

# Our material world

Teacher guidelines



# 4

## Science

Queensland Comparable  
Assessment Tasks (QCATs)  
2010

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# The 2010 QCATs

## What are QCATs?

Queensland Comparable Assessment Tasks (QCATs) are designed to provide evidence of what students know, understand and can do in relation to a selection of **Essential Learnings** for English, mathematics and science in Years 4, 6 and 9, and to the **Standards**.

QCATs are authentic, performance-based assessments that:

- engage students in solving meaningful problems
- emphasise critical thinking and reasoning
- provide teachers, students and parents/carers with information about student progress and a focus for future teaching and learning.

## Consistency of teacher judgments

QCATs support teachers in making consistent judgments about the quality of student work. Improved consistency of teacher judgments is achieved when teachers:

- engage in professional conversations about the quality of evidence in student responses
- reach consensus about the quality of student work
- adopt a consistent approach when using the **Guide to making judgments** (page 36).

Information gathered may be used by teachers to promote, assist and improve key learning area programs and help students achieve the highest standards they can.

## Additional resources **QCATs Information Statement**

[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > Prep–Year 9 > QCATs (Years 4, 6 & 9)

## **Essential Learnings and Standards**

[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > Prep–Year 9 > Essential Learnings & Standards (Years 1–9)

## Important dates

Friday 25 June	QCATs packages have arrived in schools
Tuesday 13 July ↓ Friday 17 September	Schools: <ul style="list-style-type: none"><li>• administer QCATs at any time during the school weeks of this period</li><li>• grade QCATs</li><li>• select five student samples that are representative of grades awarded</li></ul>
Monday 4 October	Schools are notified if selected to submit student samples for QSA's random sampling process
Monday 1 November	Final day for schools to submit student data to QSA
Friday 10 December*	Schools must retain all <b>Student booklets</b> until the end of the school year
*This date may vary from school to school	

# Getting ready

## Student preparation

Students should have the opportunity to do their best work. For this to occur, student preparation should include:

- opportunities to engage with the **Selected Essential Learnings** (page 25) well in advance of participating in QCATs. If students have not engaged with the **Selected Essential Learnings** recently, review and consolidation may be necessary. Preparation activities should not involve rehearsal of the actual or a similar assessment
- experience with the types of questions used within the QCAT.

The quality of information provided by the QCATs will depend on the level of interaction teachers have with their students before, during and after implementation.

**Additional resources** **Centrally-devised design brief**  
[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > Prep–Year 9 > QCATs (Years 4, 6 & 9)

## Catering for diversity — special provisions

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

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

- Students who have been identified as having specific educational requirements may be assisted using those adjustments and supports usually available in the classroom. To make participation possible in all or part of the assessment task, such help may be in the form of inclusive learning technologies, reading support or the use of support personnel.
- Students for whom English is not their first language, and who are assessed as not achieving a reading level appropriate to complete the task, may be assisted by an interpreter or educational devices (e.g. pictures, electronic whiteboards, interactive devices) to allow participation in all or part of the task.
- In exceptional circumstances, where a student's learning difficulties have precluded them from engaging with the **Selected Essential Learnings**, the principal (in consultation with specialist and support staff and parents/carers) may make a decision about the participation of that student in the task. Some students may be given an opportunity to complete some aspects of the assessment.

**Additional resources** **Inclusive strategies for implementing QCATs**  
[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > Prep–Year 9 > QCATs (Years 4, 6 & 9)  
**Equity**  
[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > P–12 approach > Equity

## Teacher preparation

### *Check contents of QCAT packages as soon as they arrive at your school*

- Check that you have the appropriate number of **Student booklets** (one per student) and **Teacher guidelines** (one per implementing teacher).
- Check for any defective **Student booklets**.
- Contact the QSA if any additional copies are required.

### *Familiarise yourself with the assessment*

- Read all the documents provided.
- Review the **Selected Essential Learnings** (page 25).
- Complete a **Student booklet** yourself, and then refer to the **Model response** (page 28) so that you understand what students are required to do.
- Download and view **Sample responses** from the **QSA Assessment Bank** (see Additional resources below).

### *Plan implementation*

- Discuss the assessment with your colleagues, and plan any teaching or revision that may be required.
- Set the times and dates for the implementation:
  - teachers have flexibility to implement the QCATs at any time during the designated period
  - the QCATs may be completed in one, two or more sessions over one or more days
  - implementation times may differ for verified students, students with specific educational requirements or students who have English as a second language.
- Plan:
  - any support required to enable students to do their best work (e.g. teacher aides or other support personnel)
  - any materials or equipment needed to implement the assessment.
- Decide:
  - how you will implement this task for all classes at this year level
  - the processes you will use to achieve consistency of teacher judgment
  - how you will select student samples for the QSA's random sampling process
  - when, how and who will submit your school's data.

### **Additional resources** **Sample responses**

QSA Assessment Bank <<https://qcar.qsa.qld.edu.au/assessmentbank>>

**Using Queensland Comparable Assessment Tasks (QCATs) to support learning**  
[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > Prep–Year 9 > QCATs (Years 4, 6 & 9)

# Implementation

## Setting up

### *Prior learning experiences*

- Ensure that students observe and test materials to identify properties relating to the mass, surface, texture, flexibility, hardness, absorbency and transparency. Students should safely test other properties relevant to a given specific material.
- They can do this by weighing, rubbing, bending, scratching, tearing, wetting, and looking through the samples of materials.

### *Preparation for the investigation*

- Each student will make two planes. This will take about 20 minutes. This activity can be completed prior to the implementation of the QCAT. Students are not assessed on their ability to make planes, so provide additional ready-made planes if required.

## Working with the Student booklet

Use the [Annotated Student booklet](#) (page 8) to set the conditions that ensure all students have the opportunity to do their best work.

Students should be encouraged to interact with teachers to seek clarification when required, and with other students if appropriate to the task.

### *Suggested implementation timeline*

#### Preparation

Setting the scene: Group discussion	20 minutes
Make planes for the investigation	20 minutes

#### The assessment task

Investigate materials (Questions 1–4)	30 minutes
Investigate materials (Questions 5–10)	40 minutes
New ideas, new questions	15 minutes
Reflection	5 minutes



Suggested time: 20 minutes

Read through the examples with the students.

It would be helpful for students to have the objects at their desk during the discussion.

Focus discussion on:

- the observable properties of the material
- the purpose of the object
- the relationship between properties of a material and the purpose of the object.

Emphasise that a material may have many properties, but some may be more important to a specific purpose than others, e.g.

The properties of a ruler might be: coloured, rigid, lightweight. The property of being rigid is most important to its purpose.

Read the words in the **Properties word bank** to the students.

Name or describe examples of familiar materials to clarify any of the words.

Add other words or phrases that could be used to describe properties of materials.

## Setting the scene: Group discussion

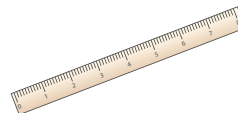
Every object in your classroom has a purpose.



Desks have a purpose. They provide a place to work on.



Drink bottles have a purpose. They are used to hold water.



Rulers have a purpose. They are used for measuring distances and drawing straight lines.

Objects are made from different types of materials. Talk about the useful properties of each material.

### Properties word bank



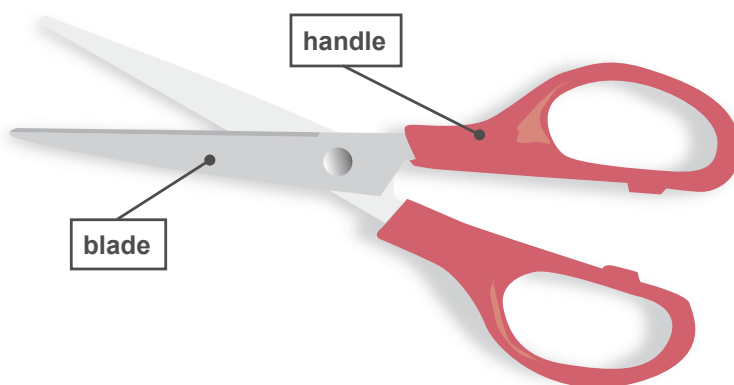
Ensure that students observe and test samples to identify properties about their mass, surface, texture, flexibility, hardness, absorbency and transparency.

They can do this by weighing, rubbing, bending, scratching, tearing, wetting, and looking through the samples of materials.

Encourage students to ask further questions in relation to specific objects and materials in their classroom.



Think about the materials used to make a pair of scissors.



Students should only choose those properties from the word bank that are relevant to the material being examined.

These scissors have two parts, a handle and a blade. Each part is made from a different material.

In the table below:

- write the purpose of each part
- use the **Properties word bank** on page 2 to list the properties of each part.

#### Properties of materials in a pair of scissors

Part of object	Purpose	Material	Properties of material
handle		plastic	smooth, ..... .....
blade		metal	can be sharpened, ..... .....

Other properties of the handle that may be identified are: strong, hard, lightweight, dull, durable.

Other properties of the blade that may be identified are: strong, hard, rigid, shiny.

Other scissors, like scissors for small children, use different materials. Talk about the properties of a material chosen to make children's scissors.

Point out to students that the plastic in these scissors has different properties to the plastic in shopping bags or a book cover. The type of plastic is chosen because of its properties.



Suggested time (Questions 1–4): 30 minutes

For guidelines on choosing objects, see **Selecting objects for Scientific idea 1** on page 26.

Students may be seated in groups around the objects.

Each student chooses one object and completes the questions individually.

Encourage students to explain how some of the properties are important to the purpose of the object they have listed.

## Investigate materials

### Scientific idea 1:

**I wonder why an object is made from a specific material.**

To investigate this idea, we use a focus question.

### Focus question 1:

**Are some properties more important than others?**

There are several objects in your work area for you to observe and test. Each object is made from a different material.

#### 1. Examine all objects. Choose one object.

##### a) Complete the table below.



Hint: The **Properties word bank** on page 2 might be useful.

Object	Purpose	Material	Properties of material

##### b) Why is the material used to make your object a good choice?

.....

.....

#### 2. We can make a toy plane that can fly.

##### a) List some **properties** that are important in the materials used to make a toy plane that flies.

.....

.....

4 | QCATs 2010 Student booklet

Questions 1–3 gather evidence of knowledge that materials have different properties, and that materials are chosen for a purpose because of those properties.

Students demonstrate this by identifying and naming the properties of materials and purpose of objects, and by using properties to suggest alternative materials.

- b) We can use paper to make a toy plane that flies. List some other **materials** that could be used.

.....

.....

### Scientific idea 2:

I wonder if toy planes that fly can be made from other materials.



### Focus question 2:

Will a toy plane made from card fly further than a toy plane made from baking paper?

## Identify properties

3. Observe and test the card and the baking paper.

- a) List the **properties** of the card and the baking paper.



Hint: The **Properties word bank** on page 2 might be useful.

Properties of card	Properties of baking paper

Hand out samples of card and baking paper.

Have students handle the samples to observe and test the properties of both materials.

Students should not discuss the properties they identify with their classmates.

- b) Circle **properties** important for making toy planes that fly.

Collect the samples back from the students before proceeding.

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Question 4 gathers evidence of making a prediction to be tested.  
Students demonstrate this by choosing an outcome and giving reasons for their choice.

### Make a prediction

Students choose one box only.

4. a) Tick the box that matches what you predict will happen.

- ☐ The **card** plane will fly further.
- ☐ The **baking paper** plane will fly further.
- ☐ Both planes will fly the **same** distance.

Before continuing, review the QCAT up to this point.

b) Explain why you chose this option.

.....

.....

Remind students that if a test is fair, we know the results are due to the changed variable (the different material) only.



Stop here: Wait for your teacher's directions.

### Investigate

#### Planning for a fair test

To be a fair test:

- one thing is **changed** (the material used to make the plane)
- one thing is **measured or observed** (distance of the flight)
- all other things are kept the **same**.

#### Materials

- card
- baking paper
- pencil

#### Method

**Step 1** Follow the **Instructions** on page 7 to make a plane from each material. Make each plane the same way.

**Step 2** Throw each of your planes once. Throw them the same way, using the **Plane-throwing technique** on page 7. (Your teacher will demonstrate.)

**Step 3** Record your results in the **Data table** on page 8.

**Step 4** Repeat Steps 2 and 3 until you have filled your data table.

**Step 5** Record your observations about the planes, the throws and the environment in the **Observations table** on page 8.

Read the method with the students.

Emphasise that **each student** will:

- make two planes using the **Instructions**
- throw both planes and record which one flew further
- repeat the throws 10 more times
- make their own observations in Question 6.

© QCATs 2010 St

Refer to the **Data table** and **Observations table** on page 8 and explain when they will be used.

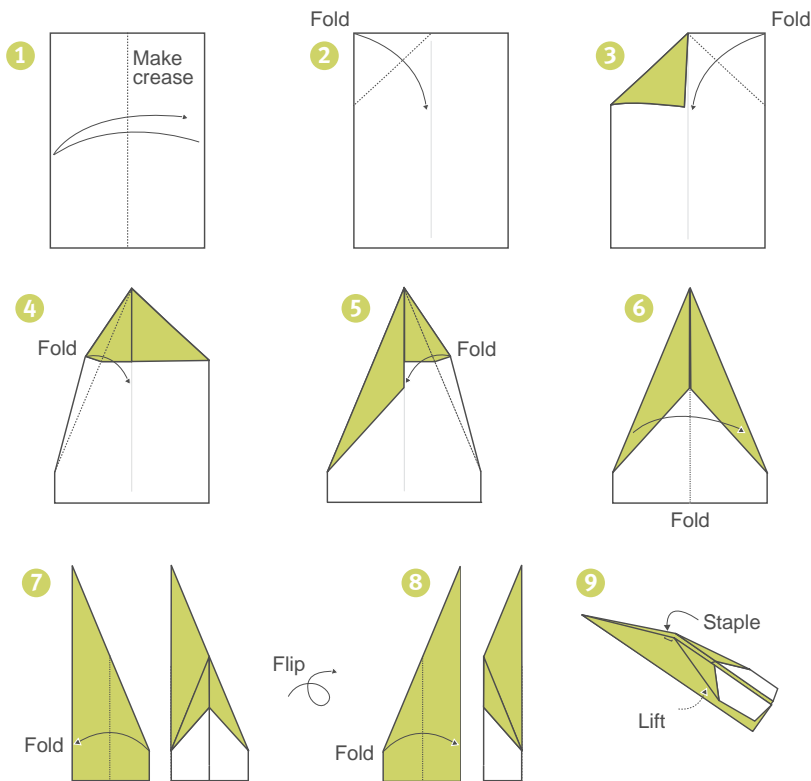
Restate the link between the scientific idea and the focus question, and how the data collected will answer the focus question.

Hand out card and baking paper to students.  
Card and baking paper should be the same size.

Suggested size: A4.

Work through the **Instructions** with students,  
demonstrating each step.

### Instructions



Students' ability to make  
planes is not assessed.  
Therefore:

- Provide assistance where necessary.
- Have extra card and baking paper available. Students may practice making planes with newspaper.
- Have extra, prepared planes available for use.

After making the planes,  
give students another  
opportunity to add  
properties to their table in  
Question 3.

Ensure students label both  
planes with their name.

### Plane-throwing technique



Prepare a clear and safe throwing space and  
demonstrate the throwing action.

If inside, turn off any fans to assist in controlling  
the environment.

Use **Throwing techniques** (page 27) to point out the  
four aspects of the throw that should be controlled.

Students may practice the throwing action in pairs.

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Suggested time (Questions 5–10): 40 minutes

Once the planes are made and throwing technique demonstrated, avoid intervening if inconsistent throwing is observed.

These factors will provide opportunities for students to comment on the fairness of the investigation in Questions 6 and 8.

Each student throws both planes in each trial.

Remind students to record their results after each trial.

Ensure all students have recorded results in the data table before proceeding.

Explain that “environmental conditions” refer to those factors that surround the thrower. They might include wind or fan currents.

## Collect data

5. Use a tick (✓) to indicate which plane flew further for each trial.

### Data table

Trial #	Card	Baking paper
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
Total number of ticks		

6. What did you observe that may have affected your data?

### Observations table

Environmental conditions	
Throws	e.g. sometimes my feet were over the line so the plane went further
Planes	

8 | QCAT

Questions 5–6 gather evidence of collecting and organising data and observations.

Students demonstrate this by recording data and observations in the tables provided.

## Check the investigation is fair

7. Use a tick (✓) to show the things you **changed, measured or observed**, and kept the **same** in the investigation.



Hint: Use evidence from Question 6.

### Fair test table

Feature of the investigation	What I did		
	Changed	Measured / observed	Kept the same
• the shape of the plane			
• the type of material			
• how to throw the plane			
• where to throw the plane			
• environmental conditions			
• the distance of the flight			

8. This investigation was **fair** **unfair** because:  
(circle one)



Hint: Use evidence from Questions 6 and 7.

.....

.....

.....

.....

### Advise students to:

- base their responses on their own trials
- place only one tick in each row
- look back at page 6 for an explanation of a fair test.

Questions 7–8 gather evidence of identifying elements of a fair test.

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Students demonstrate this by identifying the variables that were or were not controlled and commenting on the consequences for the fairness of the investigation.

Question 9 gathers evidence of drawing a conclusion that is supported by data. Students demonstrate this by drawing a conclusion based on their results (data) and on the properties they identified in Question 3.

### Look at the evidence and draw conclusions

#### Conclusion

9. a) Tick the box that matches your results from the data table.

- ☐ The **card** plane flew further.
- ☐ The **baking paper** plane flew further.
- ☐ Both planes flew the **same** distance.

b) How does the data show this?

.....

.....

c) Explain your conclusion by referring to the properties of the **card** and **baking paper**.

.....

.....

.....

.....

#### Reflection

10. Does your conclusion match your prediction in Question 4?

- ☐ Yes
- ☐ No

My prediction **was** the same as my conclusion because:  
**was not**  
(circle one)

.....

.....

.....

Students should not change their prediction or their data so that they match for this question.

Emphasise that their reasons are more important than a match.

#### Take a break

This is a good time to take a break in the QCAT.



Stop here: Wait for your teacher's directions.

10 | QCATs 2010 Student booklet Year 4

Question 10 gathers evidence of reflecting on learning to evaluate a prediction.

Students demonstrate this by considering their conclusion above and responses to Question 4, then stating reasons why their prediction did/did not match the conclusion.





Suggested time: 15 minutes

## New ideas, new questions

Wood is used by Aboriginal peoples and Torres Strait Islander peoples to make many things, including boomerangs, shields, bowls and clubs.

Wood can have many properties. Wood may be:

- soft or hard
- light or dark in colour
- smooth or rough
- flexible or rigid
- lightweight or heavy.

### The Ngadjonji people

The Ngadjonji people are an Aboriginal people whose traditional lands are in rainforest country in Far Northern Queensland. They use wood from local plants to make tools and shelters. Different types of wood are used for different objects.

#### Tools

Wood chosen for shields and axe has to be very hard and rigid.



axe



shield

Ngadjonji name: bigan

Make connections with Aboriginal and Torres Strait Islander students and members of the community where relevant.

## Shelters

Wood used to build a shelter like the one in this picture has to be very flexible.

Relate the property of flexibility to the purpose of the wood used in the shelter.

Have students make the bending motion with their own hands to reinforce that the property of flexibility is to be investigated.



The wood must bend easily.

### Shelter

Ngadjonji name: mija

The Ngadjonji people might consider bamboo and yellow lawyercane when building a shelter because they bend easily.



**Bamboo**



**Yellow lawyercane**  
Ngadjonji name: jungganju

Images are Creative Commons Attribution 2.0 Generic licensed photos  
<http://creativecommons.org/licenses/by/2.0/> accessed 31 Mar 2010.  
Bamboo: annie076's photostream, "Bamboo forest, natural light",  
<www.flickr.com/photos/annie076/14211012/>  
Yellow lawyercane: DSCN4198",  
<www.flickr.com/photos/steve1984/334206228/>

Questions 11–12 gather evidence of posing simple questions, and of planning an investigation, identifying and using elements of a fair test.

## Investigate

### Scientific idea 3:

I wonder if some woods have properties that make them better for building shelters.

11. Write a focus question to investigate this idea.

Focus question 3:

.....  
.....

12. Plan an investigation to collect data that answers your focus question.

a) Planning for a fair test

What will be **changed**? .....

What will be **measured or observed**? .....

What will be kept the **same**? .....

Encourage students to revisit relevant parts of the QCAT for clues to complete Questions 11–12, e.g.

- focus questions (pages 4–5)
- planning for a fair test (page 6)
- writing a method (page 6).

Clarify that students are writing a plan to collect data to answer their focus question. They are not writing a plan to make a shelter.

Students may include a labelled diagram to assist in communicating their method.

#### **b) Materials**

.....

.....

.....

.....

#### **c) Method**

**Step 1**.....

.....

.....

.....

.....

.....

.....



Suggested time: 5 minutes

## Reflection

New materials are being made by scientists all over the world.

Three examples are described below.

### ☐ Aerogel

One of the lightest materials ever developed. It is a glass-like mixture that is 96% air.

#### Properties

- lightweight
- strong
- can be recycled
- good insulator

### ☐ Spider silk (manufactured)

A rubber mixture with nano-crystals of clay in it to make it extremely stretchy.

#### Properties

- elastic
- strong
- lightweight
- waterproof

### ☐ Sugru

A soft plasticine-like material.

#### Properties

- sticks to many surfaces
- can be moulded
- sets hard
- waterproof
- non-slip

Throughout this QCAT, students have identified the properties of objects and materials.

Here they apply this understanding to suggest a purpose for a material with given properties.

#### Explain:

- “manufactured spider silk” is artificial or human-made, based on the properties of natural spider silk
- “nano-crystals” are parts of a material that are too small to be seen (they are one billionth of a metre!). In this material, microscopic pieces of clay have been mixed into the rubber to make it both elastic and strong.

13. Choose one new **material** by ticking the box next to its name.

a) A **purpose** for this **material** could be: .....

.....

b) State how its **properties** are useful for this purpose.

.....

.....

.....

.....

Students may suggest a purpose that is a new invention, or an improvement to an existing object.

Question 13 gathers evidence of reflecting on learning to identify a future application of a new material.

Students demonstrate this by linking the given properties to their suggested purpose.

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## Making judgments

Use the [Guide to making judgments \(GTMJ\)](#) on page 36 to grade student responses.

The [Model response](#) (page 28) and [Sample responses](#) are provided for reference purposes only. They each demonstrate possible responses and should be used to support the GTMJ.

Making judgments is not about determining whether one student's work is better than that of another. Rather, you should make standards-based judgments by matching evidence in student responses to descriptors in the GTMJ.

Read and consider all of the evidence in the student's responses before making and recording a judgment about the quality of the performance for each assessable element.

### Additional resources [Sample responses](#)

QSA Assessment Bank <<https://qcar.qsa.qld.edu.au/assessmentbank>>

### Using the GTMJ

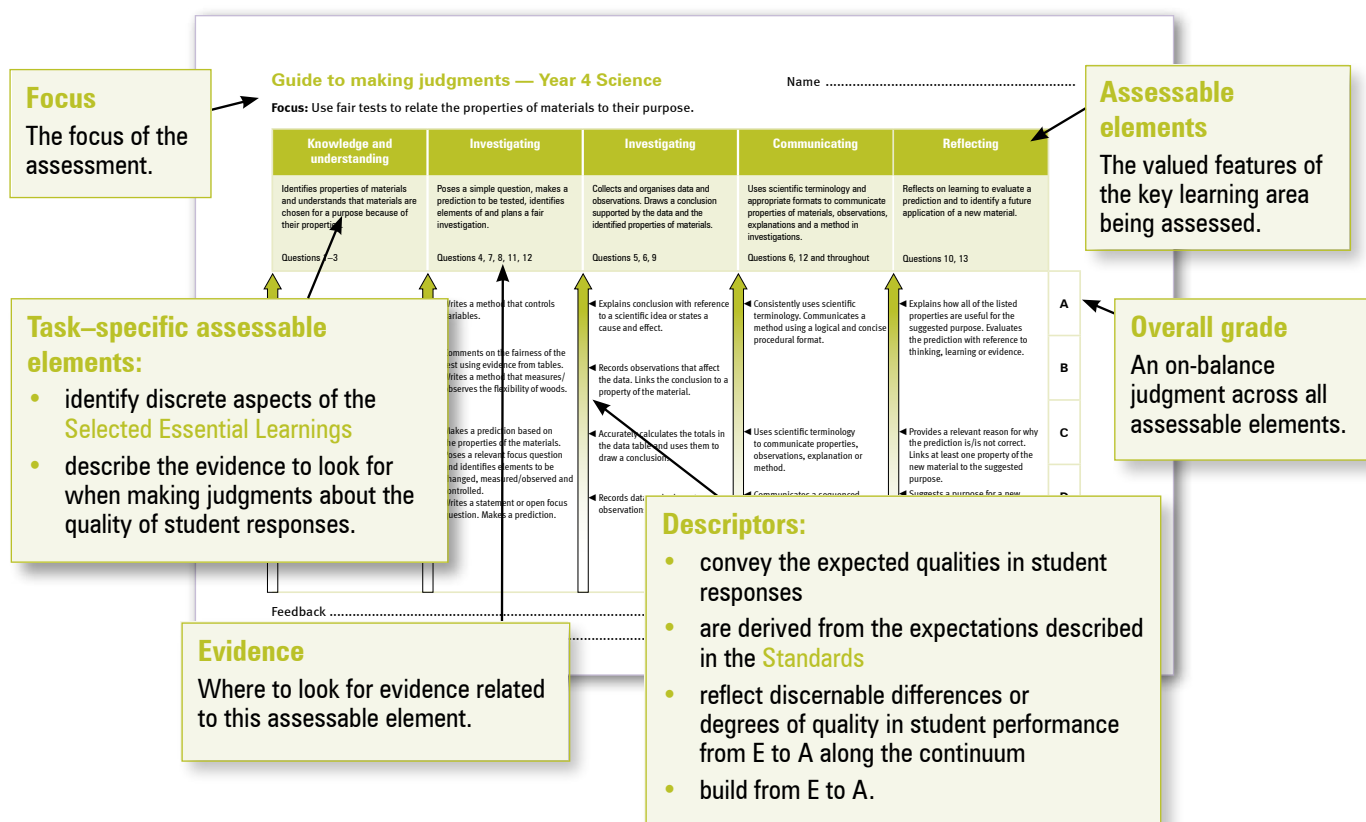
This QCAT uses a continua-style GTMJ, where descriptors are placed along a continuum within each column. The diagrams below show the different parts of the GTMJ continua model, and how to use the GTMJ when grading student responses.

Record a nil award of "N" only when there is insufficient evidence to make a judgment for an overall grade.

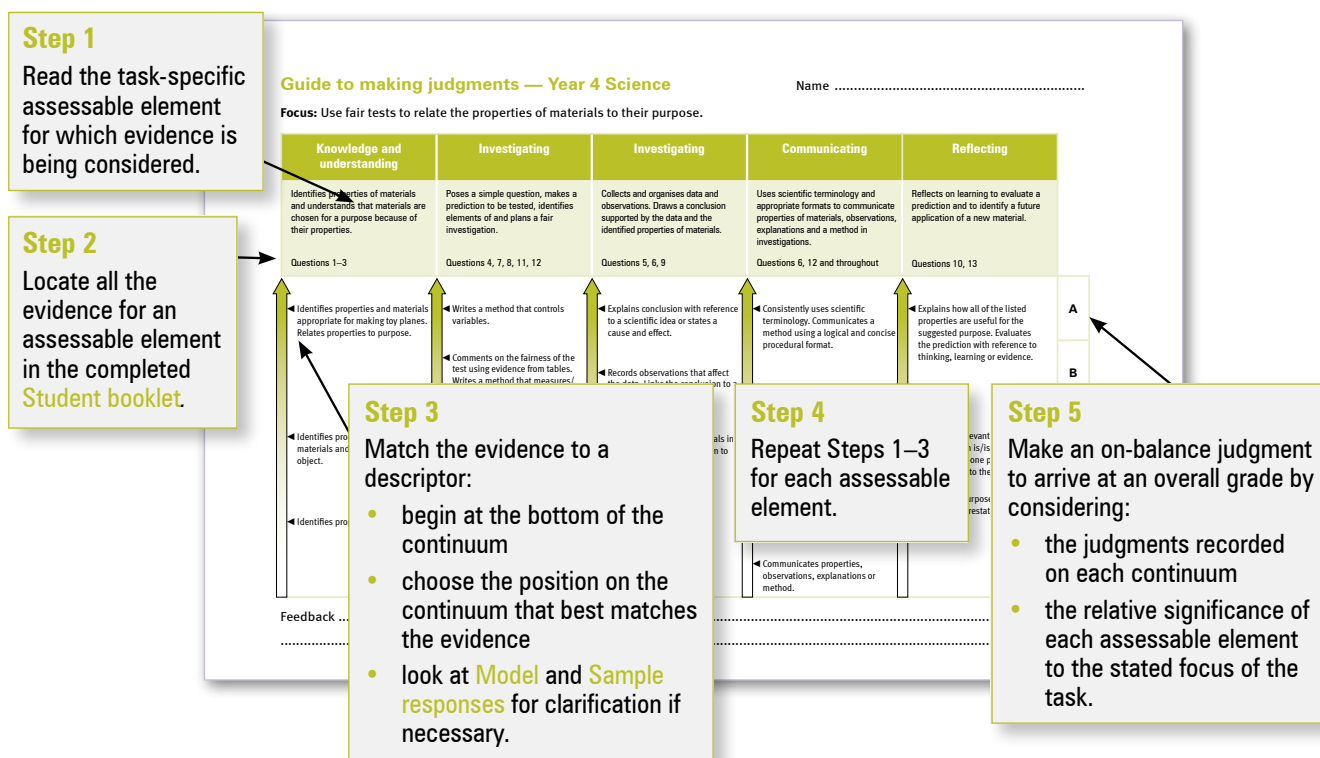
In the following diagrams:

- **Diagram 1: Understanding the GTMJ** points out the different parts of the GTMJ
- **Diagram 2: Using the GTMJ — the judgment process** gives steps to follow when grading student responses.

### Diagram 1: Understanding the GTMJ



### Diagram 2: Using the GTMJ – the judgment process



## Using feedback

Assessment alone will not contribute significantly to improved learning — it is what teachers and students do with the information gathered that makes the difference. Providing quality and useful feedback is a crucial step in using assessment information to support future learning.

Assessment feedback goes beyond a simple mark or grade. Comments on the strengths of students' achievements, and on areas for improvement, provide quality feedback that can be used to inform future teaching and learning. Assessment feedback is most helpful if the specific elements of the knowledge and skills are identified and specific suggestions are provided.

The information gathered from the implementation, marking and moderation of QCATs should feed back into future planning of teaching and learning.

### *Feedback to help students learn*

Quality feedback to a student:

- focuses on their achievement in relation to either the assessable elements with their task-specific descriptors or the **Selected Essential Learnings** (page 25) and their associated questions
- includes strengths of achievements
- identifies areas for improvement and strategies for future learning
- is communicated in student-friendly language
- is appropriate (e.g. in quantity and detail) to the student's age and their capacity to respond
- includes the use of **Sample responses** to provide examples of the quality of work corresponding to each standard.

### *Feedback to help teacher planning*

Individual and collective student performance on QCATs, along with other school-based assessment, can be used to inform teaching and learning.

**Additional resources** **Using feedback to inform teaching and learning**  
[www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > Prep–Year 9 > QCATs (Years 4, 6 & 9)

**Sample responses**  
QSA Assessment Bank <<https://qcar.qsa.qld.edu.au/assessmentbank>>



# Resources

## Selected Essential Learnings

The 2010 QCATs will assess what students know, understand and can do in relation to the following selection of **Essential Learnings**.

Science Essential Learnings by the end of Year 5	
<b>Assessable elements</b> The valued features of the key learning area about which evidence of learning is collected and assessed.	<b>Ways of working</b> The processes students use to develop and demonstrate their <b>knowledge and understanding</b> .  Students are able to:
<b>Investigating</b>	<ul style="list-style-type: none"> <li>pose and refine simple questions, and make predictions to be tested</li> <li>plan activities and investigations, identifying and using elements of a fair test</li> <li>collect and organise data, information and evidence</li> <li>draw conclusions that are supported by evidence, reproducible data and established scientific concepts</li> </ul>
<b>Communicating</b>	<ul style="list-style-type: none"> <li>communicate scientific ideas, data and findings, using scientific terminology and formats appropriate to context and purpose</li> </ul>
<b>Reflecting</b>	<ul style="list-style-type: none"> <li>reflect on learning to identify new understandings and future applications.</li> </ul>
	<b>Knowledge and understanding</b> The essential concepts, facts and procedures.
<b>Knowledge and understanding</b>	<b>Natural and processed materials</b> <b>Properties, changes and uses of materials are related.</b> <ul style="list-style-type: none"> <li>Materials are used for a particular purpose because of their specific properties.</li> </ul>
Source: <a href="http://www.qsa.qld.edu.au">www.qsa.qld.edu.au</a> > Prep–Year 9 > Essential Learnings & Standards (Years 1–9)	

## Literacy and Numeracy Indicators

The **Literacy and Numeracy Indicators** are a resource that can be used when planning for teaching, learning, assessment and monitoring in all key learning areas.

This QCAT may provide opportunities to monitor and assess student progress in a selection of the **Literacy and Numeracy Indicators**, and may provide further focus for feedback for teachers and students to support improved learning.

**Additional resources**    [www.qsa.qld.edu.au](http://www.qsa.qld.edu.au) > Prep–Year 9 > Literacy & Numeracy Indicators (P–Year 9)

## Selecting objects for Scientific idea 1

- Each object should be predominantly made from the one material.
- Choose four or five objects that are familiar to students. Sample groupings:
  - styrofoam cup, glass jar, piece of aluminium foil, plastic spoon, tea towel
  - wooden peg, eraser, coathanger, paver, leather bag

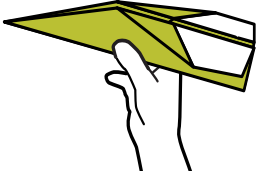
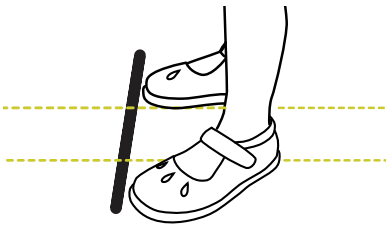
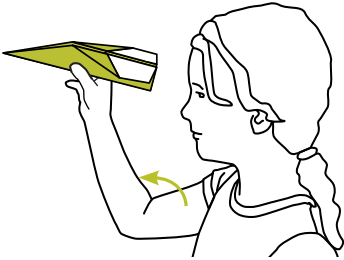
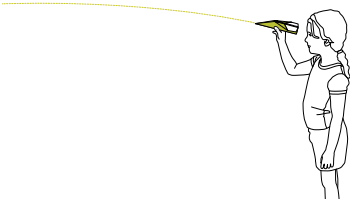
Materials	Sample objects
<b>Bark</b>	matting
<b>Clay</b>	paver, cup
<b>Cotton</b>	tea towel, fabric
<b>Glass</b>	bottle, jar, window
<b>Leather</b>	bag, belt
<b>Metal</b>	wire coathanger, aluminium can, piece of aluminium foil
<b>Paper</b>	cup, plate, serviette
<b>Plastic</b>	ruler, cup, plastic cutlery
<b>Rubber</b>	eraser, balloon, jar grip
<b>Stone</b>	tile, necklace, paver
<b>Straw</b>	hat, bag, placemat
<b>Styrofoam</b>	cup, electrical packaging, foam fruit box
<b>Wood</b>	ruler, peg, toothpick

## Throwing techniques

A fair investigation will aim to change one variable, measure its effect on another and control those remaining. There are many variables that relate to the throwing of the plane that may influence the findings.

While students will become aware of this during the investigation, they should be encouraged to throw the plane using the same method.

Explain and demonstrate the factors below to students before they complete their trials.

<p><b>Hand grip</b></p> 	<p>The thrower should:</p> <ul style="list-style-type: none"> <li>• hold spine of plane between thumb and pointer finger</li> <li>• position the fingers under the start of the wings</li> <li>• use the same grip when throwing each plane.</li> </ul>
<p><b>Stance</b></p> 	<p>The thrower should:</p> <ul style="list-style-type: none"> <li>• have both feet behind a designated line</li> <li>• position feet shoulder-width apart and try not to move during the throwing action.</li> </ul>
<p><b>Arm action</b></p> 	<p>The thrower should:</p> <ul style="list-style-type: none"> <li>• raise throwing arm until a right angle is formed at the elbow</li> <li>• only move the elbow in the throw (not the shoulder)</li> <li>• apply the same effort for each throw.</li> </ul>
<p><b>Direction</b></p> 	<p>The thrower should:</p> <ul style="list-style-type: none"> <li>• aim the front of the plane at an agreed target, e.g. a clock on the wall, a beam under a ceiling, a line or marker on the oval</li> <li>• be facing the direction of flight throughout the throwing action.</li> </ul>

## Model response

This **Model response** gives one example of a very high quality response for each question. The **Sample responses**, available for download from the **QSA Assessment Bank**, demonstrate the quality of student responses for each standard, A to E.

### Setting the scene: Group discussion

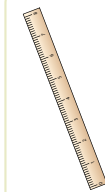
Every object in your classroom has a purpose.



Desks have a purpose. They provide a place to work on.



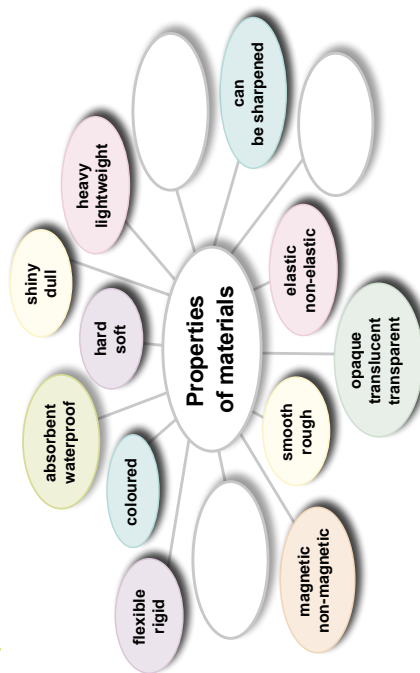
Drink bottles have a purpose. They are used to hold water.



Rulers have a purpose. They are used for measuring distances and drawing straight lines.

Objects are made from different types of materials. Talk about the useful properties of each material.

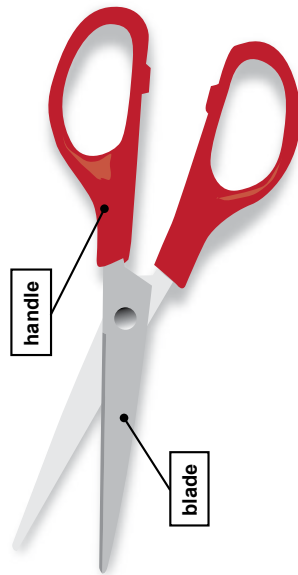
### Properties word bank



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Please read the copyright notice on our website.  
Ngadjonji Information source (pp.12-13) from: Ngadjonji - History & Culture of a Rainforest Tribe, accessed Mar 1 2010, <www.ngadjonji.bigpondhosting.com>.

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Think about the materials used to make a pair of scissors.



These scissors have two parts, a handle and a blade. Each part is made from a different material.

In the table below:

- write the purpose of each part
- use the **Properties word bank** on page 2 to list the properties of each part.

### Properties of materials in a pair of scissors

Part of object	Purpose	Material	Properties of material
handle	holding and gripping the scissors	plastic	smooth, strong, hard, lightweight, dull, durable
blade	cutting paper	metal	can be sharpened, strong, hard, rigid, shiny

Other scissors, like scissors for small children, use different materials. Talk about the properties of a material chosen to make children's scissors.

Model response

Investigate materials

**Scientific idea 1:**  
I wonder why an object is made from a specific material.

To investigate this idea, we use a focus question.

**Focus question 1:**  
Are some properties more important than others?

There are several objects in your work area for you to observe and test. Each object is made from a different material.

- 1. Examine all objects. Choose one object.
- a) Complete the table below.

Hint: The Properties word bank on page 2 might be useful.

Object	Purpose	Material	Properties of material
balloon	decoration	rubber	elastic, smooth, lightweight, waterproof, airtight

- b) Why is the material used to make your object a good choice?  
Because the rubber is elastic it can be stretched easily when it is blown up. Because it is airtight it will keep in the air. And because it is lightweight, balloons will move around and be nice decorations.

- 2. We can make a toy plane that can fly.
- a) List some properties that are important in the materials used to make a toy plane that flies.

lightweight ..... smooth  
waterproof .....  
.....

- b) We can use paper to make a toy plane that flies. List some other materials that could be used.

..... foil ..... foam .....  
..... styrene ..... plastic .....



**Scientific idea 2:**  
I wonder if toy planes that fly can be made from other materials.

**Focus question 2:**  
Will a toy plane made from card fly further than a toy plane made from baking paper?

Identify properties

- 3. Observe and test the card and the baking paper.
- a) List the properties of the card and the baking paper.



Hint: The Properties word bank on page 2 might be useful.

Properties of card	Properties of baking paper
smooth lightweight opaque dull rigid (more rigid than baking paper)	smooth lightweight (even lighter than the card) translucent dull

- b) Circle properties important for making toy planes that fly.

## Model response

### Make a prediction

4. a) Tick the box that matches what you predict will happen.

- ☐ The **card** plane will fly further.  
☒ The **baking paper** plane will fly further.  
☐ Both planes will fly the **same** distance.

Other choices are equally valid if they are supported.

- b) Explain why you chose this option.

Baking paper is lighter than the card and so will fly further.....  
 .....through the air.



Stop here: Wait for your teacher's directions.

### Investigate

#### Planning for a fair test

To be a fair test:

- one thing is **changed** (the material used to make the plane)
- one thing is **measured or observed** (distance of the flight)
- all other things are kept the **same**.

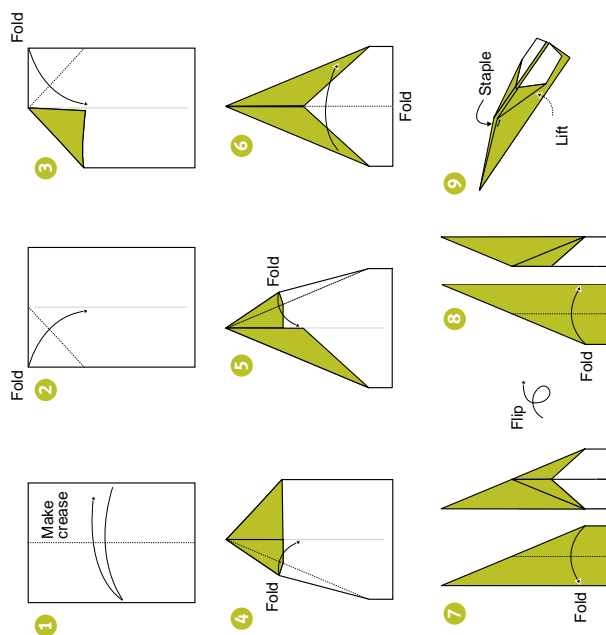
#### Materials

- card
- baking paper
- pencil

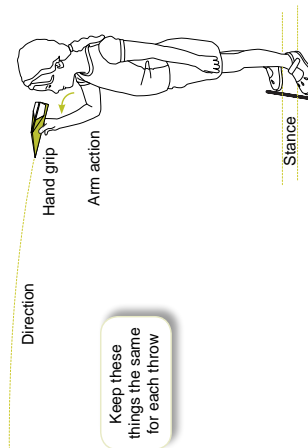
#### Method

- Step 1** Follow the **Instructions** on page 7 to make a plane from each material. Make each plane the same way.
- Step 2** Throw each of your planes once. Throw them the same way, using the **Plane-throwing technique** on page 7. (Your teacher will demonstrate.)
- Step 3** Record your results in the **Data table** on page 8.
- Step 4** Repeat Steps 2 and 3 until you have filled your data table.
- Step 5** Record your observations about the planes, the throws and the environment in the **Observations table** on page 8.

### Instructions



### Plane-throwing technique



Model response

Collect data

5. Use a tick (✓) to indicate which plane flew further for each trial.

Data table

Trial #	Card	Baking paper
1	✓	
2	✓	
3		✓
4	✓	
5	✓	
6		✓
7	✓	
8	✓	
9	✓	
10		✓
11	✓	
Total number of ticks	8	3

6. What did you observe that may have affected your data?

Observations table

Environmental conditions	Sometimes the wind blew stronger than other times, and caused the plane to travel further. This happened with the baking paper in trial 10.
Throws	e.g. sometimes my feet were over the line so the plane went further In a few trials, I let the plane go at different times. Also sometimes my feet crossed the line.
Planes	The baking-paper plane came apart at the back. This might have stopped the plane from flying very far in the last few trials.

Check the investigation is fair

7. Use a tick (✓) to show the things you changed, measured or observed, and kept the same in the investigation.



Hint: Use evidence from Question 6.

Fair test table

Feature of the investigation	What I did	
	Changed	Measured / observed
the shape of the plane		✓
the type of material	✓	
how to throw the plane	✓	
where to throw the plane		✓
environmental conditions	✓	
the distance of the flight		✓

Students' answers may vary.

8. This investigation was fair/unfair because: (circle one)



Hint: Use evidence from Questions 6 and 7.

I think the wind only affected the planes a few times and my throws affected both planes. So these would not have changed the overall result.

It is equally valid for students to decide this investigation is unfair provided they give supporting reasons.

## Model response

### Look at the evidence and draw conclusions

#### Conclusion

9. a) Tick the box that matches your results from the data table.
- ☒ The **card** plane flew further.
- ☐ The **baking paper** plane flew further.
- ☐ Both planes flew the **same** distance.
- b) How does the data show this?
- .....The card plane flew further 8 times out of 11 trials and the  
baking paper plane only flew further 3 times.....
- c) Explain your conclusion by referring to the properties of the **card**  
and **baking paper**.
- .....Even though both materials were lightweight, the baking paper  
.....was too light and was blown around by the air.....
- .....Also, the card was more rigid and this meant it held its shape  
.....better when I threw it and it lasted for more trials.....

#### Reflection

10. Does your conclusion match your prediction in Question 4?

☐ Yes ☒ No

My prediction was the same as my conclusion because:

(circle one)

.....I thought that the lighter plane would fly further, but the more  
rigid material (the card) did because it held its shape better.....



Stop here: Wait for your teacher's directions.

### New ideas, new questions

Wood is used by Aboriginal peoples and Torres Strait Islander peoples to make many things, including boomerangs, shields, bowls and clubs.

Wood can have many properties. Wood may be:

- soft or hard
- light or dark in colour
- smooth or rough
- flexible or rigid
- lightweight or heavy.

### The Ngadjonji people

The Ngadjonji people are an Aboriginal people whose traditional lands are in rainforest country in Far Northern Queensland. They use wood from local plants to make tools and shelters. Different types of wood are used for different objects.

#### Tools

Wood chosen for shields and axe has to be very hard and rigid.

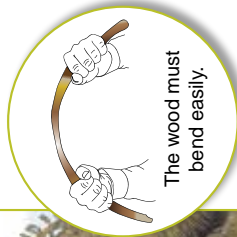




## Model response

### Shelters

Wood used to build a shelter like the one in this picture has to be very flexible.



### Shelter

Ngadionji name: mijja

The Ngadionji people might consider bamboo and yellow lawyer cane when building a shelter because they bend easily.



Bamboo



Yellow lawyer cane  
Ngadionji name: jungganiju

Images are Creative Commons Attribution 2.0 Generic licensed photos  
Bamboo: <http://commons.wikimedia.org/wiki/File:Bamboo.jpg> accessed 17 May 2010  
Yellow lawyer cane: [http://commons.wikimedia.org/wiki/File:Yellow\\_lawyer\\_cane.jpg](http://commons.wikimedia.org/wiki/File:Yellow_lawyer_cane.jpg) accessed 17 May 2010  
Ngadionji shelter: [http://commons.wikimedia.org/wiki/File:Ngadionji\\_shelter.jpg](http://commons.wikimedia.org/wiki/File:Ngadionji_shelter.jpg) accessed 17 May 2010

## Investigate

### Scientific idea 3:

I wonder if some woods have properties that make them better for building shelters.

11. Write a focus question to investigate this idea.

### Focus question 3:

Will bamboo bend more than yellow lawyer cane?  
.....  
.....

12. Plan an investigation to collect data that answers your focus question.

a) Planning for a fair test

What will be **changed**? The material (bamboo or cane).....  
.....

What will be **measured or observed**? How far the material bends.....  
over before it starts to break (distance).....  
.....

What will be **kept the same**? .....  
.....  
• the length of the materials .....  
• the ruler used to measure the distance (bend) .....  
• the starting position of the materials .....  
.....

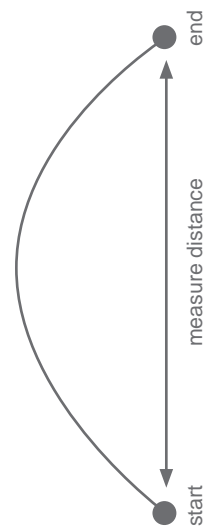
## Model response

### b) Materials

- bamboo and cane piece, 50 cm long
- ruler
- large piece of paper
- desk

### c) Method

- Step 1** Put the paper on the desk and mark a starting point on it.
- Step 2.** Hold the bamboo on the mark and bend it over until the other end touches the desk. Move the end closer to the start by bending it as far as it can go until you hear it start to break.
- Step 3.** Put a mark on the paper where it reaches.
- Step 4.** Measure the distance with a ruler and record it in a table.
- Step 5.** Do this 2 more times.
- Step 6.** Repeat the method using the cane.



## Reflection

New materials are being made by scientists all over the world. Three examples are described below.

### ☐ Aerogel

One of the lightest materials ever developed. It is a glass-like mixture that is 96% air.

#### Properties

- lightweight
- strong
- can be recycled
- good insulator

### ☐ Spider silk (manufactured)

A rubber mixture with nano-crystals of clay in it to make it extremely stretchy.

#### Properties

- elastic
- strong
- lightweight
- waterproof

### ☒ Sugru

A soft plasticine-like material.

#### Properties

- sticks to many surfaces
- can be moulded
- sets hard
- waterproof
- non-slip

13. Choose one new material by ticking the box next to its name.

- a) **A purpose for this material could be:** .....  
to make grips for swimming pool steps. ....
- b) **State how its properties are useful for this purpose.**  
Sugru sticks to many surfaces, and so will stick to tile or cement steps.  
You can mould it to fit the shape of the steps. It sets hard after moulding  
and so will keep its shape for a long time and won't rub off in the water  
because it is waterproof. Most importantly it will let your feet grip the  
steps, making the pool safer when you get out.

## Notes

# Guide to making judgments — Year 4 Science

Name .....

**Focus:** Use fair tests to relate the properties of materials to their purpose.

Knowledge and understanding	Investigating	Investigating	Communicating	Reflecting
Identifies properties of materials and understands that materials are chosen for a purpose because of their properties. Questions 1–3	Poses a simple question, makes a prediction to be tested, identifies elements of and plans a fair investigation. Questions 4, 7, 8, 11, 12	Collects and organises data and observations. Draws a conclusion supported by the data and the identified properties of materials. Questions 5, 6, 9	Uses scientific terminology and appropriate formats to communicate properties of materials, observations, explanations and a method in investigations. Questions 6, 12 and throughout	Reflects on learning to evaluate a prediction and to identify a future application of a new material. Questions 10, 13
<p>Identifies properties and materials appropriate for making toy planes. Relates properties to purpose.</p> <p>Identifies properties of given materials and the purpose of the object.</p> <p>Identifies properties.</p>	<p>Writes a method that controls variables.</p> <p>Comments on the fairness of the test using evidence from tables. Writes a method that measures/observes the flexibility of woods.</p> <p>Makes a prediction based on the properties of the materials. Poses a relevant focus question and identifies elements to be changed, measured/observed and controlled.</p> <p>Writes a statement or open focus question. Makes a prediction.</p>	<p>Explains conclusion with reference to a scientific idea or states a cause and effect.</p> <p>Records observations that affect the data. Links the conclusion to a property of the material.</p> <p>Accurately calculates the totals in the data table and uses them to draw a conclusion.</p> <p>Records data and relevant observations.</p>	<p>Consistently uses scientific terminology. Communicates a method using a logical and concise procedural format.</p> <p>Uses scientific terminology to communicate properties, observations, explanation or method.</p> <p>Communicates a sequenced method.</p> <p>Communicates properties, observations, explanations or method.</p>	<p>Explains how all of the listed properties are useful for the suggested purpose. Evaluates the prediction with reference to thinking, learning or evidence.</p> <p>Provides a relevant reason for why the prediction is/is not correct. Links at least one property of the new material to the suggested purpose.</p> <p>Suggests a purpose for a new material and restates the relevant properties.</p>
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>

Feedback .....

.....