QCATs
Queensland Comparable Assessment Tasks

2009

9

SCIENCE

TEACHER GUIDELINES

Climate change

These guidelines provide important information to support administration and implementation of the QCATs.

SECTIONS IN THIS BOOKLET:

Queensland Government

Queensland Studies Authority
Partnership and innovation

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Contact information:

Information about the QCATs is available on the QSA website <www.qsa.qld.edu.au>. Select Assessment > Queensland Comparable Assessment Tasks.

Direct questions concerning implementation or receipt of materials to:

Project Officer (Operations)
Phone: 07 3864 0299
Email: QCARadmin@qsa.qld.edu.au

Queensland Studies Authority Ground floor, 295 Ann Street Brisbane. PO Box 307 Spring Hill Qld 4004.
Phone: (07) 3864 0299 Fax: (07) 3221 2553 Email: office@qsa.qld.edu.au Website: www.qsa.qld.edu.au

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Section 1: Understanding QCATs

Queensland Comparable Assessment Tasks (QCATs)

QCATs aim to provide:

- a model of authentic, performance-based assessment aligned to a selection of Essential Learnings and to the *Standards*
- resources to support consistency in the way teachers make judgments about the qualities in student work
- information for teachers and students relevant to a selection of *Essential Learnings* about what students know, understand and can do, what is working well and what needs attention.

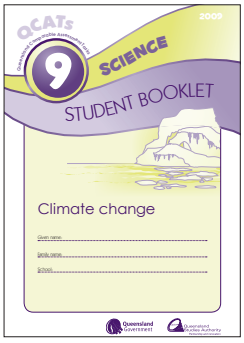
QCATs are assessments that encourage and rely upon interaction between teachers and students. They ask students to use relevant knowledge and skills to respond to a meaningful problem.

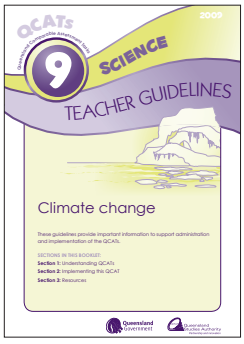
These assessments are resources that provide teachers, students and parents/carers with information to contribute to discussions about student learning and to plan for future learning. The effectiveness of these assessments in providing helpful information will depend on the level of interaction teachers have with their students before, during and after implementation.

Teacher preparation

- Check that you have the appropriate number of:
  - *Student booklets* — the assessment to be presented to students (one per student)
  - *Teacher guidelines* (one per teacher).
- Check for any defective *Student booklets*.
- Contact the QSA if any additional booklets are required.
- Read all the materials provided.
- Review the selected *Essential Learnings* listed in Section 3.
- Work through the assessment yourself so that you understand what students are required to do.
- Plan implementation with your colleagues:
  - Set times and dates for implementation.
  - Discuss how you will achieve consistency of teacher judgment.
  - Decide how to select five samples that are representative of the A to E grades for the QSA's random sampling process.

Note: *Sample responses* are available for download from the QSA Assessment Bank <https://qcar.qsa.qld.edu.au/assessmentbank>.





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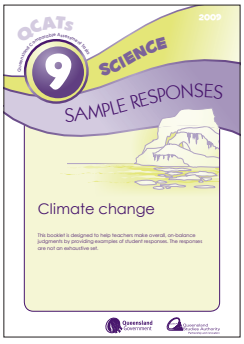


Found online in the QSA Assessment Bank

Student orientation

It is important to set conditions that provide students with the opportunity to do their best work.

- Students should have had opportunities to engage with the selected *Essential Learnings* well in advance of participating in QCATs. Review and consolidation may be necessary before implementing the QCAT, which assesses students' performance in applying knowledge and understanding in a new context.
- Allow some time to familiarise students with the expectations of the assessment. The time required will depend upon the needs of students.
- Begin each assessment with a teacher-facilitated discussion about the context of the assessment and the problem posed. It is vital that all students are engaged in this discussion.
- Ensure that preparation activities do not involve rehearsal of the actual assessment or a similar one.
- Explain what is being assessed by introducing the students to the assessable elements. These are provided in the *Guide to making judgments* located on the back page of both the *Teacher guidelines* and the *Student booklet*.
- Discuss with students ways in which this assessment can provide them with information and insight into their strengths and areas for improvement.

QCAT conditions

- You have the flexibility to implement the assessment at any time across the eight school weeks of the nominated implementation period, to suit school timetabling.
- Students need not complete the assessment in a single session. If you choose to implement the assessment over more than one session, ensure that the *Student booklets* are kept in a secure location between sessions.
- All responses must be recorded in the *Student booklet*. Extra paper may be provided to students for drafting purposes.
- *Student booklets* have clearly marked sections with prompts to indicate when students should await further instructions.
- Students should not be disadvantaged because they do not understand the instructions or questions — you may read and clarify the instructions and questions but it is important that you use professional judgment, and do not provide the information required in the response. Responses to individual student questions may be shared with the whole class.
- You may point out to a student if you notice that they have missed a question.
- Take advantage of the opportunity to interact with students during the assessment. This will enable you to gather information about future learning needs while the assessment is being implemented.
- Students absent during the administration of the QCATs should be given an opportunity to complete the assessment upon returning to school.
- Collect all *Student booklets* from students on completion of the assessment.
- Schools are responsible for the safe storage of *Student booklets* until the end of the school year.

Making judgments

- Use the *Guide to making judgments* to grade student responses. Additional resources for your reference are:
  - *Guide to making judgments* explained (Section 3)
  - model response (Section 3)
  - *Sample responses*, graded A to E and annotated to explain how they demonstrate the qualities described in the *Guide to making judgments*. *Sample responses* are available for download from the QSA Assessment Bank <https://qcar.qsa.qld.edu.au/assessmentbank>.
- The model response and *Sample responses* are provided for reference purposes only. They each demonstrate possible responses and should be used to support the *Guide to making judgments*.
- Making judgments is **not** about determining whether one student's work is better than that of another. Rather, make standards-based judgments by matching student responses to the *Guide to making judgments*.
- Read and consider all of the evidence in the *Student booklet* before making and recording a judgment about the quality of the performance for each assessable element.

The judgment process

Making a judgment about the quality of a student's response to the assessment is a two-stage process.

Stage 1: Make a judgment about the evidence related to each assessable element

- Read the purpose statement at the top of the *Guide to making judgments*. This statement describes the focus of the QCAT.
- Read the task-specific assessable elements in the *Guide to making judgments*. These identify significant and discrete aspects that you will look for in student responses.
- Identify the evidence in the *Student booklet* as indicated in the *Guide to making judgments*.
- Match the evidence from the *Student booklet* with a task-specific descriptor. Begin at the bottom of each continuum. As you move up the continuum, each task-specific descriptor signposts a discernable difference in the quality of the student performance.
- Consider all the task-specific descriptors on the continuum.
- Record a judgment on the continuum for each assessable element. A judgment may be recorded anywhere along the length of the continuum.

  Note: Refer to the model response and *Sample responses* to support the process of matching student responses to task-specific descriptors in the *Guide to making judgments*.

Stage 2: Make an overall on-balance judgment

- Reread the purpose of the assessment as stated at the top of the *Guide to making judgments*.
- Consider the judgments recorded for each assessable element. Sometimes the on-balance judgment will be an easy fit over one of the A to E grades. However, where there is uneven performance across the assessable elements, an overall on-balance judgment must be made by considering the significance of each assessable element in relation to the purpose of the assessment.
- Record the overall grade by circling the relevant letter (A to E) on the *Guide to making judgments*.
- A nil award of "N" is to be recorded only when there is insufficient evidence to inform a judgment for an overall grade. In some circumstances students completing only part of the task may have their assessment considered complete if there is sufficient evidence of student performance across the assessable elements to inform an overall on-balance judgment.

Consistency of teacher judgment

- The process of achieving consistency of teacher judgment is integral to making judgments about the quality of student responses. This involves teachers consistently applying a shared understanding of those qualities that characterise the *Standards*.
- Consistency of teacher judgment is achieved through engaging in professional conversations about the quality of evidence in student responses using *Standards*, assessable elements and task-specific descriptors as a common language. There are various ways of achieving teacher consensus. Three approaches to professional conversations are outlined in Section 3. Schools may also develop their own processes for achieving consensus.
- Teacher consensus will facilitate the process of selecting five student responses considered to be representative of the overall A to E grades. Schools may be required to provide samples as part of the QSA's random sampling process, which is carried out after implementation.

Providing feedback

- Effective feedback to students would include reference to the:
  - student responses
  - *Guide to making judgments*
  - *Essential Learnings* and *Standards*
  - model and *Sample responses*.
- Work with students and discuss information about what they were expected to know, understand and do, and how their responses were judged using the *Guide to making judgments*. Focus this discussion on developing strategies to improve learning.
- Consider strategies that could be used to cater to the needs of students who experienced either low or high levels of success in completing the assessment.

Special consideration

Schools are responsible for determining which students require special provisions. Students should have the opportunity to participate in school-based assessment.

The QCATs are designed to be part of a classroom assessment program, and principles of participation and equity apply. The QSA offers this general advice about including all students:

- Students who have been identified as having specific educational needs may be assisted using those adjustments and supports usually available in the classroom. To make participation possible in all or part of the assessment task, such help may be in the form of assistive technologies, teacher-aide time or reading support.
- Students for whom English is not their first language, and who are assessed as not achieving a reading level appropriate to complete the task, may be assisted by an interpreter or educational devices (e.g. pictures, electronic whiteboards, interactive devices) to allow participation in all or part of the task.
- In exceptional circumstances where undertaking the task may be a traumatic experience for a student, the principal (in consultation with specialist and support staff and parents/carers) may make a decision regarding the participation of that student in the task.

Important dates

24 August 2009	• QCATs arrive in schools.
24 August – 2 November 2009	• Implement QCATs. **Note:** Schools have the flexibility to implement at any time across the eight school weeks of this period. • Submit student data. • Select five student samples that are representative of grades awarded. Where a school is unable to select student samples representative of all grades (A to E), they are to select five student samples representing the awarded range of grades.
2 November 2009	• Final day to submit student data. • Schools notified if they have been randomly selected to submit their five representative samples.
December 2009	• Schools retain all *Student booklets* until the end of the school year.

Section 2: Implementing this QCAT

Read this section in conjunction with the *Student booklet*.

The purpose of this QCAT is to use evidence and scientific argument to draw conclusions and to inform an opinion about climate change and its effects.

Getting ready

To prepare for this QCAT, students carry out experiments to model the effects of global warming. The experiments are not assessed.

Students should work in groups. All students will need a copy of pages 4 and 5 of the *Student booklet*.

Suggestions for implementation

- Trial the experiments before attempting them with the class.
- Prepare equipment for Experiment 1:
  - insert glass tube into stopper so that it does not protrude through the bottom (take care — wear leather gloves)
  - add sufficient cold water to the flask so that when the stopper is inserted, the water level is just above the stopper (this may take some trial-and-error)
  - insert the stopper into the flask (make sure there is no trapped air).
- Experiment 1 may be done as a teacher demonstration if resources are limited.
- For Experiment 3, make sure that you use sufficient ice to result in a measurable rise in water level without it taking excessive time to melt. You may need to crush the ice to speed melting.
- You may wish to set up the experiments, then discuss the issues in "Setting the scene" (*Student booklet*, page 3) while the ice is melting.

Equipment required per group

Experiment 1	Experiment 2	Experiment 3
250 mL flask cold tap water container of warm water to warm flask glass tube (approx. 100 mm in length) one-holed rubber stopper permanent marker	250 mL beaker cold tap water ice — about 4 cubes permanent marker	250 mL beaker cold tap water ice — about 4 cubes permanent marker small funnel and stand

On the day

This section describes the organisation and procedures that teachers are expected to follow in the administration of this QCAT.

Setting the scene: Group discussion *Suggested time: 30 minutes*		
Teacher	**Student**	**Materials**
Engage students in a whole-class discussion to focus their thinking on the context and the task requirements. The following steps are suggested: • Set up the experiments to model the effect of global warming on sea levels (see page 9). • Read with the class "Setting the scene: Group discussion" (*Student booklet*, page 3). • Discuss issues that arise, e.g. the need to base opinions on evidence, and that media reports are not always accurate and objective. • Discuss the problem, outlining what students are expected to do. • Direct students to record their observations from the experiment once the ice has melted. • Discuss the students' observations, ensuring that there is common agreement, particularly that the melting of floating ice does not change the level of water in the beaker. • Work through the *Guide to making judgments* with students to highlight the assessable elements for this QCAT. Explain the task-specific descriptors against which student responses will be judged. These are found in the *Guide to making judgments* on the back of both these guidelines and the *Student booklet*. • Instruct students that they must stop and wait for directions at the bottom of page 5.	Students listen to task expectations, discuss the context and issues, and ask clarifying questions.	*Student booklet* Pens Pencils Resources for experiments (see page 9)

Section 1: Interpreting evidence *Suggested time: 45 minutes* *Allow 5 minutes to read and clarify the requirements of the task.*		
Teacher	**Student**	**Materials**
Briefly explain that the purpose of Section 1 is to interpret primary and secondary data and evidence to make predictions and draw conclusions. Advise students to read all information and questions carefully and to take their time to respond thoughtfully. Provide sufficient support to enable all students to produce their best work. Students should not be disadvantaged because they do not understand terms, instructions or questions. Supervise completion of the section, ensuring students attempt all questions.	Listen to expectations and ask clarifying questions if necessary. Work independently to read the relevant information and answer Questions 1 to 7. Seek clarification at any time.	*Student booklet* Pens Pencils

Section 2: Applying knowledge to inform an opinion *Suggested time: 45 minutes* *Allow 5 minutes to read and clarify the requirements of the task.*		
Teacher	**Student**	**Materials**
Briefly explain that the purpose of Section 2 is to use scientific knowledge and evidence to draw conclusions and to inform an opinion about climate change and its effects. Remind students to read all information and questions carefully and to take their time to respond thoughtfully. Provide sufficient support to enable all students to produce their best work. Students should not be disadvantaged because they do not understand terms, instructions or questions. Supervise completion of the section, ensuring students attempt all questions.	Listen to expectations and ask clarifying questions. Work independently to read the relevant information and answer Questions 8 to 15. Seek clarification at any time.	*Student booklet* Pens Pencils

Feedback from trials

This QCAT has been trialled at a number of schools across Queensland. Feedback from the trials showed these areas as common points for follow-up with students:

- identifying forms of energy during transfers and transformation
- balancing simple equations
- drawing conclusions and forming opinions based on evidence.

Section 3: Resources

The selected *Essential Learnings*

The 2009 QCATs will assess what students know, understand and can do. The following selection of Year 9 Science *Essential Learnings* form the basis of the 2009 assessment.

Science *Essential Learnings* by the end of Year 9

Ways of working

Ways of working describe processes students use to develop and demonstrate their *knowledge and understanding*.

Students are able to:

- research and analyse data, information and evidence
- evaluate data, information and evidence to identify connections, construct arguments and link results to theory
- draw conclusions that summarise and explain patterns, and that are consistent with the data and respond to the question
- communicate scientific ideas, explanations, conclusions, decisions and data, using scientific argument and terminology, in appropriate formats.

Knowledge and understanding

Knowledge and understanding describes essential concepts, facts and procedures.

Science as a human endeavour

Responsible and informed decisions about real-world issues are influenced by the application of scientific knowledge.

- Responsible, ethical and informed decisions about social priorities often require the application of scientific understanding.

Earth and beyond

Events on earth and in space can be explained using scientific theories and ideas, including the geological and environmental history of the earth and the universe.

- Geological evidence can be interpreted to provide information about past and present events.

Energy and change

Forces and energy are identified and analysed to help understand and develop technologies, and to make predictions about events in the world.

- Energy is conserved when it is transferred or transformed.

Natural and processed materials

The properties of materials are determined by their structure and their interaction with other materials.

- Chemical reactions can be described using word and balanced equations.

Assessable elements

Assessable elements identify the valued features of the key learning area about which evidence of learning is collected and assessed.

- Knowledge and understanding
- Investigating
- Communicating

Standards

Standards are integral to the alignment of curriculum, assessment and reporting. For teachers, parents and students, they provide a shared language for describing the quality of student achievement.

The *Standards* are achievement standards linked to the *Essential Learnings*. Using a five-point scale, the *Standards* describe how well a student has demonstrated their learning based on a collection of evidence. They can also be used to report student progress and achievement.

Standards

Standards describe how well a student has demonstrated their learning based on a collection of evidence.

A standard
Evidence in a student's work typically demonstrates a very high level of knowledge and understanding of concepts, facts and procedures, and application of processes.

B standard
Evidence in a student's work typically demonstrates a high level of knowledge and understanding of concepts, facts and procedures, and application of processes.

C standard
Evidence in a student's work typically demonstrates a sound level of knowledge and understanding of concepts, facts and procedures, and application of processes.

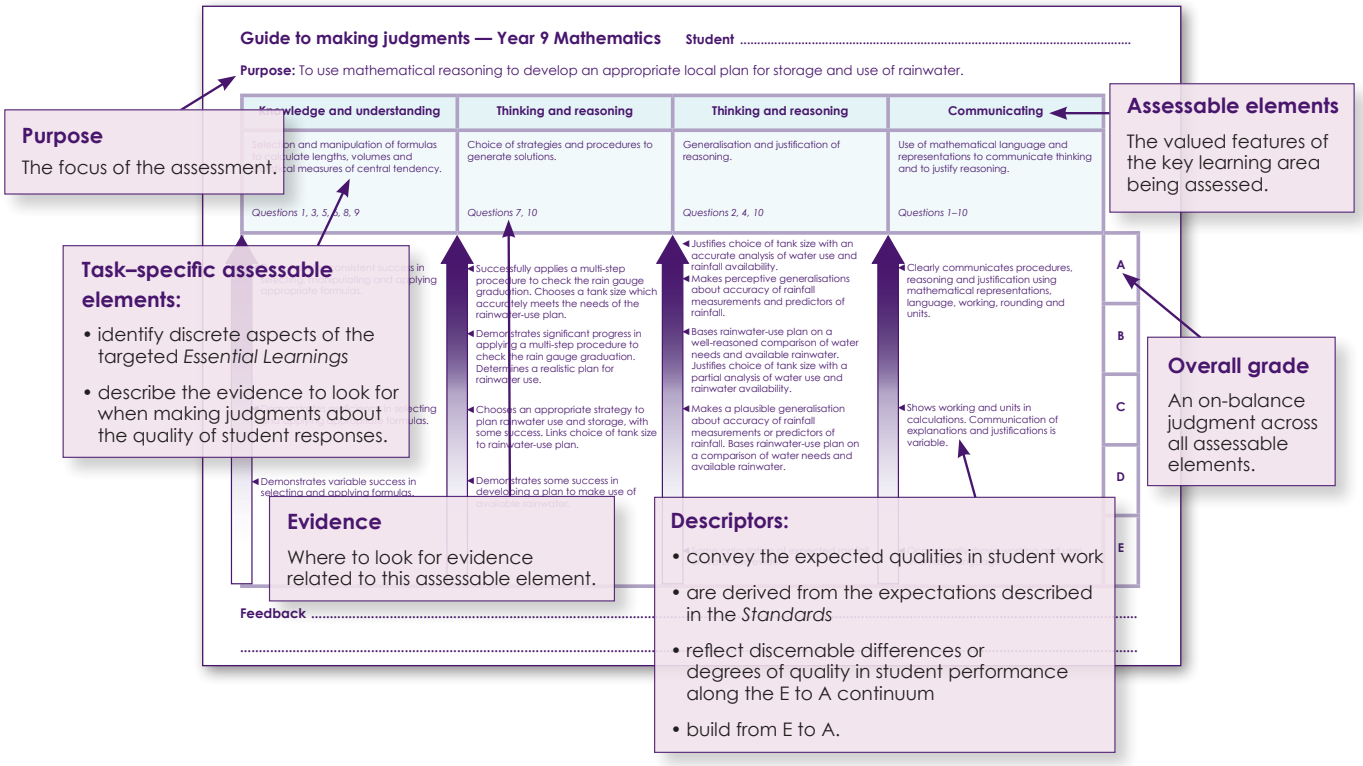
D standard
Evidence in a student's work typically demonstrates a limited level of knowledge and understanding of concepts, facts and procedures, and application of processes.

E standard
Evidence in a student's work typically demonstrates a very limited level of knowledge and understanding of concepts, facts and procedures, and application of processes.

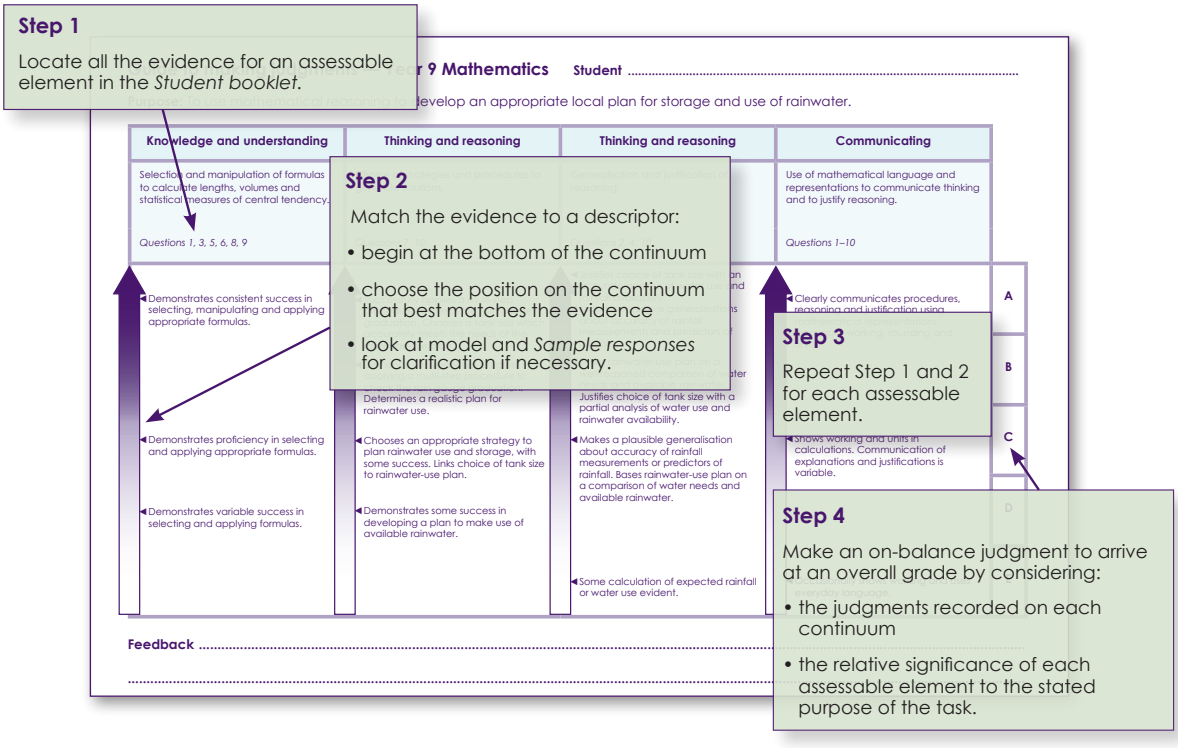
Guide to making judgments (GTMJ) explained

This QCAT uses a continua-style GTMJ, where descriptors are placed along a continuum for each assessable element. The diagrams below show the different parts of the GTMJ continua model, and how to use the GTMJ when grading student responses.

Understanding the GTMJ



Using the GTMJ



Three approaches for consistency of teacher judgment

Calibration model

A facilitator selects samples deemed to be of a certain standard to be used in the calibration process. Teachers individually grade the samples and then compare their judgment with the grade nominated for the sample. Task-specific descriptors are used as the basis for common and explicit language for teachers to use in their discussions about the quality of student performance. These discussions are based on evidence provided in student responses.

Through this professional dialogue, teachers aim to adjust their interpretation and application of the *Standards* to reach consensus about the quality of the sample. This process is repeated for all the student samples. Teachers then individually grade all student responses, applying the shared understanding achieved through this calibration process.

Advantage — Saves time because it focuses on establishing a common understanding of the *Standards* in context, before marking all of the student responses.

Disadvantage — Making the initial quality judgments in isolation can be difficult.

Conferencing model

Teachers grade student responses individually and then select student samples that are representative of their application or understanding of the A to E qualities.

A meeting is convened in which a conferencing process is employed to enable teachers to share samples and discuss their judgments. Task-specific descriptors are used as the basis for a common and explicit language for teachers to use during discussions about the quality of student performance. These discussions are based on the evidence provided in student responses.

Through professional dialogue, teachers aim to reach consensus on the interpretation and application of the *Standards*. Teachers review judgments about their previously graded student responses, applying the shared understanding achieved through this conferencing process.

Advantage — Teachers are involved in professional dialogue with other teachers to reach consensus.

Disadvantage — Establishes a common interpretation and application of the *Standards* after student work has been allocated a grade. Extra time is needed to review and adjust previously graded work.

Expert model

Teachers grade all student responses and then submit selected samples that are representative of their application or understanding of the A to E qualities to an expert. Advice is provided by the expert confirming whether there is consistency in the way the *Standards* are interpreted and applied, or whether teachers need to adjust their understanding, and why. This advice is used by teachers when reviewing judgments about their previously graded student responses.

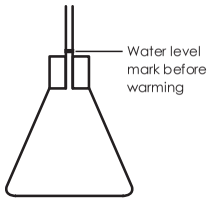
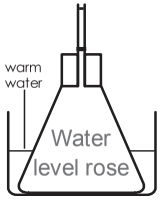
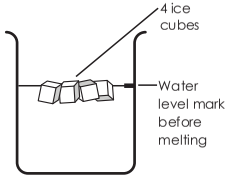
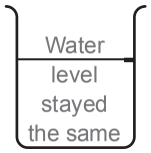
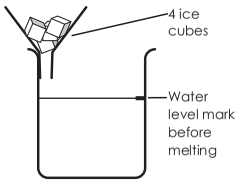
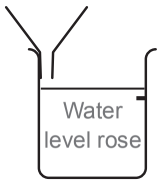
Advantage — Imposes a common school-based view of the interpretation and application of the *Standards*.

Disadvantage — Teachers are not involved in the rich professional dialogue of reaching consensus with other teachers. This model can be used to reach consistency within a school, but does not best support consistency of teacher judgments across the state.

Model response

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: **Melting of floating sea ice** Modelled by melting ice floating in a beaker of water.	Before melting 	After melting 
Experiment 3: **Melting of ice on land** Modelled by melting ice above a beaker of water.	Before melting 	After melting 

STOP HERE: WAIT FOR YOUR TEACHER'S DIRECTIONS

Section 1: Interpreting evidence

1. **Complete Table 1 using your Recording sheet observations on page 5 and the information given in the table.**

Table 1

Global warming event	**Effect on sea level** (circle your prediction)	**Use observations from the modelling experiments to support your prediction**
Warming of *water* in the oceans The oceans cover about two-thirds of the Earth's surface.	(rise) fall no effect	Experiment 1 shows that water expands when it is warmed, so the oceans would expand and rise.
Melting of *ice* in the Arctic Ocean The Arctic Ocean is: • about twice the size of Australia • mostly covered by floating ice about 3 metres thick.	rise fall (no effect)	Experiment 2 shows that when floating ice melts it doesn't change the water level.
Melting of *ice* in Antarctica The continent of Antarctica is: • about twice the size of Australia • covered with a layer of ice about 2 kilometres thick.	(rise) fall no effect	Experiment 3 shows that when ice melts before it enters the water, it causes the water level to rise.

Model response

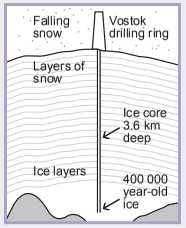
Use the evidence below to answer Questions 2 to 5.

In 1995, scientists at Vostok Station in Antarctica drilled down 3.6 kilometres through ice formed by the compaction of falling snow. They retrieved ice cores containing air bubbles trapped in snow over the past 400 000 years.

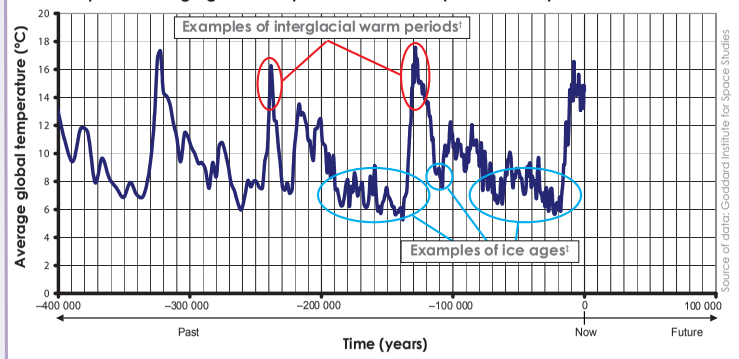
By analysing the air in the bubbles, scientists were able to calculate the **average global temperature*** for each of the past 400 000 years.

Graph 1 below shows the results of this investigation.

***average global temperature** is the mean air temperature over the Earth's surface



Graph 1: Average global temperatures over the past 400 000 years



†**interglacial warm periods** are warm times between ice ages

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

2. Describe the variation in the average global temperature over the past 400 000 years. Refer to Graph 1.

Over the past 400 000 years, the average global temperature has fluctuated between about 6 and 17 degrees Celsius. Mostly the temperature has been below 10 degrees but about once every 100 000 years it has briefly risen to 17 degrees.

3. Use any patterns in Graph 1 to predict how the temperature might change in the next 20 000 years. Explain.

After each previous interglacial period the temperature has dropped to about 8 degrees over a period of about 20 000 years. As we are now in an interglacial period I would expect a similar drop to an ice age (about 8 degrees) over the next 20 000 years.

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.

In the past 20 000 years the temperature has risen from 6 degrees to 17 degrees. I would expect this to have caused a steady rise in sea levels as ice melted and seas warmed.

Read the statements below to answer Question 5.

- Archaeological evidence shows that Aboriginal people have lived in Australia for over 50 000 years.
- Aboriginal stories record that the Moreton Bay islands were once part of the mainland, but long ago, water filled the low areas, separating Stradbroke, Moreton and the other islands from the mainland.

5. Do the modelling experiments and the evidence from Graph 1 support the Aboriginal stories about the Moreton Bay islands? Explain.

The evidence supports the stories. Graph 1 shows that about 15 000 years ago the last ice age ended and sea levels would have risen as ice on land melted and the oceans warmed (experiments 1 and 3). Aboriginal people have lived in Australia for much longer than this, so would have seen the sea levels in Moreton Bay rise.

Model response

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."

The CO_2 graph doesn't fluctuate as much as the temperature graph but both show a rise between 1880 and 2000, with a steeper rise in the past 50 years. This supports the hypothesis.

7. **Suggest an alternative hypothesis that is supported by the evidence presented in Graphs 2 and 3.**

The amount of carbon dioxide in the atmosphere is increasing because the Earth is becoming warmer.

Section 2: Applying knowledge to inform an opinion

Since the Industrial Revolution, human activity has been releasing significant amounts of carbon dioxide (CO_2) into the atmosphere.

Heating water for use in homes is an activity that can produce carbon dioxide. Most people in Australia use electric, gas or solar hot-water systems.

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

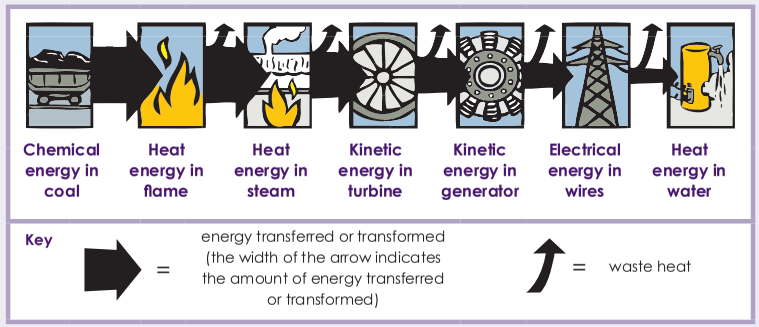
Electric hot-water systems

Most of Australia's electricity is generated by burning coal to boil water. The steam produced drives turbine-powered generators which generate electricity (electrical energy). Electrical energy is transmitted in wires to the electric hot-water system in the home. An electric element in the hot-water system heats the water.

When coal (mostly carbon) burns, it combines with oxygen from the air and produces carbon dioxide.

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.

Diagram 1: Energy changes for an electric hot-water system



8. **Write a word equation for the burning of the carbon in coal.**

carbon + oxygen → carbon dioxide

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

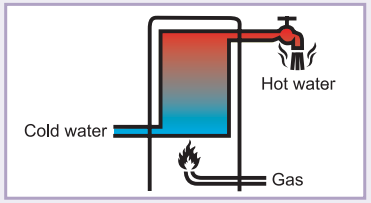
$C + O_2 \rightarrow CO_2$

Model response

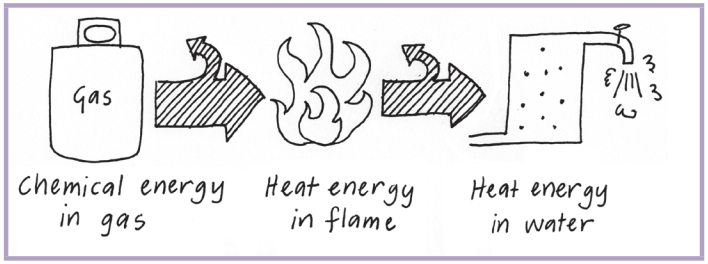
Gas hot-water systems

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 and label a diagram (similar to Diagram 1 on page 12) showing the energy changes that occur for a gas hot-water system.**



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

methane + oxygen → carbon dioxide + water

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

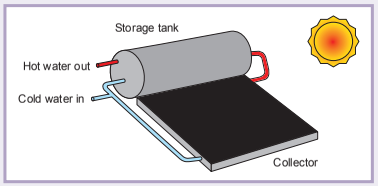
$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

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

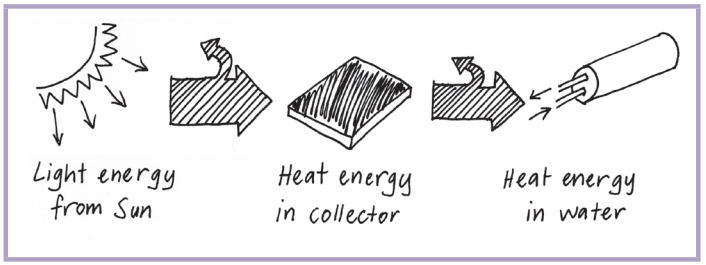
A gas hot-water system doesn't waste as much energy as an electric hot-water system because there are less energy changes and each energy change produces waste heat energy. Because it uses less energy to heat the same amount of water, a gas hot-water system will use less fuel and emit less CO_2.

Solar hot-water systems

A solar hot-water system heats water by absorbing solar radiation (sunlight) and transforming it into heat energy.



12. **Draw and label a diagram (similar to Diagram 1 on page 12) showing the energy changes that occur for a solar hot-water system.**



13. **Does using a solar hot-water system emit CO_2? Explain.**

Using a solar hot-water system does not emit CO_2 because no fuel is burned.

14. **Do your answers to Questions 8 to 13 support the following statement? Explain.**

"Our energy choices affect the amount of CO_2 released into the atmosphere."

I have shown that choosing a gas hot-water system produces less CO_2 than an electric one and that a solar hot-water system produces no CO_2 so it is clear that we can make energy choices which affect the amount of CO_2 released.

Model response

15. **Read the comment below.**

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

Do you agree with the comment? (circle one)

I agree I partially agree (I disagree)

Justify your opinion by referring to:

- historic and recent temperature and CO_2 data in Questions 2 to 7
- information about energy choices in Questions 8 to 14
- your predictions from Question 1.

Graph 1 shows us that climate change does occur naturally, and that the Earth has been through regular ice ages and interglacial periods over the past 400 000 years. It seems that we can probably expect an ice age within the next 20 000 years, but at the moment the atmosphere seems to be warming up, as Graph 2 shows. Evidence from Graphs 2 and 3 and the information in Section 2 shows that using energy is putting more CO_2 into the air and this may be causing the temperature rise. Because the modelling experiments showed that a higher temperature will cause sea levels to rise, we should start making choices to reduce CO_2 emissions, even if we are not absolutely sure if that is what's causing the temperature rise. We can't afford to take the chance. We probably cannot stop the next ice age happening, but that is not likely to occur for thousands of years. We can probably do something about the warming that is occurring now if we make the right energy choices.

15

Notes

Notes

Notes

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 and evidence.	Uses equations and diagrams to describe and explain chemical changes and energy transformations.	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.
Questions 1, 2, 3, 4, 5, 11, 13	*Questions 8, 9, 10, 12*	*Questions 6, 7, 14, 15*	*Questions 1–15*
◀ Consistently and accurately interprets data and evidence to justify valid conclusions and predictions.	◀ Writes chemical formulas with correct ratios and balances chemical equations. Energy diagrams correctly identify all energy forms and illustrate all transfers and transformations, including waste heat.	◀ Provides accurate and insightful scientific arguments, considering all data and evidence. ◀ Supports the evaluation and proposal of hypotheses with valid interpretations of evidence. Gives a reasoned opinion about climate change and its effects based on a thorough analysis of the evidence.	◀ Displays fluency in the use of scientific terminology when drawing conclusions, making predictions and constructing arguments. ◀ Uses accepted formats when constructing formulas for chemical compounds and when writing and balancing equations. Draws clear, fully labelled energy diagrams.
◀ Uses data and evidence to explain some valid conclusions and plausible predictions.	◀ Correctly identifies reactants and products in word equations. Chooses correct chemical symbols and writes most chemical formulas with correct ratios. Energy diagrams identify and illustrate most energy transfers and transformations.	◀ Offers a valid opinion about climate change and its effects based on an incomplete analysis of the evidence. Uses evidence to evaluate or propose a credible hypothesis. ◀ Offers an opinion based on a minimal consideration of the evidence, with some confusion of concepts or misinterpretation of evidence.	◀ Correctly uses some scientific 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.	◀ Provides an opinion or hypothesis based on preconceptions.	◀ Makes minimal use of scientific terminology and formats.

A

B

C

D

E

Feedback .....

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