sea level (circle your prediction)	Use the observations from the modelling experiments to support your prediction.
Warming of <u>water</u> in the oceans <ul style="list-style-type: none"> The oceans cover about two thirds of the Earth's surface. 	<div>rise</div> <div>fall</div> <div>no effect</div>	It will rise because the warming of water in the oceans will increase as shown on page 5.
Warming of <u>ice</u> in the Arctic Ocean The Arctic ocean is <ul style="list-style-type: none"> about twice the size of Australia mostly covered by floating ice about 3 metres thick. 	<div>rise</div> <div>fall</div> <div>no effect</div>	The warming of ice in the Arctic Ocean will have no effect on its water level as it has been experimented on page 5.
Warming of <u>ice</u> in Antarctica The continent of Antarctica is <ul style="list-style-type: none"> about twice the size of Australia covered with a layer of ice about 2 kilometres thick. 	<div>rise</div> <div>fall</div> <div>no effect</div>	The warming of ice in Antarctica will rise because the ice will melt. This is shown on page 5.

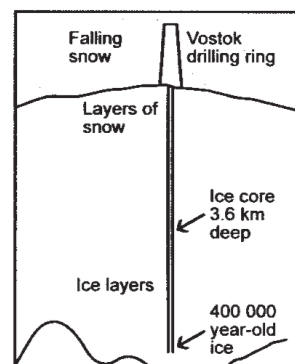
D sample: Response 1

Use the evidence below to answer questions 2 to 5.

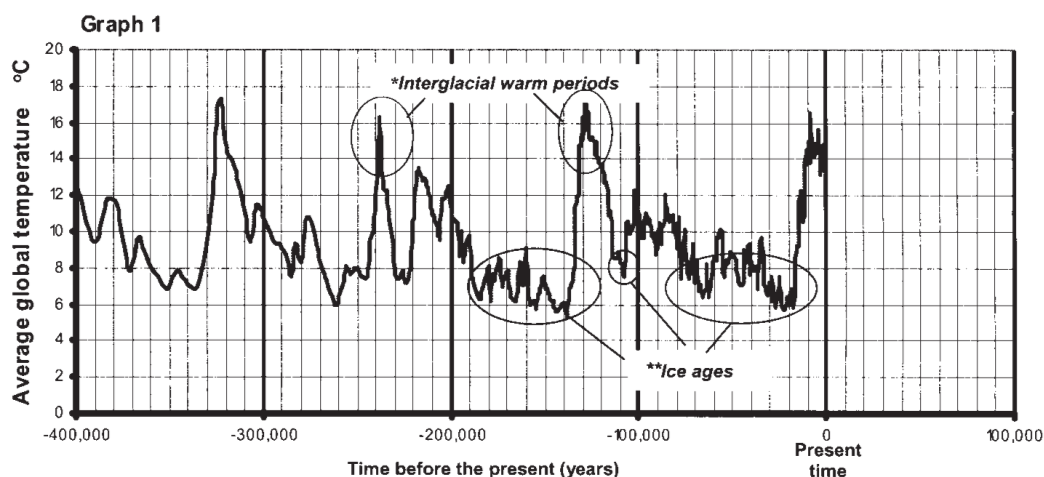
In 1995, scientists at Vostok Station in Antarctica drilled down 3.6 kilometres and retrieved ice cores containing air bubbles which have become trapped in snow over the past 400 000 years.

By analysing the air in the bubbles, scientists were able to calculate the [†]**average global temperature** over the past 400 000 years.

[†]**average global temperature** is the mean temperature of the air at the Earth's surface



Graph 1 shows the results of this investigation.



****Ice ages** refer to times when the polar ice caps expanded and much of the northern hemisphere was covered in ice
***Interglacial warm periods** are warm times between ice ages

2. Describe how the average global temperature has varied over the past 400 000 years.

The global temperature has varied over the past 400 000 years because of the changes in the global temperature. Graph 1 shows that near the end of the year, the temperature gets higher.

D sample: Response 1

- 3. Use any patterns in the graph to predict how the temperature might change in the next 20 000 years. Explain.**

The temperature might change in the next 20 years using the same pattern as shown in Graph 1 on page 8. Although there might be minor changes in the pattern.

- 4. Describe how sea levels may have changed over the past 20 000 years. In your answer, refer to Graph 1 and your answers to question 1.**

Sea levels may change over the past 20 000 years as the pattern changes. Also according to my answers in question 1, the sea levels will probably rise because of the warming of water.

Aboriginal stories record that the Moreton Bay islands were once part of the mainland, but long ago, water filled all the low areas, separating Stradbroke, Moreton and the other islands from the mainland.

- 5. Archaeological evidence shows that Aboriginal people have lived in Australia for over 50 000 years. Does the evidence from Graph 1 and the modelling experiments support these Aboriginal stories? Explain.**

Yes, because 50 000 years ago the investigation had not started yet and therefore Graph 1 and the modelling experiments would support the Aboriginal stories.

D sample: Response 1

- 6. Does the evidence presented in Graphs 2 and 3 support the following hypothesis? Explain.**

"The Earth is becoming warmer due to increased amounts of carbon dioxide in the atmosphere"

Yes, the Earth is becoming warmer due to increased amounts of carbon dioxide in the atmosphere. Referring to Graphs 2 and 3, it shows that this hypothesis is correct as it supports it.

- 7. Offer a different hypothesis to explain the evidence presented in Graph 2 and Graph 3.**

"The Earth is becoming warmer as the variations of carbon dioxide increases"
This is all explained in Graphs 2 and 3.

D sample: Response 1

Section 2: Applying knowledge to form an opinion

Since the Industrial Revolution of the 1800s, human activity has been contributing significant amounts of CO₂ into the atmosphere.

For example, heating water for use in homes can produce CO₂.

Most people in Australia choose to use electric, gas or solar hot water systems.

Use the information given below to answer questions 8 to 14.

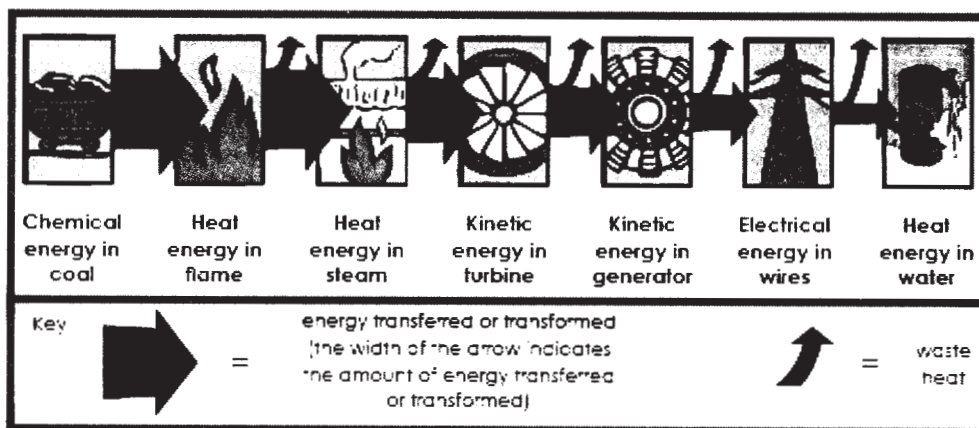
Electric hot water systems

Most of Australia's electricity is generated by burning coal (carbon) which combines with oxygen from the air, producing carbon dioxide.

The heat from burning coal boils water, producing steam to drive turbine-powered generators which produce electricity (electrical energy). Electrical energy is transmitted in wires to the electric hot water system in our homes. The electric element in the hot water system heats the water.

Energy Diagram 1 shows the energy changes that occur when electricity from a coal-fired power station is used to heat water in an electric hot water system at home.

Energy diagram 1: An electric hot-water system



8. Write a word equation for the burning of coal (carbon).

Coal + heat → carbon dioxide.

Use chemical symbols to write a balanced equation for the burning of coal.

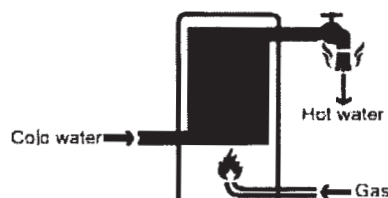
C + H → CO₂ + H₂O

D sample: Response 1

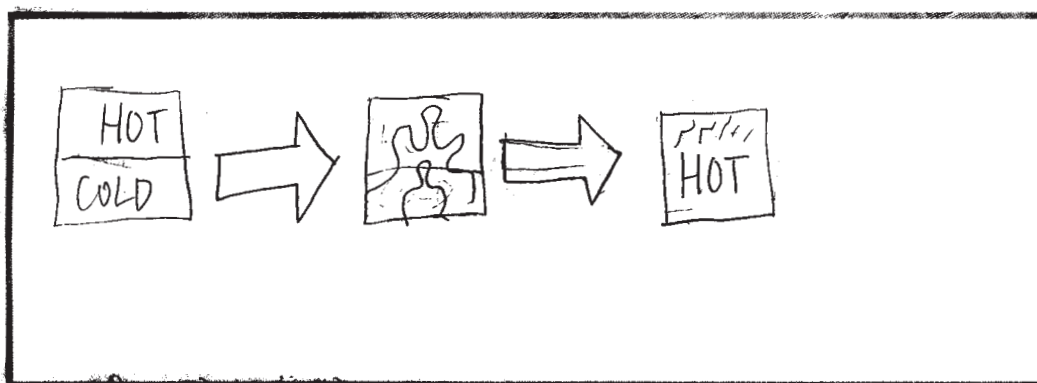
Gas hot water systems

A gas hot water system heats water by burning gas.

The gas used in a gas hot water system is mostly methane (CH_4). Methane burns by combining with oxygen to produce carbon dioxide and water.



9. Draw a labelled energy diagram below (similar to Energy diagram 1 on page 12) to show the energy changes that occur in a gas hot water system.



10. Write a word equation for the burning of methane.

$\text{H}_2\text{O} + \text{M} \rightarrow \text{H}_2\text{O}$

Use chemical symbols to write a balanced equation for the burning of methane.

$\text{H} + \text{H}_2\text{O} + \text{M} \rightarrow \text{H} + \text{H}_2\text{O}$

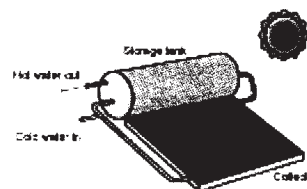
11. Does using a gas hot water system produce more or less CO_2 than using an electric hot water system? Explain by referring to the energy diagrams.

Using a gas hot water system will produce less CO_2 than using an electric hot water system as shown in energy diagram 1.

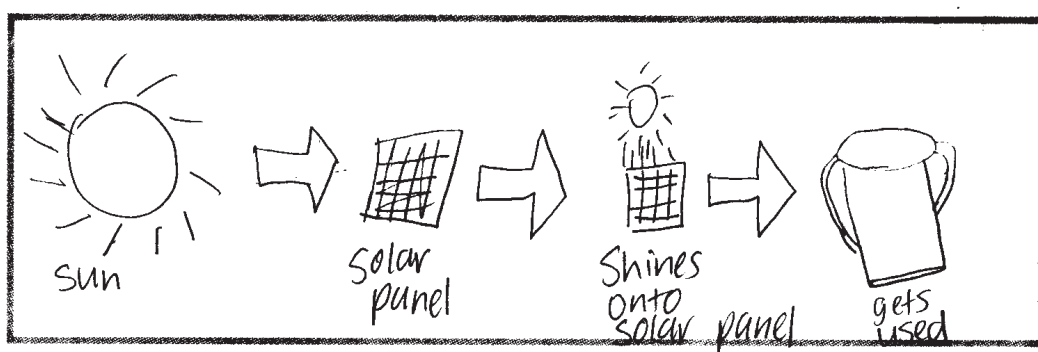
D sample: Response 1

Solar hot water systems

A solar hot water system heats water by absorbing heat from the sun



12. Draw a labelled energy diagram for a solar hot water system.



13. Does using a solar hot water system emit CO₂? Explain.

A: solar hot water system emits CO₂ as shown in question 12.

14. Do your answers to questions 8 to 13 support the following hypothesis? Explain.

"Our energy choices can affect the amount of CO₂ released into the atmosphere."

Yes it does, because depending on how much water we use, it will affect how much H₂O is released into the atmosphere.

D sample: Response 1

"Global temperature changes occur naturally, so there's nothing we can do about it. Anyway, there's no problem being a few degrees warmer."

15. What is your opinion of the statement above?

agree

disagree

partially agree

(circle one)

Justify your opinion by referring to:

- historic and recent temperature and CO₂ data in questions 2 to 8
- information about energy choices in questions 9 to 13
- your predictions from the model in question 1

I disagree to the statement above as it is not true. Even though global temperatures occur naturally, we can do something about the atmosphere in which we live in. Referring back to questions 2-8 it shows that this is not true. In questions 9-13, it shows that we CAN choose what we do with our energy. From the predictions in question 1, we can see that depending on the global warming event, we can still predict what is going to happen. Even though it occurs naturally we can do something about it and not leave it where it can affect the future generation. We can change this! The statement above is incorrect.

D sample: Response 2

Guide to making judgments — Year 9 Science

Student

Purpose: To use evidence and scientific argument to draw conclusions and to inform an opinion about climate change and its effects.

Investigating	Knowledge and understanding	Investigating	Communicating
Draws conclusions and makes predictions consistent with data evidence.	Uses equations and diagrams to changes	Uses data, evidence and scientific argument to evaluate and propose hypotheses and to inform an opinion.	Uses scientific terminology in conclusions, predictions and arguments. Uses appropriate formats in chemical equations and energy diagrams.
Investigating Made use of some data and evidence to draw a valid conclusion and make some plausible predictions. Most explanations lacked detail.	Knowledge and understanding Attempted to write a word equation. Chose some correct chemical symbols and wrote some chemical formulas with correct ratios. Energy diagrams were attempted with minimal success.	Investigating Made some use of evidence to partially evaluate hypotheses. Offered an opinion based on an incomplete evaluation of the evidence.	Communicating Wrote a chemical equation using accepted formats. Energy diagrams conveyed some meaning. Used some scientific terminology correctly.
some valid conclusions and plausible predictions.	products in word equations. Chose correct chemical symbols and writes most chemical formulas with correct ratios. Energy diagrams identify and illustrate most energy transfers and transformations.	change and its effects based on an incomplete analysis of the evidence. Uses evidence to evaluate or propose a credible hypothesis.	terminology when drawing conclusions, making predictions and constructing arguments. Writes formulas and equations with variable use of accepted formats. Draws energy diagrams which adequately convey meaning.
Draws a valid conclusion or makes a plausible prediction.	Partially completes word equations and energy diagrams. Chooses some correct chemical symbols.	Offers an opinion based on a minimal consideration of the evidence, with some confusion of concepts or misinterpretation of evidence.	Makes minimal use of scientific terminology and formats.
		Provides an opinion or hypothesis based on preconceptions.	

Overall grade

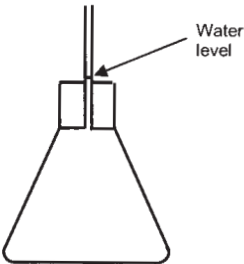
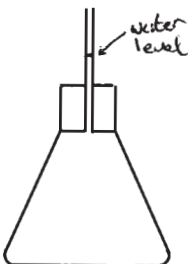
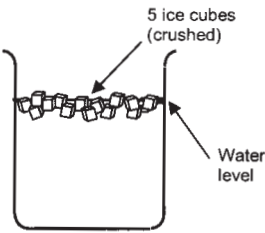
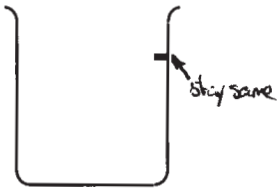
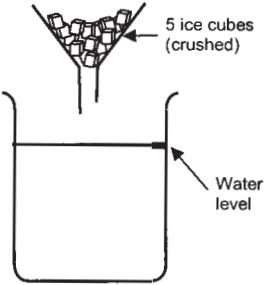

Although this response demonstrates a very limited level of achievement in Knowledge and understanding, the limited level in Investigating and Communicating suggests an on-balance judgment of an overall D.

Feedback

D sample: Response 2

Recording sheet

Modelling the effect of global warming on sea levels

		Observations Draw the water level after warming or melting
Experiment 1: Warming of the oceans Modelled by warming water in a flask.	Before warming 	After warming 
Experiment 2: Warming of floating sea ice Modelled by melting ice floating in a beaker of water.	Before warming 	After warming 
Experiment 3: Warming of ice on land Modelled by melting ice above a beaker of water.	Before warming 	After warming 

D sample: Response 2

Section 1: Interpreting evidence

1. Use your recorded observations from *Modelling the effect of global warming on sea levels* to complete Table 1.

Table 1

Global warming event	Effect on sea level (circle your prediction)	Use the observations from the modelling experiments to support your prediction.
Warming of <u>water</u> in the oceans <ul style="list-style-type: none"> The oceans cover about two thirds of the Earth's surface. 	<div>rise</div> <div>fall</div> <div>no effect</div>	<p>I believe that the water levels will rise but not as dramatically as predicted. I will rise from ice melting. the ice will have to be in water.</p>
Warming of <u>ice</u> in the Arctic Ocean The Arctic ocean is <ul style="list-style-type: none"> about twice the size of Australia mostly covered by floating ice about 3 metres thick. 	<div>rise</div> <div>fall</div> <div>no effect</div>	<p>It will rise from ice that is on rocks. The ice that is in the water will not effect sea levels.</p>
Warming of <u>ice</u> in Antarctica The continent of Antarctica is <ul style="list-style-type: none"> about twice the size of Australia covered with a layer of ice about 2 kilometres thick. 	<div>rise</div> <div>fall</div> <div>no effect</div>	<p>The ice that floats in the water when melted it will have no effect.</p>

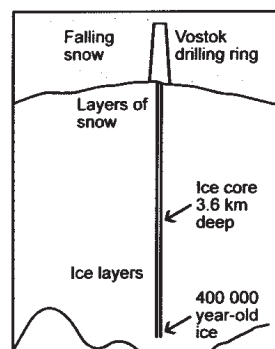
D sample: Response 2

Use the evidence below to answer questions 2 to 5.

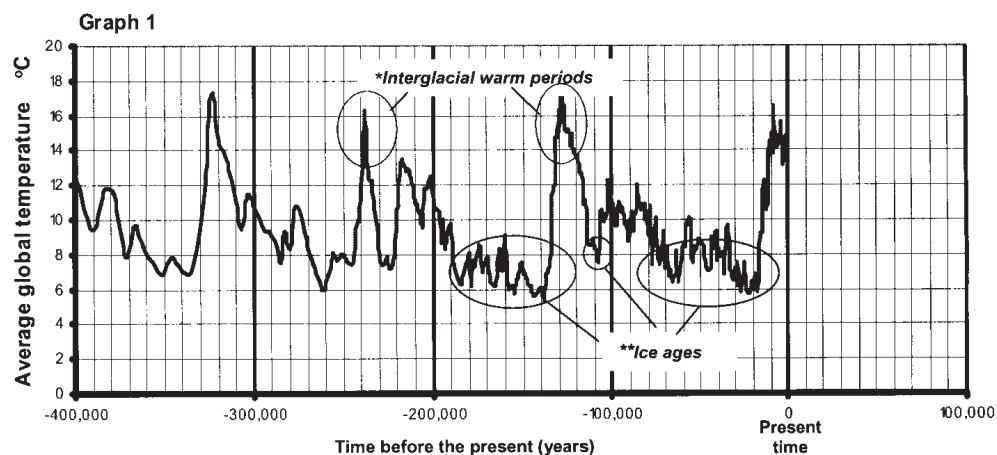
In 1995, scientists at Vostok Station in Antarctica drilled down 3.6 kilometres and retrieved ice cores containing air bubbles which have become trapped in snow over the past 400 000 years.

By analysing the air in the bubbles, scientists were able to calculate the ^t**average global temperature** over the past 400 000 years.

^t**average global temperature** is the mean temperature of the air at the Earth's surface



Graph 1 shows the results of this investigation.



****Ice ages** refer to times when the polar ice caps expanded and much of the northern hemisphere was covered in ice.

***Interglacial warm periods** are warm times between ice ages

2. Describe how the average global temperature has varied over the past 400 000 years.

The graph shows that the present temperature is rising.
 It is almost at the temperature of the interglacial warm periods.
 It shows a great rise in temperature since the latest ice age.

D sample: Response 2

3. Use any patterns in the graph to predict how the temperature might change in the next 20 000 years. Explain.

I believe that the temperature will rise for a further 1000 years. However after this it will ~~not~~ start to decrease and stay at an average temperature of 11°C .

4. Describe how sea levels may have changed over the past 20 000 years. In your answer, refer to Graph 1 and your answers to question 1.

As temperature rises it causes the sea level will expand. Over the past 20 000 years the graph shows a dramatic increase of temperature. This indicates that sea levels have been rising.

Aboriginal stories record that the Moreton Bay islands were once part of the mainland, but long ago, water filled all the low areas, separating Stradbroke, Moreton and the other islands from the mainland.

5. Archaeological evidence shows that Aboriginal people have lived in Australia for over 50 000 years. Does the evidence from Graph 1 and the modelling experiments support these Aboriginal stories? Explain.

In any case, for the temperature over the last 50 000 years has been rising, this could cause sea levels to rise to ^{more} ~~the~~ Moreton a island.

D sample: Response 2

6. Does the evidence presented in Graphs 2 and 3 support the following hypothesis? Explain.

"The Earth is becoming warmer due to increased amounts of carbon dioxide in the atmosphere"

Yes it does for as more carbon is being released into the atmosphere, more the temperature has been rising. This is shown in both graphs.

7. Offer a different hypothesis to explain the evidence presented in Graph 2 and Graph 3.

As the temperature rises more carbon dioxide needs to be attracted so society stays cool.

D sample: Response 2

Section 2: Applying knowledge to form an opinion

Since the Industrial Revolution of the 1800s, human activity has been contributing significant amounts of CO₂ into the atmosphere.

For example, heating water for use in homes can produce CO₂.

Most people in Australia choose to use electric, gas or solar hot water systems.

Use the information given below to answer questions 8 to 14.

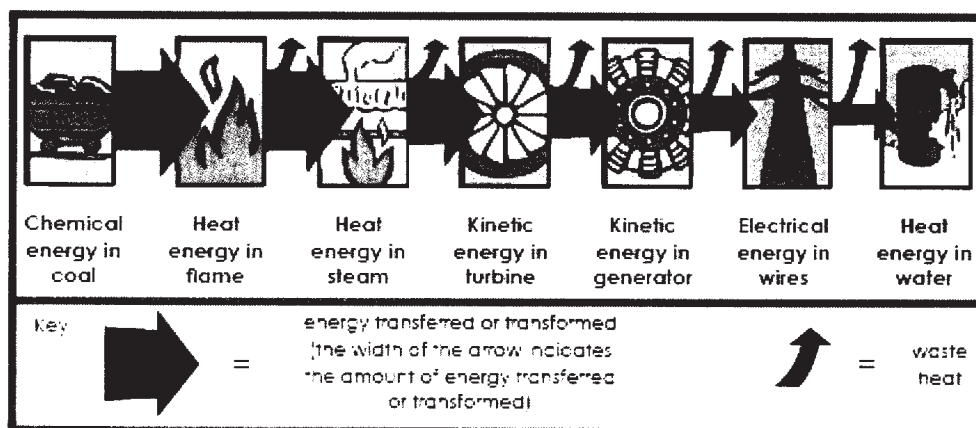
Electric hot water systems

Most of Australia's electricity is generated by burning coal (carbon) which combines with oxygen from the air, producing carbon dioxide.

The heat from burning coal boils water, producing steam to drive turbine-powered generators which produce electricity (electrical energy). Electrical energy is transmitted in wires to the electric hot water system in our homes. The electric element in the hot water system heats the water.

Energy Diagram 1 shows the energy changes that occur when electricity from a coal-fired power station is used to heat water in an electric hot water system at home.

Energy diagram 1: An electric hot-water system



8. Write a word equation for the burning of coal (carbon).

coal is burnt → steam is made → steam turns turbine → turbine creates kinetic energy

Use chemical symbols to write a balanced equation for the burning of coal.

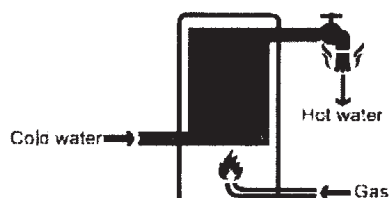
$2C + O_2 + 2H_2 \rightarrow 2CH_4 + O_2$

D sample: Response 2

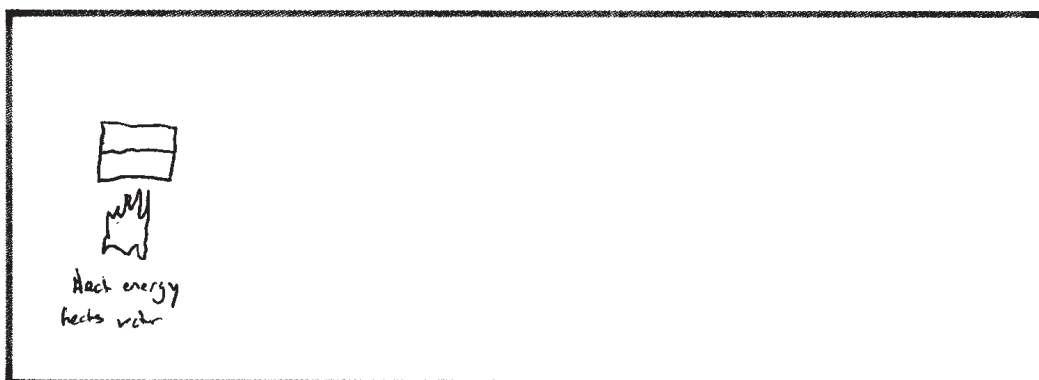
Gas hot water systems

A gas hot water system heats water by burning gas.

The gas used in a gas hot water system is mostly methane (CH_4). Methane burns by combining with oxygen to produce carbon dioxide and water.



9. Draw a labelled energy diagram below (similar to Energy diagram 1 on page 12) to show the energy changes that occur in a gas hot water system.



10. Write a word equation for the burning of methane.

.....

Use chemical symbols to write a balanced equation for the burning of methane.

.....

11. Does using a gas hot water system produce more or less CO_2 than using an electric hot water system? Explain by referring to the energy diagrams.

less, for in electric systems you need electricity

to get electricity you will burn coal and coal will create CO_2

.....

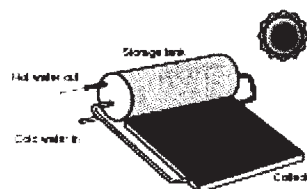
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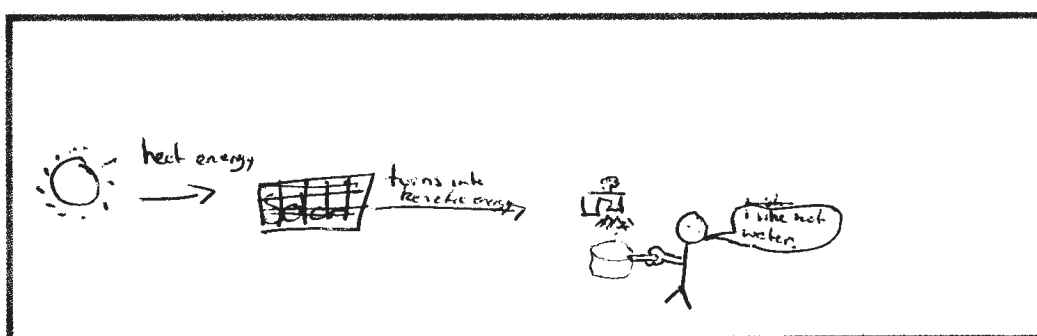
D sample: Response 2

Solar hot water systems

A solar hot water system heats water by absorbing heat from the sun



12. Draw a labelled energy diagram for a solar hot water system.



13. Does using a solar hot water system emit CO₂? Explain.

no for no carbon is used when creating the electricity

14. Do your answers to questions 8 to 13 support the following hypothesis? Explain.

"Our energy choices can affect the amount of CO₂ released into the atmosphere."

yes. If more solar panels are used, less coal will be burnt therefore less CO₂ will be emitted into the atmosphere.

D sample: Response 2

"Global temperature changes occur naturally, so there's nothing we can do about it. Anyway, there's no problem being a few degrees warmer."

15. What is your opinion of the statement above?

agree

disagree

partially agree

(circle one)

Justify your opinion by referring to:

- historic and recent temperature and CO₂ data in questions 2 to 8
- information about energy choices in questions 9 to 13
- your predictions from the model in question 1

Yes the temperature ~~will~~ changes will occur naturally but there
is thing we can do to lower them. As graph 2.63 show
the more CO₂ we ~~attain~~ ~~climate~~ the higher the temperature rises.
therefore if we stop emitting CO₂ the temperature will not rise.
There are many ways we can stop this from happening. We can
use solar, gas, wind power to power cities this would cut back
on carbon emissions. Also a slight temperature
change is all that is needed to trigger ice caps melting.