

Sugar, sugar!

Teacher guidelines



9

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 > Prep–Year 9 > QCATs (Years 4, 6 & 9)

Essential Learnings and Standards

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">• 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 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 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. 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 > 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 > Prep–Year 9 > QCATs (Years 4, 6 & 9)
Equity
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 27) 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 > Prep–Year 9 > QCATs (Years 4, 6 & 9)

Implementation

Setting up

- Students need to make a simple hydrometer before starting the assessment. The diagram [Making a hydrometer](#) (page 26) can be given to students to guide them.
- Students will work in groups to carry out the investigation, so only one hydrometer will be needed per group.
- A detailed materials list for the investigation is provided on page 26.

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

Making a hydrometer	15 minutes
Setting the scene: Group discussion	15 minutes
Investigation: How much sugar is in soft drink?	40 minutes

The assessment task

Analysing the investigation	15 minutes
Sugar and your body	40 minutes
Reflecting on your sugar habit	15 minutes

Each group will need a simple hydrometer before carrying out the investigation on page 4 of the **Student booklet**.

See **Making a hydrometer** for guidance (page 26).

Stimulus pictures.



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Sourced images (left to right, top to bottom) are Creative Commons: Attribution 2.0 Generic licensed photos <http://creativecommons.org/licenses/by/2.0> accessed 21 Apr 2010. Jelly beans: NightRPStar's photostream, "13 jelly beans 07", <www.flickr.com/photos/nightrpstar/1586210850/> Soft drink refrigerator: nicksitch's photostream, "IMG_5477", <www.flickr.com/photos/nicksitch/3037315024/> Chocolate: Sona Watson's photostream, "Chocolate", <www.flickr.com/photos/25149290@N02/3871518072/> Sugar bowl: Ayale's photostream, "Raw sugar thimble", <www.flickr.com/photos/ayale/501145395/> Orange juice: Leonid Namchenkov's photostream, "breakfast", <www.flickr.com/photos/namchenkov/70956347/> Chocolate cake: moonlightclub's photostream, "Delicious cake at Tivoli", <www.flickr.com/photos/moonlightclub/4141749322/> Bananas: Carver Calf & Catering's photostream, "Fresh fruit", <www.flickr.com/photos/37466351@N03/354716344/>

Setting the scene: Group discussion



Use the stimulus pictures and speech bubbles to promote discussion on diet, exercise and health, and the possible health risks of a diet high in sugar.

In this assessment, you will:

- measure the sugar content of a soft drink and evaluate the method of measurement
- describe how our body systems work together to provide fuel for the body
- explore the effects of high-sugar drinks on health
- reflect on how sugar may be affecting your health.

Before you start: Assess your sugar consumption

How much sugar do think you consume? (place a mark on the arrow)



Where does most of the sugar you consume come from? (circle one)

fruit fruit juice soft drinks cakes and desserts lollies the sugar bowl

Do you think your sugar consumption is affecting your health? Explain.

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Ask students to think about their sugar consumption and record their opinion here. This will not be assessed, but later in the task students will be asked if their opinion has changed.

Discuss the expectations of the task.

Work through the [Guide to making judgments](#) (page 36) with students to highlight the assessable elements for this QCAT. Explain, in student-friendly terms, the task-specific assessable elements. These identify what is being valued in the student responses.



Suggested time: 40 minutes

Discuss the aim of the investigation.

Provide an appropriate level of support for all students to engage with the investigation.

Investigation: How much sugar is in soft drink?



Follow your teacher's directions to carry out the investigation.

Place students in appropriately-sized groups and provide materials.

See **Materials for the investigation** (page 26) for guidance on preparing materials.

Ask students to make sure their hydrometer is not leaking.

Aim: To measure how many teaspoons of sugar there are in a 375 mL can of soft drink.

Sugar concentration

Solutions with higher sugar concentration have higher densities. The sugar concentration of solutions can be compared by comparing densities, using a hydrometer.

Materials

- beaker
- 2 test tubes
- test-tube rack
- measuring cylinder
- can of soft drink, flat and at room temperature
- water at room temperature
- white sugar
- teaspoon
- stirrer
- fine permanent marking pen
- a hydrometer (prepared earlier)

Do not use diet soft drink!

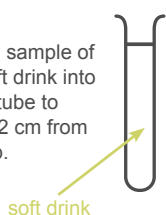
Method

In Steps 1 and 2 you will use your hydrometer to measure the density of the soft drink.

Explain the flow chart instructions, demonstrating where necessary.

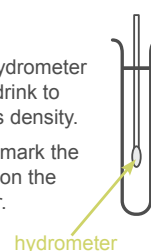
Step 1

Pour a sample of the soft drink into a test tube to about 2 cm from the top.



Step 2

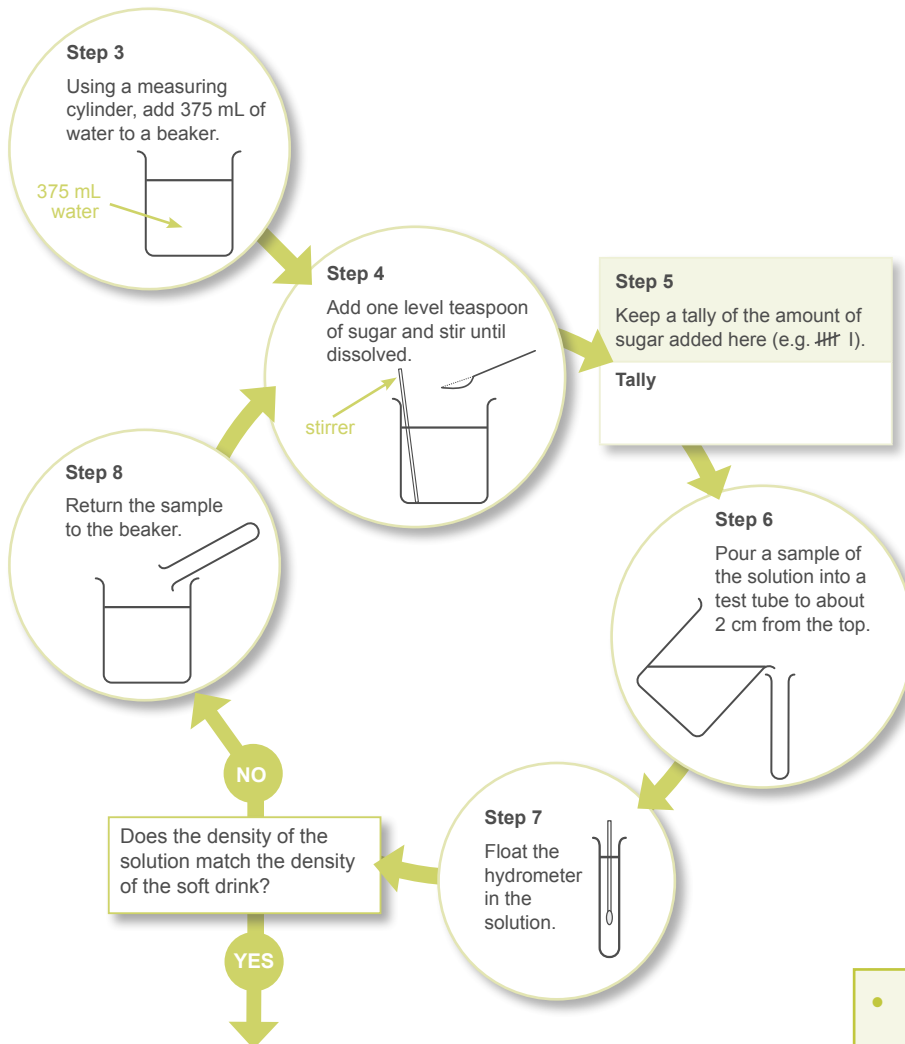
Float the hydrometer in the soft drink to measure its density. Accurately mark the liquid level on the hydrometer.



Assist students in gently moving the hydrometer away from the side of test tube, where it may stick to the glass.

Hint: Use the marking pen to make tentative marks on the hydrometer (straw), and then check the level before marking clearly.

In Steps 3 to 8, you will find out how much sugar to add to water to match the density of the soft drink.



Remind students to:

- make sure all the sugar is dissolved
- keep a tally of the number of spoons of sugar added in the space provided.

- Ensure all students record their results.
- Share results and discuss with the class to ensure no misconceptions are carried through the task.



Stop here: Discussion point.

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The investigation is not assessed.



Suggested time: 15 minutes

Inform students that from this point onward, they must work on their own.

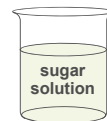
They may ask for assistance if they do not understand questions or instructions.

Analysing the investigation



Work on your own to complete the remainder of the assessment.

In the investigation, you measured the amount of sugar in a can of soft drink by comparing the density of a sugar solution to the density of soft drink.



What factors could have affected your measurement?

1. Complete Table 1 to show:

- factors (variables) that could have affected the measurement
- whether each factor was controlled (kept the same)
- how these factors were controlled.

Table 1: Factors that could affect the measurement of the amount of sugar in the soft drink

Factor (variable)	Was it kept the same? (controlled)	Explain how it was controlled (or not controlled)
Temperature	Yes	The soft drink and water were both at room temperature.
Volume		
Presence of bubbles		
Presence of substances other than sugar		
Other:		
Other:		

Discuss the purpose of this section, i.e.

Determine if the investigation was a suitable way to measure the sugar content of a can of soft drink, using the elements of a fair test.

Questions 1–4 gather evidence about analysing an investigation for fairness of design and implementation.

2. Is the investigation a fair (suitable) method of measuring the amount of sugar in a can of soft drink? Explain by referring to Table 1.

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3. a) Complete Table 2 to compare your measurement to the information on the drink label.

Table 2: Sugar content of soft drink

	Mass of sugar in 375 mL (grams)	Teaspoons of sugar in 375 mL (1 standard level teaspoon of sugar = 4 grams)
From the information on the label
My measurement (from page 5)

Provide students with the mass of sugar from the label on a can of soft drink.

Calculators may be used.

- b) How accurate was your measurement? Explain by referring to Table 2.

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4. State two reasons why your measurement could be different from the information on the label.

- a) One reason relating to the method:

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- b) One reason relating to how carefully you carried out the investigation:

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Stop here: Wait for your teacher's directions.

The “Stop here” direction marks a convenient point to break the task and introduce the next section.



Suggested time: 40 minutes

Discuss the purpose of this section, i.e.

Recall the names and functions of parts of the digestive system, and show how sugar is used by the body.

Sugar and your body

As with all foods, when you drink a sugary drink, it must be digested before the body can use it.

What do you know about your digestive system?

5. Complete the diagram of the digestive system by naming parts A, C, D and E and describing their functions. B has been completed for you.

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B oesophagus

moves food from

mouth to stomach by

muscular contraction

(peristalsis)

C

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liver

pancreas

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D

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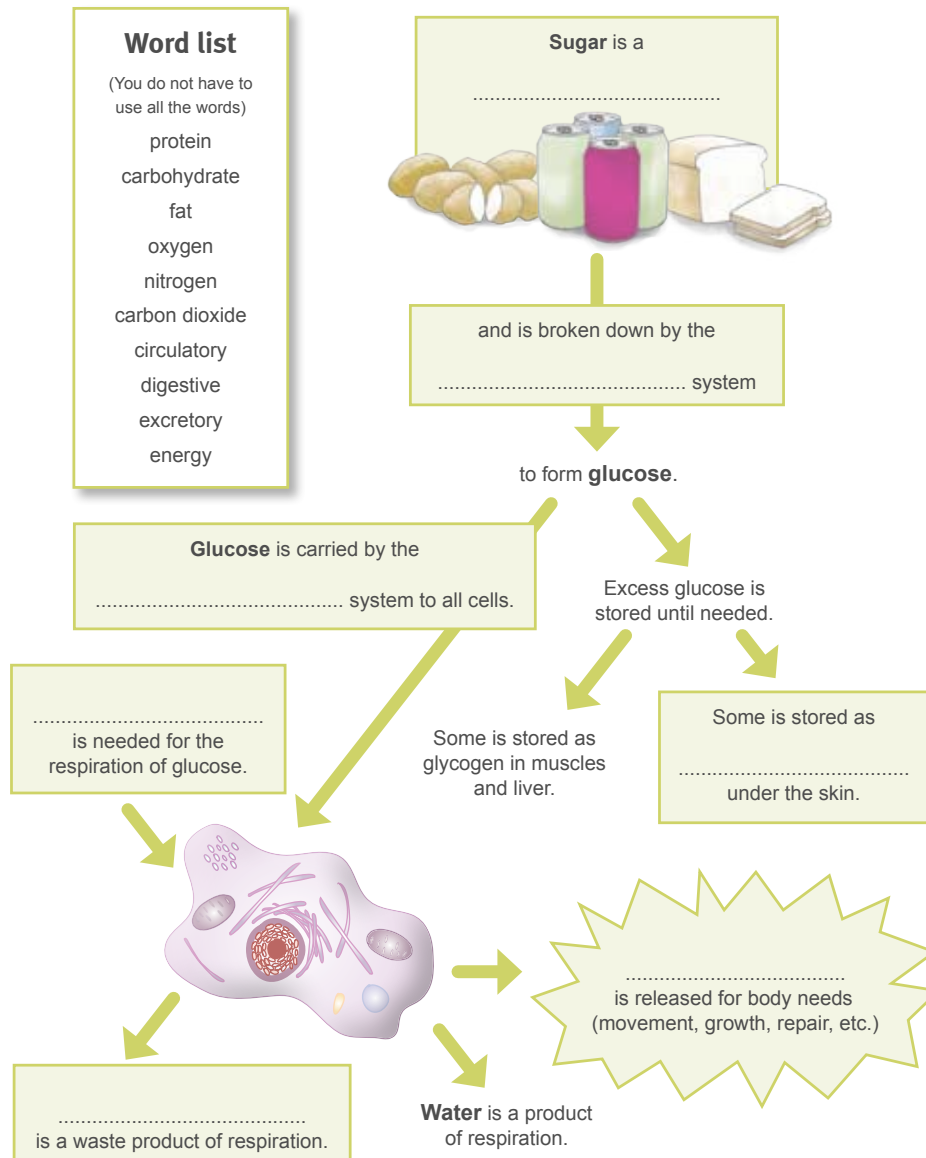
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Questions 5–6 gather evidence about knowledge of the digestive system and understanding of how digestion, circulation and respiration work together to provide energy for the body.

What happens to sugar in the body?

6. Complete the diagram below, using words from the list, to show what happens to the sugar in a soft drink after you drink it.



Discuss the purpose of this section, i.e.
Determine how much exercise needs to be done to use the energy in a can of soft drink.

How can you use the energy from a sugary drink?

Sugar fact

1 gram of sugar provides 17 kilojoules (kJ) of energy.

7. Calculate how much energy your body could get from a can of soft drink.

Refer to Table 2, page 7.

Mass of sugar in 375 mL soft drink =

Energy in 375 mL of soft drink =

8. How many minutes of exercise will you need to do to use the energy in 375 mL of soft drink?

Choose a type of exercise and intensity from Table 3 on page 11.

Activity:

Intensity:

I will need to do approximately minutes of exercise.

9. What happens to the sugar from the soft drink if you don't use all the available energy?

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Stop here: Wait for your teacher's directions.

Questions 7–9 gather evidence about using experimental data to draw conclusions.

Provide students with the mass of sugar from the label on a can of soft drink.

Suggest students pick an activity they enjoy.

Table 3: Energy used during exercise

Activity	Intensity	Energy used* (kJ per minute)
Basketball	shooting hoops	15
	competitive	30
Computer games	general	7
Cycling	recreational	24
	racing	51
Dancing	aerobic	24
Football	recreational	27
	game	33
Martial arts	general	33
Netball	recreational	27
	game	38
Running	jog	31
	sprint	55
Skateboarding	general	18
Surfing	small wave	17
	big wave	26
Swimming	recreational	21
	competitive	43
Tennis	recreational	21
	competitive	32
Volleyball	recreational	12
	competitive/beach	29
Walking	stroll	11
	brisk	19
Watching TV	couch potato	5

Explain that factors such as weight, sex, metabolism and intensity would affect energy used.

*A guide only — actual values vary between people

Adapted from Energy expenditure database, Fitness2live, accessed 21 Apr 2010, <www.fitness2live.com.au/energy-expenditure>.

Discuss the purpose of this section, i.e.

Analyse information and graphs to explain patterns and to draw conclusions.

Read and discuss the **Glycaemic index (GI)** information with students.

Point out features of Graph 1 to students:

- key
- quantities shown on axes.

How does a sugary drink affect your body?

Use the information below to answer Questions 10 and 11.

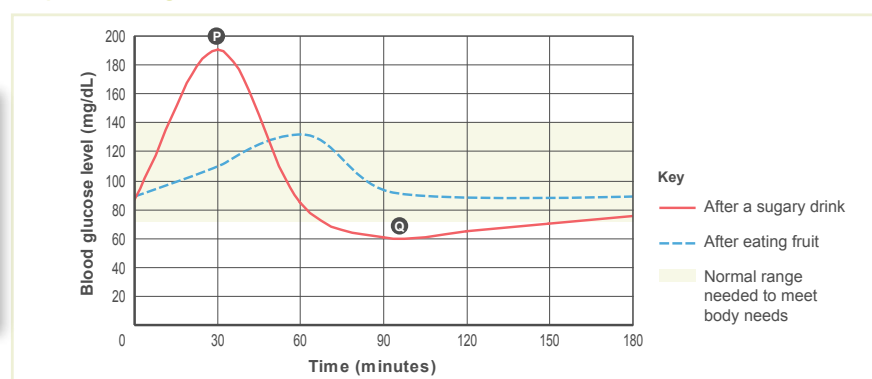
Glycaemic index (GI)

Sugary drinks have a high **glycaemic index**, meaning that they are digested very quickly.

Graph 1 shows how the glucose levels in the blood change after:

- eating fruit (low GI)
- drinking a sugary drink (high GI).

Graph 1: Blood glucose levels



Adapted from Glycaemic index database, Glycaemic index, accessed 21 Apr 2010, <www.glycaemicindex.com>

10. Describe how eating fruit and drinking sugary drinks affect blood glucose levels. Refer to Graph 1.

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11. Complete the following statement.

I would feel tired if my blood glucose level was similar to point (P or Q) in Graph 1 because

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Questions 10–14 gather evidence of analysing graphical data and information to explain patterns and draw conclusions.

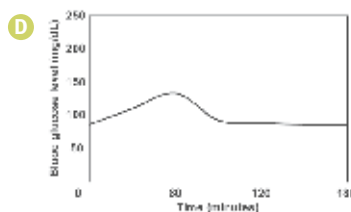
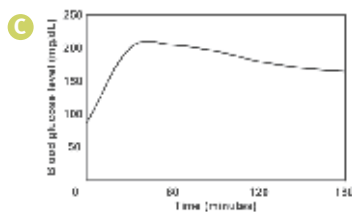
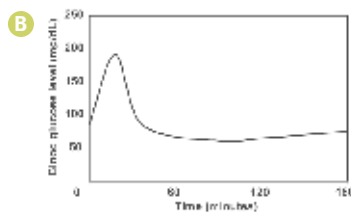
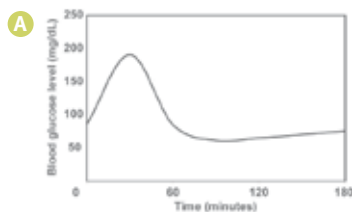
Use the information below and on pages 9 and 12 to answer Questions 12 to 14.

Insulin facts

- The pancreas releases the hormone **insulin** when blood glucose levels rise after eating or drinking.
- Insulin causes:
 - the cells of the body to absorb glucose from the blood
 - excess glucose to be removed from the blood and stored as glycogen until it is needed.
- Regular **spikes** in blood glucose levels (similar to **P** on Graph 1) can eventually cause **insulin resistance** (type 2 diabetes), a decrease in the body's ability to use insulin.
- Regular exercise and weight control can reduce the effects of insulin resistance.

Read and discuss **Insulin facts** with students.

12. Which graph below best shows the effect of **insulin resistance** on blood glucose levels after a sugary drink? (circle one)



Ask students to circle the letter on the correct graph when answering.

13. Explain your choice by referring to your chosen graph.

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14. Explain why **tiredness** is a symptom of insulin resistance.

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Stop here: Wait for your teacher's directions.



Suggested time: 15 minutes

Reflecting on your sugar habit

In this section, you will reconsider how sugar may be affecting your health.

Use Table 4 to help you answer Questions 15 to 17.

Discuss the purpose of this section, i.e.

Reflect on your understandings to:

- suggest ways of minimising risks to your health
- explain the influence of culture on health choices.

Table 4: Sugar content and GI of some common foods

Common food	Typical sugar content* (grams per serve)	GI (Glycaemic index)*
white bread	1.3	High GI (rapidly digested)
jasmine rice	0.2	
potatoes	1.2	
cornflakes	25.1	
doughnut	10.6	
soft drink	Medium GI
orange juice	20.0	
chocolate bar	40.2	
orange	10.7	Low GI (slowly digested)
wholegrain bread	2.0	
pasta, noodles	0.0	
long grain rice	0.2	
fresh vegetables	3.1	
kidney beans	0.5	
rolled oats	2.2	
lean meat, fish	0.0	
chocolate cake	30.8	
vanilla ice cream	15.9	

Adapted from: Australian Food database, Calorie King Australia, accessed 21 Apr 2010, <www.calorieking.com.au> and Glycaemic index database, Glycaemic index, accessed 21 Apr 2010, <www.glycaemicindex.com>.

*A guide only — actual values vary between brands

15. Do you still agree with your assessment of your sugar consumption and its effects on your health? (Refer to page 3.)

Circle your answer: **yes** **unsure** **no**

Explain why you agree, disagree or are unsure.

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Questions 15–17 gather evidence about reflecting on new understandings to suggest ways to minimise health risks and to consider the influence of culture on health-related choices.

16. Do you need to change your lifestyle to minimise your risk of developing insulin resistance? Justify your answer by referring to:

- your intake of particular foods (see Table 4 on page 14)
- how much exercise you do
- **Insulin facts** (page 13) and any other relevant information in the booklet.

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Students who cannot answer this question from their own experiences (e.g. students with diabetes) may wish to make recommendations for another person.

Making choices

Even when we are presented with scientific evidence, we don't always use the evidence to make choices that are good for our health.

17. a) Give an example of a poor health choice that might be made because of the influence of family, social or cultural experiences.

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- b) Explain why the scientific evidence might be ignored.

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This question need not be answered in the context of sugar, but may relate to any health issue.

Making judgments

Use the **Guide to making judgments (GTMJ)** on page 36 to grade student responses.

The **Model response** (page 27) 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

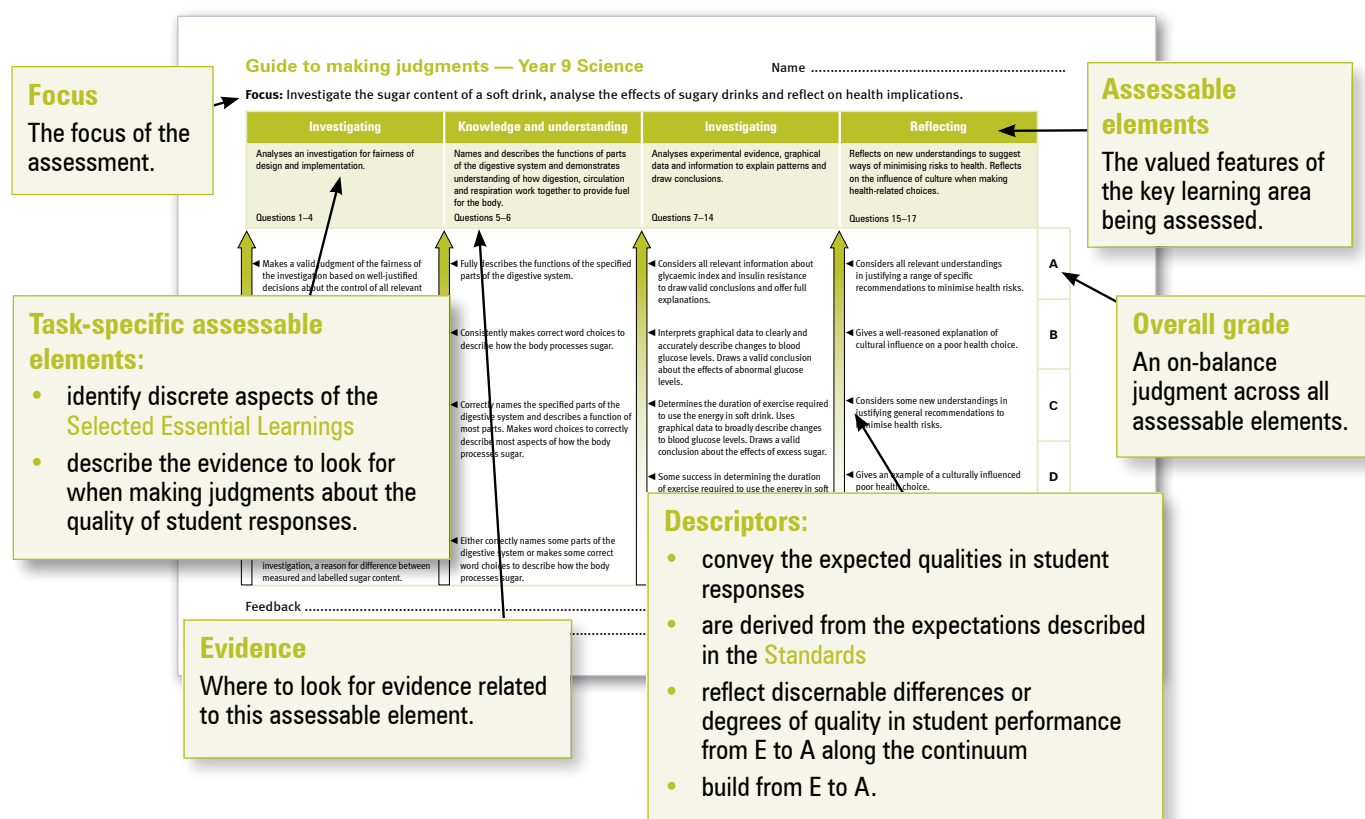
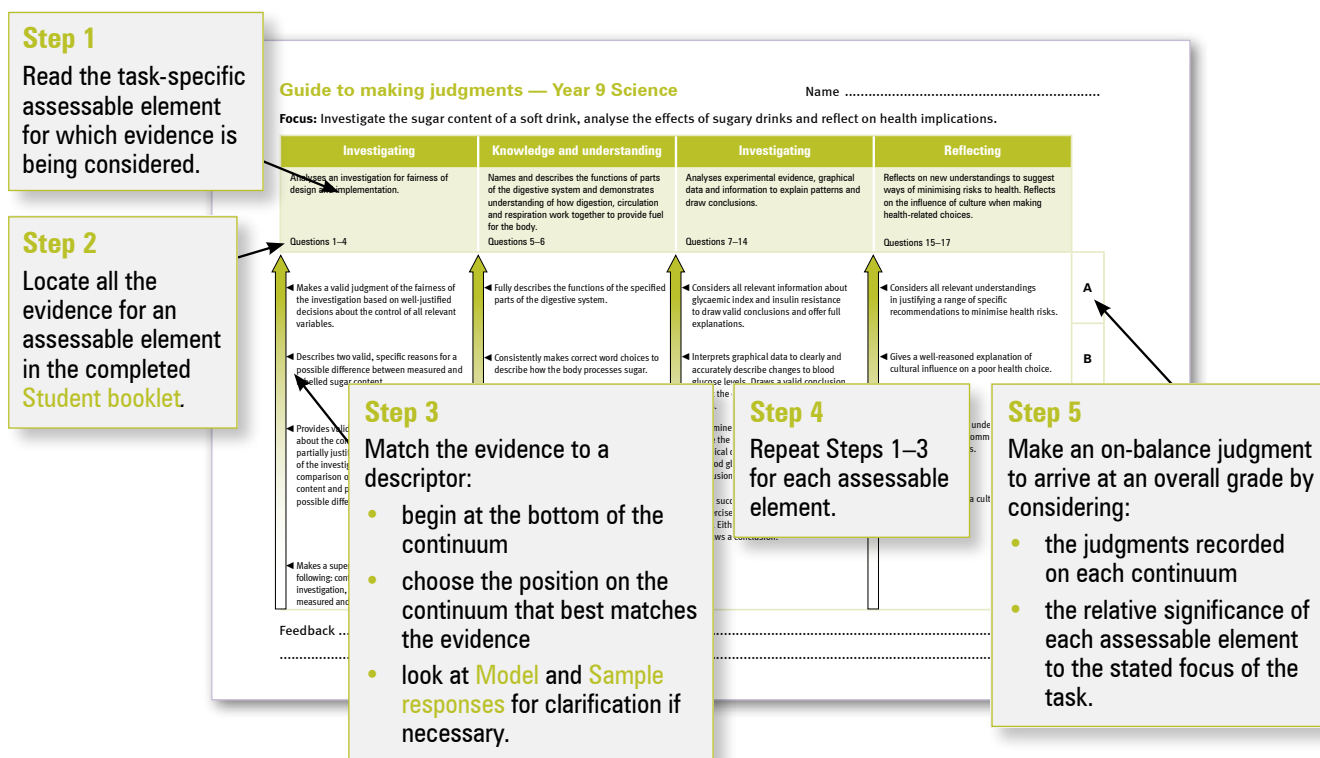


Diagram 2: Using the GTMJ — the judgment process



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 > 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 9	
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	<ul style="list-style-type: none"> plan investigations guided by scientific concepts and design and carry out fair tests research and analyse data, information and evidence evaluate data, information and evidence to identify connections, construct arguments and link results to theory draw conclusions that summarise and explain patterns, and that are consistent with the data and respond to the question
Reflecting	<ul style="list-style-type: none"> reflect on different perspectives and evaluate the influence of people's values and culture on the applications of science reflect on learning, apply new understandings and justify future applications.
	Knowledge and understanding The essential concepts, facts and procedures.
Knowledge and understanding	Life and living Organisms interact with their environment in order to survive and reproduce. <ul style="list-style-type: none"> Complex organisms depend on interacting body systems to meet their needs internally and with respect to their environment.
Source: www.qsa.qld.edu.au > Prep–Year 9 > Essential Learnings & Standards (Years 1–9)	

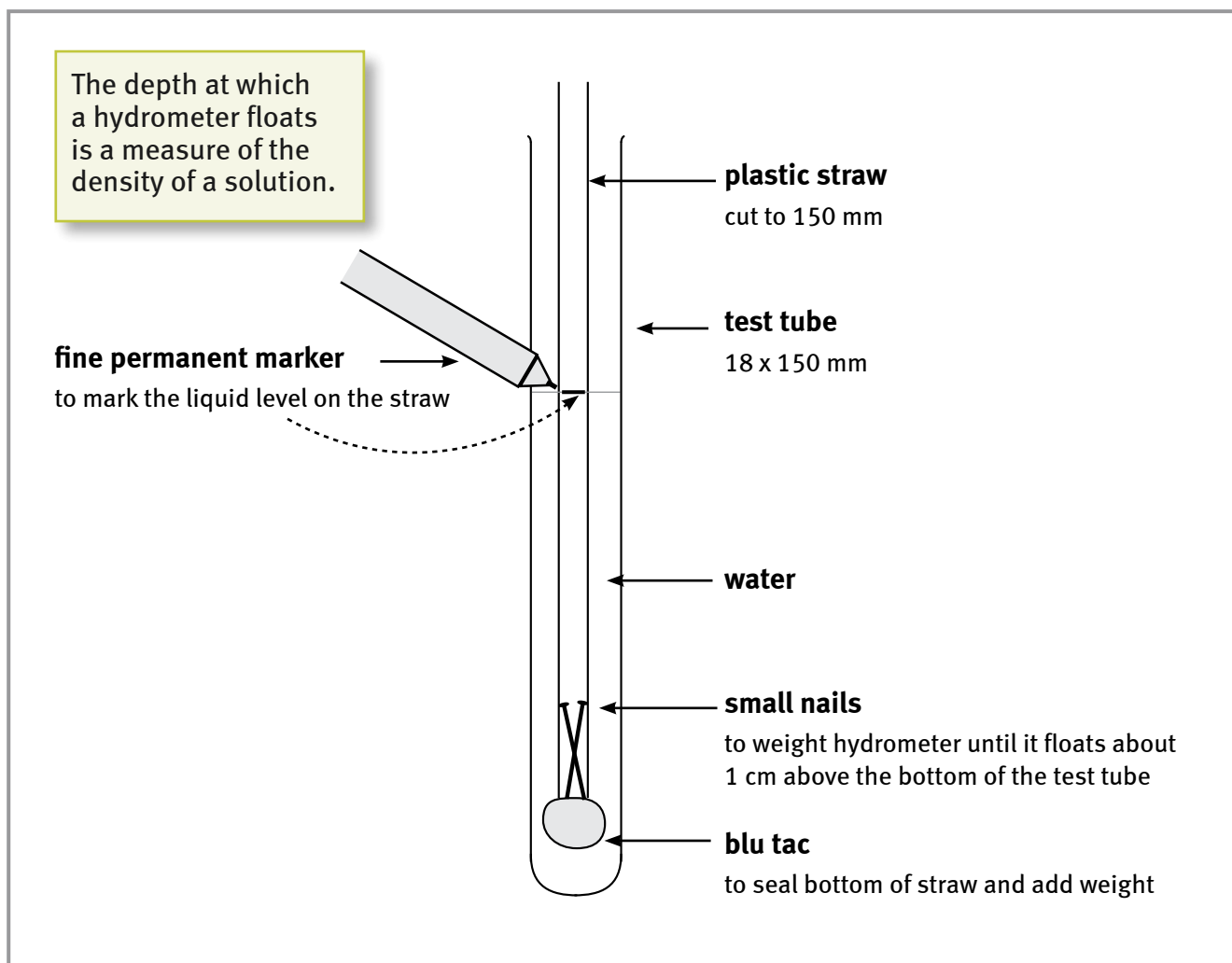
Literacy and Numeracy Indicators

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 [Literacy and Numeracy Indicators Information Statement](#)
www.qsa.qld.edu.au > Prep–Year 9 > Literacy & Numeracy Indicators (P–Year 9)

Making a hydrometer



Materials for the investigation

Each group will need:

- beaker (400–500 mL)
- 2 test tubes (18 x 150 mm)
- test-tube rack
- measuring cylinder (100–500 mL)
- about 200 mL soft drink, flat and at room temperature (do not use diet soft drink)
- water at room temperature
- white sugar
- teaspoon
- stirrer
- fine permanent marking pen
- 1 hydrometer (prepared earlier)

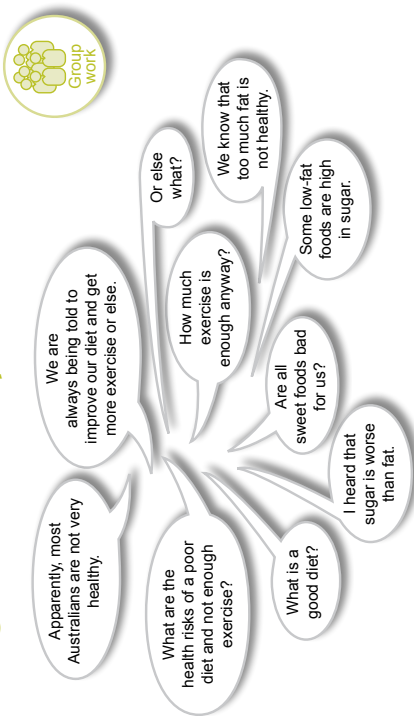
Model response

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.



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Setting the scene: Group discussion



In this assessment, you will:

- measure the sugar content of a soft drink and evaluate the method of measurement
- describe how our body systems work together to provide fuel for the body
- explore the effects of high-sugar drinks on health
- reflect on how sugar may be affecting your health.

Before you start: Assess your sugar consumption

How much sugar do think you consume? (place a mark on the arrow)



Where does most of the sugar you consume come from? (circle one)

Do you think your sugar consumption is affecting your health? Explain.

...I think I have a healthy diet because I eat lots of fruit and vegetables.....

...I do snack on chocolate bars a lot though, and I am not sure if it is affecting my health.....

Model response

Investigation: How much sugar is in soft drink?



Follow your teacher's directions to carry out the investigation.

Aim: To measure how many teaspoons of sugar there are in a 375 mL can of soft drink.

Sugar concentration

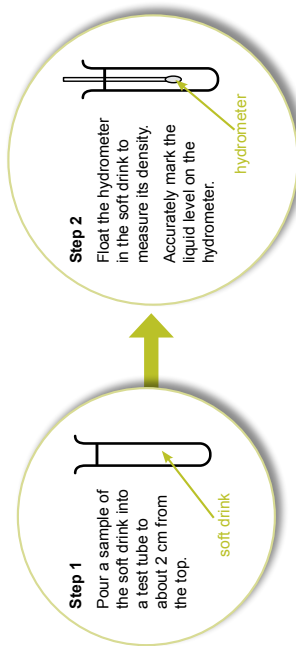
Solutions with higher sugar concentration have higher densities. The sugar concentration of solutions can be compared by comparing densities, using a hydrometer.

Materials

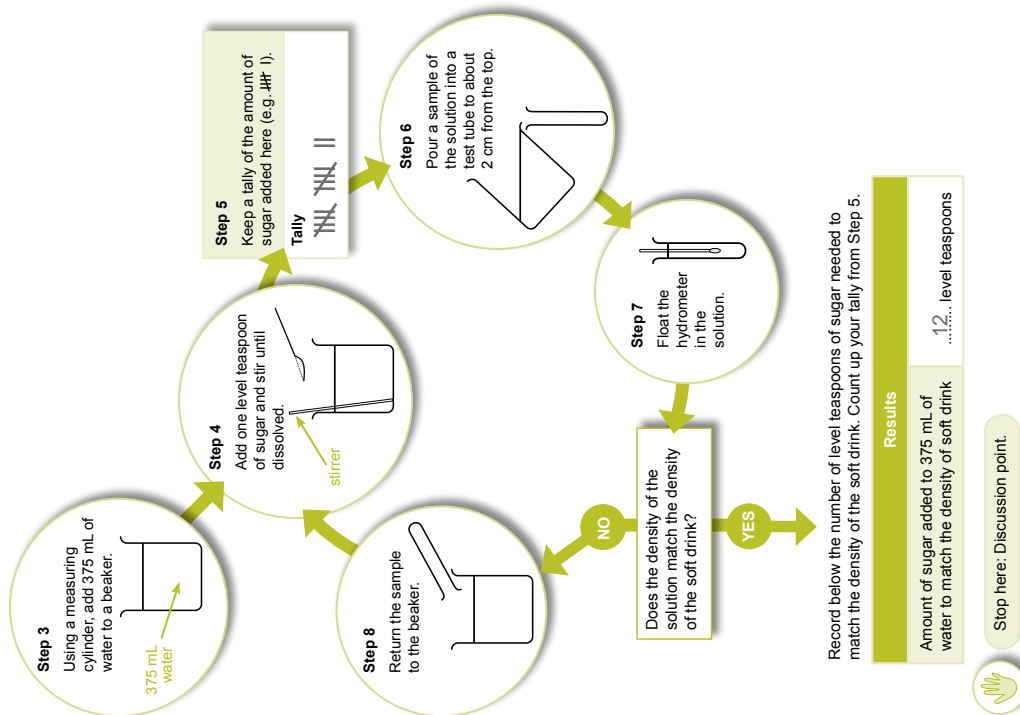
- beaker
- 2 test tubes
- test-tube rack
- measuring cylinder
- can of soft drink, flat and at room temperature
- water at room temperature
- white sugar
- teaspoon
- stirrer
- fine permanent marking pen
- a hydrometer (prepared earlier)

Method

In Steps 1 and 2 you will use your hydrometer to measure the density of the soft drink.



In Steps 3 to 8, you will find out how much sugar to add to water to match the density of the soft drink.



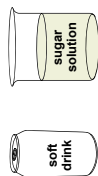
Model response

Analysing the investigation



Work on your own to complete the remainder of the assessment.

In the investigation, you measured the amount of sugar in a can of soft drink by comparing the density of a sugar solution to the density of soft drink.



What factors could have affected your measurement?

1. Complete Table 1 to show:

- factors (variables) that could have affected the measurement
- whether each factor was controlled (kept the same)
- how these factors were controlled.

Table 1: Factors that could affect the measurement of the amount of sugar in the soft drink

Factor (variable)	Was it kept the same? (controlled)	Explain how it was controlled (or not controlled)
Temperature	Yes	The soft drink and water were both at room temperature.
Volume	Yes	The volume of water was the same as the volume of soft drink in the can (375 mL)
Presence of bubbles	Yes	The soft drink was flat
Presence of substances other than sugar	No	The soft drink contains colour and flavour, but the water did not
Other: Amount of sugar added	Yes	We always added one level teaspoon of sugar at a time
Other:		

2. Is the investigation a fair (suitable) method of measuring the amount of sugar in a can of soft drink? Explain by referring to Table 1.

Yes. Because we only changed the amount of sugar and controlled all the important variables, the density is a fair measure of the amount of sugar in the soft drink (assuming that there are only tiny amounts of colour and flavour).

3. a) Complete Table 2 to compare your measurement to the information on the drink label.

Table 2: Sugar content of soft drink

	Mass of sugar in 375 mL (grams)	Teaspoons of sugar in 375 mL (1 standard level teaspoon of sugar = 4 grams)
From the information on the label	40	10
My measurement (from page 5)		12

b) How accurate was your measurement? Explain by referring to Table 2.

My measurement was quite close to the actual amount — only 2 teaspoons more.

4. State two reasons why your measurement could be different from the information on the label.

a) One reason relating to the method:

The teaspoon that we used may not have been a standard teaspoon and may have held less than 4 grams of sugar.

b) One reason relating to how carefully you carried out the investigation:

We didn't always check that all the sugar was dissolved before we poured a sample into the test tube.



Stop here: Wait for your teacher's directions.

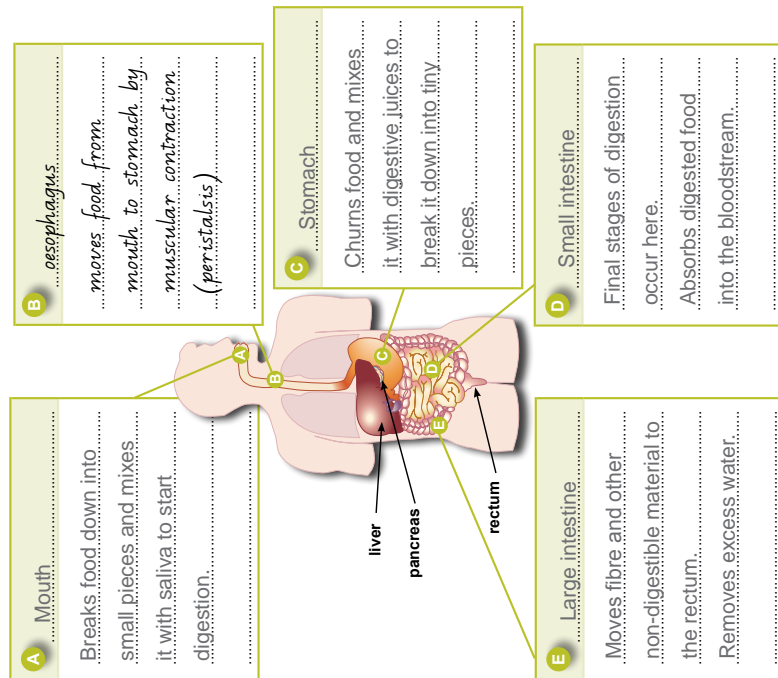
Model response

Sugar and your body

As with all foods, when you drink a sugary drink, it must be digested before the body can use it.

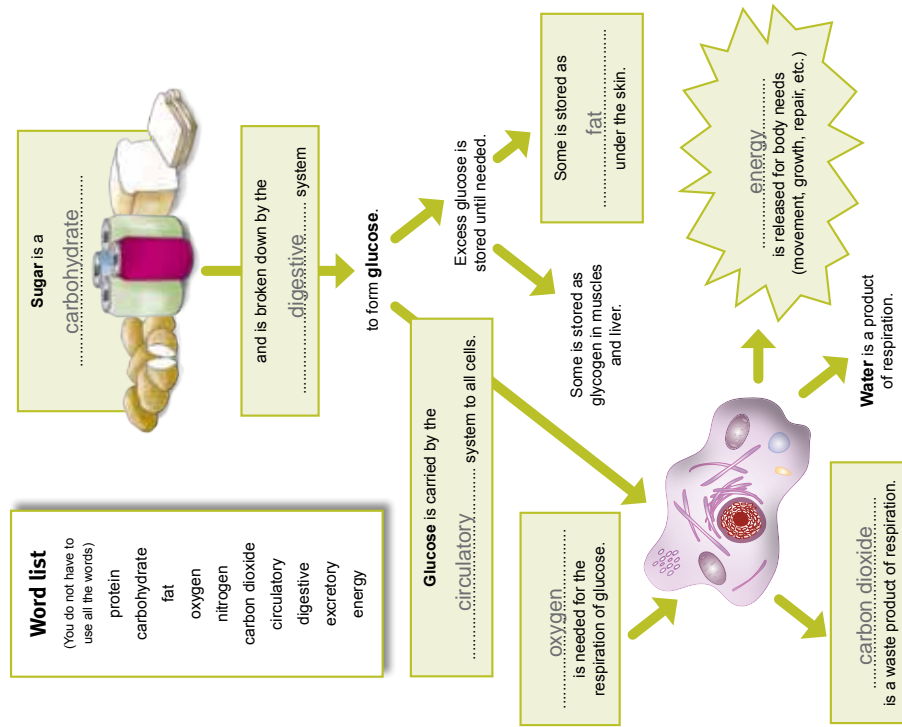
What do you know about your digestive system?

5. Complete the diagram of the digestive system by naming parts A, C, D and E and describing their functions. B has been completed for you.



What happens to sugar in the body?

6. Complete the diagram below, using words from the list, to show what happens to the sugar in a soft drink after you drink it.



Model response

How can you use the energy from a sugary drink?

Sugar fact
1 gram of sugar provides 17 kilojoules (kJ) of energy.

7. Calculate how much energy your body could get from a can of soft drink.

Refer to Table 2, page 7.

Mass of sugar in 375 mL soft drink = 40 grams

$40 \times 17 = 680$

Energy in 375 mL of soft drink = 680 kJ

8. How many minutes of exercise will you need to do to use the energy in 375 mL of soft drink?

Choose a type of exercise and intensity from Table 3 on page 11.

Activity: running

Intensity: jog $680 \div 31 = 21.9$

I will need to do approximately 22 minutes of exercise.

9. What happens to the sugar from the soft drink if you don't use all the available energy?
The excess sugar is converted to fat and stored under the skin.

 Stop here. Wait for your teacher's directions.

Table 3: Energy used during exercise

Activity	Intensity	Energy used* (kJ per minute)
Basketball	shooting hoops	15
	competitive	30
Computer games	general	7
Cycling	recreational	24
	racing	51
Dancing	aerobic	24
Football	recreational	27
	game	33
Marital arts	general	33
Netball	recreational	27
	game	38
Running	jog	31
	sprint	55
Skateboarding	general	18
Surfing	small wave	17
	big wave	26
Swimming	recreational	21
	competitive	43
Tennis	recreational	21
	competitive	32
Volleyball	recreational	12
	competitive/beach	29
Walking	stroll	11
	brisk	19
Watching TV	couch potato	5

*A guide only — actual values vary between people

Adapted from Energy expenditure database, Fitness360, accessed 21 Apr 2010, <www.fitness360.com.au/energy-expenditure>.

Model response

How does a sugary drink affect your body?

Use the information below to answer Questions 10 and 11.

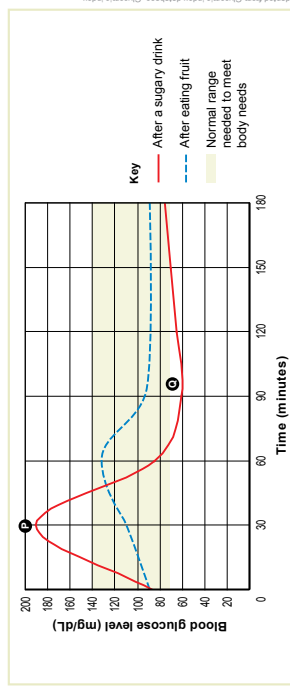
Glycaemic index (GI)

Sugary drinks have a high **glycaemic index**, meaning that they are digested very quickly.

Graph 1 shows how the glucose levels in the blood change after:

- eating fruit (low GI)
- drinking a sugary drink (high GI).

Graph 1: Blood glucose levels



10. Describe how eating fruit and drinking sugary drinks affect blood glucose levels.

Refer to Graph 1.

After eating fruit, the blood glucose level rises slowly for about 60 minutes then slowly falls to the original level, always staying within the normal range. After a sugary drink the blood glucose level rises rapidly and is well above the normal range after about 30 minutes. It then falls rapidly and after about 90 minutes is below the normal range. The level then slowly returns to normal after about 3 hours.

11. Complete the following statement.

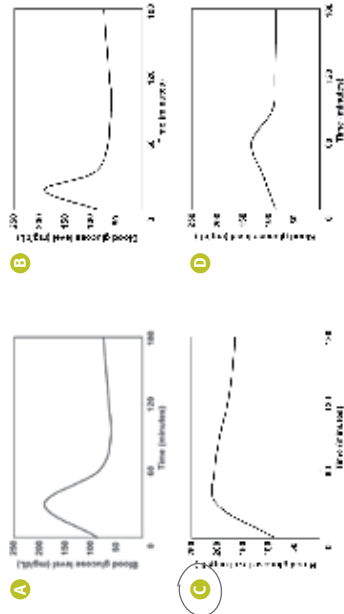
I would feel tired if my blood glucose level was similar to point A (● or ●) in Graph 1 because I wouldn't have enough energy to meet my body's needs.

Use the information below and on pages 9 and 12 to answer Questions 12 to 14.

Insulin facts

- The pancreas releases the hormone **insulin** when blood glucose levels rise after eating or drinking.
- Insulin causes:
 - the cells of the body to absorb glucose from the blood
 - excess glucose to be removed from the blood and stored as glycogen until it is needed.
- Regular **spikes** in blood glucose levels (similar to ● on Graph 1) can eventually cause **insulin resistance** (type 2 diabetes), a decrease in the body's ability to use insulin.
- Regular exercise and weight control can reduce the effects of insulin resistance.

12. Which graph below best shows the effect of **insulin resistance** on blood glucose levels after a sugary drink? (circle one)



13. Explain your choice by referring to your chosen graph.

With insulin resistance, less glucose is absorbed by the cells, and less is removed from the blood for storage, so the blood glucose level remains high.

14. Explain why **tiredness** is a symptom of insulin resistance.

Because the cells absorb less glucose, they do not have sufficient energy to function normally, causing tiredness.



Stop here: Wait for your teacher's directions.

Model response

Reflecting on your sugar habit

In this section, you will reconsider how sugar may be affecting your health. Use Table 4 to help you answer Questions 15 to 17.

Table 4: Sugar content and GI of some common foods

Common food	Typical sugar content* (grams per serve)	GI (Glycaemic Index)*
white bread	1.3	High GI (rapidly digested)
jasmine rice	0.2	
potatoes	1.2	
cornflakes	25.1	
doughnut	10.6	
soft drink	Medium GI
orange juice	20.0	
chocolate bar	40.2	
orange	10.7	
wholegrain bread	2.0	
pasta, noodles	0.0	Low GI (slowly digested)
long grain rice	0.2	
fresh vegetables	3.1	
kidney beans	0.5	
rolled oats	2.2	
lean meat, fish	0.0	
chocolate cake	30.8	
vanilla ice cream	15.9	

*A guide only — actual values vary between brands

15. Do you still agree with your assessment of your sugar consumption and its effects on your health? (Refer to page 3.)

Circle your answer: yes unsure no

Explain why you agree, disagree or are unsure.

I didn't realise that soft drinks had so much sugar. I don't drink a lot of soft drinks but combined with the chocolate, I may be putting myself at risk of developing insulin resistance.

16. Do you need to change your lifestyle to minimise your risk of developing insulin resistance? Justify your answer by referring to:

- your intake of particular foods (see Table 4 on page 14)
- how much exercise you do
- **Insulin facts** (page 13) and any other relevant information in the booklet.

By referring to Table 4, I know that I eat mainly low GI foods, so the only things I would change in my diet would be to give up soft drinks (which I can do without) and cut down on chocolate (which I'm not sure I can do without altogether). Also, the GI of the chocolate is not as high as the soft drink so it shouldn't cause such big spikes in my blood glucose level. I do jog a couple of times a week but now I know that each chocolate bar gives me enough energy for a 22-minute jog, I will be jogging more often to use all the energy and control my weight. According to the information on page 13, those changes should help to minimise my risk of developing insulin resistance.

Making choices

Even when we are presented with scientific evidence, we don't always use the evidence to make choices that are good for our health.

17. a) Give an example of a poor health choice that might be made because of the influence of family, social or cultural experiences.

Many teenagers smoke even though the health risks are well known.

- b) Explain why the scientific evidence might be ignored.

Peer pressure on teenagers is very strong. The need to belong often outweighs possible future health risks, so many teenagers think they need to take up smoking to be accepted by their peer group.

Notes

Notes

Focus: Investigate the sugar content of a soft drink, analyse the effects of sugary drinks and reflect on health implications.

Investigating	Knowledge and understanding	Investigating	Reflecting
<p>Analyses an investigation for fairness of design and implementation.</p> <p>Questions 1–4</p>	<p>Names and describes the functions of parts of the digestive system and demonstrates understanding of how digestion, circulation and respiration work together to provide fuel for the body.</p> <p>Questions 5–6</p>	<p>Analyses experimental evidence, graphical data and information to explain patterns and draw conclusions.</p> <p>Questions 7–14</p>	<p>Reflects on new understandings to suggest ways of minimising risks to health. Reflects on the influence of culture when making health-related choices.</p> <p>Questions 15–17</p>
<p>◀ Makes a valid judgment of the fairness of the investigation based on well-justified decisions about the control of all relevant variables.</p> <p>◀ Describes two valid, specific reasons for a possible difference between measured and labelled sugar content.</p> <p>◀ Provides valid explanations for decisions about the control of some variables and partially justifies a judgment of the fairness of the investigation. Makes an accurate comparison of measured and labelled sugar content and provides a valid reason for a possible difference.</p> <p>◀ Makes a superficial judgment about one of the following: control of a variable, fairness of the investigation, a reason for difference between measured and labelled sugar content.</p>	<p>◀ Fully describes the functions of the specified parts of the digestive system.</p> <p>◀ Consistently makes correct word choices to describe how the body processes sugar.</p> <p>◀ Correctly names the specified parts of the digestive system and describes a function of most parts. Makes word choices to correctly describe most aspects of how the body processes sugar.</p> <p>◀ Either correctly names some parts of the digestive system or makes some correct word choices to describe how the body processes sugar.</p>	<p>◀ Considers all relevant information about glycaemic index and insulin resistance to draw valid conclusions and offer full explanations.</p> <p>◀ Interprets graphical data to clearly and accurately describe changes to blood glucose levels. Draws a valid conclusion about the effects of abnormal glucose levels.</p> <p>◀ Determines the duration of exercise required to use the energy in soft drink. Uses graphical data to broadly describe changes to blood glucose levels. Draws a valid conclusion about the effects of excess sugar.</p> <p>◀ Some success in determining the duration of exercise required to use the energy in soft drink. Either provides a partial description or draws a conclusion.</p>	<p>A</p> <p>◀ Considers all relevant understandings in justifying a range of specific recommendations to minimise health risks.</p> <p>B</p> <p>◀ Gives a well-reasoned explanation of cultural influence on a poor health choice.</p> <p>C</p> <p>◀ Considers some new understandings in justifying general recommendations to minimise health risks.</p> <p>D</p> <p>◀ Gives an example of a culturally influenced poor health choice.</p> <p>E</p>

Feedback

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