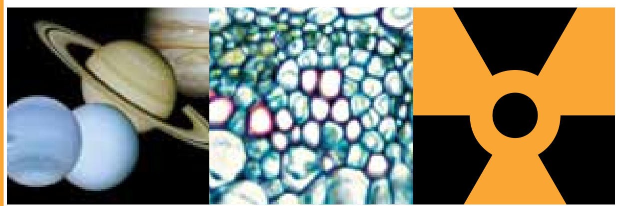

National Assessment Program – Science Literacy School Release Materials

2012

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AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

NAP–SL 2012 Project Staff

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Preface

In July 2001, the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA, now the Standing Council on School Education and Early Childhood [SCSEEC[1]]) agreed to the development of assessment instruments and key performance measures for reporting on student skills, knowledge and understandings in primary science. The development and implementation of this national assessment in science literacy is undertaken by the Australian Curriculum, Assessment and Reporting Authority (ACARA).

ACARA convenes a national committee to advise it on critical aspects of the assessment program and ensure that the assessments and results are valid across the states and territories. The main function of the Science Literacy Review Committee (SLRC) is to ensure that the scientific literacy assessment domain is inclusive of the different state and territory curricula and that the items comprising the assessments are fair for all students, irrespective of where they attend school.

The National Assessment Program – Science Literacy (NAP–SL) measures scientific literacy. This is the application of broad conceptual understandings of science to make sense of the world, understand natural phenomena and interpret media reports about scientific issues. It also includes asking investigable questions, conducting investigations, collecting and interpreting data, and making decisions. This construct evolved from the definition of scientific literacy used by the Organisation for Economic Co-operation and Development (OECD) – Programme for International Student Assessment (PISA):

> *... the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.*
> *(OECD 1999, p. 60)*

NAP–SL is one of a suite of three national sample assessments (with Civics and Citizenship, and Information and Communications Technology (ICT) Literacy) which are conducted with random samples of students in three-year cycles. The findings allow reporting on how Australian students are progressing towards the achievement of the Educational Goals for Young Australians specified in the Melbourne Declaration.

The first Science Literacy assessment was conducted in 2003. The Primary Science Assessment Program (PSAP) – as it was then known – tested a sample of Year 6 students. The assessment is conducted with a new sample of Year 6 students every three years in order to monitor student achievement in scientifc literacy and to identify trends over time.

1 SCSEEC was previously known as the Ministerial Council for Education, Early Childhood and Youth Affairs (MCEECDYA) and, prior to that, the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA).

The fourth NAP–SL assessment was conducted by Educational Assessment Australia (EAA) in October 2012. The public report 'National Assessment Program – Science Literacy Year 6 Report 2012' (the 2012 NAP–SL Public Report) describes the latest findings and provides comparisons of student performance over the four cycles in the scientific literacy of Year 6 Australian students.

The 2012 NAP–SL School Release Materials enable schools to replicate and conduct their own assessment by using a set of items from the actual 2012 NAP–SL assessment. Schools can then compare their students' scores with the national Proficiency Levels, allowing them to gauge the scientific literacy capabilities of individual students and to use this information to enhance the effectiveness of teaching programs.

Chapter 1
Overview of the National Assessment

Introduction

In 1999, the state, territory and Commonwealth ministers of education agreed to the Adelaide Declaration on National Goals for Schooling in the Twenty-First Century. The National Goals were superseded in December 2008, when the state, territory and Commonwealth ministers of education released the Melbourne Declaration on Educational Goals for Young Australians. The Educational Goals for Young Australians set the direction for Australian schooling for the next years (Ministerial Council on Education, Employment, Training and Youth Affairs [MCEETYA] 1999 and 2008[1]) (available at www.mceecdya.edu.au).

In July 2001, MCEETYA agreed to the development of assessment instruments and key performance measures for reporting on student skills, knowledge and understandings in primary science. The National Assessment Program – Science Literacy (NAP–SL) was the first assessment program designed specifically to provide information about performance against the National Goals (now the Educational Goals). Similar sample assessment programs are now also undertaken for Civics and Citizenship, and Information and Communication Technology Literacy. Each sample assessment program is conducted every three years so that student performance in these areas of study can be monitored over time.

1 subsequently the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA) and now the Standing Council on School Education and Early Childhood (SCSEEC)

The development and implementation of NAP–SL is undertaken by the Australian Curriculum, Assessment and Reporting Authority (ACARA), the independent statutory authority responsible for the overall management and development of a national curriculum, the National Assessment Program and a national data collection and reporting program that supports 21st Century learning for all Australian students. ACARA was established under an Act of Federal Parliament on 8 December 2008 and became operational in mid-2009. ACARA receives direction from the Standing Council on School Education and Early Childhood (SCSEEC). At the direction of SCSEEC, ACARA manages the National Assessment Program.

Of the three national sample assessments NAP–SL is the only program that focuses entirely on primary students' performance. This is because MCEECDYA agreed to use the Program for International Student Assessment (PISA) as the measure of performance for scientific literacy among secondary students (see www.nap.edu.au).

The previous NAP–SL assessments were conducted in 2003, 2006 and 2009. In January 2011, ACARA awarded the contract for the fourth cycle of NAP–SL to Educational Assessment Australia (EAA).

Implementation of the 2012 NAP–SL assessment involved a large number of separate but related steps, including the clarification of the assessment domain; development and trialling of items and instruments; administration of the final assessment to a sample of students; marking of student responses; and analysis and reporting of the results. Students also completed a Student Survey which sought to elicit their perceptions of and attitudes to science and their experiences of science learning at school.

What does NAP–SL measure?

NAP–SL measures scientific literacy.

Scientific literacy has been defined by the Organisation for Economic Co-operation and Development (OECD) – Programme for International Student Assessment (PISA) as:

> *… the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.*
>
> *(OECD 1999, p. 60)*

This definition has been adopted for the purpose of monitoring primary science in NAP–SL (Ball et al. 2000). The NAP–SL assessment instruments assess outcomes that contribute to scientific literacy, including skills and conceptual understandings, rather than focusing solely on scientific knowledge. They also assess student competence in carrying out investigations in realistic situations.

NAP–SL assesses students' ability to think scientifically in a world in which science and technology are increasingly shaping their lives.

A scientific literacy Progress Map (see Appendix 1) has been developed based on this construct of scientific literacy and on an analysis of the state and territory curriculum and assessment frameworks. The Progress Map describes the development of scientific literacy across three strands of knowledge which are inclusive of Ball et al.'s concepts and processes and the elements of the OECD–PISA definition of scientific literacy.

What aspects of scientific literacy were assessed?

As in the previous three NAP–SL assessments, three main areas of scientific literacy were assessed in 2012:

Strand A: formulating or identifying investigable questions and hypotheses, planning investigations and collecting evidence

Strand B: interpreting evidence and drawing conclusions from students' own or others' data, critiquing the trustworthiness of evidence and claims made by others, and communicating findings

Strand C: using science understandings for describing and explaining natural phenomena, and for interpreting reports about phenomena.

In addition, the items drew on four major scientific concept areas: Earth and Space (ES); Energy and Force (EF); Living Things (LT); and Matter (M). These concept areas, found most widely in state and territory curriculum documents, were used by item developers to guide item and test development. The list of endorsed examples for each of these concept areas is included in Appendix 2.

A conscious effort was made to develop assessment items that related to everyday contexts. The intention was to ensure that all Year 6 students were familiar with the materials and experiences to be used in the NAP–SL assessment and so avoid any systematic bias in the instruments being developed.

Who participated in the 2012 NAP–SL assessment?

Approximately five per cent of the total Australian Year 6 student population was sampled randomly and assessed. The sample was drawn from all states and territories. Government, Catholic and independent schools participated. Table 1.1 shows the number of schools and students in the target sample and in the final sample for which results were reported.

Table 1.1 Number of schools and students by state and territory in the NAP–SL sample 2012

State/Territory	Number of schools in target sample	Number and percentage of schools in final sample	Number of students in target sample	Number and percentage of students in final sample
ACT	54	54 (100%)	1305	1242 (95.2%)
NSW	92	90 (97.8%)	2246	2060 (91.7%)
NT	50	41 (82.0%)	959	710 (74.0%)
QLD	92	92 (100%)	2207	2052 (93.0%)
SA	94	94 (100%)	2082	1926 (92.5%)
TAS	64	64 (100%)	1420	1259 (88.7%)
VIC	93	90 (96.8%)	2112	1854 (87.8%)
WA	94	92 (97.9%)	2344	2133 (91.0%)
AUST	633	617 (97.5%)	14675	13236 (90.2%)

Note: The student participation percentage calculation includes within-school exclusions.

A grade-based population of students enrolled at schools was chosen. This is consistent with the other NAP sample assessments. There are differences between the states and territories in the structure and organisation of pre-primary education and the age of entry to full-time formal schooling. Table 1.2. presents information about the average ages of students at the time of testing.

Table 1.2 Distribution of ages of students in the sample by state and territory

State/Territory	Average age at time of testing
ACT	12 yrs 0 mths
NSW	12 yrs 0 mths
NT	11 yrs 10 mths
QLD	11 yrs 5 mths
SA	12 yrs 0 mths
TAS	12 yrs 3 mths
VIC	12 yrs 3 mths
WA	11 yrs 9 mths

The 2012 NAP–SL Public Report provides detailed information about the participating sample and the results of the testing.

What did the NAP–SL participants have to do?

Participating students had to complete an objective (pencil-and-paper) assessment and a practical task. The objective assessment had approximately 40 items.

The practical task required students to undertake an activity in groups of three to collect and record data from that activity. Students then responded individually to 10 or 11 items, depending on the practical task they had completed. Only individual student responses were used in the analysis of the assessment results and the generation of proficiency data.

Both the objective assessment and the practical task included multiple-choice and open-ended items. The open-ended items required students to construct their own responses. These were categorised into items that required responses of one or more words (short-answer items) and items that required more substantive responses of one to three sentences (extended-response items). The multiple-choice and short-answer items had only single correct answers. The scores allocated to these items were zero or one. The scores allocated to extended-response items were zero, one or two.

Students were allowed 60 minutes to complete the objective assessment and 45 minutes for the practical task.

How are the NAP–SL results reported?

The results of NAP–SL are reported as mean scores and distributions of scores across Proficiency Levels. They are also described in terms of the understandings and skills that students demonstrated in the assessment. These understandings and skills are mapped against the scientific literacy Progress Map.

NAP–SL covers a range of five Proficiency Levels: Level 2, Level 3.1, Level 3.2, Level 3.3 and Level 4. Typically, students whose results are located within a particular Proficiency Level are able to demonstrate the understandings and skills associated with that level and possess the understandings and skills of lower Proficiency Levels. Further details of the Proficiency Levels, including results in relation to the levels by state and territory, are included in the 2012 NAP–SL Public Report. This report also presents results for groups such as males and females, Indigenous and non-Indigenous students and students from different language backgrounds and geographic locations.

The 2012 NAP–SL assessment was designed to provide as much information as possible about student performance in scientific literacy at the Year 6 level. To achieve this, a rotational test design was implemented. Items were first organised in clusters of approximately 13 items. The clusters were then placed into seven different assessment forms. Each cluster appeared in three forms, either in the first, second or third section of the form. This methodology was adopted so that the greatest number of items possible could be assessed and also to mitigate against any bias in item performance due to its placement within an assessment form. In order to produce comparable results among students who had completed different forms, statistical analyses were performed and scaled scores were generated for all students.

The tables produced in Chapter 6 enable the raw scores achieved by students in the Science Literacy School Assessment to be converted into equivalent scaled scores and mapped to the Progress Map used to report the performance of students in NAP–SL.

Chapter 2
Use of the School Release Materials

Overview

Some assessment items from the 2012 National Assessment Program – Science Literacy (NAP–SL) have been released to enable teachers to administer these items under similar conditions and gauge their own students' proficiency in relation to the national science literacy standards. These items are the Science Literacy School Release Materials included in Chapter 4.

The remaining 2012 assessment items have been secured for the purpose of equating the next NAP–SL assessment, which is to be undertaken in 2015. The secured items, together with student performance data from previous NAP–SL assessments, will allow longitudinal data on student performance to be obtained.

Assessment tasks

The Science Literacy School Release Materials comprise two parts:

- an objective assessment, with 39 multiple-choice and open-ended questions, which assess Proficiency Levels 2, 3.1, 3.2, 3.3 and 4 of the national scientific literacy assessment domain (Appendix 1); and

- a practical task requiring students to carry out an investigation in groups of three and then respond individually to a set of questions about the investigation.

Teachers can decide whether they want to administer both the objective assessment and the practical task (as in NAP–SL) or only the objective assessment.

A summary of the assessment structure, including the unit topics, the science concept areas and a brief description of the processes assessed, is provided in Table 2.1 and Table 2.2.

Table 2.1 Objective Assessment items

Q no.	Unit topic	Concept area	Item descriptor
1	Life in the desert	ES	interprets line graphs to identify the highest average temperature
2	Life in the desert	LT	identifies adaptations of an Australian mammal to low rainfall
3	Light and shadows	EF	identifies the relationship between blocking the path of light and the formation of a shadow
4	Light and shadows	EF	can generalise the rule by predicting future events
5	Light and shadows	ES	identifies the approximate time when the shortest shadow occurs
6	Light and shadows	ES	explains the changing length of shadows during the day
7	Mixing liquids	M	identifies a change to properties of substances
8	Mixing liquids	M	identifies the change that suggests the formation of a new substance
9	Food and energy	ES	compares data in a supplied table
10	Food and energy	ES	demonstrates awareness of 'fair testing'
11	Food and energy	ES	makes a suggestion for improving the method
12	Food and energy	EF	makes an inference by comparing aspects of data in a table
13	Testing paper towels	M	demonstrates awareness of the need for 'fair testing'
14	Testing paper towels	M	identifies the paper towel brand that soaks up the most water
15	Curtains	M	explains interactions that have been reported in terms of an abstract scientific concept
16	Curtains	M	applies knowledge of relationships to make appropriate selection
17	Curtains	M	applies knowledge of relationships to explain observed phenomenon
18	Making jelly	M	identifies the question being investigated by an experiment
19	Making jelly	M	interpolates data in a line graph
20	Making jelly	M	identifies an appropriate suggestion about how to improve an investigation
21	Evaporating liquids	M	describes evaporation as a change from liquid to gas
22	Evaporating liquids	M	identifies processes in which a liquid changes to a gas as examples of evaporation
23	Evaporating liquids	M	demonstrates an awareness of the meaning of 'fair testing' by identifying one factor that should be kept the same in an experiment
24	Evaporating liquids	M	demonstrates an awareness of the need for 'fair testing'

Table 2.1 Objective Assessment items (cont.)

Q no.	Unit topic	Concept area	Item descriptor
25	Evaporating liquids	M	compares aspects of data supplied in a table of results (and provides appropriate reference units)
26	Evaporating liquids	M	draws a conclusion that summarises the pattern in the data
27	Evaporating liquids	M	accounts for increased evaporation in terms of one factor that affects the evaporation rate
28	Seed dispersal	LT	identifies a feature that helps seed dispersal
29	Seed dispersal	LT	identifies the relationship between seeds carried into an ant nest and protection (from predators and extreme environmental conditions)
30	Seed dispersal	LT	selects the most likely purpose of plant adaptation
31	Seed dispersal	LT	draws an inference about a predator-prey relationship from information about ant/stick insect behaviour
32	Recycling	M	determines from a graph the percentage of waste processed at a recycling depot
33	Recycling	M	identifies waste material that can be added to a compost heap
34	Recycling	LT	explains why decomposers are important in composting
35	Changing rocks	ES	draws a conclusion that summarises a pattern in the data
36	Changing rocks	ES	makes a prediction based on the pattern in the data
37	Changing rocks	ES	relates a model to real world applications
38	Solar energy	EF	identifies the experimental set-up that will help answer a scientific question
39	Solar energy	EF	explains the rising of a solar balloon in terms of an abstract science concept

Table 2.2 Practical Task items

Q no.	Task	Concept area	Item descriptor
Prac Q1	Reaction time	LT	compares data to identify the smallest value recorded
Prac Q2	Reaction time	LT	draws a conclusion that summarises the pattern in the data
Prac Q3	Reaction time	LT	identifies an advantage of calculating average values from repeated trials
Prac Q4	Reaction time	LT	applies knowledge of the nervous system to explain an experienced phenomenon
Prac Q5	Reaction time	LT	selects an appropriate change to the method that would improve data collection
Prac Q6	Reaction time	LT	identifies a suggestion that would result in an improvement to the method and justifies choice
Prac Q7	Reaction time	LT	reads a conversion chart to determine reaction time
Prac Q8	Reaction time	LT	interprets a column graph to identify the number of categories that match a specified criterion
Prac Q9	Reaction time	LT	provides a justification for disagreeing with a statement that summarises the data in a column graph
Prac Q10	Reaction time	LT	interprets a column graph to identify the category most likely to contain unreliable data

Assessment materials

This document contains the released items required to conduct the Science Literacy School Assessment. Conducting the assessment will enable schools to analyse the performance of their students and gauge their proficiency against the national science literacy standards. The materials may be reproduced freely.

The assessment materials include:

- two assessment tasks – an objective assessment and a practical task
- assessment administration guidelines
- marking guidelines for the objective assessment and the practical task
- a class record sheet
- an item analysis sheet
- a class analysis sheet.

Using the assessment materials at the classroom and whole-school levels

At the classroom level, the Science Literacy School Release Materials can be used to:

- diagnose individual students' strengths and weaknesses in terms of their demonstrated skills and understandings in science
- ascertain the strengths and weaknesses in science of the class as a whole
- help teachers to analyse the effectiveness of their own science teaching and their students' learning strategies
- provide models of sound assessment tasks
- moderate individual teachers' judgements with those of the 2012 NAP–SL assessment.

At the whole-school level, they can be used to:

- infer levels of student science achievement in the particular state or territory's curriculum framework
- make comparisons between science performance in the school and the national mean (see Tables 7.4 and 7.5 in Chapter 7)
- make comparisons between the range in science performance in the school and the range achieved nationally
- report to the school community on student achievement in science

- report to school authorities on student achievement in science
- set priorities for school development planning
- provide continuity for students moving from other schools.

In using the assessment materials, it should be noted that:

- NAP–SL is a comprehensive assessment but cannot assess all science knowledge and skills
- test results are one source of information about student progress, and information from other sources is necessary for accurate assessments of student achievement to be made
- the materials cannot be used to compare teachers and schools.

In order to ensure consistency in the delivery of the assessment, the Assessment Administration Guidelines (see Chapter 3) must be followed carefully.

Using the results from the Science Literacy School Assessment

Although the major concept areas tested – Earth and Space, Energy and Force, Living Things and Matter – are common to all jurisdictions, the manner in which they are taught varies according to the teaching strategies used in individual classrooms, teachers' own science backgrounds and enthusiasm for science, and the student outcomes established by the curriculum frameworks in use in particular states and territories.

Also, due to differences between jurisdictions in the way in which primary schooling is structured, there are variations in the average ages of students and the length of prior schooling at the time of testing.

However, although the ways in which these assessment materials are used will inevitably vary, they can provide very valuable information at the classroom, school and system levels.

It is important to remember that these tests were developed through a rigorous consultative process that included input from educational experts from all jurisdictions and reference groups. The assessment items and tasks were subjected to intensive development and review, and were trialled and administered under strict conditions to ensure the soundness of the 2012 NAP–SL assessment. Users can therefore be confident that these tests meet the highest possible professional and ethical criteria.

The tests are standards-based. They allow inferences to be made about students' levels of achievement in the domain, the mean level of performance of a class or cohort, and the range of levels that a class or cohort achieves.

Some teachers may use the tests to obtain information about students' existing skills or understandings: for example, a Year 7 teacher might use the Year 6 materials for diagnostic purposes. This information could then assist the teacher's planning for the year. However, before doing so, the teacher should determine whether students have previously participated in NAP–SL. If they have, their results could be inflated and, therefore, not provide an accurate estimation of performance, or they might not engage with the test for a second time and so the results may not reflect student ability.

Chapter 3
Assessment Administration Guidelines

This assessment of scientific literacy comprises two parts:

Part A: an objective assessment (a pencil-and-paper test), with 39 multiple-choice and open-ended questions

Part B: a practical task requiring students to carry out an investigation in groups of three and then respond individually to a set of questions about the investigation.

Teachers can decide whether they want to administer both the objective assessment and the practical task (as in the National Assessment Program – Science Literacy [NAP–SL]) or only the objective assessment. No provision has been made for using the results of the practical task alone.

When photocopying the assessment in Chapter 4 of this document for the class, it is important to ensure that the format displayed in the resources is maintained in the back-to-back mode, and with second and third pages facing one another. This maintains the test conditions and format allowing students to refer to the stimulus or background information whilst answering the accompanying items.

Before conducting the assessment

Make yourself familiar with these guidelines. They must be followed closely if the results of testing in your school are to be comparable with the national data.

The assessment has an objective component and a practical task component. The objective (pencil-and-paper) test session is completed by students working on their own. The practical task involves students working in groups of three at a table. A normal classroom should be suitable for both sessions.

Time allocation

The two assessment components will take approximately three hours in total to administer, including time to read the instructions and distribute the materials. A short break should be allowed between the objective (pencil-and-paper) and practical task sections of the assessment. The recommended test administration times are listed in Table 3.1.

Table 3.1 Time allocation for Objective Assessment and Practical Task

Objective (pencil-and-paper) test	**Time allowed**
Reading the instructions and distributing the booklets, completing/checking the student information on the cover page and completing the practice questions	15 minutes
Students undertake the test	60 minutes
Collecting the booklets and ending the session	5 minutes
	Total: approximately 1 hour 20 minutes
Allow a break of approximately 15-20 minutes before starting the practical task	
Practical task	**Time allowed**
Reading the instructions and then handing out the packaged materials to each group of students	15 minutes
Students read the instructions	5 minutes
Students undertake the test: Part A (Group activity)	25 minutes
Students undertake the test: Part B (Individual work)	20 minutes
Collecting the materials and ending the session	15 minutes
	Total: approximately 1 hour 20 minutes
Total assessment session: approximately 3 hours	

Materials required

Students

- 2B or B pencil, eraser, sharpener and ruler
- one test booklet per student
- a set of practical task materials for every group of three students.

Teachers

- the reading script on pages 16-22
- a watch or clock
- a set of practical task materials (see below for practical task materials)
- spare test booklets, 2B or B pencils, erasers, sharpeners and rulers
- reading materials for students who finish the assessment early.

Assistance

You may read questions to individual students if asked, but no further assistance, such as explaining the meaning of words or in any way helping students to answer a question, can be given.

Students should be encouraged to attempt all questions to demonstrate their understanding. If a student finds a question difficult, suggest that he or she leave it and move on to other questions. The student can return to the question if time permits.

Preparing for the practical task

The practical task (Reaction time) comprises:

Part A: Group activity: students work in groups of three (25 minutes).

Part B: Students work individually to answer questions on the group activity (20 minutes).

Before the practical task, the teacher should:

- organise a classroom where students will not be disturbed, and where furniture can be arranged into a sufficient number of work stations to accommodate each group of three students
- set up the practical task materials in groups on a table at the side of the room beforehand. One student from each group can then collect the materials when told to do so.

Practical task materials (per group of three students)
• 40 cm ruler

Arranging groups for the practical task

For the practical task, groups of three students should be constructed by random assignment so that there is no bias caused by 'friendship' or 'similar-ability' groups working together on the practical task. Students could be assigned to groups according to alphabetical order by family name. If you have students left over then allocate them into groups of two (the minimum number of students in a group).

Reading the script

To ensure that the assessment is conducted in the same way as the 2012 NAP–SL assessment, it is important that all students hear the same instructions.

The only text to be read to the students is in the shaded boxes, and to ensure test administration consistency it should be read WORD-FOR-WORD without omissions or additions. The unshaded text provides instructions and background information for the test administrator. Please follow these instructions.

Distribute the test booklets, if you have not done so already.

Introduction

You should have a test booklet on your desk. Please do not open it yet. Put up your hand if you do not have a test booklet. Please put up your hand if you do not have a 2B or B pencil, a ruler, a sharpener and an eraser.

Give students who do not have all the materials additional items as necessary.

You should not have anything on your desk apart from your test booklet, a pencil, a ruler, a sharpener and an eraser. If you have brought a book or magazine to read if you finish early, place this on the floor under your desk.

Beginning the session

To make sure that all students doing this test receive exactly the same instructions, I will be reading them to you.
If you need another pencil or you have difficulty in reading the questions during the session, please raise your hand and I will assist you.
Please look at the cover page of the test booklet.

Completing the student information on the front page of the test booklet

Please print your name neatly in pencil in the space provided on the front cover of your test booklet.

Ensure that students do not move on to the practice questions on the back cover until all students have completed writing their names and you are ready to commence the assessment.

Completing the practice questions

In this test booklet you will find questions about science.
Read each question carefully and answer it as well as you can. You may find some of the questions in this test easy, and others difficult. Answer as many questions as you can.
Do not start working through the test questions yet. You will be told when to begin.
First we will do some practice questions together. There are five types of questions in the test. Turn the test booklet over, so you are looking at the back cover.

Multiple choice

Look at practice question 1.
In these questions you must shade the bubble next to the correct answer. There is only **one** correct answer in this type of question.

Read practice question 1 to the students.

Q1 Shade in the bubble next to the correct answer.

The colour of blood is

◯ blue.
◯ green.
◯ red.
◯ yellow.

Shade in the bubble next to the correct answer.

Allow time for students to answer practice question 1.

The answer is ‘red’ so you should have shaded the third bubble next to the word ‘red’.

Check that students have shaded in the bubble for 'red'.

Respond to any questions or problems.

Tick the boxes

Look at practice question 2.
In these questions you must place a tick in the boxes next to the correct answers.
There may be more than one correct answer in this type of question.

Read practice question 2 to the students.

Q2 Which of the following are fruit? **Tick all possible answers.**

☐ banana ☐ bicycle ☐ apple ☐ chair

Allow time for students to answer practice question 2.

The answer is 'banana' and 'apple', so you would have placed a tick in the boxes next to both of those words.

Check that students have placed a tick in the appropriate boxes.

Respond to any questions or problems.

Write in the boxes

Look at practice question 3.
In these questions you must fill in all the boxes with numbers.

Read practice question 3 to the students.

Q3 Rank these animals from **smallest** (1) to **largest** (4).

Write the numbers 1, 2, 3 and 4 in the following boxes to show your ranking.

☐ horse
☐ dog
☐ mouse
☐ elephant

Allow time for students to answer practice question 3.

The answer is: the number 1 is in the box next to mouse, the number 2 is in the box next to dog, the number 3 is in the box next to horse and the number 4 is in the box next to elephant. All the boxes must be filled in with the correct numbers.

Check that students have placed the numbers in all the boxes.

Respond to any questions or problems.

One or two word answer

Look at practice question 4.
In these questions you only need to write one or two word answers.

Read practice question 4 to the students.

Q4	On a clear, sunny day the colour of the sky is ______________ .

Write your answer in the space provided.

Allow time for students to answer practice question 4.

What answers would you suggest?

Respond to the student answers as they are given. Typical answers would be: 'blue' or 'light blue'.

Remind students that answers which repeat information in the question would not be rewarded, e.g. 'clear'.

Respond to any questions or problems.

Long answer

Look at practice question 5.
In these questions 'explain' means give a full explanation for your answer.
You may need to write two or three sentences to give the best answer.

Read practice question 5 to the students.

Q5	Explain why plastic bags cause problems for sea creatures. ______________________________ ______________________________

Write your answer in the space provided.

Allow time for students to answer practice question 5.

What answers would you suggest?

Respond to the student answers as they are given. Typical answers would be: 'Animals can die', or 'Animals eat them'.

Encourage students to provide well-considered and complete answers like: ‘Some animals can mistake plastic bags for food and eat them. They can get caught in their digestive systems and the animals could die’.

Explain that answers that provide more information may be awarded higher marks.

Explain that, for questions like practice question 5, the number of lines is a guide to how much they will need to write.

Are there any questions about how to record your answers?

Respond to any questions.

Do **not** turn to the first page of the test booklet until I tell you to.

The objective (pencil-and-paper) test session

You have now finished the practice questions.
You will have one hour to complete the first section of the test booklet. Then you will have a break before you start the second section of the test booklet, the practical task.
You will work on your own to answer the questions in the test booklet.
Read carefully the text that comes before the questions. It includes information that will help you answer the questions.
If you make a mistake and want to change your answer, erase it and write your new answer.
If you don’t know the answer to a question, try the next one. If you have time, go back to the questions you didn’t finish, and attempt to complete them.
Do not start until I tell you to. Are there any questions?

Answer any student questions.

Now turn to the first page of questions inside the front cover.
Use your time carefully and do as much as you can. Please begin.

Monitor the students.

After 30 minutes, say:

You have 30 minutes to go. When you finish, go back through the test and answer any questions you may have missed.

After 55 minutes, say:

You have about 5 minutes to go.

After 60 minutes, say:

Please stop. Close your test booklet. We shall now have a break.

The break does not have to be timed exactly and is at the discretion of the teacher. It should align with normal school policies or breaks. It should be no less than 15 minutes.

Preparing the students for the practical task

After the break, organise students into groups of three as described on page 16. When the students are seated in the assigned groups and quiet, say:

Today you will be doing a science practical task called **Reaction time**. You will work in your group for the practical activity (Part A). You must work alone for the rest of the task (Part B), when you write your answers to questions by yourself.
There are the same types of questions in this practical task as there were in the first section, so we will not look at the practice questions again.
You will do Part A of the practical task in your group. You will need to read through all the instructions carefully and do the task as a group. While completing the task you will write all of your results in your own test booklet.
You may discuss the task quietly as a group while you are completing Part A of the task. For Part B, you will work on your own.
If you make a mistake and want to change your answer, erase it and write your new answer.
If you don't know the answer to a question, try the next one. If you have time, go back to any question you didn't finish.
Do not start until I tell you to. Are there any questions?

Answer any student questions.

Let's read the Introduction to the practical task that describes what the task is about.

Read the Introduction to the task contained in the test booklet.

Have one student from each group collect the equipment from the side table.

Before you start the task, we will check that each group has all the materials.

Read through the list of materials for the practical task assigned to your class. This is shown on page 15 of this manual and in the test booklet.

Starting the practical task

Begin the practical task when the students are ready.

You will have 5 minutes to read through all the instructions carefully.

Monitor the students.

After 5 minutes, say:

You have 45 minutes to complete Part A and Part B of the task. You should spend about 25 minutes on Part A. Use your time carefully and do as much as you can. Please begin Part A. Do not start Part B until I tell you.

Monitor the students.

The students have 45 minutes to complete the practical task, Part A and Part B. Part A should take no longer than 25 minutes so that there is at least 20 minutes for students to complete Part B. Use your judgement as to exactly when you ask these groups to stop working and start the individual work.

After 20 minutes, warn the students that they have 5 minutes to finish the practical activity (Part A) before starting the questions.

After a further 5 minutes, ask the students to stop work, put the ruler down and sit at their desks.

You must now work on your own to answer the questions in your test booklet for Part B.
You have 20 minutes to complete Part B of the assessment. Use your time carefully and do as much as you can. Please begin.

While students are completing Part B, quietly collect the practical materials.

As the end time approaches, watch for students who appear to have finished and remind them to check their work. A student who, in your opinion, has satisfactorily completed as much as possible of the test, may read a book or magazine after you have collected their test booklet.

After a total of 45 minutes, say:

Please stop. Close your test booklet.

Monitor the students. At your discretion you may allow a minute or two extra to finish answering the question they are working on.

Collect the test booklets. This concludes the assessment.

Chapter 4
Science Literacy School Release Materials

The Science Literacy School Release Materials can be found on the following pages. Two forms of the materials have been included. The first form includes both an objective assessment and a practical task. The second form includes an objective assessment only for those schools that do not wish to administer a practical task.

SCIENCE LITERACY 2012

YEAR 6

RELEASED ITEMS

2012 NATIONAL ASSESSMENT PROGRAM (NAP-SL)

OBJECTIVE ASSESSMENT AND PRACTICAL TASK

First Name: ______________________________

Last Name: ______________________________

School: ______________________________

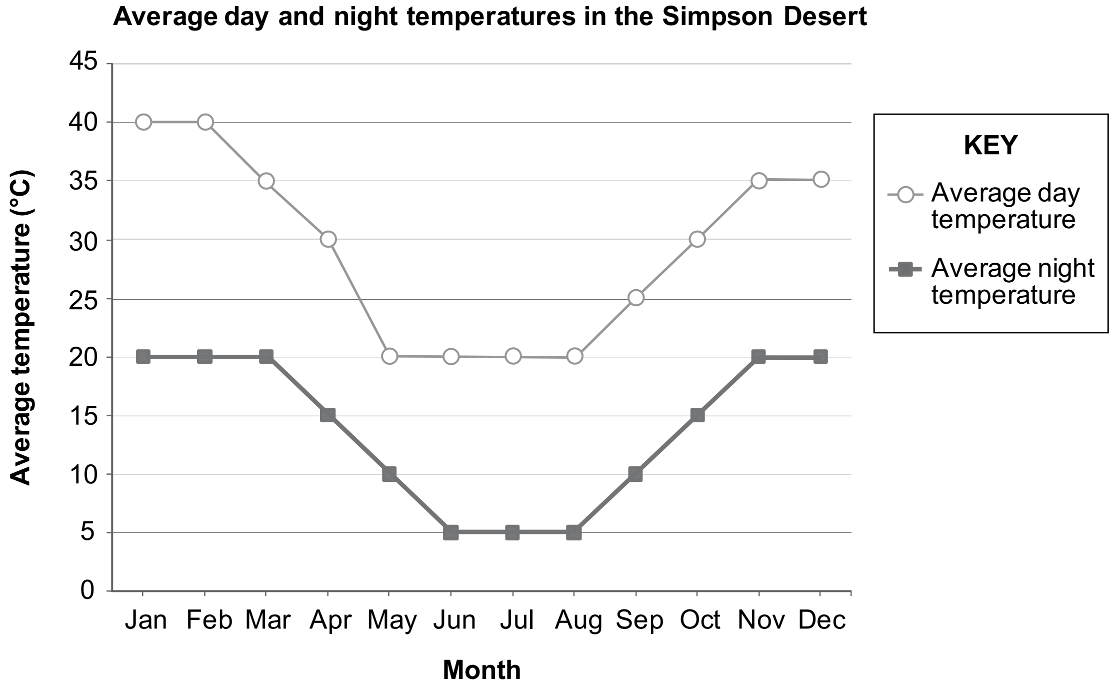
acara AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

UNSW Global THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA

Life in the desert

The Simpson Desert is located in Central Australia. It is a dry environment with long periods of no rainfall.

The graph shows the average day and night temperatures in the Simpson Desert for each month of the year.



Q1 What is the highest average day temperature in the Simpson Desert?

____________ °C

Q2 The Spinifex Hopping Mouse lives in the Simpson Desert. It has several adaptations that help it to survive in the desert.

Which of these adaptations would help the Spinifex Hopping Mouse to survive without rainfall?

Tick all possible answers.

- ☐ It has a long tail.
- ☐ It has big back legs.
- ☐ It stays underground on hot days.
- ☐ It gets water from the seeds it eats.

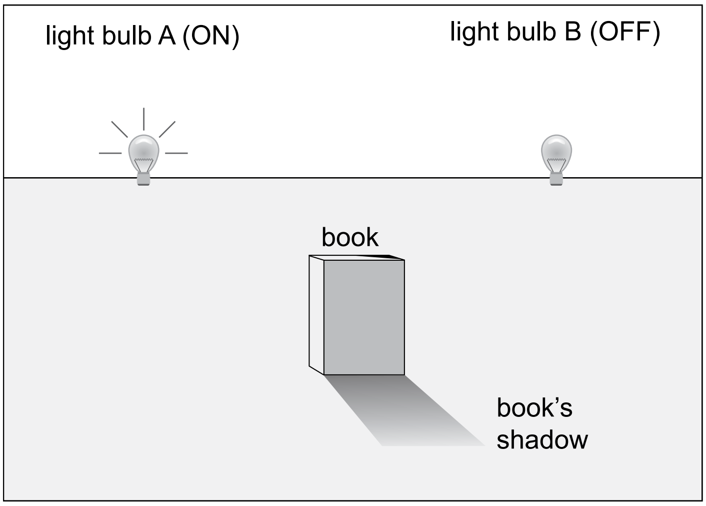
Light and shadows

The photograph shows a boy and his shadow.

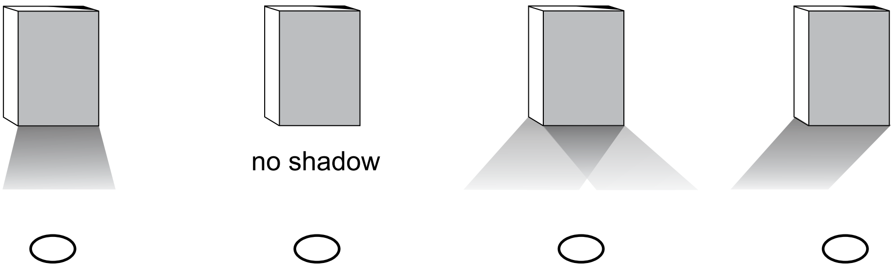
Q3 Shadows form when

- ◯ a light is turned off.
- ◯ light reflects off an object.
- ◯ light shines through an object.
- ◯ the path of light is blocked by an object.

Q4 Kale placed a book in front of two identical light bulbs. The picture shows the shadow of the book when light bulb A is turned on.



Which picture shows what happens when **both** light bulbs are turned on?



Kale and Tanya wanted to find out how the length of shadows changes during the day. They measured the length of the shadow of a flag pole at different times of the day.

Q5 At approximately what time would you expect the shadow of the flag pole to be the shortest?

- ◯ 9 am
- ◯ 12 noon
- ◯ 3 pm
- ◯ 5 pm

Q6 Why does the length of the shadow of the flag pole change during the day?

Mixing liquids

Curds are a milk product made by mixing milk and a sour substance such as lemon juice or vinegar.

For her Year 6 science project Linda made curds.

She mixed 3 cups of warm milk with 1 cup of vinegar.

The mixture began to change very quickly when she stirred it.

Q7 Look at the photos of Linda's project. What change took place?

- ◯ The mixture changed into a liquid.
- ◯ The mixture changed into two solids.
- ◯ The mixture changed into two liquids.
- ◯ The mixture changed into a liquid and a solid.

Q8 Which of the following suggests that a new substance was formed?

- ◯ There was liquid left.
- ◯ A solid was produced.
- ◯ The change was quick.
- ◯ Vinegar was dissolved in milk.

Food and energy

People use Earth's resources for food and energy.

Food

On average, Australians throw out a quarter of the food they buy.

Throwing away food means that the resources needed to produce and transport the food have been wasted.

Q9 The table shows how much water is needed to produce different types of food.

Table: Amount of water needed to produce different types of food

Type of food	Amount of water needed to produce 1kg of food (litres)
beef	100 000
chicken	3 900
potatoes	500
white rice	1 550

Rank the types of food from the one that needs the **smallest** amount of water (1) to the one that needs the **largest** amount of water (4).

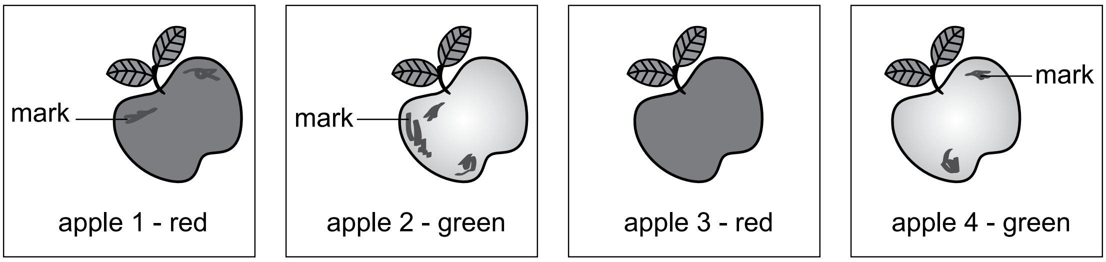
Write the numbers 1, 2, 3 and 4 in the following boxes to show your ranking.

☐ beef
☐ chicken
☐ potatoes
☐ white rice

Supermarkets throw away fruit and vegetables that do not look nice.

Tim conducted a test to find out whether marks on apples affect the taste of the apples.

Tim had four apples.



Q10 Which apples should he have used for his test?

- ◯ apple 1 and apple 2
- ◯ apple 1 and apple 3
- ◯ apple 1 and apple 4
- ◯ apple 2 and apple 3

Q11 What could Tim do to improve his test?

____

____

____

Energy

Most of the electrical energy that Australians use is produced by burning fossil fuels which are a non-renewable resource. A non-renewable resource is a resource that is used up faster than it can be replaced.

Q12 The table shows information about some sources of energy.

Energy source	Is carbon dioxide released?	Is the energy source renewable?
coal	Yes	No
biofuel	Yes	Yes
solar	No	Yes
wind	No	Yes

Joe claims that no carbon dioxide is released when renewable energy sources are used.

From the table, which energy source can be used to show that Joe's claim is not always correct?

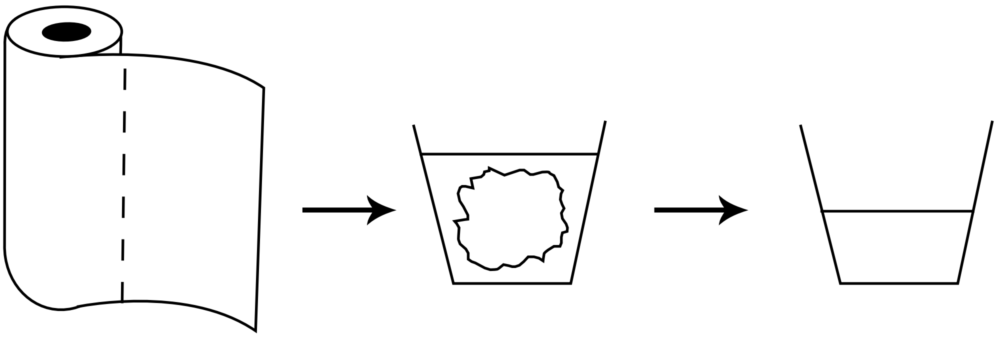
- ◯ coal
- ◯ biofuel
- ◯ solar
- ◯ wind

Testing paper towels

Emily tested four different brands of paper towel.

She tore a sheet of paper towel from each of the rolls. The sizes of the paper towel sheets were the same for all four brands.

The paper towels were placed into cups containing exactly 100 mL of water. After one minute Emily removed the towels and measured how much water was left in each cup.



Emily recorded her results in the table below.

Table: Amount of water left in the cup for different brands of paper towel

Brand of paper towel	Water left in the cup (mL)
WOW	75
Super	85
Power	65
Great	80

Q13 Why did Emily make sure that she used exactly one sheet of towel in each test?

Q14 After finishing her tests, Emily spilt a large amount of water on the floor. She wanted to soak up the spill using the smallest number of sheets of paper towel.

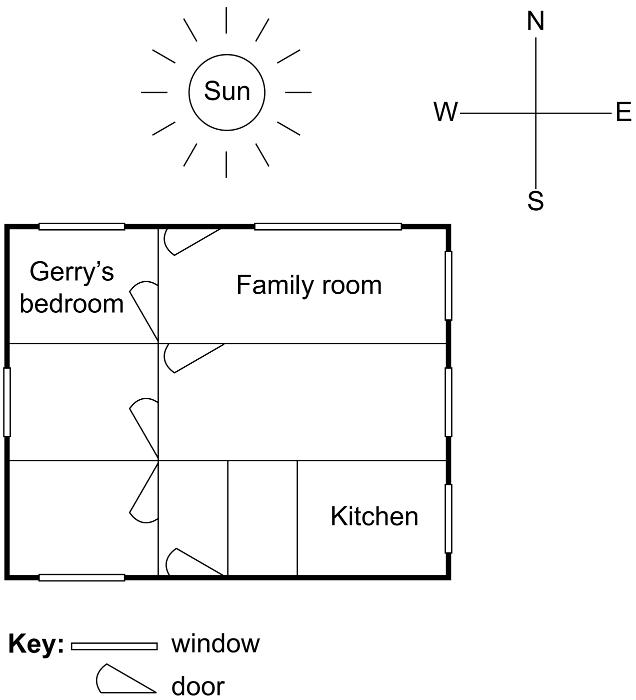
Based on her test results, which brand should she use?

- ◯ WOW
- ◯ Super
- ◯ Power
- ◯ Great

Curtains

Gerry and his family moved into a new house. They needed curtains for three of the windows:

- a large family room window in the front of the house, facing north (toward the sun for most of the day).
- a smaller kitchen window on the side of the house.
- Gerry's bedroom window, which faced north.



Gerry's father said the family room curtain needed a special layer on the window side. The layer would need to be a silver colour and shiny.

Q15 What do you think this layer is for?

____

____

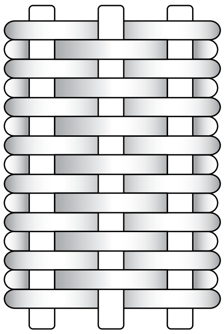
____

____

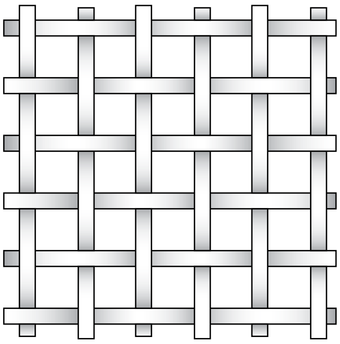
Some sample materials are shown below. They have been magnified to show the way the material is made.

An **open-weave** material is one in which the fibres (or threads) are **not** close together.

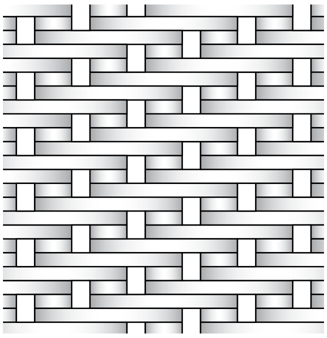
A **close-weave** material is one in which the fibres are close together.



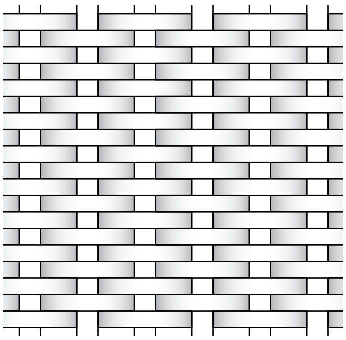
A



B



C



D

Gerry's mother said the curtain over the kitchen window should let some light in.

Q16 Which of these materials would be **best** for the kitchen curtain?

- ◯ A
- ◯ B
- ◯ C
- ◯ D

The third curtain was to hang in Gerry's bedroom window. This was at the front of the house.

Gerry decided he needed a curtain that would keep:

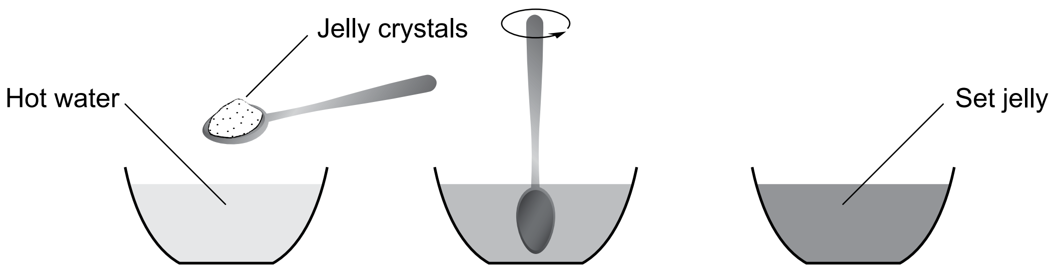
- sunlight out
- heat in.

Q17 Which of the following is the **best** choice?

- ◯ a woollen, close-weave curtain
- ◯ a woollen, open-weave curtain
- ◯ a cotton, close-weave curtain
- ◯ a cotton, open-weave curtain

Making jelly

Jelly is made by dissolving jelly crystals in hot water. After the crystals have dissolved, the mixture is cooled to allow the jelly to set. The jelly is ready to eat after it has set.



Bob made jelly using five bowls.

He did the following:

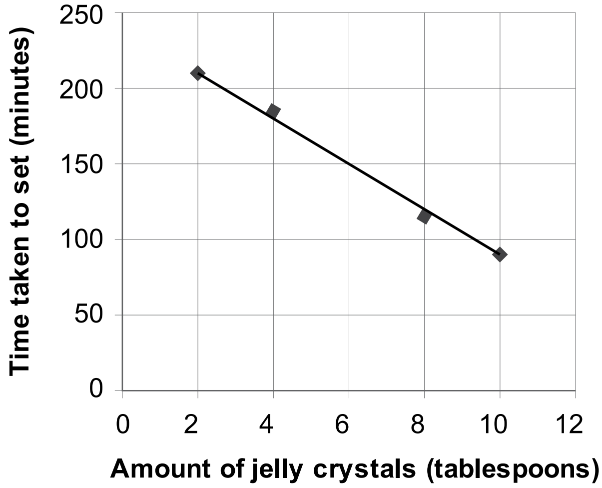
- He filled each bowl with two cups of hot water.
- He added jelly crystals to each bowl.
- He stirred the mixtures.
- He covered the bowls and placed them in the fridge.

Bob measured how long it took for each bowl of jelly to set. He recorded his results in the table below.

Bowl	Number of tablespoons of jelly crystals	Time taken to set (minutes)
1	2	210
2	4	185
3	6	Not recorded
4	8	115
5	10	90

Q18 What question was Bob trying to answer?

Q19 Bob made a graph of the results.



Bob forgot to time how long it took for the jelly in bowl 3 to set. Use the graph to predict the setting time for the jelly in bowl 3.

_______________ minutes

Q20 What is one thing that Bob could have done to improve his investigation?

Bob could have

- ◯ used cold water to make the jelly crystals dissolve faster.
- ◯ put the jelly mixtures into different fridges to set.
- ◯ used different types of jelly crystals in each bowl.
- ◯ repeated the experiment to check his results.

Evaporating liquids

Luca placed a glass of water beside his bed to drink during the night. He did not drink the water, but he noticed after several days that there was less water in the glass.

Luca knew that this was because the water had evaporated.

Q21 What does the word 'evaporation' mean?

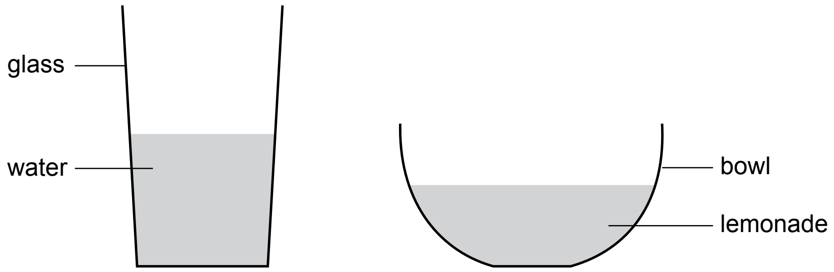
Evaporation is the change from ________________ to ________________.

Q22 Which of the following are examples of evaporation?

Tick all possible answers.

- ☐ ice melting
- ☐ wet footprints on concrete disappearing
- ☐ sugar dissolving when stirred in water
- ☐ clothes drying in the sun

Luca wanted to find out if water or lemonade evaporates faster. He put 100 mL of water in a glass and 100 mL of lemonade in a bowl.



Q23 Luca placed both containers on a windowsill and left them there for five days. Then he compared the levels of the two liquids.

Describe one thing in Luca's experiment that stops it from being a fair test.

____

____

____

Q24 In science, it is important to conduct fair tests. Why is this necessary?

____

____

____

Luca changed his method so that his experiment was a fair test. He measured the volumes of water and lemonade at 9 am every morning for five days. His results are shown in the table.

Table: Volume of water and lemonade on five days

Day	Volume of water (mL)	Volume of lemonade (mL)
1	100	100
2	96	94
3	92	88
4	80	73
5	76	65

Q25 How much water had evaporated from the glass by the end of the experiment?

____

Q26 What conclusion can you draw from Luca's results?

____

____

____

Q27 Luca's results show that more liquid evaporated on Day 3 than any other day. Give one reason why this might have happened.

____

____

____

Seed dispersal

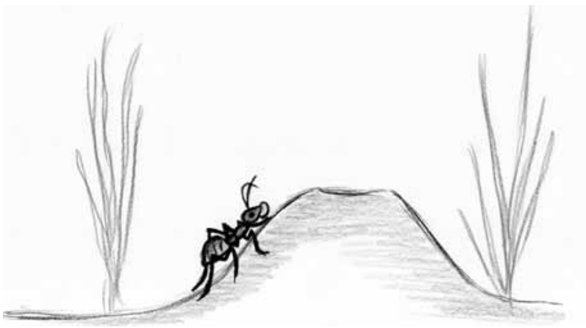
Seed dispersal is the transport of a plant's seeds from the plant to another location by wind, water or animals.

Q28 Some seeds are dispersed on the fur of animals.

Which of the following seeds are most likely to be dispersed this way?

- ◯ seeds with hooks
- ◯ seeds that can float
- ◯ seeds with a bright colour
- ◯ seeds with a smooth surface

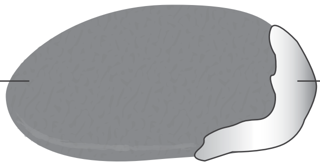
Q29 Ants help the seed dispersal of many Australian plants. The ants move the seeds to their nest.



An advantage to the seeds being in an ant nest is that they are protected

from ____.

Q30 Plants that disperse their seeds often produce chemicals in a fat-rich lump attached to the seed. The ants use the fat-rich lump for energy and leave the rest of the seed in the nest.



Which of the following describes the role of the chemicals and the fat-rich lump?

	The chemicals	The fat-rich lump is a
◯	stop ants from eating the seed.	source of food for the ants.
◯	attract ants to the seed.	source of food for the plant.
◯	stop ants from eating the seed.	source of food for the plant.
◯	attract ants to the seed.	source of food for the ants.

Q31 Some types of stick insects lay eggs that look like plant seeds. These eggs often end up in ant nests.

When the stick insect eggs hatch, the young stick insects look and behave like ants to increase their chances of survival.

What does the behaviour of young stick insects suggest about ants?

◯ Ants eat other insects.

◯ Ants only eat plant seeds.

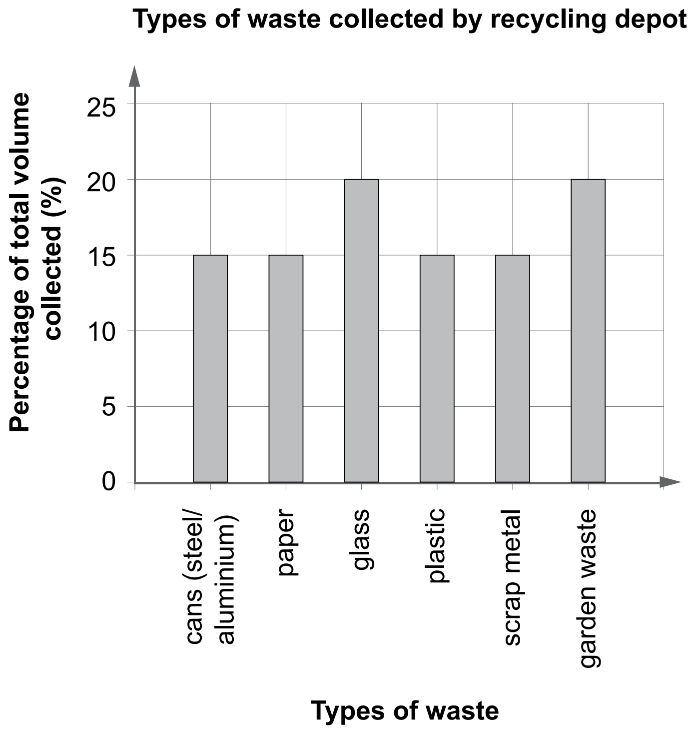
◯ Ants look like adult stick insects.

◯ Ant eggs look like stick insect eggs.

Recycling

A council waste recycling depot collects various materials. They sort the cans, glass, plastic and scrap metal and send them to other places for recycling. They recycle all other waste at the depot.

The column (bar) graph shows the types of waste collected by the depot.



Q32 What percentage of the waste is recycled at the depot?

- ◯ 15%
- ◯ 20%
- ◯ 30%
- ◯ 35%

Q33 Jason prepared chicken vegetable soup.

Soup Ingredients
1 chicken wrapped in plastic
12 cups of water
2 potatoes
2 onions
2 sticks of celery
parsley
1 can of tomatoes

Compost heap

Jason had a compost heap at his house. Which waste could Jason add to his compost?

- ◯ empty tomato can
- ◯ peel from potatoes
- ◯ plastic wrapper
- ◯ nylon onion bag

Q34 Why are decomposers (e.g. worms) important in composting?

____

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____

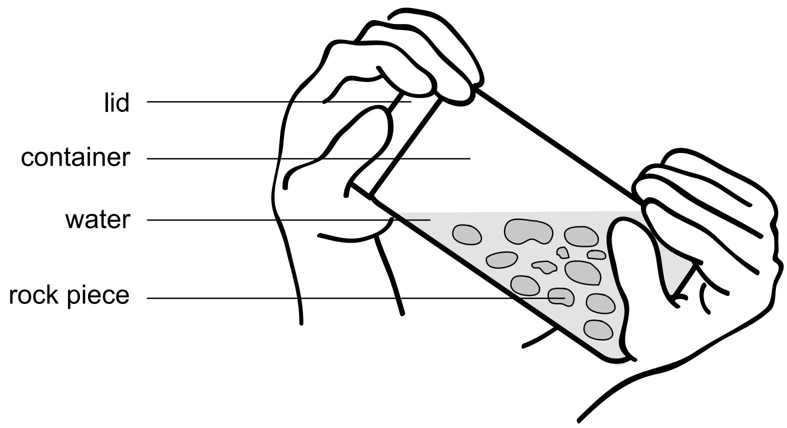
Changing rocks

Rocks can be broken down by water, ice, wind and the actions of plants and animals.

Class 6B wanted to find out whether some rocks break down more easily than others.

They conducted the following experiment:

1. They took 100 g of sandstone pieces and 100 g of quartzite pieces. The sandstone and quartzite pieces were approximately the same size.
2. They placed the sandstone and quartzite pieces in separate containers, each half full of water.
3. They covered each container and shook each one for 5 minutes.



4. They removed the small pieces that were chipped off by draining each container.
5. They dried and weighed the remaining sandstone and quartzite pieces.
6. They repeated steps 2-5 three times.

The table shows the students' results.

Table: Mass of rock pieces at the end of each trial

Trial	Mass of sandstone pieces (g)	Mass of quartzite pieces (g)
1	98.5	99.7
2	96.9	99.4
3	95.3	99.3
4	92.7	99.0

Q35 Write a conclusion that summarises the results from this experiment.

Q36 The students are now planning to shake each container for 30 minutes, remove the small pieces that are chipped off, then dry and weigh the remaining sandstone and quartzite pieces.

Predict what will happen to the masses of the remaining sandstone and quartzite pieces.

Q37 In what way is the experiment conducted by Class 6B similar to how rocks break down in the environment?

Solar energy

Fiona wanted to investigate the effect of sunlight on objects.

She knew that objects left in the sunlight will absorb some energy from the Sun and reflect some energy as well.

Fiona took some small boxes and placed them in the sunlight. She used a thermometer to measure the temperature of the air inside each of the boxes.

The table lists the results of her measurements.

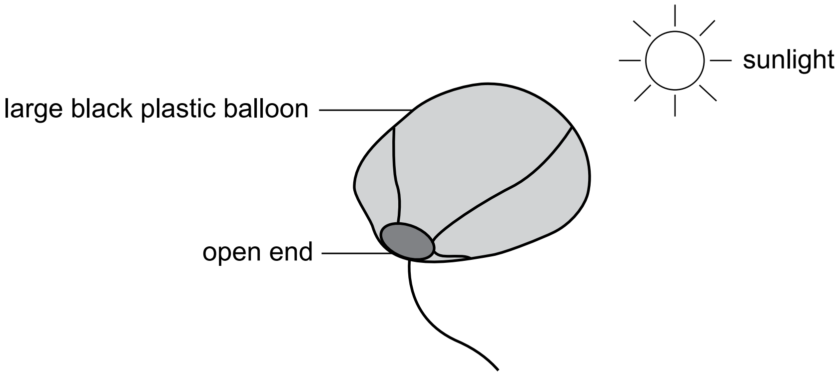
Box number	Box material	Outside surface colour	Type of outside surface	Temperature at the start (°C)	Temperature after one hour (°C)
1	cardboard	white	shiny	20	23
2	cardboard	black	dull	20	28
3	plastic	white	shiny	20	25
4	plastic	black	shiny	20	36
5	metal	black	dull	20	52
6	metal	white	dull	20	30
7	metal	black	shiny	20	49
8	metal	white	shiny	20	30

Q38 The box **material** affects the temperature of the air inside the box.

Which of the following two boxes show this?

- ◯ Box 2 and Box 3
- ◯ Box 3 and Box 6
- ◯ Box 4 and Box 7
- ◯ Box 5 and Box 7

Q39 Fiona constructed a large balloon using black plastic. She used a fan to fill the balloon with air and left it in the sunlight.



After some time, the balloon rose in the air without Fiona having to do anything more to it.

Explain in detail why the balloon rose.

____

____

____

____

PRACTICAL TASK

Reaction time

Introduction

Reaction time is the time it takes you to react to a change around you.
Quick reaction times are important in sports such as netball, tennis and cricket.

You will perform an experiment to investigate how long it takes to react and catch a falling ruler.

What to do

Complete Part A of the activity in your group. You will collect and record your results in Part A.

Complete Part B by yourself. You will use the results you collected in Part A to answer questions.

What you will need per group of three students

- 40 cm ruler

PART A

Group work (Work as a group of three students.)

Investigating reaction time

You will complete an experiment to investigate reaction time. You will collect and record your results as a group.

Practising for the experiment

Before you begin the experiment, practise dropping the ruler, catching the ruler and measuring the distance the ruler falls. You will do this three times. Make sure that each group member has a turn at dropping the ruler, catching it and measuring the distance it falls.

You should stand while doing this experiment.

1. The first person holds the ruler at the 40 cm mark and lets it hang down.
2. A second person places their thumb and index finger in line with the 0 cm mark as shown in Figure 1. This person must not touch the ruler.
3. Check that everything is correctly positioned.
4. The first person drops the ruler **without warning**.
5. The second person catches the ruler as soon as they see it fall.
   The second person must not move their hand up or down as the ruler falls.

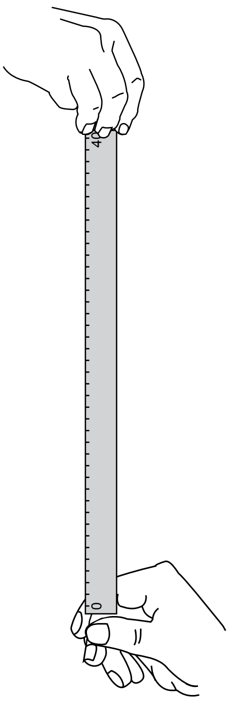


Figure 1

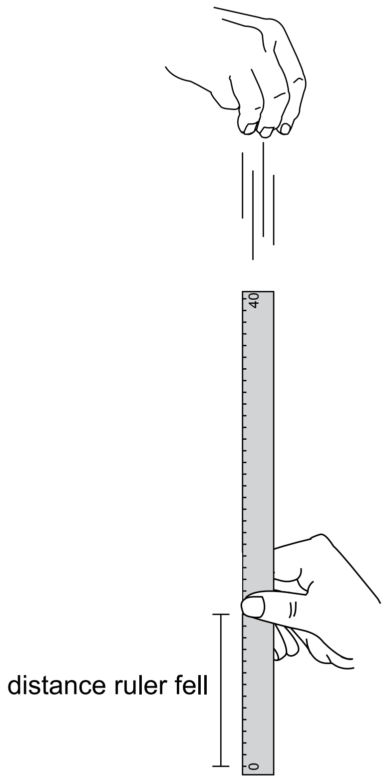


Figure 2

6. The third person checks how far the ruler fell before it was caught. The reading should be taken from the top of the thumb as shown in Figure 2.
7. Do this three times. Then change jobs with another group member so that each person has a turn at dropping the ruler, catching it and measuring the distance it falls.

Now begin your experiment.

1. Using your dominant hand

Preparing for the experiment

In this part of the experiment each person will use the hand they write with to catch the ruler. This is called the **dominant** hand.

Decide who will be Person 1, Person 2 and Person 3. Record this information.

Name		Circle hand used
Person 1 ______________________	Dominant hand	right/left
Person 2 ______________________	Dominant hand	right/left
Person 3 ______________________	Dominant hand	right/left

Conducting the experiment

- Each person will have five trials (turns) to catch the ruler.
- If a person doesn't catch the ruler, do not count that turn. Try again until they catch it and record the distance in Table 1.
- You need to record all of your group's results for this part of the experiment in Table 1.

Person 1: Catching the ruler with their dominant hand

- Person 1 will catch the ruler; Person 2 will hold the ruler; Person 3 will record the results.
- When Person 1 is ready, Person 2 should drop the ruler.
- Person 3 should record the distance the ruler fell (to the nearest centimetre) before it was caught.
- Do this five times altogether and record all of your results in Table 1.

Person 2: Catching the ruler with their dominant hand

- Person 2 will catch the ruler; Person 3 will hold the ruler; Person 1 will record the results.
- Do this five times altogether and record all of your results in Table 1.

Person 3: Catching the ruler with their dominant hand

- Person 3 will catch the ruler; Person 1 will hold the ruler; Person 2 will record the results.
- Do this five times altogether and record all of your results in Table 1.

Recording your data

Use this space to record your results for the dominant hand.

Table 1: Distance ruler fell before it was caught – **Dominant hand**

Trial	Distance ruler fell (nearest cm)		
	Person 1	Person 2	Person 3
1			
2			
3			
4			
5			

Make sure you have recorded your group's results for **all** three people in Table 1.

2. Using your non-dominant hand

Preparing for the experiment

In this part of the experiment each person will use the hand they do not write with to catch the ruler. This is called the **non-dominant** hand.

Make sure you keep Person 1, Person 2 and Person 3 the same as before.

Complete this information for all three people in your group.

Name		**Circle hand used**
Person 1 ______________________	Non-dominant hand	right/left
Person 2 ______________________	Non-dominant hand	right/left
Person 3 ______________________	Non-dominant hand	right/left

Conducting the experiment

Repeat all previous steps but this time use your non-dominant hand.

- Each person will have five trials (turns) to catch the ruler.
- If a person doesn't catch the ruler, do not count that turn. Try again until they catch it and record the distance in Table 2.
- You need to record **all** of your group's results for this part of the experiment in Table 2.

Recording your data

Use this space to record your results for the non-dominant hand.

Table 2: Distance ruler fell before it was caught – **Non-dominant hand**

Trial	Distance ruler fell (nearest cm)		
	Person 1	Person 2	Person 3
1			
2			
3			
4			
5			

Before you go on, make sure you have recorded all of your group's results in Tables 1 and 2. You will need to use these results when you work by yourself in Part B.

You have finished Part A.

Do not turn the page until you are told to do so.

PART B

Individual work (Answer these questions by yourself.)

Q1 Look at the results in **Table 1**: Distance ruler fell before it was caught – **Dominant hand**.

What was the shortest distance recorded for **Person 1**? ____________ cm

Q2 Look at **all** the results in Tables 1 and 2.

Write a conclusion about your group's reaction time when using your dominant hand compared to when using your non-dominant hand.

____

____

____

Q3 Your group conducted five trials for each person.

Why would it be useful to calculate the average distance the ruler fell for each person?

- ◯ It makes it easier to record the results.
- ◯ It makes it easier to compare people's results.
- ◯ It makes it easier to measure the distance the ruler fell.
- ◯ It makes it easier to see if people are dropping the ruler properly.

Q4 Which of these sequences best shows what happens when a person catches a dropped ruler?

- ◯ eyes detect ruler movement ➔ hand muscles work ➔ brain receives signal ➔ brain sends signal
- ◯ brain receives signal ➔ eyes detect ruler movement ➔ hand muscles work ➔ brain sends signal
- ◯ eyes detect ruler movement ➔ brain receives signal ➔ brain sends signal ➔ hand muscles work
- ◯ brain sends signal ➔ brain receives signal ➔ eyes detect ruler movement ➔ hand muscles work

Q5 In this experiment the instructions said: *If a person doesn't catch the ruler, do not count that turn.*

The experiment would be improved if students caught the ruler every time.

Which one of these would help improve the experiment?

- ◯ use a longer ruler
- ◯ let go of the ruler more slowly
- ◯ measure to the closest mm on the ruler
- ◯ wait for 10 seconds before dropping the ruler

Q6 Three students were discussing this experiment. They had some more suggestions for improving the experiment.

Matt: 'People who always write with their right hand should have been put into the same group.'

Kim: 'We should have practised with our non-dominant hand too.'

Dana: 'We should have used our dominant hand for all of the tests.'

Which student made a suggestion that would improve the experiment?

◯ Matt ◯ Kim ◯ Dana

Give a reason for your choice.

____

____

____

In this experiment you recorded the distance that the ruler fell before it was caught.

The distance the ruler falls before it is caught indicates a person's reaction time.

The chart shows the reaction time a person has if they catch the ruler at a particular distance.

The reaction time is given in milliseconds (1 second = 1000 milliseconds).

Conversion chart: Distance ruler fell and reaction time

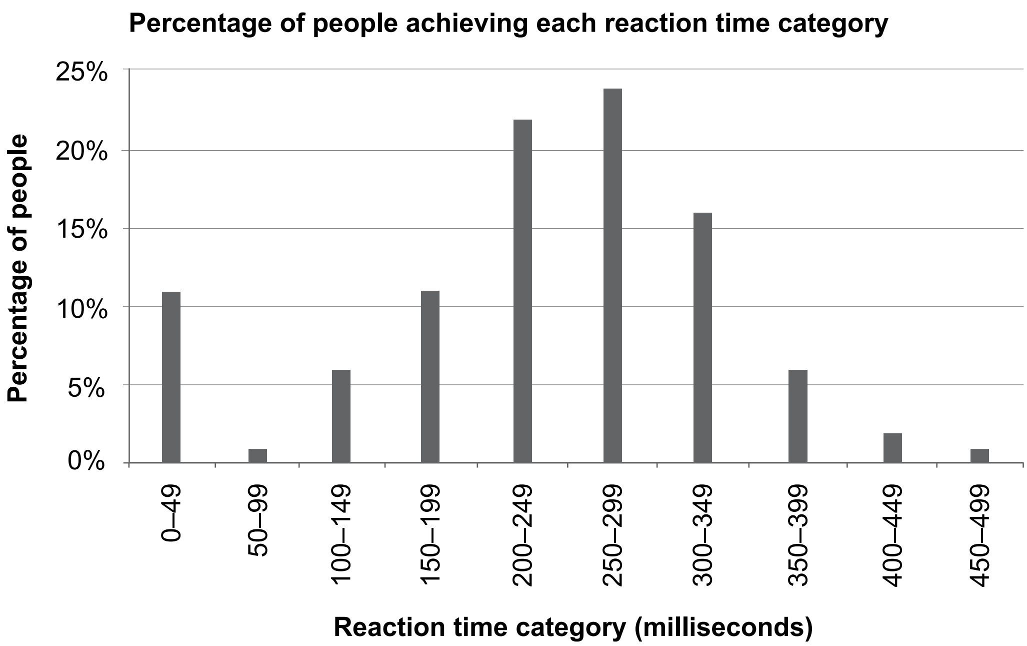
Distance ruler fell (cm)	Reaction time (milliseconds)
3	78
6	110
9	135
12	156
15	175
18	192
21	207
24	221
27	235
30	247

Q7 When Jack did the experiment, the ruler fell 12 cm before he caught it. Jack's reaction time is

- ◯ 110 milliseconds.
- ◯ 135 milliseconds.
- ◯ 156 milliseconds.
- ◯ 175 milliseconds.

There are computer programs that test reaction time. One of these programs asks you to click on the mouse as soon as an object on the screen changes colour. The computer measures your reaction time. You can enter your results and the program then combines them with the results entered by other people.

This graph shows the reaction times entered by a large number of people.



Q8 How many categories had fewer than 5% of the people in them?

◯ 0 ◯ 1 ◯ 2 ◯ 3

Q9 A student looked at the graph and said: 'The most common reaction time was between 200 and 249 milliseconds.' Do you agree with the student's statement about the graph?

◯ Yes ◯ No

Give a reason for your answer.

____

____

Q10 Which reaction time category is most likely to contain incorrect results?

__________ milliseconds

Give a reason for your answer.

____

____

Practice questions

Multiple choice

Q1 Shade in the bubble next to the correct answer.

The colour of blood is

- ◯ blue.
- ◯ green.
- ◯ red.
- ◯ yellow.

Tick the boxes

Q2 Which of the following are fruit? **Tick all possible answers.**

☐ banana ☐ bicycle ☐ apple ☐ chair

Write in the boxes

Q3 Rank these animals from **smallest** (1) to **largest** (4).

Write the numbers 1, 2, 3 and 4 in the following boxes to show your ranking.

- ☐ horse
- ☐ dog
- ☐ mouse
- ☐ elephant

One or two word answer

Q4 On a clear, sunny day the colour of the sky is ____________________ .

Long answer

Q5 Explain why plastic bags cause problems for sea creatures.

____

____

SCIENCE LITERACY 2012

YEAR 6

RELEASED ITEMS

2012 NATIONAL ASSESSMENT PROGRAM (NAP-SL)

OBJECTIVE ASSESSMENT

First Name: ______________________________

Last Name: ______________________________

School: ______________________________

acara AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

UNSW Global
THE UNIVERSITY OF NEW SOUTH WALES
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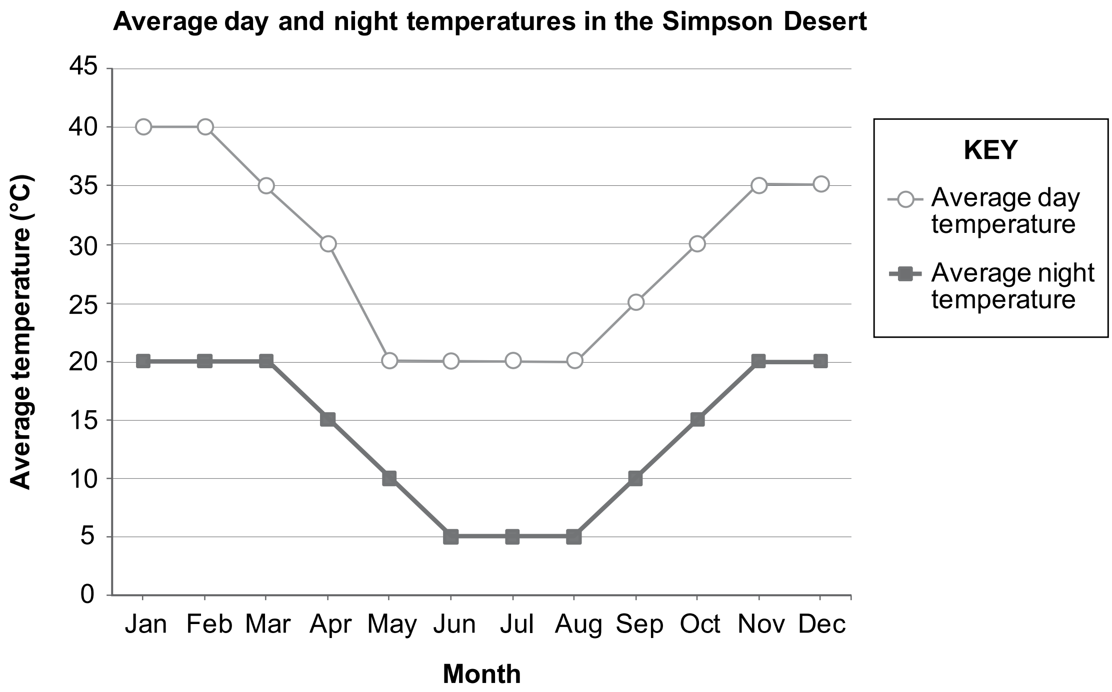
Life in the desert

The Simpson Desert is located in Central Australia. It is a dry environment with long periods of no rainfall.

The graph shows the average day and night temperatures in the Simpson Desert for each month of the year.



Q1 What is the highest average day temperature in the Simpson Desert?

___________°C

Q2 The Spinifex Hopping Mouse lives in the Simpson Desert. It has several adaptations that help it to survive in the desert.

Which of these adaptations would help the Spinifex Hopping Mouse to survive without rainfall?

Tick all possible answers.

- ☐ It has a long tail.
- ☐ It has big back legs.
- ☐ It stays underground on hot days.
- ☐ It gets water from the seeds it eats.

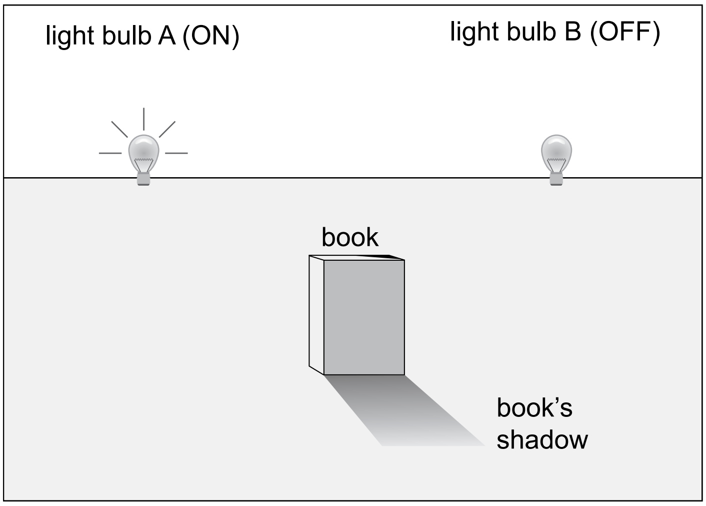
Light and shadows

The photograph shows a boy and his shadow.

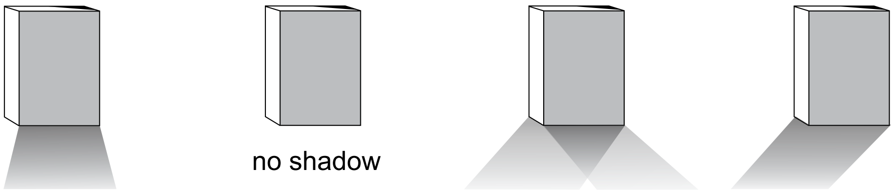
Q3 Shadows form when

- ◯ a light is turned off.
- ◯ light reflects off an object.
- ◯ light shines through an object.
- ◯ the path of light is blocked by an object.

Q4 Kale placed a book in front of two identical light bulbs. The picture shows the shadow of the book when light bulb A is turned on.



Which picture shows what happens when **both** light bulbs are turned on?



◯ ◯ ◯ ◯

Kale and Tanya wanted to find out how the length of shadows changes during the day. They measured the length of the shadow of a flag pole at different times of the day.

Q5 At approximately what time would you expect the shadow of the flag pole to be the shortest?

- ◯ 9 am
- ◯ 12 noon
- ◯ 3 pm
- ◯ 5 pm

Q6 Why does the length of the shadow of the flag pole change during the day?

Mixing liquids

Curds are a milk product made by mixing milk and a sour substance such as lemon juice or vinegar.

For her Year 6 science project Linda made curds.

She mixed 3 cups of warm milk with 1 cup of vinegar.

The mixture began to change very quickly when she stirred it.

Q7 Look at the photos of Linda's project. What change took place?

- ◯ The mixture changed into a liquid.
- ◯ The mixture changed into two solids.
- ◯ The mixture changed into two liquids.
- ◯ The mixture changed into a liquid and a solid.

Q8 Which of the following suggests that a new substance was formed?

- ◯ There was liquid left.
- ◯ A solid was produced.
- ◯ The change was quick.
- ◯ Vinegar was dissolved in milk.

Food and energy

People use Earth's resources for food and energy.

Food

On average, Australians throw out a quarter of the food they buy.

Throwing away food means that the resources needed to produce and transport the food have been wasted.

Q9 The table shows how much water is needed to produce different types of food.

Table: Amount of water needed to produce different types of food

Type of food	Amount of water needed to produce 1kg of food (litres)
beef	100 000
chicken	3 900
potatoes	500
white rice	1 550

Rank the types of food from the one that needs the **smallest** amount of water (1) to the one that needs the **largest** amount of water (4).

Write the numbers 1, 2, 3 and 4 in the following boxes to show your ranking.

☐ beef

☐ chicken

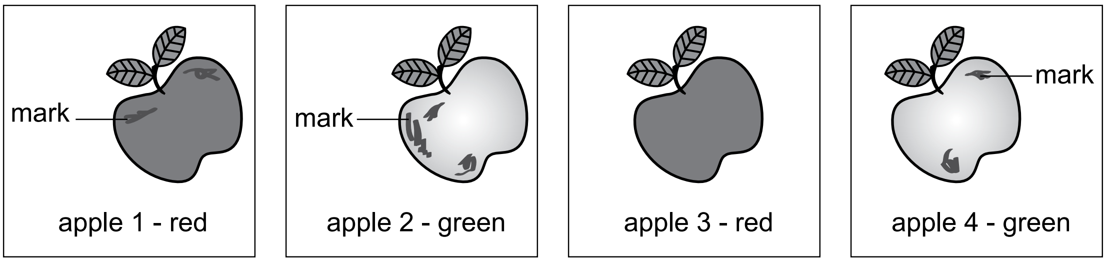
☐ potatoes

☐ white rice

Supermarkets throw away fruit and vegetables that do not look nice.

Tim conducted a test to find out whether marks on apples affect the taste of the apples.

Tim had four apples.



Q10 Which apples should he have used for his test?

- ◯ apple 1 and apple 2
- ◯ apple 1 and apple 3
- ◯ apple 1 and apple 4
- ◯ apple 2 and apple 3

Q11 What could Tim do to improve his test?

Energy

Most of the electrical energy that Australians use is produced by burning fossil fuels which are a non-renewable resource. A non-renewable resource is a resource that is used up faster than it can be replaced.

Q12 The table shows information about some sources of energy.

Energy source	Is carbon dioxide released?	Is the energy source renewable?
coal	Yes	No
biofuel	Yes	Yes
solar	No	Yes
wind	No	Yes

Joe claims that no carbon dioxide is released when renewable energy sources are used.

From the table, which energy source can be used to show that Joe's claim is not always correct?

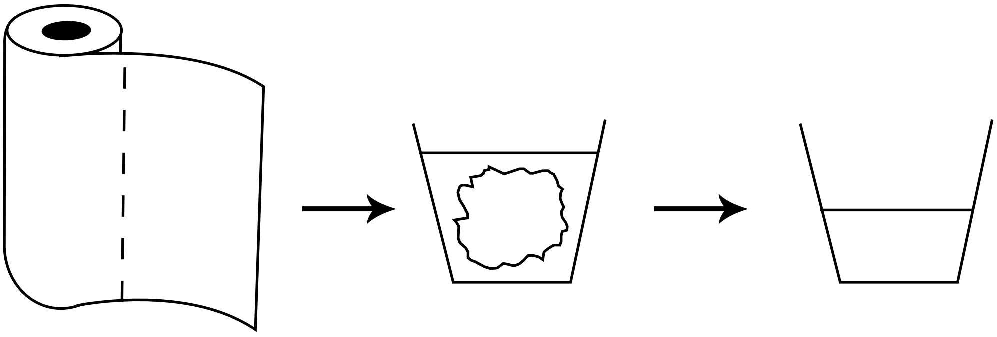
- ◯ coal
- ◯ biofuel
- ◯ solar
- ◯ wind

Testing paper towels

Emily tested four different brands of paper towel.

She tore a sheet of paper towel from each of the rolls. The sizes of the paper towel sheets were the same for all four brands.

The paper towels were placed into cups containing exactly 100 mL of water. After one minute Emily removed the towels and measured how much water was left in each cup.



Emily recorded her results in the table below.

Table: Amount of water left in the cup for different brands of paper towel

Brand of paper towel	Water left in the cup (mL)
WOW	75
Super	85
Power	65
Great	80

Q13 Why did Emily make sure that she used exactly one sheet of towel in each test?

Q14 After finishing her tests, Emily spilt a large amount of water on the floor. She wanted to soak up the spill using the smallest number of sheets of paper towel.

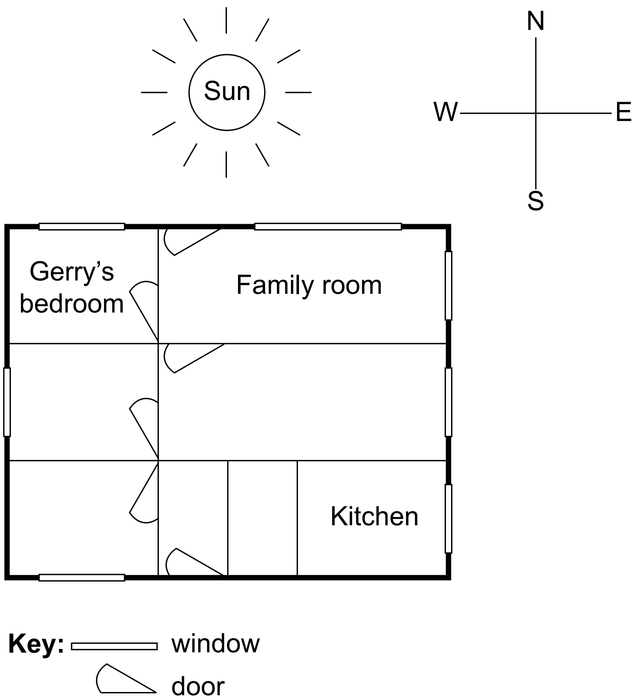
Based on her test results, which brand should she use?

- ◯ WOW
- ◯ Super
- ◯ Power
- ◯ Great

Curtains

Gerry and his family moved into a new house. They needed curtains for three of the windows:

- a large family room window in the front of the house, facing north (toward the sun for most of the day).
- a smaller kitchen window on the side of the house.
- Gerry's bedroom window, which faced north.



Gerry's father said the family room curtain needed a special layer on the window side. The layer would need to be a silver colour and shiny.

Q15 What do you think this layer is for?

____

____

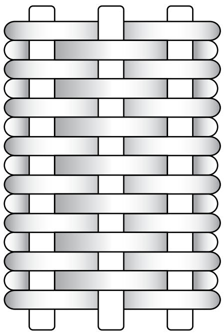
____

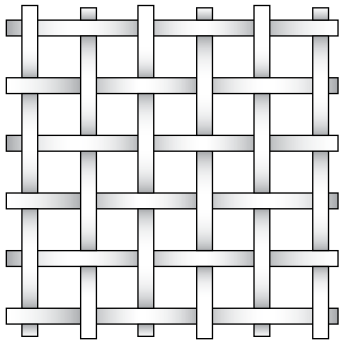
____

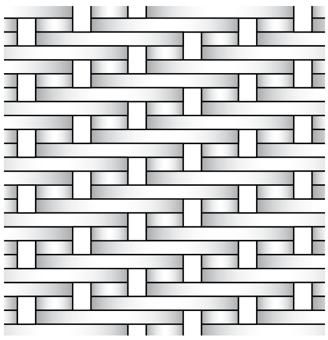
Some sample materials are shown below. They have been magnified to show the way the material is made.

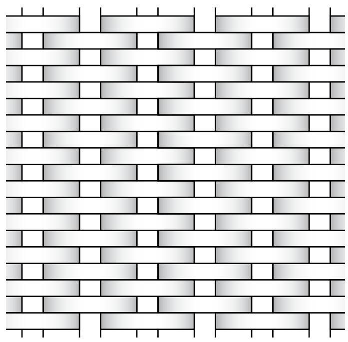
An **open-weave** material is one in which the fibres (or threads) are **not** close together.

A **close-weave** material is one in which the fibres are close together.


A


B


C


D

Gerry's mother said the curtain over the kitchen window should let some light in.

Q16 Which of these materials would be **best** for the kitchen curtain?

- ◯ A
- ◯ B
- ◯ C
- ◯ D

The third curtain was to hang in Gerry's bedroom window. This was at the front of the house.

Gerry decided he needed a curtain that would keep:

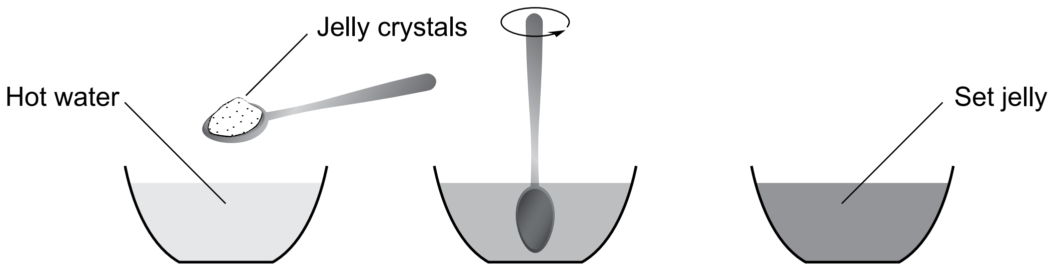
- sunlight out
- heat in.

Q17 Which of the following is the **best** choice?

- ◯ a woollen, close-weave curtain
- ◯ a woollen, open-weave curtain
- ◯ a cotton, close-weave curtain
- ◯ a cotton, open-weave curtain

Making jelly

Jelly is made by dissolving jelly crystals in hot water. After the crystals have dissolved, the mixture is cooled to allow the jelly to set. The jelly is ready to eat after it has set.



Bob made jelly using five bowls.

He did the following:

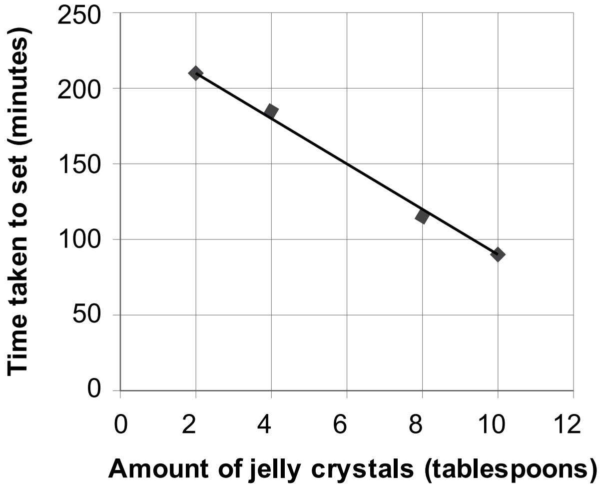
- He filled each bowl with two cups of hot water.
- He added jelly crystals to each bowl.
- He stirred the mixtures.
- He covered the bowls and placed them in the fridge.

Bob measured how long it took for each bowl of jelly to set. He recorded his results in the table below.

Bowl	Number of tablespoons of jelly crystals	Time taken to set (minutes)
1	2	210
2	4	185
3	6	Not recorded
4	8	115
5	10	90

Q18 What question was Bob trying to answer?

Q19 Bob made a graph of the results.



Bob forgot to time how long it took for the jelly in bowl 3 to set. Use the graph to predict the setting time for the jelly in bowl 3.

_______________ minutes

Q20 What is one thing that Bob could have done to improve his investigation?

Bob could have

- ◯ used cold water to make the jelly crystals dissolve faster.
- ◯ put the jelly mixtures into different fridges to set.
- ◯ used different types of jelly crystals in each bowl.
- ◯ repeated the experiment to check his results.

Evaporating liquids

Luca placed a glass of water beside his bed to drink during the night. He did not drink the water, but he noticed after several days that there was less water in the glass.

Luca knew that this was because the water had evaporated.

Q21 What does the word 'evaporation' mean?

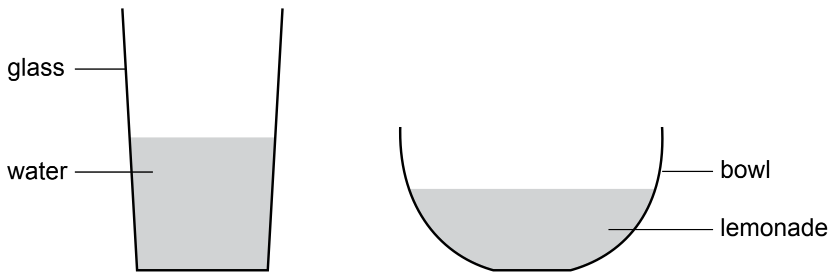
Evaporation is the change from ______________ to ______________.

Q22 Which of the following are examples of evaporation?

Tick all possible answers.

- ☐ ice melting
- ☐ wet footprints on concrete disappearing
- ☐ sugar dissolving when stirred in water
- ☐ clothes drying in the sun

Luca wanted to find out if water or lemonade evaporates faster. He put 100 mL of water in a glass and 100 mL of lemonade in a bowl.



Q23 Luca placed both containers on a windowsill and left them there for five days. Then he compared the levels of the two liquids.

Describe one thing in Luca's experiment that stops it from being a fair test.

____

____

____

Q24 In science, it is important to conduct fair tests. Why is this necessary?

____

____

____

Luca changed his method so that his experiment was a fair test. He measured the volumes of water and lemonade at 9 am every morning for five days. His results are shown in the table.

Table: Volume of water and lemonade on five days

Day	Volume of water (mL)	Volume of lemonade (mL)
1	100	100
2	96	94
3	92	88
4	80	73
5	76	65

Q25 How much water had evaporated from the glass by the end of the experiment?

____

Q26 What conclusion can you draw from Luca's results?

____

____

____

Q27 Luca's results show that more liquid evaporated on Day 3 than any other day. Give one reason why this might have happened.

____

____

____

Seed dispersal

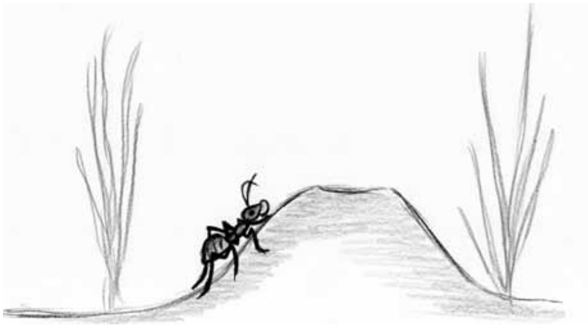
Seed dispersal is the transport of a plant's seeds from the plant to another location by wind, water or animals.

Q28 Some seeds are dispersed on the fur of animals.

Which of the following seeds are most likely to be dispersed this way?

- ◯ seeds with hooks
- ◯ seeds that can float
- ◯ seeds with a bright colour
- ◯ seeds with a smooth surface

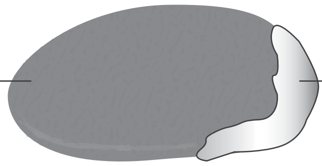
Q29 Ants help the seed dispersal of many Australian plants. The ants move the seeds to their nest.



An advantage to the seeds being in an ant nest is that they are protected

from ____.

Q30 Plants that disperse their seeds often produce chemicals in a fat-rich lump attached to the seed. The ants use the fat-rich lump for energy and leave the rest of the seed in the nest.



Which of the following describes the role of the chemicals and the fat-rich lump?

	The chemicals	The fat-rich lump is a
◯	stop ants from eating the seed.	source of food for the ants.
◯	attract ants to the seed.	source of food for the plant.
◯	stop ants from eating the seed.	source of food for the plant.
◯	attract ants to the seed.	source of food for the ants.

Q31 Some types of stick insects lay eggs that look like plant seeds. These eggs often end up in ant nests.

When the stick insect eggs hatch, the young stick insects look and behave like ants to increase their chances of survival.

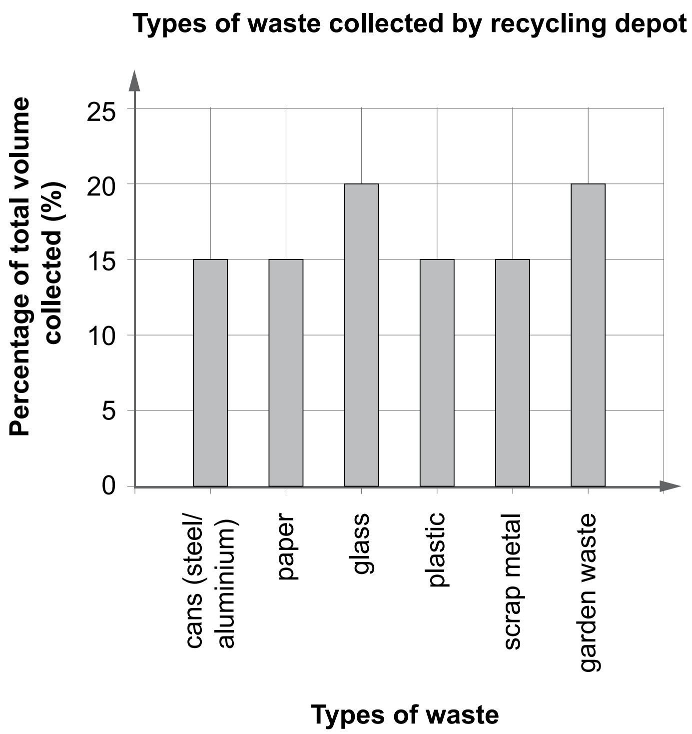
What does the behaviour of young stick insects suggest about ants?

- ◯ Ants eat other insects.
- ◯ Ants only eat plant seeds.
- ◯ Ants look like adult stick insects.
- ◯ Ant eggs look like stick insect eggs.

Recycling

A council waste recycling depot collects various materials. They sort the cans, glass, plastic and scrap metal and send them to other places for recycling. They recycle all other waste at the depot.

The column (bar) graph shows the types of waste collected by the depot.



Q32 What percentage of the waste is recycled at the depot?

- ◯ 15%
- ◯ 20%
- ◯ 30%
- ◯ 35%

Q33 Jason prepared chicken vegetable soup.

Soup Ingredients
1 chicken wrapped in plastic
12 cups of water
2 potatoes
2 onions
2 sticks of celery
parsley
1 can of tomatoes

Compost heap

Jason had a compost heap at his house. Which waste could Jason add to his compost?

- ◯ empty tomato can
- ◯ peel from potatoes
- ◯ plastic wrapper
- ◯ nylon onion bag

Q34 Why are decomposers (e.g. worms) important in composting?

____

____

____

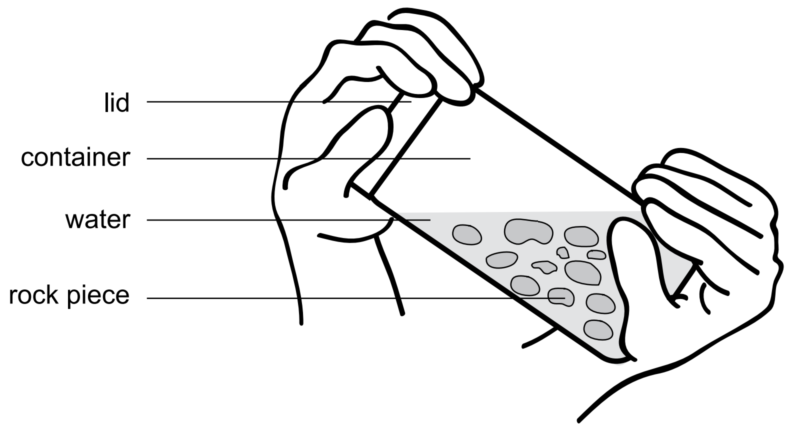
Changing rocks

Rocks can be broken down by water, ice, wind and the actions of plants and animals.

Class 6B wanted to find out whether some rocks break down more easily than others.

They conducted the following experiment:

1. They took 100 g of sandstone pieces and 100 g of quartzite pieces. The sandstone and quartzite pieces were approximately the same size.
2. They placed the sandstone and quartzite pieces in separate containers, each half full of water.
3. They covered each container and shook each one for 5 minutes.



4. They removed the small pieces that were chipped off by draining each container.
5. They dried and weighed the remaining sandstone and quartzite pieces.
6. They repeated steps 2-5 three times.

The table shows the students' results.

Table: Mass of rock pieces at the end of each trial

Trial	Mass of sandstone pieces (g)	Mass of quartzite pieces (g)
1	98.5	99.7
2	96.9	99.4
3	95.3	99.3
4	92.7	99.0

Q35 Write a conclusion that summarises the results from this experiment.

Q36 The students are now planning to shake each container for 30 minutes, remove the small pieces that are chipped off, then dry and weigh the remaining sandstone and quartzite pieces.

Predict what will happen to the masses of the remaining sandstone and quartzite pieces.

Q37 In what way is the experiment conducted by Class 6B similar to how rocks break down in the environment?

Solar energy

Fiona wanted to investigate the effect of sunlight on objects.

She knew that objects left in the sunlight will absorb some energy from the Sun and reflect some energy as well.

Fiona took some small boxes and placed them in the sunlight. She used a thermometer to measure the temperature of the air inside each of the boxes.

The table lists the results of her measurements.

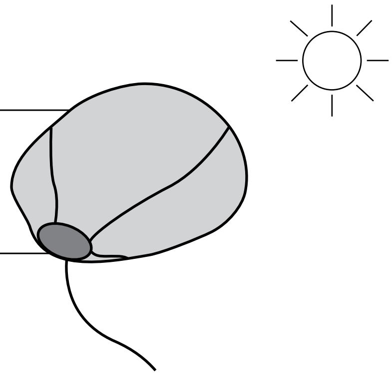
Box number	Box material	Outside surface colour	Type of outside surface	Temperature at the start (°C)	Temperature after one hour (°C)
1	cardboard	white	shiny	20	23
2	cardboard	black	dull	20	28
3	plastic	white	shiny	20	25
4	plastic	black	shiny	20	36
5	metal	black	dull	20	52
6	metal	white	dull	20	30
7	metal	black	shiny	20	49
8	metal	white	shiny	20	30

Q38 The box **material** affects the temperature of the air inside the box.

Which of the following two boxes show this?

- ◯ Box 2 and Box 3
- ◯ Box 3 and Box 6
- ◯ Box 4 and Box 7
- ◯ Box 5 and Box 7

Q39 Fiona constructed a large balloon using black plastic. She used a fan to fill the balloon with air and left it in the sunlight.



After some time, the balloon rose in the air without Fiona having to do anything more to it.

Explain in detail why the balloon rose.

____

____

____

____

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Practice questions

Multiple choice

Q1 Shade in the bubble next to the correct answer.

The colour of blood is

- ◯ blue.
- ◯ green.
- ◯ red.
- ◯ yellow.

Tick the boxes

Q2 Which of the following are fruit? **Tick all possible answers.**

☐ banana ☐ bicycle ☐ apple ☐ chair

Write in the boxes

Q3 Rank these animals from **smallest** (1) to **largest** (4).

Write the numbers 1, 2, 3 and 4 in the following boxes to show your ranking.

- ☐ horse
- ☐ dog
- ☐ mouse
- ☐ elephant

One or two word answer

Q4 On a clear, sunny day the colour of the sky is ____________________ .

Long answer

Q5 Explain why plastic bags cause problems for sea creatures.

____

____

Chapter 5
Marking Guide

The guide in this chapter reflects the final marking guide used for the 2012 National Assessment Program – Science Literacy (NAP–SL) and provides a standardised means of scoring student responses. Use of this rubric in scoring class responses will allow valid comparisons to be made of your students' results with the results of the 2012 NAP–SL assessment presented in Chapters 6 and 7.

While most items are marked on a 0/1 basis, items 15 and 39 in the Objective Assessment are polytomous. This means that scores of either 1 or 2 are possible, depending on the level of the response.

The marking guide provides examples of the types of responses that would be awarded 1 mark or 2 marks (where applicable).

It is estimated that it would take 15 minutes to mark one complete 2012 School Release Materials assessment (including the Objective Assessment and the Practical Task).

National Assessment Program – Science Literacy

Marking Guide

2012 Released Items

PART A: **Objective Assessment**

PART B: **Practical Task**

MARKING GUIDE

PART A: OBJECTIVE ASSESSMENT

Responses that are ‘other’ than those indicated in the marking instructions are given zero, (‘0’).

All multiple choice questions are marked as 1 mark or zero (‘0’) marks.

Question	Score	Marking instructions
LIFE IN THE DESERT		
Q1	1	Key: 40°C
Q2	1	*Ticks ‘It stays underground on hot days.’* ***AND*** *‘It gets water from the seeds it eats.’* ☐ It has a long tail. ☐ It has big back legs. ☑ It stays underground on hot days. ☑ It gets water from the seeds it eats.

Question	Score	Marking instructions
LIGHT AND SHADOWS		
Q3	1	Key (D): the path of light is blocked by an object.
Q4	1	Key (C): position C
Q5	1	Key (B): 12 noon
Q6	1	*Response indicates that:* *the position of the Sun in the sky changes* ***OR*** *the angle of the Sun's rays change* ***OR*** *the height of the Sun above the horizon changes* ***OR*** *Earth is rotating on its axis.* **Examples of correct answers (score 1):** • The length changes because the Sun is at different heights. • The Sun moves/changes position across the sky. • The Sun moves up and down depending on time of day. **Examples of incorrect answers (score 0):** • The Sun moves. • The Sun moves around. • The Sun moves/rotates around the Earth. • The Earth moves around the Sun. • because the light is changing

Question	Score	Marking instructions
MIXING LIQUIDS		
Q7	1	Key (D): The mixture changed into a liquid and a solid.
Q8	1	Key (B): A solid was produced.

Question	Score	Marking instructions
FOOD AND ENERGY		
Q9	1	Writes the numbers 1, 2, 3 and 4 in the correct boxes. 4 beef 3 chicken 1 potatoes 2 white rice
Q10	1	Key (B): apple 1 and apple 3
Q11	1	*Response describes a suggestion that improves the test. Accept all reasonable responses.* **Examples of correct answers (score 1):** • Tim should compare more apples (larger sample size). • Tim should compare apples of a different type. • Tim could have taken one apple of every colour without marks and one apple of every colour with marks, then compared. • Tim should include more tasters. • Tim should compare apples with different amounts of damage. **Examples of incorrect answers (score 0):** • test all of the apples to see if they all taste the same or different • taste different fruits • He could show a graph of whether they tasted nicer with marks on them or with no marks.
Q12	1	Key (B): biofuel

Question	Score	Marking instructions
TESTING PAPER TOWELS		
Q13	1	*Response indicates that this would make the experiment a fair test.* **Example of correct answer (score 1):** • to make the experiment a fair test **Examples of incorrect answers (score 0):** • because that was all she had • because that was enough • because she did not want to waste paper towels
Q14	1	Key (C): Power

Question	Score	Marking instructions
CURTAINS		
Q15	2	*To keep heat out <u>with</u> an explanation of how the layer achieves it.* **Example of correct answer (score 2):** • to keep heat out because shiny or silvered surfaces reflect heat
	1	*To keep heat out <u>without</u> explanation.* ***Note:*** *Response must refer in some way to keeping out heat.* **Examples of correct answers (score 1):** • to keep out the sun • to keep the room cool • to keep out heat • to keep out UV **Example of incorrect answer (score 0):** • to keep warmth in
Q16	1	Key (B): B
Q17	1	Key (A): a woollen, close-weave curtain

Question	Score	Marking instructions
MAKING JELLY		
Q18	1	*Question links the quantity of jelly used and the setting time of the jelly mixture.* **Examples of correct answers (score 1):** • Does the amount of jelly crystals affect the time it takes for the jelly to set? • How does the number of spoons of jelly crystals change the setting time? • What happens to the setting time for jelly when we change the amount of jelly crystals used? **Example of incorrect answer (score 0):** • How do you make jelly?
Q19	1	Key: 150 **Note:** Accept: 'two hours thirty minutes' or '2½ hrs (minutes may be crossed out). Do not accept: 2½ (with no units).
Q20	1	Key (D): repeated the experiment to check his results.

Question	Score	Marking instructions
EVAPORATING LIQUIDS		
Q21	1	*Response indicates that evaporation is the change from:* *liquid to gas* ***OR*** *liquid water to (water) vapour.* **Examples of incorrect answers (score 0):** Evaporation is the change from: • liquid to air. • water to cloud. • water to steam. *(Note: Steam is <u>condensed</u> vapour.)*

Question	Score	Marking instructions
EVAPORATING LIQUIDS (cont.)		
Q22	1	*Ticks 'wet footprints on concrete disappearing'* ***AND*** *'clothes drying in the sun'.* ☐ ice melting ☑ wet footprints on concrete disappearing ☐ sugar dissolving when stirred in water ☑ clothes drying in the sun
Q23	1	*Response indicates that:* *the containers are not the same size* ***OR*** *the containers are not the same shape.* **Examples of correct answers (score 1):** • The water is in a glass and the lemonade is in a bowl which are both different sizes. • In a fair test you can only change one thing and they have changed two, the liquid and the shape the container is in. • A glass is not as wide as a bowl and won't evaporate as quickly. • It is unfair because he put water in a glass and the lemonade in a bowl. Therefore it would be easier for the lemonade to evaporate because the bowl is more open than the glass. • The levels of lemonade and water are different. *(Note: Accept as correct, given that Luca started with the same volume of liquid.)* **Examples of incorrect answers (score 0):** • One was in a glass the other in a bowl. • Two things have changed. *(does not specify what has changed)*

<table>
<tr><th>Question</th><th>Score</th><th>Marking instructions</th></tr>
<tr><td colspan="3">EVAPORATING LIQUIDS (cont.)</td></tr>
<tr><td>Q24</td><td>1</td><td>Response indicates that:

the data collected cannot be compared meaningfully if a test is not fair

OR

a valid conclusion cannot be drawn if a test is not fair.

Examples of correct answers (score 1):
• Otherwise you cannot draw correct/accurate conclusions.
• Otherwise you will not know which variable caused the result.
• So you know what is making the change, otherwise you might think something else is making the change.

Examples of incorrect answers (score 0):
• so you can see the differences of your test
• so that the data are accurate
• otherwise test results wouldn’t be right
• if it is not fair you will never get the right answer
• so that the results are not affected</td></tr>
<tr><td>Q25</td><td>1</td><td>Key: 24 or 24 mL</td></tr>
</table>

Question	Score	Marking instructions
EVAPORATING LIQUIDS (cont.)		
Q26	1	*Response indicates that:* *lemonade evaporates faster than water* ***OR*** *water evaporates slower than lemonade* ***OR*** *liquids can evaporate at different rates.* **Examples of correct answers (score 1):** • Lemonade evaporates faster than water. • Lemonade takes less time to evaporate. **Examples of incorrect answers (score 0):** • The water evaporated faster than the lemonade. • Both liquids evaporate. • More water was left after 5 days. *(observation not conclusion)* • More lemonade evaporated. • 24 ml of water evaporated and 35 ml of lemonade evaporated.
Q27	1	*Response states* ***one*** *factor that affects evaporation.* **Examples of correct answers (score 1):** • higher temperature • Sun stronger/sunnier day • less cloudy day • lower humidity • increased wind **Example of incorrect answer (score 0):** • The day was hot and humid. *(Note: Humid is wrong.)*

Question	Score	Marking instructions
SEED DISPERSAL		
Q28	1	Key (A): seeds with hooks
Q29	1	*Response names* ***one*** *appropriate advantage.* **Examples of correct answers (score 1):** Seeds are protected from: • things that eat the seeds • extreme temperatures • drying out in the Sun • getting stepped on **Examples of incorrect answers (score 0):** Seeds are protected from: • the environment • ant predators • bad weather • rain, flood • water • Sun *(incomplete)* • insects *(incomplete)* • animals *(incomplete)*
Q30	1	Key (D): attract ants to the seed./source of food for the ants.
Q31	1	Key (A): Ants eat other insects.

Question	Score	Marking instructions
RECYCLING		
Q32	1	Key (D): 35%
Q33	1	Key (B): peel from potatoes
Q34	1	*Response indicates that decomposers break down waste into compost or that decomposers feed on waste material.* **Examples of correct answers (score 1):** • The decomposers break down the waste. • They feed on the waste and convert it to compost. **Example of incorrect answer (score 0):** • eat waste

Question	Score	Marking instructions
CHANGING ROCKS		
Q35	1	*Conclusion:* *indicates that quartzite is more resistant to breaking down than sandstone* ***OR*** *indicates that sandstone is less resistant to breaking down than quartzite* ***OR*** *indicates that some rocks resist breaking down more than others* ***OR*** *otherwise summarises the results accurately.* **Examples of correct answers (score 1):** • The sandstone breaks down more than quartzite. • Sandstone breaks down more over the four trials. • Sandstone breaks down faster than quartzite. • Sandstone breaks down much more easily than quartzite when the water is a factor. • Sandstone broke down the most. • Quartzite is stronger/harder than sandstone. **Examples of incorrect answers (score 0):** • Sandstone and quartzite decreased. • Rocks will break down in water. • Trial 4 broke it down the most because it had been shaken the most times.

Question	Score	Marking instructions
CHANGING ROCKS (cont.)		
Q36	1	*Response indicates that:* *the mass of the sandstone pieces will continue to decrease and that the mass of the quartzite pieces will decrease very little/hardly decrease further* ***OR*** *the mass of the remaining sandstone pieces will be much smaller than the mass of the remaining quartzite pieces.* ***Note:*** *Accept plausible numerical values. Values need to be plausible for both types of rock.* **Examples of correct answers (score 1):** • The sandstone will be almost nothing and the mass of the quartzite won't have changed very dramatically. • The sandstone will become pieces of sand and the quartzite will only chip away a little bit. • The sandstone will break down heaps but the quartzite will go down a couple of percent. **Examples of incorrect answers (score 0):** • There will be nothing left. • I predict that the sandstone pieces will still break down more easily than the quartzite after being shaken for 30 minutes.

Question	Score	Marking instructions
CHANGING ROCKS (cont.)		
Q37	1	*Response indicates that the experiment shows that rocks can be broken down by collisions/grinding against each other* ***OR*** *gives examples of how this occurs in the environment.* **Examples of correct answers (score 1):** • Rocks in rivers, lakes, oceans etc. are always rubbing off each other in the water, so 6B's experiment and the environment are similar. • They made it like rocks in a river that smoothen and little pieces fall off. • The experiment done by Class 6B is similar in that of a rough coast the waves would be crashing. That is like the water shaking in the jar. • rivers carrying rocks rushing down mountains **Examples of incorrect answers (score 0):** • In the environment rocks wear down by sea and rain. • Because there is water in the environment that breaks down rocks. • When water washes over rocks naturally, similar situations occur between different types of rock. • Shaking the water in the jar is like it being rainy, windy or snowy in the environment. • In the environment rocks are regularly submerged in water and shaken around, much like 6B did to their rocks. • The experiment shows how when rocks are rained on or soaked they can break down quite easily. • The experiment was similar to how rocks break down in the environment because they were being bumped and shaken. • In the environment there could be a stampede of animals or an earthquake or rocks could be crushed by a very heavy animal.

Question	Score	Marking instructions
SOLAR ENERGY		
Q38	1	Key (C): Box 4 and Box 7
Q39	2	*Response indicates that the balloon absorbs heat and that the air inside the balloon expands making the air inside the balloon lighter/less dense.* **Example of correct answer (score 2):** • The black plastic absorbs heat from the Sun, the air inside the balloon heats causing the air to expand, and since hot air is lighter (inside) than cold air (outside) it rises above it.
	1	*Response indicates that:* *the balloon absorbs heat and that hot air rises* ***OR*** *the balloon absorbs heat, therefore the air expands and the balloon rises* ***OR*** *the balloon absorbs heat making the air/balloon lighter.*

Question	Score	Marking instructions
SOLAR ENERGY (cont.)		
Q39 (cont.)		**Examples of correct answers (score 1):** • When the air inside the balloon got really hot the air got lighter making the balloon rise. *(connection between air expanding and air/ balloon becoming lighter not explicit)* • The air inside the balloon slowly turned warm in the sunlight and because warm air rises the balloon rose with the air in it. • The air was pushed in the open end. The black plastic absorbs heat and hot air rises, lifting the balloon. • Because it is a hot day and the balloon is black, the air inside the balloon heats up making the air expand and the balloon rise. **Examples of incorrect answers (score 0):** • The balloon rose because it got hotter and hotter and the hotter the balloon got the higher it rose. • The air inside the balloon heated up therefore the hot air made the light rubber float in the air. • The hot air balloon needs hot air to travel up so if she left it in the Sun the air inside the balloon would become hot making it go up. • Hot air rises. *(incomplete)* • Hot air expands. *(incomplete)*

MARKING GUIDE

PART B: PRACTICAL TASK

In the practical task, only the questions in Part B (Individual work) are marked.

Responses which are 'other' than those indicated in the marking instructions are given zero, ('0').

All multiple choice questions are marked as 1 mark or zero ('0') marks.

Question	**Score**	**Marking instructions**
REACTION TIME		
Q1	1	*Provides a response consistent with the data recorded for Person 1 in Table 1 (on page 32).*
Q2	1	*Provides a response that summarises the results from the two experiments regarding the reaction time AND is consistent with the results recorded in Tables 1 and 2 (on pages 32 and 33).* **Examples of correct answers (score 1):** • Dominant hand caught the ruler faster/slower. • Dominant hand reaction was slower/faster than non-dominant hand. • No conclusion can be drawn because data was unclear. • Person 1 and Person 2 got smaller reaction times using the dominant hand whereas Person 3 got smaller reaction times using the non-dominant hand. **Examples of incorrect answers (score 0):** • In Table 2 there were less results than in Table 1. • much harder/easier to grab ruler with non-dominant hand
Q3	1	Key (B): It makes it easier to compare people's results.
Q4	1	Key (C): eyes detect ruler movement/brain receives signal/brain sends signal/hand muscles work
Q5	1	Key (A): use a longer ruler

<table>
<tr><th>Question</th><th>Score</th><th>Marking instructions</th></tr>
<tr><td colspan="3">REACTION TIME (cont.)</td></tr>
<tr><td>Q6</td><td>1</td><td>Selects ‘Kim’ AND provides a plausible justification to support this choice.

Examples of correct answers (score 1):
‘Kim’ AND:
• It is a fairer comparison if they practise with both hands.
• It wouldn’t be fair to compare the distance the ruler fell using the dominant hand with the distance the ruler fell using the non-dominant hand.
• The results would be more reliable for the non-dominant hand.
• It would be less likely that people would completely miss the ruler with some practice.
• The data could be compared to the dominant hand data with more confidence.

Examples of incorrect answers (score 0):
• Because it would be unfair if they could not use their better reaction hand.
• Because the dominant hand is easier.
• It makes it work better.</td></tr>
<tr><td>Q7</td><td>1</td><td>Key (C): 156 milliseconds.</td></tr>
<tr><td>Q8</td><td>1</td><td>Key (D): 3</td></tr>
</table>

Question	Score	Marking instructions
REACTION TIME (cont.)		
Q9	1	*Selects 'No'* ***AND*** *provides an appropriate justification for choice indicating:* *there were more people in another category/the 250–299 category* ***OR*** *the "200–249" column was not the longest.* **Examples of correct answers (score 1):** **'No' AND:** • 200–249 is the second highest column and the 250–299 is the tallest. • The most common reaction time was between 250–299. • 250–299 has more people in it. **Examples of incorrect answers (score 0):** • No - The reaction time 200–249 is not most common. • No - Because the graph says it gets caught by 23%.

Question	Score	Marking instructions
REACTION TIME (cont.)		
Q10	1	*Provides '0–49 milliseconds'* ***AND*** *appropriate justification to support this conclusion. Justification indicates that:* *the '0–49 milliseconds' category does not fit the pattern in the data* ***OR*** *people could have kept clicking (rather than click as soon as the object on the screen changes colour).* **Examples of correct answers (score 1):** **'0–49' AND:** • It does not match the pattern. • It should have the least people in it. • If 50–99 is 1%, 0–49 can't be 12%. • It shows less people got 50–99 than 0–49. • People could have kept clicking. **Examples of incorrect answers (score 0):** • Mistakes could be anywhere. • 250–299 - because it is the quickest time out of them all. • 0–49 - because people don't go this quickly/react that fast. • 0–49 - it is impossible for 12% to be 0–49.

Chapter 6
Performance Profile and Proficiency Standard

Standard for Year 6 scientific literacy

A standard for scientific literacy was established after the 2003 testing to provide parents, educators and the community with a clear picture of the proficiency that students are expected to demonstrate by the end of Year 6.

To identify what students should know and be able to do by the end of Year 6, university science educators, curriculum experts and experienced primary teachers in all states and territories, from government, Catholic and independent schools, were brought together. The members of this expert group used their classroom experience and knowledge of the science curricula in the various jurisdictions to examine the test items from the 2003 national assessment.

The crucial scientific literacy skills and understandings needed by students for the next phase of science learning at school were discussed and debated before consensus was reached on a 'proficient standard' for Year 6. This standard informed the development of the tests for the 2006, 2009 and 2012 assessments.

The proficient standard is a challenging level of performance, with students needing to demonstrate more than minimal or elementary skills to be regarded as reaching it.

The Proficency Levels can be found in Appendix 3, Table 3.1. The proficient standard was found to be equivalent to Level 3.2; that is, students achieving at Level 3.2 are considered to have a sound understanding of Year 6 science. Students at this level demonstrate considerably more skill and understanding than those performing at Levels 3.1 and below.

Year 6 students who exceed the proficient standard (those who perform at Level 3.3 and above) demonstrate exemplary performance.

Student performance and the Year 6 standard

One of the main objectives of the National Assessment Program – Science Literacy (NAP–SL) is to monitor trends in scientific literacy performance over time. One convenient and informative way of doing so is to reference the results to Proficiency Levels.

Table 6.1 and Table 6.2 enable teachers to determine whether their students have demonstrated proficiency in science by reaching Level 3.2 or better on the scientific literacy scale.

The tables can be used to convert students' raw scores on the Science Literacy School Release Materials to corresponding scaled scores on the 2012 NAP–SL assessment. The 2012 NAP–SL mean score is 394 and the standard deviation of the scale is 100.

The following tables can be used to determine the Proficiency Level of a student by matching his or her raw score with the scaled score and corresponding Proficiency Level.

If students have attempted **only** the **objective assessment**, Table 6.1 provides the information needed to convert their scores to the national scale.

If students have attempted **both** the **objective assessment** and the **practical task**, Table 6.2 provides the information needed to convert their scores to the national scale.

Table 6.1 Conversion of raw scores to scaled scores and level attained: **Objective Assessment only**

Student raw score	Equivalent sample scaled score	Level attained	Descriptor: a student at this level may display skills like
0	n/a	Level 2	Makes a choice for a situation based on first-hand concrete experience, requiring the application of limited knowledge. Identifies simple patterns in the data and/or interprets a data set containing some interrelated elements. Makes measurements or comparisons involving information or stimulus in a familiar context.
1	7		
2	68		
3	112		
4	146		
5	175		
6	200		
7	222		
8	242		
9	261		
10	278	Level 3.1	Makes simple standard measurements and records data as descriptions. Interprets simple data set requiring an element of comparison. Selects appropriate reason to explain reported observation related to personal experience.
11	295		
12	310		
13	325		
14	340		
15	354		
16	367		
17	381		
Proficient Standard			
18	394	Level 3.2	Collates and compares data set of collected information. Interprets data and identifies patterns in – and/or relationships between – elements of the data. Interprets information in a contextualised report by application of relevant science knowledge.
19	407		
20	420		
21	433		
22	445		
23	459		
24	472		
25	485		
26	499		
27	513		
28	528	Level 3.3	Demonstrates an awareness of the principles of conducting an experiment and controlling variables. Extrapolates from an observed pattern to describe an expected outcome or event. Applies knowledge of relationship to explain a reported phenomenon.
29	543		
30	559		
31	576		
32	595		
33	614		
34	636		
35	661	Level 4	When provided with an experimental design involving multiple variables, can identify the questions being investigated. Conclusions summarise and explain the patterns in the data in the form of a rule and are consistent with the data. Explains interactions that have been observed in terms of an abstract science concept.
36	688		
37	721		
38	761		
39	812		
40	884		
41	1020		

Table 6.2 Conversion of raw scores to scaled scores and level attained: **Objective Assessment and Practical Task**

Student raw score	Equivalent sample scaled score	Level attained	Descriptor: a student at this level may display skills like
0	n/a	Level 2	Makes a choice for a situation based on first-hand concrete experience, requiring the application of limited knowledge. Identifies simple patterns in the data and/or interprets a data set containing some interrelated elements. Makes measurements or comparisons involving information or stimulus in a familiar context.
1	n/a		
2	32		
3	74		
4	106		
5	133		
6	157		
7	178		
8	197		
9	214		
10	231		
11	246		
12	261		
13	275	Level 3.1	Makes simple standard measurements and records data as descriptions. Interprets simple data set requiring an element of comparison. Selects appropriate reason to explain reported observation related to personal experience.
14	289		
15	302		
16	314		
17	326		
18	338		
19	350		
20	362		
21	373		
22	384		
Proficient Standard			
23	395	Level 3.2	Collates and compares data set of collected information. Interprets data and identifies patterns in – and/or relationships between – elements of the data. Interprets information in a contextualised report by application of relevant science knowledge.
24	406		
25	417		
26	428		
27	440		
28	451		
29	462		
30	474		
31	485		
32	497		
33	510		
34	522		
35	536	Level 3.3	Demonstrates an awareness of the principles of conducting an experiment and controlling variables. Extrapolates from an observed pattern to describe an expected outcome or event. Applies knowledge of relationship to explain a reported phenomenon.
36	549		
37	563		
38	578		
39	594		
40	611		
41	629		
42	649		

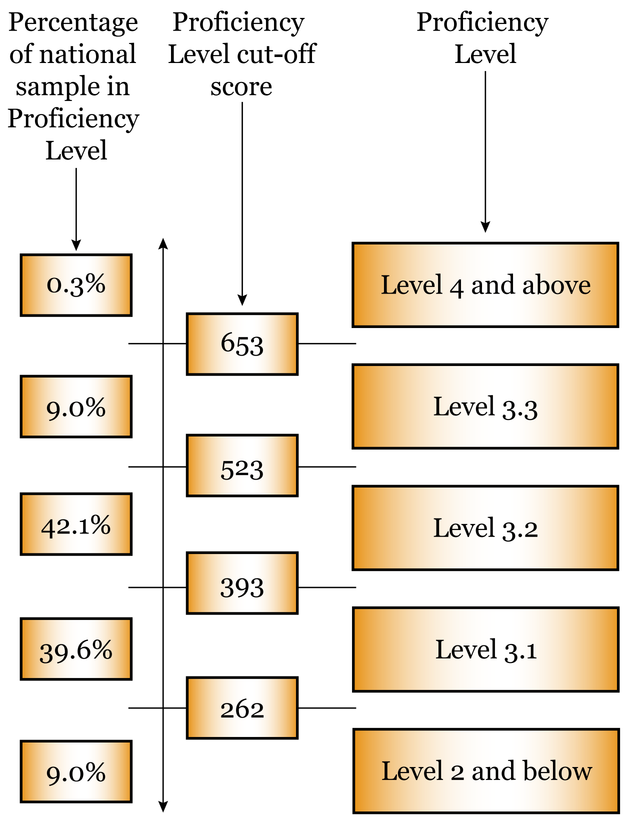
Table 6.2 Conversion of raw scores to scaled scores and level attained: **Objective Assessment and Practical Task** (cont.)

Student raw score	Equivalent sample scaled score	Level attained	Descriptor: a student at this level may display skills like
43	670	Level 4	When provided with an experimental design involving multiple variables, can identify the questions being investigated. Conclusions summarise and explain the patterns in the data in the form of a rule and are consistent with the data. Explains interactions that have been observed in terms of an abstract science concept.
44	693		
45	719		
46	748		
47	781		
48	820		
49	868		
50	934		
51	1062		

Distribution of Year 6 student performance

Figure 6.1 shows the national distribution of students who achieved each Proficiency Level in the 2012 NAP–SL assessment. The information draws on the distribution of students' performances across Proficiency Levels as presented in Chapter 5 of the 2012 Public Report.

Figure 6.1 Percentages of students from the 2012 NAP–SL assessment at each Proficiency Level and the corresponding scaled score



Chapter 7
Class Record and Item Analysis Sheet

Class record sheet

The class record sheet provided in Table 7.1 is to be used in conjunction with the Marking Guide (see Chapter 5). It provides a template for recording student marks and a format for recording information for later analysis.

The record sheet can be used to:

- record the scores for each student for each item
- calculate the total score for each student for comparison with the information provided in Table 6.1 and Table 6.2
- record the number of students who score each category of the item for use in the analysis in Table 7.2 and Table 7.3.

Table 7.1 Year 6 class record sheet

Year 6 class record sheet

	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25
	Maximum possible score	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1
No.	Name																									
1																										
2																										
3																										
4																										
5																										
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24																										
25																										
26																										
27																										
No. scoring zero																										
No. scoring 1 mark																										
No. scoring 2 marks																										

Table 7.1 Year 6 class record sheet (cont.)

Year 6 class record sheet (cont.)

	Item (cont.)	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Total score
	Maximum possible score	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	
No.	Name																									
1																										
2																										
3																										
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21																										
22																										
23																										
24																										
25																										
26																										
27																										
No. scoring zero																										
No. scoring 1 mark																										
No. scoring 2 marks																										

Item analysis sheet

The item analysis sheets (Table 7.2 and Table 7.3) provide a tool for comparing class performance against the results reported in the 2012 National Assessment Program – Science Literacy (NAP–SL).

The percentage of students who have achieved the correct answer on an item can be calculated using the formula:

$$\frac{\text{number of students at score point}}{\text{number of students assessed}} \times 100$$

This formula can also be used to calculate the percentage of students who achieved 2 marks by using the number of students who scored 2 marks instead of 1. The percentage can be compared with the results reported in the 2012 NAP–SL Public Report, which are shown in the column headed 'National % correct'. For those questions worth 2 marks, the percentage of students scoring both 1 mark and 2 marks are shown.

In making comparisons, teachers are advised to consider the items in relation to their school's science program and educational context.

Table 7.2 Item analysis sheet for the **Objective Assessment**

Number of students assessed	

Item number	Proficiency Level	Number of students correct	Percentage of students correct	National % correct
Q1	≤ 2			86.6
Q2	3.2			61.5
Q3	3.1			75.2
Q4	3.1			75.4
Q5	3.2			41.0
Q6	3.3			33.6
Q7	3.1			81.2
Q8	3.2			43.7
Q9	3.1			81.1
Q10	3.2			44.5
Q11	3.3			33.9
Q12	3.2			58.9
Q13	3.3			32.3
Q14	3.2			55.9
Q15 (1 or 2 marks)	3.2 ≥ 4			46.5 14.4
Q16	3.1			64.7
Q17	3.2			47.3
Q18	3.3			34.6
Q19	3.2			53.4
Q20	3.2			55.1
Q21	3.3			32.4
Q22	3.2			37.8
Q23	3.2			62.1
Q24	≥ 4			3.7
Q25	3.2			50.9
Q26	3.2			48.3
Q27	3.2			53.2
Q28	3.2			45.9
Q29	3.3			28.9
Q30	3.2			42.8
Q31	3.2			43.6
Q32	3.3			25.6
Q33	≤ 2			87.3
Q34	3.2			39.8
Q35	3.3			38.3
Q36	≥ 4			14.3
Q37	≥ 4			8.9
Q38	3.3			25.9
Q39 (1 or 2 marks)	≥ 4 ≥ 4			16.7 0.7

Table 7.3 Item analysis sheet for the **Practical Task**

		Number of students assessed		
Item number	**Proficiency Level**	**Number of students correct**	**Percentage of students correct**	**National % correct**
P1	3.1			83.9
P2	≥ 4			6.8
P3	3.2			59.4
P4	3.1			71.3
P5	3.2			44.4
P6	≥ 4			5.4
P7	3.1			83.8
P8	3.1			82.7
P9	3.2			50.0
P10	≥ 4			3.5

Class analysis sheet

The class analysis sheet (Table 7.4 or Table 7.5) is designed to assist in drawing a graph of class or school performance that enables comparisons to be made between a student group and the national sample for the 2012 NAP–SL assessment.

The graph is a simple pictorial presentation of the data that enables visual comparisons to be made of the performance of a student group with the national sample study findings. It also includes the national mean and distribution estimates.

However, teachers should use these as indicators only. NAP–SL was constructed and implemented scientifically to provide a representative estimate of the national Year 6 population. Small groups such as schools or classes may have distributions that are unique to them at the time they use this material.

Using the class analysis sheet

The graph can be constructed as a simple histogram by shading the cells vertically to represent the number of students who have achieved a particular score.

National test mean and distribution

The shaded vertical column at the scaled score of 394 represents the best estimate of the mean for the national test in 2012.

The shaded bars titled 'National distribution' indicate the proportions of students falling within the lower 25th percentile, the middle 50th percentile and top 25th percentile in the 2012 NAP–SL assessment.

Student proficiency

With respect to Proficiency Levels, the shaded bars titled 'Level distribution' indicate the proportions of students falling within each of the levels defined in the scientific literacy assessment domain. Level 3 has been divided into three sub-levels (Level 3.1, Level 3.2 and Level 3.3) for the purpose of providing more precise descriptors of the level of performance than those provided by Level 3.

The hatched areas in the proficiency bars represent a degree of uncertainty (measurement error) of the estimates around the cut scores that have been used to define achievement at each Proficiency Level.

Table 7.4 Class analysis sheet for students who attempted the **Objective Assessment only**

Number of students achieving score: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

sample mean

Scaled score	Raw score	Level distribution	National distribution
n.a	0	Level 2	25% of national sample
7	1		
68	2		
112	3		
146	4		
175	5		
200	6		
222	7		
242	8		
261	9		
278	10		
295	11	Level 3.1	
310	12		
325	13		
340	14		50% of national sample
354	15		
367	16		
381	17		
394	18		
407	19	Level 3.2	
420	20		
433	21		
445	22		
459	23		
472	24		25% of national sample
485	25		
499	26		
513	27		
528	28		
543	29	Level 3.3	
559	30		
576	31		
595	32		
614	33		
636	34		
661	35		
688	36	Level 4	
721	37		
761	38		
812	39		
884	40		
1020	41		

Table 7.5 Class analysis sheet for students who attempted both the **Objective Assessment and the Practical Task**

Number of students achieving score: 27, 26, 25, 24, 23, 22, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1

Raw score	Scaled score	Level distribution	National distribution
0	n.a	Level 2	25% of national sample
1	n.a		
2	32		
3	74		
4	106		
5	133		
6	157		
7	178		
8	197		
9	214		
10	231		
11	246		
12	261	(hatched)	
13	275	(hatched)	
14	289	Level 3.1	
15	302		
16	314		
17	326		
18	338		50% of national sample
19	350		
20	362		
21	373		
22	384	(hatched)	
23	395 (sample mean)	(hatched)	
24	406	Level 3.2	
25	417		
26	428		
27	440		
28	451		
29	462		25% of national sample
30	474		
31	485		
32	497		
33	510		
34	522	(hatched)	
35	536	(hatched)	
36	549	Level 3.3	
37	563		
38	578		
39	594		
40	611		
41	629		
42	649	(hatched)	
43	670	(hatched)	
44	693	Level 4	
45	719		
46	748		
47	781		
48	820		
49	868		
50	934		
51	1062		

References

Ball, S. et al. (2000) Options for the assessment and reporting of primary students in the key learning area of science to be used for the reporting of nationally comparable outcomes of schooling within the context of the National Goals for Schooling in the Twenty-First Century: Report for the National Education Performance Monitoring Taskforce.

Biggs, J.B. & Collis, K.F. (1982) Evaluating the quality of learning: The SOLO taxonomy. New York: Academic Press.

Goodrum, D., Hackling, M. & Rennie, L. (2001) The status and quality of teaching and learning of science in Australian schools. Canberra: Department of Education, Training and Youth Affairs.

Laugksch, R.C. (2000) Scientific literacy: A conceptual overview. *Science Education*, 84(1), 71–94.

OECD Programme for International Student Assessment (1999) Measuring student knowledge and skills: A new framework for assessment. Paris: OECD.

Appendix 1
National Year 6 Primary Science Assessment Domain

Assessment strands: Scientific literacy

The national review of the status and quality of teaching and learning of science in Australian schools (Goodrum, Hackling & Rennie 2001) argued that the broad purpose of science in the compulsory years of schooling is to develop scientific literacy for all students.

Scientific literacy is a high priority for all citizens, helping them to:

- be interested in and understand the world around them
- engage in discourses of and about science
- be sceptical and questioning of claims made by others about scientific matters
- be able to identify questions, investigate and draw evidence-based conclusions
- make informed decisions about the environment and their own health and wellbeing.

Scientific literacy is important because it contributes to the economic and social wellbeing of the nation and improved decision-making at public and personal levels (Laugksch 2000).

The Programme for International Student Assessment (PISA) focuses on aspects of preparedness for adult life in terms of functional knowledge and skills that allow citizens to participate actively in society. It is argued that scientifically literate people are 'able to use scientific knowledge and processes not just to understand the natural world but also to participate in decisions that affect it' (OECD 1999, p. 13).

The OECD–PISA defined scientific literacy as:

> *... the capacity to use scientific knowledge, to identify questions (investigate)*[1] *and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.*
>
> (OECD 1999, p. 60)

This definition has been adopted for the National Assessment Program – Science Literacy (NAP–SL) in accord with the Ball et al. 2000 report recommendation.

1 Because of the constraints of large-scale testing, PISA was not able to include performance tasks such as conducting investigations. Consequently, its definition of scientific literacy omitted reference to investigating. The word 'investigate' was inserted into the definition for the purposes of NAP–SL, as the sample testing methodology to be used allowed for assessments of students' ability to conduct investigations.

Scientific literacy: Progress Map

A scientific literacy Progress Map was developed based on the construct of scientific literacy and an analysis of state and territory curriculum and assessment frameworks. The Progress Map describes the development of scientific literacy across three strands of knowledge which are inclusive of Ball et al.'s concepts and processes and the elements of the OECD–PISA definition.

The five elements of scientific literacy, including concepts and processes used in PISA 2000 (OECD 1999), include:

1. demonstrating understanding of scientific concepts
2. recognising scientifically investigable questions
3. identifying evidence needed in a scientific investigation
4. drawing or evaluating conclusions
5. communicating valid conclusions.

These elements have been clustered into three more holistic strands which are described below. The second and third elements and conducting investigations to collect data are encompassed in Strand A; the fourth and fifth elements and conducting investigations to collect and interpret data are included in Strand B; and the first element is included in Strand C.

Strand A: Formulating or identifying investigable questions and hypotheses, planning investigations and collecting evidence.

This process strand includes posing questions or hypotheses for investigation or recognising scientifically investigable questions; planning investigations by identifying variables and devising procedures where variables are controlled; gathering evidence through measurement and observation; and making records of data in the form of descriptions, drawings, tables and graphs using a range of information and communications technologies.

Strand B: Interpreting evidence and drawing conclusions from their own or others' data, critiquing the trustworthiness of evidence and claims made by others, and communicating findings.

This process strand includes identifying, describing and explaining the patterns and relationships between variables in scientific data; drawing conclusions that are evidence-based and related to the questions or hypotheses posed; critiquing the trustworthiness of evidence and claims made by others; and communicating findings using a range of scientific genres and information and communications technologies.

Strand C: Using science understandings for describing and explaining natural phenomena, and for interpreting reports about phenomena.

This conceptual strand includes demonstrating conceptual understandings by being able to describe, explain and make sense of natural phenomena; understand and interpret reports (e.g. TV documentaries, newspaper or magazine articles or conversations) related to scientific matters; and make decisions about scientific matters in students' own lives which may involve some consideration of social, environmental and economic costs and benefits.

Scientific literacy has been described here in three strands to facilitate the interpretation of student responses to assessment tasks. However, authentic tasks should require students to apply concepts and processes together to address problems set in real-world contexts. These tasks may involve ethical decision-making about scientific matters in students' own lives and some consideration of social, environmental and economic costs and benefits.

The scientific literacy Progress Map (see Table A1.1) describes progression in six levels from 1 to 6 in terms of three aspects:

- increasing complexity, from explanations that involve one aspect to several aspects, through to relationships between aspects of a phenomenon
- progression from explanations that refer to and are limited to directly experienced phenomena (concrete) to explanations that go beyond what can be observed directly and involve abstract scientific concepts (abstract)
- progression from descriptions of 'what' happened in terms of objects and events, to explanations of 'how' it happened in terms of processes, to explanations of 'why' it happened in terms of science concepts.

Strand C has been abstracted and makes no reference to particular science concepts or contexts. As the progression in this strand is based on increasing complexity and abstraction, links have been made to the Structure of Observed Learning Outcomes (SOLO) taxonomy (Biggs & Collis 1982).

The taxonomy was written to describe levels of student responses to assessment tasks. The basic SOLO categories include:

prestructural	no logical response
unistructural	refers to only one aspect
multistructural	refers to several independent aspects
relational	can generalise (describe relationships between aspects) within the given or experienced context
extended abstract	can generalise to situations not experienced.

The three main categories of unistructural, multistructural and relational can also be applied, as cycles of learning, to the four modes of representation:

sensorimotor	the world is understood and represented through motor activity
iconic	the world is represented as internal images
concrete	writing and other symbols are used to represent and describe the experienced world
formal	the world is represented and explained using abstract conceptual systems.

The conceptual strand, Strand C, of the Progress Map therefore makes links to the SOLO categories of concrete unistructural (level 1), concrete multistructural (level 2), concrete relational (level 3), abstract unistructural (level 4), abstract multistructural (level 5) and abstract relational (level 6).

The SOLO levels of performance should not be confused with Piagetian stages of cognitive development. Biggs and Collis (1982, p. 22) explain that the relationship between Piagetian stages and SOLO levels 'is exactly analogous to that between ability and attainment' and that level of performance depends on quality of instruction, motivation to perform, prior knowledge and familiarity with the context. Consequently, performance for a given individual is highly variable and often sub-optimal.

NAP–SL focuses on levels 2, 3 and 4 of the scientific literacy Progress Map, the levels of scientific literacy attained by students in Year 6.

The agreed Proficiency Levels serve to further elaborate the Progress Map. Level 3 is described as 3.1, 3.2, and 3.3. A 'proficient' standard is a challenging level of performance, with students needing to demonstrate more than minimal or elementary skills.

Table A1.1 Scientific Literacy Progress Map

Level	Strands of scientific literacy		
	Strand A Formulating or identifying investigable questions and hypotheses, planning investigations and collecting evidence. Process strand: experimental design and data gathering.	**Strand B** Interpreting evidence and drawing conclusions from their own or others' data, critiquing the trustworthiness of evidence and claims made by others, and communicating findings. Process strand: interpreting experimental data.	**Strand C** Using understandings for describing and explaining natural phenomena, and for interpreting reports about phenomena. Conceptual strand: applies conceptual understanding.
6	Uses scientific knowledge to formulate questions, hypotheses and predictions and to identify the variables to be changed, measured and controlled. Trials and modifies techniques to enhance reliability of data collection.	Selects graph type and scales that display the data effectively. Conclusions are consistent with the data, explain the patterns and relationships in terms of scientific concepts and principles, and relate to the question, hypothesis or prediction. Critiques the trustworthiness of reported data (e.g. adequate control of variables, sample or consistency of measurements, assumptions made in formulating the methodology), and consistency between data and claims.	Explains complex interactions, systems or relationships using several abstract scientific concepts or principles and the relationships between them. SOLO taxonomy: Abstract relational
5	Formulates scientific questions or hypotheses for testing and plans experiments in which most variables are controlled. Selects equipment that is appropriate and trials measurement procedure to improve techniques and ensure safety. When provided with an experimental design involving multiple independent variables, can identify the questions being investigated.	Conclusions explain the patterns in the data using science concepts, and are consistent with the data. Makes specific suggestions for improving/extending the existing methodology (e.g. controlling an additional variable, changing an aspect of measurement technique). Interprets/compares data from two or more sources. Critiques reports of investigations noting any major flaw in design or inconsistencies in data.	Explains phenomena, or interprets reports about phenomena, using several abstract scientific concepts. SOLO taxonomy: Abstract multistructural
4	Formulates scientific questions, identifies the variable to be changed, the variable to be measured and in addition identifies at least one variable to be controlled. Uses repeated trials or replicates. Collects and records data involving two or more variables.	Calculates averages from repeat trials or replicates, plots line graphs where appropriate. Interprets data from line graph or bar graph. Conclusions summarise and explain the patterns in the science data. Able to make general suggestions for improving an investigation (e.g. make more measurements).	Explains interactions, processes or effects that have been experienced or reported, in terms of a non-observable property or abstract science concept. SOLO taxonomy: Abstract unistructural

Table A1.1 Scientific literacy Progress Map (cont.)

Level	Strands of scientific literacy		
3	Formulates simple scientific questions for testing and makes predictions. Demonstrates awareness of the need for fair testing and appreciates scientific meaning of 'fair testing'. Identifies variable to be changed and/or measured but does not indicate variables to be controlled. Makes simple standard measurements. Records data as tables, diagrams or descriptions.	Displays data as tables or constructs bar graphs when given the variables for each axis. Identifies and summarises patterns in science data in the form of a rule. Recognises the need for improvement to the method. Applies the rule by extrapolating and predicting.	Describes the relationships between individual events (including cause and effect relationships) that have been experienced or reported. Can generalise and apply the rule by predicting future events. SOLO taxonomy: Concrete relational
2	Given a question in a familiar context, identifies that one variable/factor is to be changed (but does not necessarily use the term 'variable' to describe the changed variable). Demonstrates intuitive level of awareness of fair testing. Observes and describes or makes non-standard measurements and limited records of data.	Makes comparisons between objects or events observed. Compares aspects of data in a simple supplied table of results. Can complete simple tables and bar graphs given table column headings or prepared graph axes.	Describes changes to, differences between or properties of objects or events that have been experienced or reported. SOLO taxonomy: Concrete multistructural
1	Responds to the teacher's questions and suggestions, manipulates materials and observes what happens.	Shares observations; tells, acts out or draws what happened. Focuses on one aspect of the data.	Describes (or recognises) one aspect or property of an individual object or event that has been experienced or reported. SOLO taxonomy: Concrete unistructural

Appendix 2
National Year 6 Primary Science Major Scientific Concepts

Major scientific concepts in the National Assessment Program – Science Literacy (NAP–SL)

A table of the major scientific concepts found most widely in the various state and territory curriculum documents has been developed to accompany the scientific literacy Progress Map (see Table A1.1).

These major concepts are broad statements of scientific understandings that Year 6 students would be expected to demonstrate. They provided item writers with a specific context in which to assess scientific literacy. An illustrative list of examples for each of the major concepts provides elaboration of these broad conceptual statements and, in conjunction with the scientific literacy Progress Map which describes the typical developmental stages for scientific literacy, was used as a guide for the development of assessment items.

It should be noted that, because the NAP–SL test instruments are constructed within the constraints of test length, it is not feasible to include all the listed concepts in instruments constructed for a single testing cycle.

Table A2.1 Major scientific concepts in the 2012 NAP–SL

Major scientific concepts	Examples
Earth and Space (ES)	
Earth, sky and people: Our lives depend on air, water and materials from the ground; the ways we live depend on landscape, weather and climate.	Features of weather, soil and sky and effects on me. People use resources from the Earth; need to use them wisely. Sustainability.
The changing Earth: The Earth is composed of materials that are altered by forces within and upon its surface.	Changes in weather, weather data, seasons, soil landscape and sky (e.g. Moon phases, weathering and erosion, movement of the Sun and shadows, bush fires, land clearing). Climate change.
Our place in space: The Earth and life on Earth are part of an immense system called the universe.	Rotation of the Earth and night/day, spatial relationships between Sun, Earth and Moon. Planets of our solar system and their characteristics. Space exploration and new developments.
Energy and Force (EF)	
Energy and us: Energy is vital to our existence and our quality of life as individuals and as a society.	Uses of energy, patterns of energy use and variations with time of day and season. Energy sources, renewable and non-renewable.
Transferring energy: Interaction and change involve energy transfers; control of energy transfer enables particular changes to be achieved.	Sources, transfers, carriers and receivers of energy, energy and change. Types of energy, energy of motion – toys and other simple machines – light, sound.
Energy sources and receivers: Observed change in an object or system is indicated by the form and amount of energy transferred to or from it.	Forces as pushes and pulls, magnetic attraction and repulsion.
Living Things (LT)	
Living together: Organisms in a particular environment are interdependent.	Living vs non-living. Plant vs animal and major groups. Dependence on the environment: survival needs – food, space and shelter. Interactions between organisms and interdependence (e.g. simple food chains).
Structure and function: Living things can be understood in terms of functional units and systems.	Major structures and systems and their functions. Healthy lifestyle, diet and exercise.
Biodiversity, change and continuity: Life on Earth has a history of change and disruption, yet continues generation to generation.	Change over lifetime, reproductions and lifecycles. Adaptation to physical environment.
Matter (M)	
Materials and their uses: The properties of materials determine their uses; properties can be modified.	Materials have different properties and uses. Processing materials to make useful things produces waste, use of alternative materials to better care for the environment. Waste reduction – recycling. Nanotechnology.
Structure and properties: The substructure of materials determines their behaviour and properties.	The properties of materials can be explained in terms of their visible substructure, such as fibres.
Reactions and change: Patterns of interaction of materials enable us to understand and control those interactions.	Materials can change their state and properties. Solids, liquids and gases.

Appendix 3
National Year 6 Primary Science Proficiency Level Descriptors

Proficiency Levels and the Proficient Standard

As shown in Table 7.2 and Table 7.3, items comprising the scientific literacy assessment have been partitioned into Proficiency Levels.

To establish Proficiency Levels, a combination of expert knowledge of the skills required to answer each of the science items and results from the analysis of student responses was used.

Items located within each Proficiency Level were judged by subject experts to share similar features and requirements and to differ in recognisable ways from items at other levels.

Table A3.1 provides a description of the level of knowledge and skills assessed by items operating at each Proficiency Level. Items at the higher Proficiency Levels require more demanding skills and understandings to answer than do items at lower Proficiency Levels.

In relation to the item analysis sheets (Table 7.2 and Table 7.3) it may be expected that the percentage correct for the items increases as the Proficiency Level decreases.

Table A3.1 Description of skills assessed at each Proficiency Level

Proficiency Level	Descriptor: a student at this level may display skills like
Level 2 and below	Makes measurements or comparisons involving information or stimulus in a familiar context. Identifies simple patterns in the data and/or interprets a data set containing some interrelated elements. Makes a choice for a situation based on first-hand concrete experience, requiring the application of limited knowledge.
Level 3.1	Makes simple standard measurements and records data as descriptions. Interprets simple data set requiring an element of comparison. Selects appropriate reason to explain reported observation related to personal experience.
Level 3.2	Collates and compares data set of collected information. Selects experimental design that respresents a fair test. Interprets data and identifies patterns in – and/or relationships between – elements of the data. Interprets information in a contextualised report by application of relevant science knowledge.
Level 3.3	Demonstrates an awareness of the principles of conducting an experiment and taking into account variables to be changed and/or measured. Extrapolates from an observed pattern to describe an expected outcome or event. Applies knowledge of relationship to explain a reported phenomenon.
Level 4 and above	When provided with an experimental design involving multiple variables, can identify the questions being investigated. Conclusions summarise and explain the patterns in the data in the form of a rule and are consistent with the data. Explains interactions that have been observed in terms of an abstract science concept.

In terms of the Proficiency Levels described in Table A3.1, the standard for proficiency in scientific literacy at Year 6 was determined to be equivalent to Level 3.2. Students achieving at Level 3.2 are considered to have a sound understanding of Year 6 science (refer to pages 47-48).