Ink spots

Teacher guidelines

4

Science

Queensland Comparable
Assessment Tasks
(QCATs) 2011

Queensland Government
Queensland Studies Authority

Queensland Studies Authority

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Contents

The 2011 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 (back page).

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

Additional resources

2011 QCATs Information statement
www.qsa.qld.edu.au/3163.html

Essential Learnings and Standards
www.qsa.qld.edu.au/574.html

Important dates

Friday 24 June	QCATs packages have arrived in schools
Monday 11 July ↓ Friday 16 September	Schools: • administer QCATs at any time during the school weeks of this period • grade QCATs • select five student samples that are representative of grades awarded
Monday 10 October	Schools are notified if selected to submit student samples for QSA's random sampling process
Monday 21 November	Final day for schools to submit student data to QSA
Friday 9 December*	Schools must retain all Student booklets 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
- experience with the types of questions used within the QCAT.

Suggested learning experiences and resources are outlined in the document 2011 QCATs – Preparation.

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

Additional resources Queensland Comparable Assessment Tasks (QCATs)
www.qsa.qld.edu.au/3163.html

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 Queensland Studies Authority (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/3163.html

Equity
www.qsa.qld.edu.au/10188.html

Teacher preparation

Check the 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 implementation, considering these points:
  - teachers have flexibility to implement the QCATs at any time during the designated period
  - 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
  - QCATs will ideally replace an existing piece of assessment in the student portfolio of work for Semester 2.
- 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

Queensland Comparable Assessment Tasks (QCATs)
www.qsa.qld.edu.au/3163.html

Sample responses, QSA Assessment Bank
https://qcar.qsa.qld.edu.au/assessmentbank (registration required)

8 – Using Queensland Comparable Assessment Tasks (QCATs) to support learning
www.qsa.qld.edu.au/3166.html

Implementation

Setting up

Students carry out two investigations as part of the assessment task.

Please read Preparation for investigations on page 27 for advice on material selection and preparation.

Working with the Student booklet

Use advice given in the Annotated Student booklet (page 8) to set the conditions that ensure all students have the opportunity to do their best work.

Encourage students 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	10 minutes
Investigating properties: Solubility	20 minutes (carried our after Question 1)

The assessment task

Identifying properties (Question 1)	10 minutes
Choosing an ink to label my hat	30 minutes
Choosing an ink to write in a journal	30 minutes
Reflecting	10 minutes

Suggested time: 10 minutes

Compare these important properties with properties of art paint that are less important, such as *smooth*, *lightweight*.

Read the words in the Properties word bank.

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

To demonstrate these properties, you may provide a variety of materials for students to observe and touch.

Add other words or phrases from class discussion or students' learning experiences.

Define *durable* as hard-wearing. A durable ink or paint would not fade over time.

Emphasise the difference between the properties *waterproof* and *insoluble* by giving examples.

Setting the scene: Group discussion

Different materials have different properties.

Some properties are **more useful** for a particular purpose than other properties. These are **important** properties.

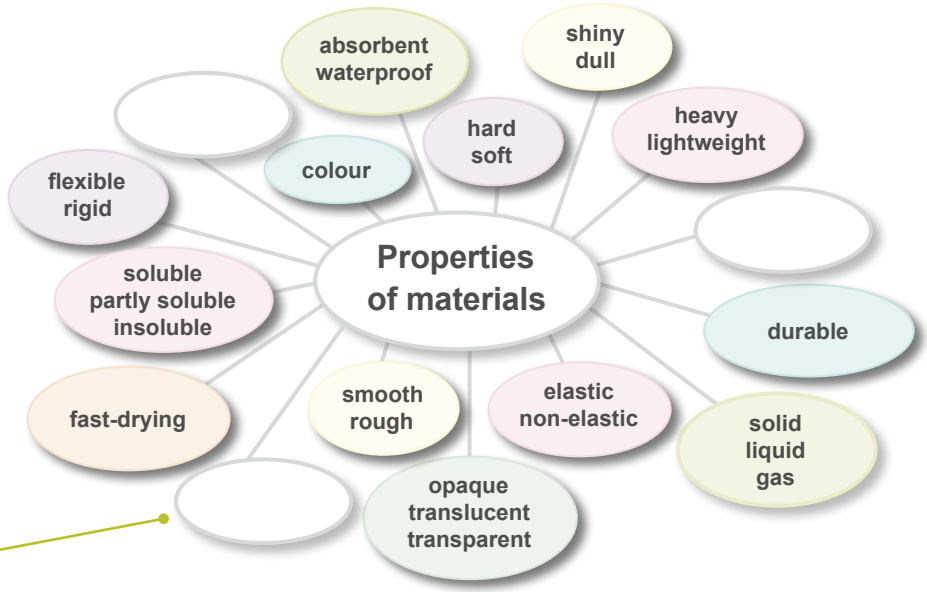
For example, art paint is often **non-toxic** and **water-soluble**.

Discuss why these two properties are important for children's art paint.

Discuss some other important properties of art paint.

Use the **Properties word bank** below.

Properties word bank



As you work through the QCAT with students, check for understanding of the task and provide clarification as needed.

Where students ask individual questions, answers should be shared with all students wherever possible.

In this assessment, you will:

- identify some important properties of materials
- investigate the best ink to label a hat
- investigate the best ink to write in a journal
- reflect on the property of flexibility in different materials.

Identifying properties

Suggested time: 10 minutes

1. Tick (✓) the properties that are important in the materials listed.

	Material and purpose		
	red nail polish (dry) to make nails colourful	**highlighter ink** to make some words stand out on the page	**face paint** to decorate a face
			
hard			
water-soluble dissolves in water			
durable hard-wearing			
opaque			
transparent			

Check for understanding of each property listed in the table.

One or more properties may be identified for each material.

Stop here: Wait for your teacher's directions.

Stop here directions are placed at convenient points to finish a session, or to discuss the next part of the QCAT.

What is being assessed

Question 1 gathers evidence of knowledge of properties and understanding of the link between properties and purpose of materials.

Students demonstrate this by identifying the properties (from a given list) important for each stated purpose.

Suggested time: 20 minutes

Students choose a black pen for this first paper strip test.

See Preparation for investigations on page 27 for guidance on running the investigation.

Investigating properties: Solubility

The property **solubility** describes how well a material dissolves.

Set up a paper strip test

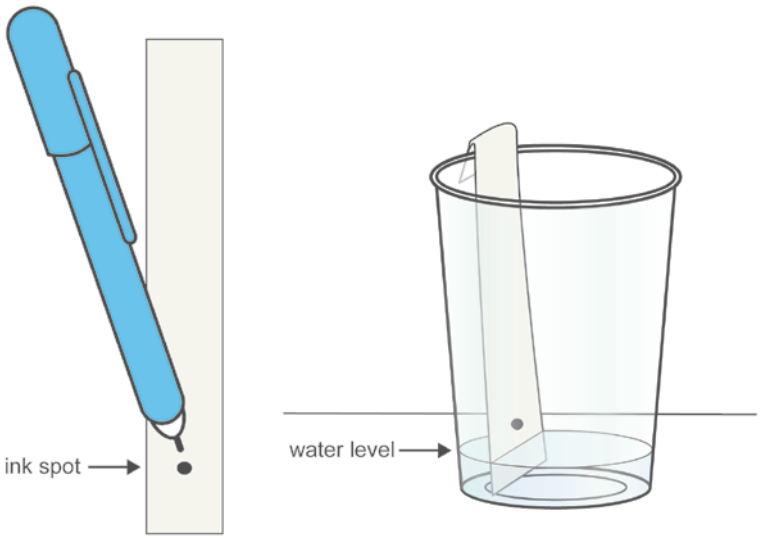
Use the materials provided by your teacher to test a property of ink.

- Choose a black pen from around the room.
- Write your name on the top of the paper strip.
- Colour a small spot near the bottom of the strip.
- Fold the strip over the cup so that it sits in the water as shown in the diagram.
- Set your test aside.

Demonstrate how to set up the paper strip and cup.

Emphasise that the ink spot is not covered by water in the cup.

Estimate where to fold the strip by holding the strip on the outside of the cup before placing it in the water.



Stop here: Wait for your teacher's directions.

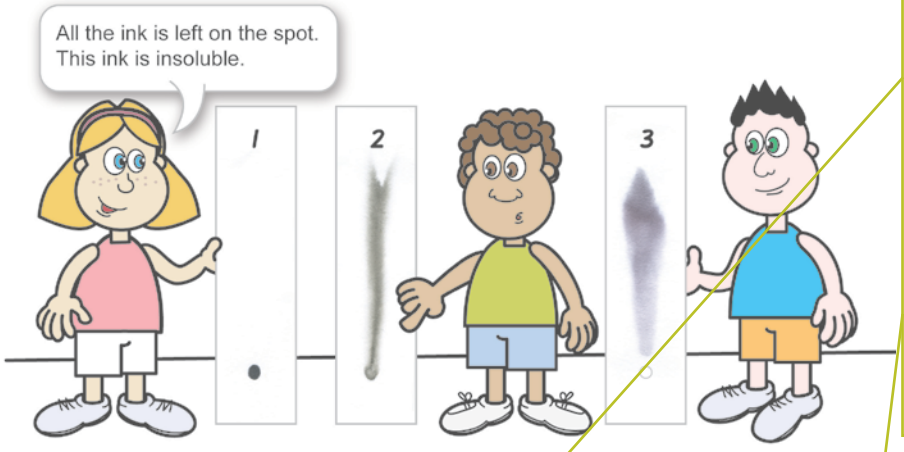
The paper strip test will take 3–4 minutes to finalise. Results will begin to appear as soon as water is absorbed through the paper and ink.

This activity is not assessed.

Discuss results with the class, checking for understanding.

Observe a paper strip test

Three students tested the solubility of some black pens from around their classroom. They used a paper strip test like the one you have just set up.



Ink 1 is insoluble. Look at its position on the scale below.

1

insoluble	partly soluble	soluble
All of the ink is left on the spot.	Some of the ink is left on the spot.	None of the ink is left on the spot.

Write the numbers 2 and 3 on the scale above to show the solubility of each ink.

Observe your paper strip test

- Observe your paper strip to see the amount of ink left on the spot.
- Compare and discuss your paper strip with your classmates.
- Draw a cross (✗) on the scale above to show the solubility of the ink you tested.

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Ask students to write "2" and "3" on the solubility scale, then discuss responses.

Ink 2 is partly soluble, with about half of the ink left on the spot, and is likely to be positioned near the middle of the scale.

Ink 3 is soluble, with no ink left on the spot, and is likely to be positioned at the far left of the scale.

Allow students to compare and discuss their own paper strip result with others and check for:

- understanding of *solubility* in this context
- use of the whole scale.

Ensure students have shown the relative solubility of their ink on the scale using the definitions provided.

Students may attach their paper strip to this page when dry.

Some black inks tested may contain a mixture of dyes and therefore show a separation of colours.

This is explored on page 6 of the Student booklet.

This activity is not assessed.

Discuss results with the class, checking for understanding.

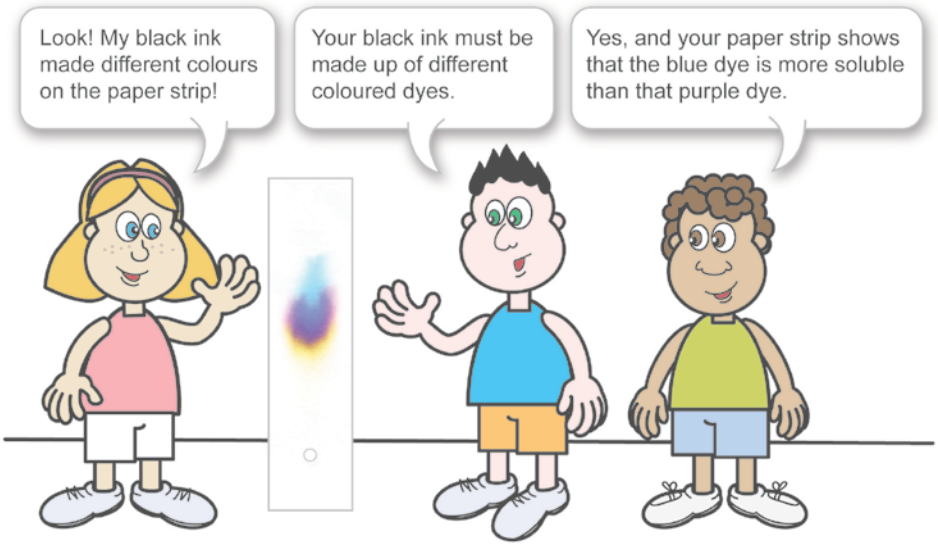
Choose three students to roleplay this scenario.

A surprising result!

One student observed the result below on her paper strip.

Compare and discuss with your class any paper strips that show coloured patterns.

Encourage students to use these statements as a model to describe any results that show colour separation.



Some black inks are made up of different coloured dyes.

Suggested time: 30 minutes

Choosing an ink to label my hat

I want to label my school hat. When my hat is labelled with my name, it can be returned to me if lost.

2. a) Why is pen ink better than a pencil to label a hat?

.....

.....

b) List some important properties of an ink you would use to label a hat.

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

- .....
- .....
- .....

Stop here: Discuss how a paper strip test could help you choose an ink.

What is being assessed

Question 2 gathers evidence of knowledge of properties and understanding of the link between properties and purpose of materials.

Students demonstrate this by stating the advantage of using a pen over a pencil and listing the important properties (not given) of an ink to label a hat.

Carefully choose three different black pens with different solubilities for students to test.

Students work in groups. Each student tests one pen.

See Preparation for investigations on page 27 for guidance on the investigation.

Draw attention to the elements of a fair test.

Each student will:

- test one pen
- share the paper strip results with their group
- compare and discuss results
- complete the Observations table on page 9 of the Student booklet.

Ensure the ink spot is not covered by water in the cup.

Investigate the solubility of three inks

Group work

Question to investigate:

Which pen has the best ink to label my hat?

Planning for a fair test

To be a fair test:

- one thing is **changed** (the ink)
- one thing is **measured** or **observed** (the amount of ink left on the spot)
- all other things are kept the **same**.

Materials

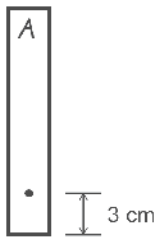
- 3 paper strips
- 1 pencil
- 1 cup with 2 cm water
- 3 different black pens (labelled **A**, **B** and **C**)

I am testing the ink in pen **A** **B** **C**
(circle one)

Method for each strip

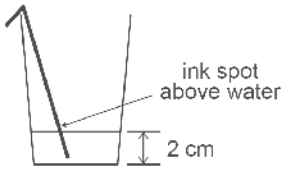
Step 1 Label the strip **A**, **B** or **C** using a pencil.

Step 2 Colour a small spot with the pen, 3 cm from the bottom of the strip.



Step 3 Fold the strip over the cup so that the paper rests in the water.

Step 4 Observe the amount of ink on the spot. Show your paper strip to your group members.
Complete the Observations table on page 9.



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Results should be finalised after 3–4 minutes.

Leave the paper strips where each student in the group can see them to complete the Observations table.

Circle the word in the table that matches your observations for each pen.

Observations table

Ink	Amount of ink left on the spot			
Pen A	all	most	some	none
Pen B	all	most	some	none
Pen C	all	most	some	none

Work by yourself to answer the rest of the questions.

3. The ink in pen A B C is the best to label my hat.
(circle one)

This is because: .....

.....

.....

4. Write A, B and C on the scale below to show the solubility of each ink tested.

insoluble partly soluble soluble

Stop here: Wait for your teacher's directions.

Conduct a discussion of class results, comparing:

- all Pen A results
- all Pen B results
- all Pen C results.

Identify any discrepancies in data and allow students to modify their choices in the Observation table.

Students may return to Question 2 to add any other important properties for an ink to label a hat.

What is being assessed

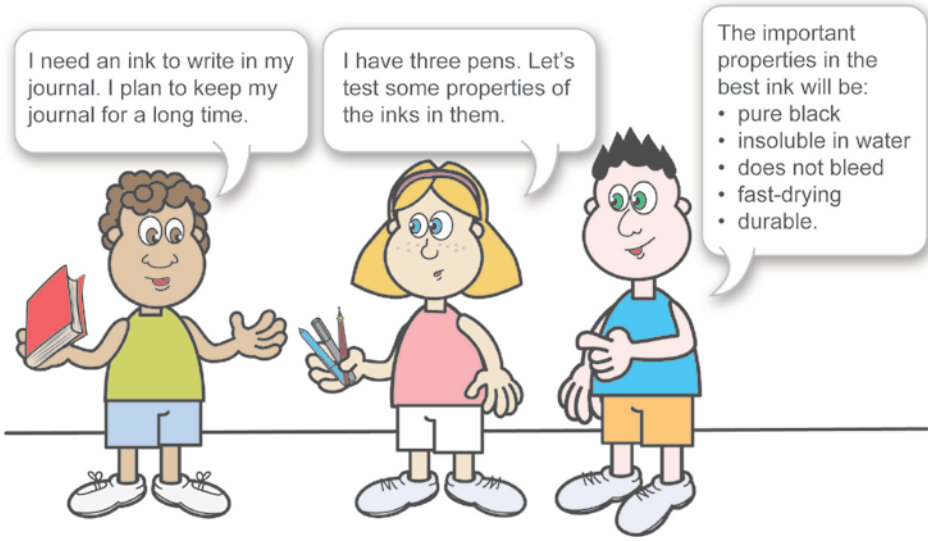
Questions 3 and 4 gather evidence of using data to draw conclusions.

Students demonstrate this by choosing an ink that is consistent with the data and purpose, and showing the relative solubility of each ink on a scale.

Suggested time: 30 minutes

Choosing an ink to write in a journal

Choose three students to roleplay this scenario.



Discuss the purpose and use of journals and diaries.

If your students use a school diary, use this as an example. Mention personal diaries that may be kept for many years.

The property **bleed** describes how much ink will soak through the paper.

Check for understanding of the terms *bleed* and *durable*, but do not discuss why the properties listed are important for this purpose.

The stated important properties could be listed on the board for later reference.

5. **Explain why the properties below are important when choosing an ink to write in a journal.**

- does not bleed (does not soak through the paper to the other side)

  .....

  .....

- fast-drying

  .....

  .....

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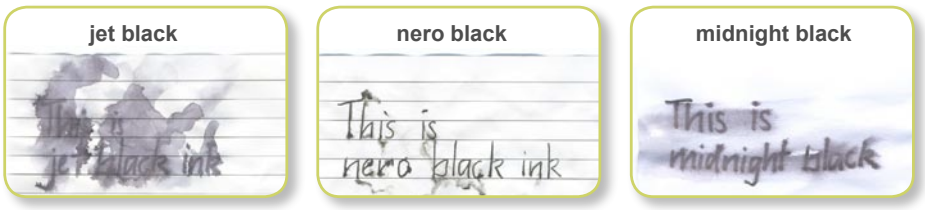
What is being assessed

Question 5 gathers evidence of knowledge of properties and understanding of the link between properties and purpose of materials.

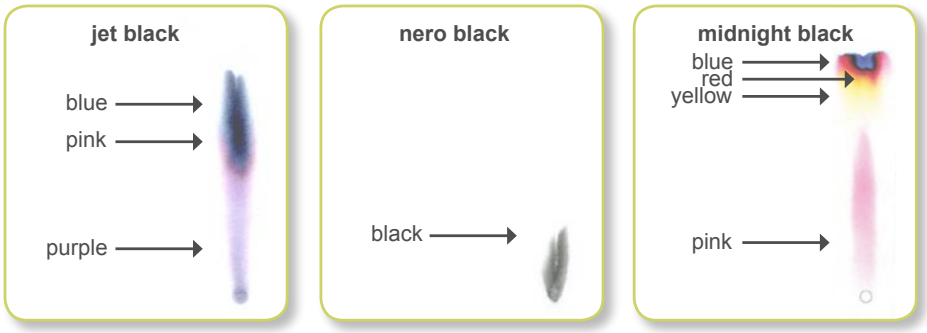
Students demonstrate this by explaining why the given properties are important for the given purpose.

Three tests were performed to compare some properties of the black inks.
The results of each test are shown below.

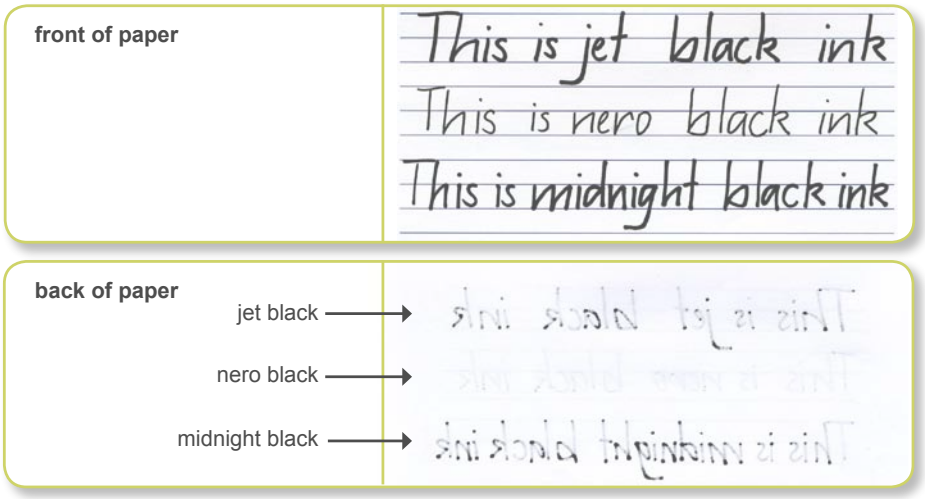
Test 1. We poured water across the paper after the ink dried.



Test 2. We did a paper strip test in water.



Test 3. We wrote on paper and compared the front and back.



6. **Complete the Observations table below.**

- Choose the properties tested from the **Properties list**.
- Record your observations.

Properties list

colour	drying time	bleed
solubility	hardness	durability

Properties may be used once, more than once or not at all.

Observations table

	Property tested	Observations
Test 1	• *solubility*	*All three inks were affected by water. Jet ran the most and was hardest to read. Nero ran the least and was the easiest to read.*
Test 2	• •	
Test 3	•	

Point out that students must identify two properties for Test 2.

7. **The best ink to write in a journal is** jet black / nero black / midnight black **because:**

(circle one)

.....

.....

.....

Ask students to look at the cartoon on page 10 in the Student booklet, and re-read the list of important properties in a journal for ink.

List them on the board if required.

What is being assessed

Question 6 gathers evidence of recording and organising observations.

Students demonstrate this by identifying the properties of each test, and recording observations from the results.

Question 7 gathers evidence of using data to draw conclusions.

Students demonstrate this by identifying an ink consistent with its stated purpose, listed important properties and results.

Refer students to Test 1 on page 12 of the Student booklet. Encourage them to re-examine the results carefully when answering Question 8.

Refer students to page 10 of the Student booklet or the board and revise the list of important properties of an ink to use in a journal.

Choose three students to roleplay this scenario.

Look at Test 1 on page 12.

8. **Test 1** is / is not **a fair test.**

(circle one)

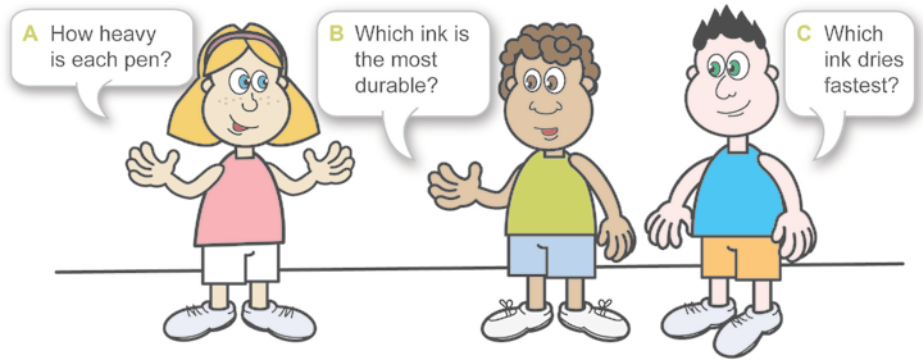
This is because: .....

.....

.....

Look at the important properties for the best ink to write in a journal listed on page 10. Not all of these properties were tested.

Each student posed another question to investigate in a lesson.



9. **Question C is better than A because:** .....

.....

.....

Question C is better than B because: .....

.....

.....

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What is being assessed

Question 8 gathers evidence of identifying elements of a fair test.

Students demonstrate this by judging the fairness of Test 1 using evidence from the results.

Question 9 gathers evidence of understanding scientific investigation questions.

Students demonstrate this by comparing the three questions and giving reasons why Question C is better than questions A and B.

Suggested time: 10 minutes

Reflecting

The property **flexibility** describes how well a material bends.

10. a) Write A, B and C on the scale below to show the flexibility of each material.

A garden hose

B toothpaste tube

C outdoor chair

rigid — flexible

b) Explain the position of each material on the scale.

Hint

Think about:

- the **purpose** of the object
- the **flexibility** of the material.

garden hose: .....

.....

toothpaste tube: .....

.....

outdoor chair: .....

.....

Check for understanding of the words that describe the flexibility of a material: *rigid* and *flexible*.

Remind students to consider the whole scale.

What is being assessed

Question 10 gathers evidence of applying understandings of the link between properties and purpose to a new context.

Students demonstrate this by showing the relative flexibility of each material on the scale and giving reasons that support each position.

Making judgments

Use the Guide to making judgments (GTMJ) on the back page 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 (registration required)

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

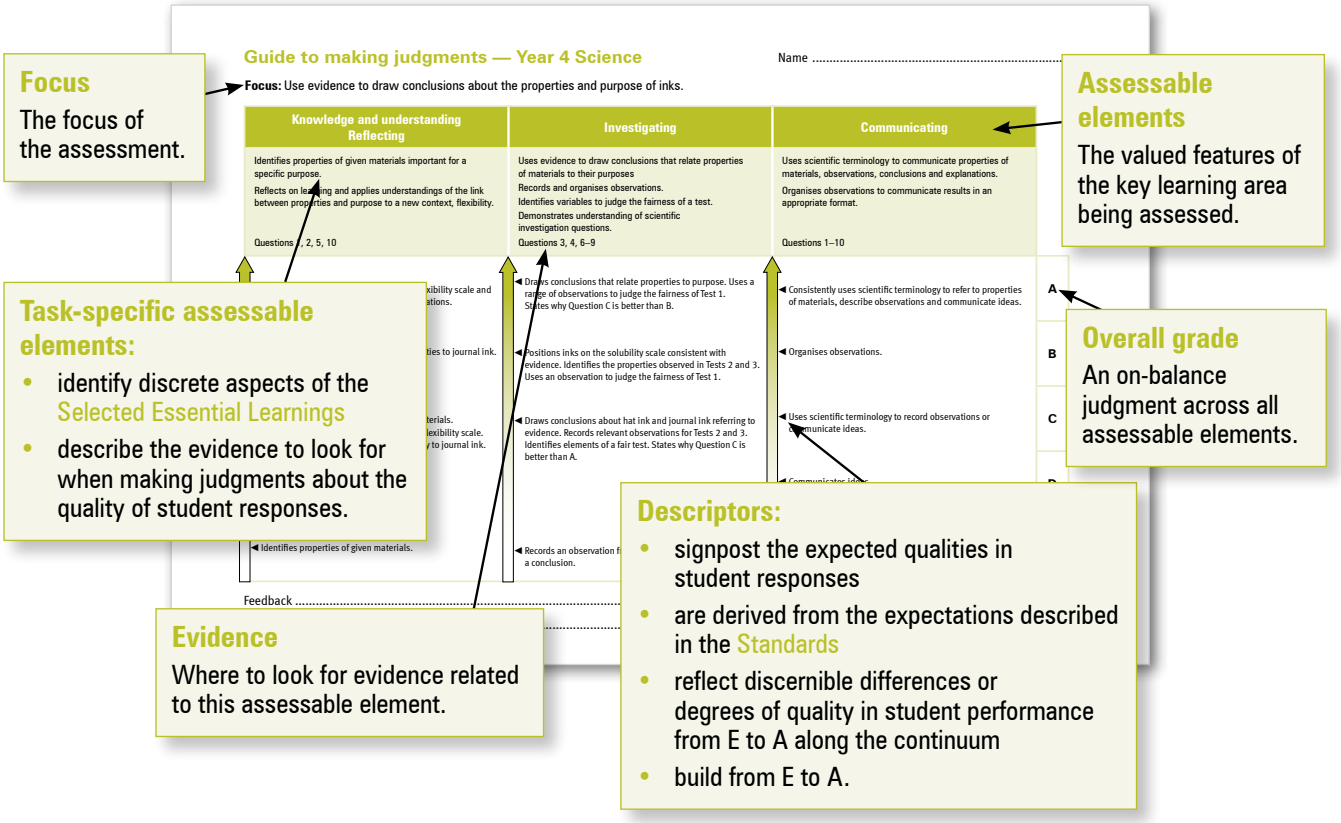
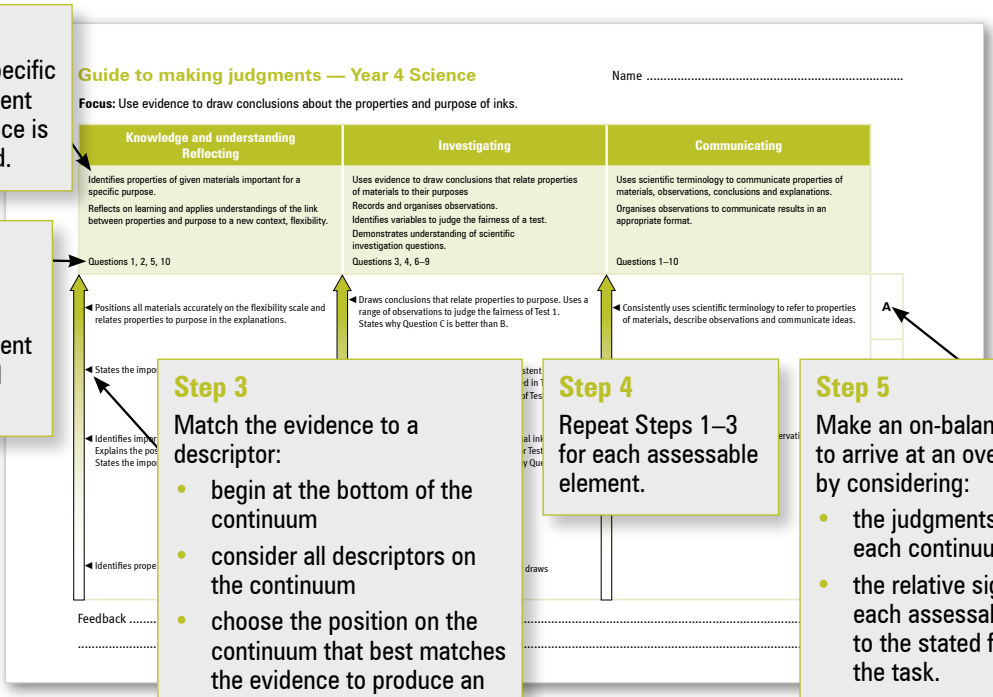


Diagram 2: Using the GTMJ — the judgment process



Step 1

Read the task-specific assessable element for which evidence is being considered.

Step 2

Locate all the evidence for an assessable element in the completed Student booklet.

Step 3

Match the evidence to a descriptor:

- begin at the bottom of the continuum
- consider all descriptors on the continuum
- choose the position on the continuum that best matches the evidence to produce an on-balance judgment for the assessable element
- look at Model and Sample responses for clarification if necessary.

Step 4

Repeat Steps 1–3 for each assessable element.

Step 5

Make an on-balance judgment to arrive at an overall grade by considering:

- the judgments recorded on each continuum
- the relative significance of each assessable element to the stated focus of the task.

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/3163.html

Sample responses, QSA Assessment Bank
https://qcar.qsa.qld.edu.au/assessmentbank (registration required)

Resources

Selected Essential Learnings

This QCAT 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	
Assessable elements The valued features of the key learning area about which evidence of learning is collected and assessed.	**Ways of working** The processes students use to develop and demonstrate their knowledge and understanding. Students are able to:
Investigating	• pose and refine simple questions, and make predictions to be tested • plan activities and investigations, identifying and using elements of a fair test • collect and organise data, information and evidence • draw conclusions that are supported by evidence, reproducible data and established scientific concepts
Communicating	• communicate scientific ideas, data and findings, using scientific terminology and formats appropriate to context and purpose
Reflecting	• reflect on learning to identify new understandings and future applications.
	Knowledge and understanding The essential concepts, facts and procedures.
Knowledge and understanding	***Natural and processed materials*** **Properties, changes and uses of materials are related.** • Materials are used for a particular purpose because of their specific properties.

Source: www.qsa.qld.edu.au/7297.html

Connection to the Australian Curriculum

This QCAT connects to the following content descriptions of the Australian Curriculum.

The Australian Curriculum: Year 4 Science	Version 1.2
Strands	**Content descriptions**
Science Understanding	***Chemical sciences*** • Natural and processed materials have a range of physical properties; these properties can influence their use.
Science Inquiry Skills	***Questioning and predicting*** • With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge. ***Planning and conducting*** • Suggest ways to plan and conduct investigations to find answers to questions. • Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate. ***Processing and analysing data and information*** • Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends. ***Evaluating*** • Reflect on the investigation; including whether a test was fair or not. ***Communicating*** • Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports.
Source: Australian Curriculum, Assessment and Reporting Authority (ACARA) 2011, www.australiancurriculum.edu.au/Science Resources: QSA 2011, www.qsa.qld.edu.au/13658.html	

Preparation for investigations

Materials list for this QCAT

- plastic cups (1 per student or 1 per group of 3)
- paper strips, approximately 2 x 12 cm (2 per student plus additional spares)
- various black pens from around the classroom
- 3 black pens chosen for their differing solubility (1 set per group or 1 set per class): see table below.

Material selection

- paper — try coffee filter paper, laboratory filter paper, paper towel (photocopy paper is not suitable for this purpose as it will not absorb water)
- pens — try felt pens (likely to show colour separation), markers, biros, whiteboard pens
- cups — use any container such as a plastic cup or small glass jar to hold the water and the paper strip

Set up a paper strip test (Student booklet page 4)

- Each student will perform a paper strip test using a black pen from those collected in the classroom.
- It is important to carry out the test prior to implementing the QCAT to be sure that you will generate a good range of results that will stimulate group discussion.

Investigate the solubility of three inks (Student booklet page 8)

- Select three pens that meet the criteria described in the table below.
- Label the pens A, B and C. Place the label over the pen name and any description of solubility to avoid students' drawing conclusions about solubility from the label.
- Try to choose pens of similar-sized points/nibs.
- Students will work in groups of three to test pens A, B and C supplied by you.
- It is important to carry out the test prior to implementing the QCAT to ensure you will get suitable results.

Selecting pens for solubility test, Student booklet page 8

Pen	Property	Possible types
A, C	some solubility	water-soluble pens such as Uniball eye, textas, felt pens, non-permanent overhead transparency pen
B	insoluble	permanent pens such as Sharpie or Nikko

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

Different materials have different properties.

Some properties are **more useful** for a particular purpose than other properties. These are **important** properties.

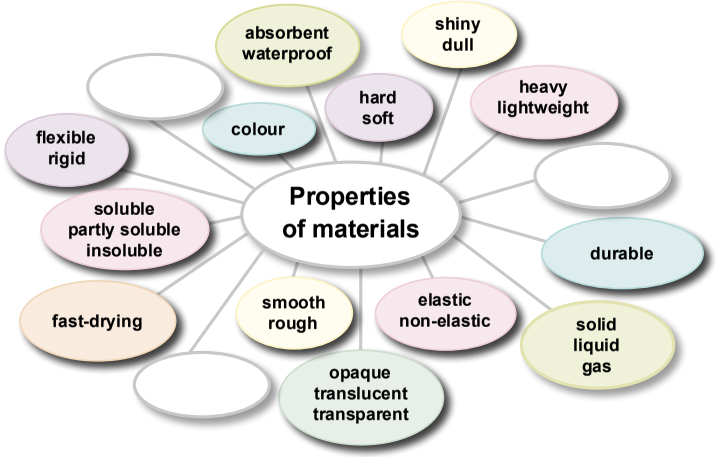
For example, art paint is often **non-toxic** and **water-soluble**.

Discuss why these two properties are important for children's art paint.

Discuss some other important properties of art paint.

Use the **Properties word bank** below.

Properties word bank



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Images p. 3 Highlighter pen: 4061552 <www.123rf.com/photo_4061552_highlighter-and-word-idea--concept-business-background.html>; Face painting: used with permission — © John Miles/Survival — Survival International supports the rights of tribal peoples worldwide, helping to defend their lives, protect their lands and determine their own futures. For more information, films and photographs log onto <www.survivalinternational.org>; p. 15 Garden hose: 6207941, <www.123rf.com/photo_6207941_coiled-rubber-garden-hose-on-grass--horizontally-framed-shot.html>; Toothpaste tube: <www.123rf.com/photo_2505332_partially-empty-tube-of-tooth-paste-over-red-background.html>; Blue chair: procsilas' photostream, "happy to serve" <www.flickr.com/photos/procsilas/3869782763> Creative Commons Attribution 2.0 Generic licensed photo <http://creativecommons.org/licenses/by/2.0> accessed 10 Mar 2011. All other images © QSA.

In this assessment, you will:

- identify some important properties of materials
- investigate the best ink to label a hat
- investigate the best ink to write in a journal
- reflect on the property of flexibility in different materials.

Identifying properties

1. Tick (✓) the properties that are important in the materials listed.

	Material and purpose		
	red nail polish (dry) to make nails colourful	**highlighter ink** to make some words stand out on the page	**face paint** to decorate a face
			
hard	✓		
water-soluble dissolves in water			✓
durable hard-wearing	✓	✓	
opaque	✓		✓
transparent		✓	

Stop here: Wait for your teacher's directions.

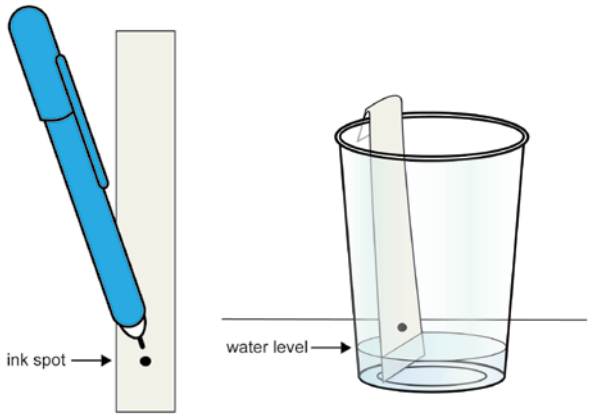
Investigating properties: Solubility

The property **solubility** describes how well a material dissolves.

Set up a paper strip test

Use the materials provided by your teacher to test a property of ink.

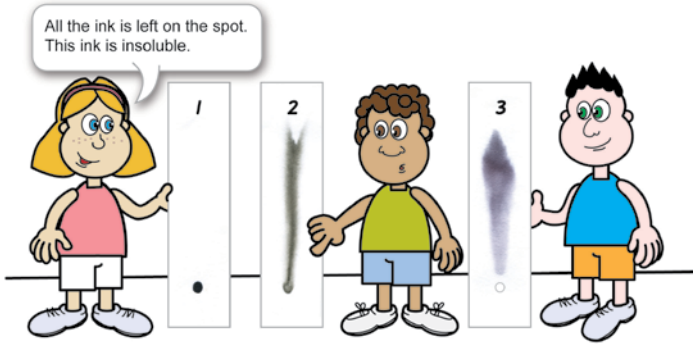
- Choose a black pen from around the room.
- Write your name on the top of the paper strip.
- Colour a small spot near the bottom of the strip.
- Fold the strip over the cup so that it sits in the water as shown in the diagram.
- Set your test aside.



Stop here: Wait for your teacher's directions.

Observe a paper strip test

Three students tested the solubility of some black pens from around their classroom. They used a paper strip test like the one you have just set up.



Ink 1 is insoluble. Look at its position on the scale below.

1

insoluble	partly soluble	soluble
All of the ink is left on the spot.	Some of the ink is left on the spot.	None of the ink is left on the spot.

Write the numbers 2 and 3 on the scale above to show the solubility of each ink.

Observe your paper strip test

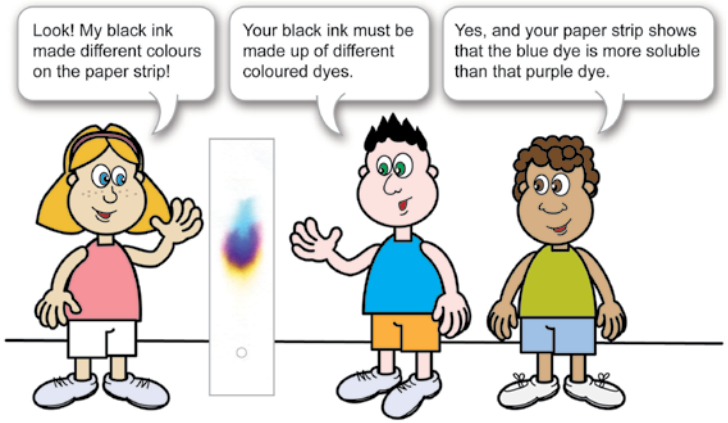
- Observe your paper strip to see the amount of ink left on the spot.
- Compare and discuss your paper strip with your classmates.
- Draw a cross (✗) on the scale above to show the solubility of the ink you tested.

Model response

A surprising result!

One student observed the result below on her paper strip.

Compare and discuss with your class any paper strips that show coloured patterns.



Some black inks are made up of different coloured dyes.

Choosing an ink to label my hat

I want to label my school hat. When my hat is labelled with my name, it can be returned to me if lost.

2. a) Why is pen ink better than a pencil to label a hat?

Pencil rubs off easily.

b) List some important properties of an ink you would use to label a hat.

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

- opaque
- insoluble (permanent)
- fast-drying

Note to teachers: Other relevant properties include: *dark colour*, *durable*.

Irrelevant properties include: *absorbent*, *smooth*, *soft*.

Stop here: Discuss how a paper strip test could help you choose an ink.

Model response

Note to teachers: Responses to Questions 2–4 will vary depending on the pens provided by the teacher for testing.

Investigate the solubility of three inks

Group work

Question to investigate:
Which pen has the best ink to label my hat?

Planning for a fair test

To be a fair test:

- one thing is **changed** (the ink)
- one thing is **measured** or **observed** (the amount of ink left on the spot)
- all other things are kept the **same**.

Materials

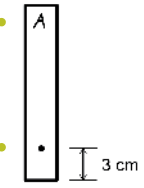
- 3 paper strips
- 1 pencil
- 1 cup with 2 cm water
- 3 different black pens (labelled **A**, **B** and **C**)

I am testing the ink in pen **A** **B** **C**
(circle one)

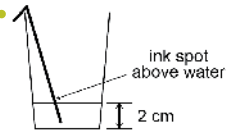
Method for each strip

Step 1 Label the strip **A**, **B** or **C** using a pencil.

Step 2 Colour a small spot with the pen, 3 cm from the bottom of the strip.



Step 3 Fold the strip over the cup so that the paper rests in the water.



Step 4 Observe the amount of ink on the spot. Show your paper strip to your group members.
Complete the Observations table on page 9.

Circle the word in the table that matches your observations for each pen.

Observations table

Ink	Amount of ink left on the spot			
Pen A	all	(most)	some	none
Pen B	(all)	most	some	none
Pen C	all	most	(some)	none

Individual work

Work by yourself to answer the rest of the questions.

3. The ink in pen A (B) C is the best to label my hat.
(circle one)

This is because: Pen B is insoluble in water and will stay on the hat when it gets wet or is washed.

4. Write A, B and C on the scale below to show the solubility of each ink tested.

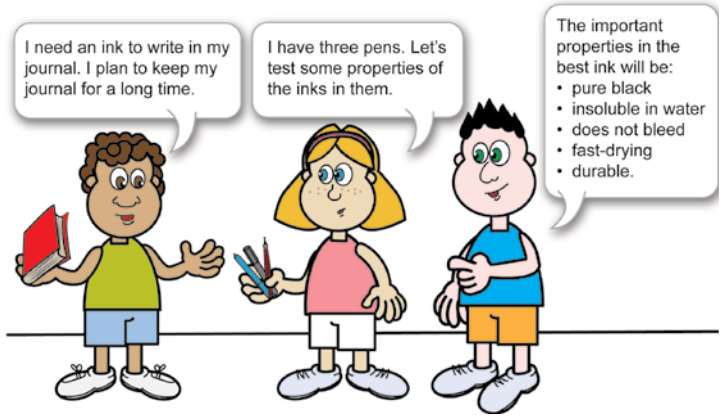
B A C

insoluble **partly soluble** **soluble**

Stop here: Wait for your teacher's directions.

Model response

Choosing an ink to write in a journal



The property **bleed** describes how much ink will soak through the paper.

5. Explain why the properties below are important when choosing an ink to write in a journal.

- does not bleed (does not soak through the paper to the other side)

so you can write on both sides of the paper and still read the writing

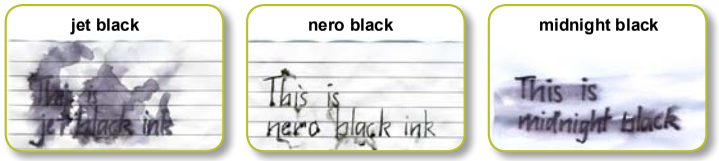
- fast-drying

so you don't smudge it when writing or when you close the book

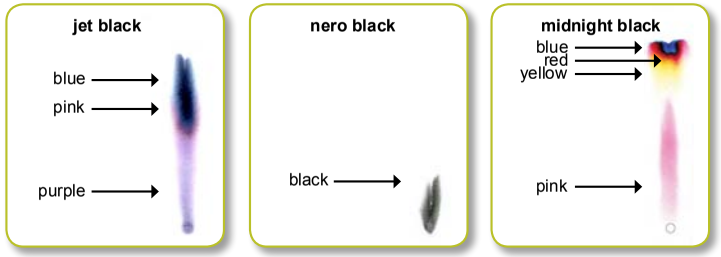
Model response

Three tests were performed to compare some properties of the black inks.
The results of each test are shown below.

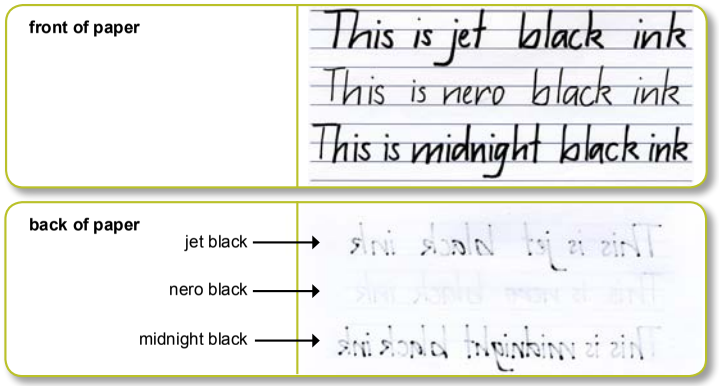
Test 1. We poured water across the paper after the ink dried.



Test 2. We did a paper strip test in water.



Test 3. We wrote on paper and compared the front and back.



6. Complete the Observations table below.

- Choose the properties tested from the Properties list.
- Record your observations.

Properties list

colour	drying time	bleed
solubility	hardness	durability

Observations table

	Property tested	Observations
Test 1	• solubility	All three inks were affected by water. Jet ran the most and was hardest to read. Nero ran the least and was the easiest to read.
Test 2	• colour • solubility	Nero has only one colour. Midnight and jet are made up of different coloured dyes. More of the ink is left on the Nero spot, so it is the least soluble.
Test 3	• bleed	Midnight soaks through the paper more than the other two inks. Nero soaks through the paper the least.

7. The best ink to write in a journal is jet black / **nero black** / midnight black (circle one) **because:**

Nero has three important properties for the best journal ink:
it is the only ink that is pure black, it is less soluble in water than the other two inks, and it does not bleed.

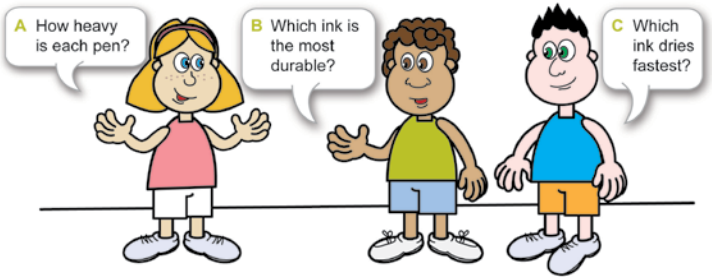
Model response

Look at Test 1 on page 12.

8. **Test 1** ~~is~~ **is not** **a fair test.**
(circle one)

This is because: more than one thing was changed in the test: the ink, the type of paper, the writing, and how the water was poured across the paper.

Look at the important properties for the best ink to write in a journal listed on page 10. Not all of these properties were tested.
Each student posed another question to investigate in a lesson.



9. **Question C is better than A because:** A tests a property of the pen, not the ink.

Question C is better than B because: you cannot test durability in a lesson, it would take too long.

Reflecting

The property **flexibility** describes how well a material bends.

10. **a) Write A, B and C on the scale below to show the flexibility of each material.**


A garden hose


B toothpaste tube


C outdoor chair

C A B

rigid **flexible**

b) Explain the position of each material on the scale.

Hint

Think about:
- the **purpose** of the object
- the **flexibility** of the material.

garden hose: flexible enough to roll up, not too flexible that the water can get cut off if you stand on it

toothpaste tube: very flexible, so that you can squeeze it to get out all the toothpaste

outdoor chair: needs to be very rigid so it keeps its shape when you sit on it, but a little bit flexible so that it is comfortable

Notes

Guide to making judgments — Year 4 Science

Name .....

Focus: Use evidence to draw conclusions about the properties and purpose of inks.

Knowledge and understanding Reflecting	Investigating	Communicating	
Identifies properties of given materials important for a specific purpose. Reflects on learning and applies understandings of the link between properties and purpose to a new context, flexibility. Questions 1, 2, 5, 10	Uses evidence to draw conclusions that relate properties of materials to their purposes Records and organises observations. Identifies variables to judge the fairness of a test. Demonstrates understanding of scientific investigation questions. Questions 3, 4, 6–9	Uses scientific terminology to communicate properties of materials, observations, conclusions and explanations. Organises observations to communicate results in an appropriate format. Questions 1–10	
◀ Positions all materials accurately on the flexibility scale and relates properties to purpose in the explanations.	◀ Draws conclusions that relate properties to purpose. Uses a range of observations to judge the fairness of Test 1. States why Question C is better than B.	◀ Consistently uses scientific terminology to refer to properties of materials, describe observations and communicate ideas.	**A**
◀ States the importance of both given properties to journal ink.	◀ Positions inks on the solubility scale consistent with evidence. Identifies the properties observed in Tests 2 and 3. Uses an observation to judge the fairness of Test 1.	◀ Organises observations.	**B**
◀ Identifies important properties of given materials. Explains the positions of materials on the flexibility scale. States the importance of one given property to journal ink.	◀ Draws conclusions about hat ink and journal ink referring to evidence. Records relevant observations for Tests 2 and 3. Identifies elements of a fair test. States why Question C is better than A.	◀ Uses scientific terminology to record observations or communicate ideas.	**C**
		◀ Communicates ideas.	**D**
◀ Identifies properties of given materials.	◀ Records an observation from Test 2 or 3, or draws a conclusion.		**E**

Feedback .....

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