Australian Curriculum Year 4 Science Sample assessment | Teacher guidelines

The force of friction

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| **Assessment description** | **Category** |
| Students conduct a fair test to establish how friction affects the distance travelled by a toy car. | Written |
| Technique |
| Experimental investigation |
| Context for assessment | Alignment |
| This assessment requires students to explore the force of friction.  In Section 1 they investigate how far a toy car will travel across different surfaces and explain their observations using their knowledge of friction.  In Section 2 students apply their knowledge of friction to a real-life scenario. | * Australian Curriculum 5.[0](http://www.australiancurriculum.edu.au/CurriculumHistory),  Year 4 Science Australian Curriculum content and achievement standard ACARA — Australian Curriculum, Assessment and Reporting Authority  [www.australiancurriculum.edu.au](http://www.australiancurriculum.edu.au) * Year 4 Science standard elaborations [www.qsa.qld.edu.au/downloads/p\_10/ac\_sci\_yr4\_se.pdf](http://www.qsa.qld.edu.au/downloads/p_10/ac_sci_yr4_se.pdf) |
| Connections |
| This assessment can be used with the QSA Australian Curriculum resource titled *Year 4 plan — Science exemplar* [www.qsa.qld.edu.au/downloads/p\_10/ac\_science\_yr4\_plan.doc](http://www.qsa.qld.edu.au/downloads/p_10/ac_science_yr4_plan.doc) |
| Definitions |
| **Force:** a push or pull between objects which may cause one or both objects to change speed and/or the direction of their motion (i.e. accelerate) or change their shape  **Friction**: a force that exists whenever two things move over or rub against each other |
| In this assessment | Assessment materials |
| Teacher guidelines  Student booklet  Task-specific standards — continua  Task-specific standards — matrix  Sample response  Assessment resource — Scientific concepts and student’s prior understandings  Assessment resource — Scientific inquiry process | Per group:   * access to three different surfaces, e.g. concrete, carpet, linoleum, tiles * one metre measuring tape or ruler * toy car * ramp |

# Teacher guidelines

## Identify curriculum

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| Content descriptions to be taught | | |
| Science Understanding | Science as a Human Endeavour | Science Inquiry Skills |
| Physical sciences   * Forces can be exerted by one object on another through direct contact or from a distance [ACSSU076](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSSU076) | Nature and development of science   * Science involves making predictions and describing patterns and relationships [ACSHE061](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSHE061) | **Questioning and predicting**   * With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge [ACSIS064](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS064)   **Planning and conducting**   * Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate [ACSIS066](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS066)   **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 [ACSIS068](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS068) * Compare results with predictions, suggesting possible reasons for findings [ACSIS216](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS216)   **Evaluating**   * Reflect on the investigation; including whether a test was fair or not [ACSIS069](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS069)   **Communicating**   * Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports [ACSIS071](http://www.australiancurriculum.edu.au/Curriculum/ContentDescription/ACSIS071) |
| General capabilities (GCs) and cross‑curriculum priorities (CCPs) This assessment may provide opportunities to engage with the following GCs and CCPs. Refer also to the Resources tab on the P-10 Science Curriculum and Assessment page[: [www.qsa.qld.edu.au/yr4-science-resources.html](http://www.qsa.qld.edu.au/yr4-science-resources.html)](file:///\\file1\home\smul\Assessments%20for%20Year%203\Science\:%20http:\www.qsa.qld.edu.au\yr3-science-resources.html) | | |
| Description: gc_literacy **Literacy**  Description: Description: gc_numeracy **Numeracy**  Description: gc_ict **ICT capability**  *Description: Description: gc_critical* **Critical and creative thinking**  Description: Description: gc_personal_social **Personal and social capability** | | |
| Achievement standard This assessment provides opportunities for students to demonstrate the following highlighted aspects. | | |
| By the end of Year 4, students apply the [observable](http://www.australiancurriculum.edu.au/Glossary?a=S&t=Observable) [properties](http://www.australiancurriculum.edu.au/Glossary?a=S&t=Property) of [materials](http://www.australiancurriculum.edu.au/Glossary?a=S&t=Material) to explain how objects and [materials](http://www.australiancurriculum.edu.au/Glossary?a=S&t=Material) can be used. They use contact and non-contact [forces](http://www.australiancurriculum.edu.au/Glossary?a=S&t=Force) to describe interactions between objects. They discuss how natural and human processes cause changes to the Earth’s surface. They describe [relationships](http://www.australiancurriculum.edu.au/Glossary?a=S&t=Relationship) that assist the survival of living things and sequence key stages in the life cycle of a plant or animal. They identify when science is used to ask questions and make predictions. They describe situations where science understanding can influence their own and others’ actions.  Students follow instructions to [identify](http://www.australiancurriculum.edu.au/Glossary?a=&t=Identify) investigable questions about [familiar](http://www.australiancurriculum.edu.au/Glossary?a=&t=Familiar) contexts and predict likely outcomes from investigations. They [discuss](http://www.australiancurriculum.edu.au/Glossary?a=&t=Discuss) ways to conduct investigations and safely use equipment to make and record observations. They use provided tables and simple column graphs to organise their data and [identify](http://www.australiancurriculum.edu.au/Glossary?a=&t=Identify) patterns in data. Students suggest explanations for observations and [compare](http://www.australiancurriculum.edu.au/Glossary?a=&t=Compare) their findings with their predictions. They suggest reasons why their methods were fair or not. They complete simple reports to communicate their methods and findings. | | |
| Source: ACARA, The Australian Curriculum v5.0, [www.australiancurriculum.edu.au](http://www.australiancurriculum.edu.au) | | |

**Sequence learning**

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| **Suggested learning experiences** |
| This assessment leads on from the learning experiences outlined in the QSA’s Year 4 Science Year level plan. The knowledge, understanding and skills in the Year level plan will prepare students to engage in this assessment.  See Year 4 plan — Science exemplar [www.qsa.qld.edu.au/downloads/p\_10/ac\_science\_yr4\_plan.doc](http://www.qsa.qld.edu.au/downloads/p_10/ac_science_yr4_plan.doc) |
| Adjustments for needs of learners |
| To make adjustments, teachers refer to learning area content aligned to the student’s chronological age, personalise learning by emphasising alternate levels of content, general capabilities or cross‑curriculum priorities in relation to the chronological age learning area content. The emphasis placed on each area is informed by the student’s current level of learning and their strengths, goals and interests. Advice on the process of curriculum adjustment for all students and in particular for those with disability, gifted and talented or for whom English is an additional language or dialect are addressed in *Australian Curriculum — Student Diversity* materials.  For information to support students with diverse learning needs, see:   * Queensland Studies Authority materials for supporting students with diverse learning needs [www.qsa.qld.edu.au/10188.html](http://www.qsa.qld.edu.au/10188.html) * Australian Curriculum Student Diversity [www.australiancurriculum.edu.au/StudentDiversity/Overview](http://www.australiancurriculum.edu.au/StudentDiversity/Overview) * The *Melbourne Declaration* *on Educational Goals for Young Australians* [www.mceecdya.edu.au/mceecdya/melbourne\_declaration,25979.html](http://www.mceecdya.edu.au/mceecdya/melbourne_declaration,25979.html) * *Disability Standards for Education* <http://deewr.gov.au/disability-standards-education>. |

## Develop assessment

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| **Preparing for the assessment** |
| Learning experiences in preparation for the assessment could include:  Revising key concepts   * Revise from Year 2 how pushes and pulls change the speed, direction or shape of an object.   Exploring forces   * Investigate questions about forces, for example:   + What is a force?   + What is a contact force?   + What is a non-contact force?   + What is friction?   + Where are forces acting in my everyday life? * Explore different contact and non-contact forces and the effects of these forces on the movement of objects. * Consider how non-contact forces are similar to contact forces in terms of objects pushes and pulls. * Draw labelled and force-arrow diagrams to show the forces that are acting on an object.   + Arrows pointing away indicate that a pull is being applied while an arrow pointing into the object indicates a push.   + The size of the arrows can also represent the size of the force that is applied. * Explore friction (forces working against each other) through pushing an object across different surfaces This would be demonstrated in a force diagram as an arrow pointing in the opposite direction from the movement. * Experience how the application of additional forces to objects upset balance and cause motion. For example, kicking a ball, knocking down dominoes. * Explore everyday situations where friction is an advantage and where it is a disadvantage. * Explore the concept of measuring forces and that they have unit of measurement (Newton: N) just as distance can be measured and has a unit of measurement (metres: m; centimetres: cm).   Conducting investigations to explore forces   * Identify questions in familiar contexts that can be investigated scientifically and predict what might happen. * Guide students to suggest ways to plan and conduct safe and fair investigations about the characteristics of liquids and solids and their change in state. * Support students to carry out simple investigations in small groups. * Support students to record and represent data using tables, column graphs and labelled scientific diagrams and model the appropriate features of these. * Practise using and reading a spring balance to measure force. * Support students to calculate averages when multiple trials are conducted. * Discuss any data collected as a class in order to identify and explain patterns in the data, justify findings and compare with predictions. * Support students to communicate ideas using a simple report format. |

| **Implementing** | |
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| Section 1: Question and prediction | |
| **Student role**   * Participate in a discussion about the purpose of the assessment. * Clarify your understanding of the investigation question (if necessary). * Write your prediction and explain why you think it will happen. | **Teacher role**   * Introduce the assessment and relate to students’ prior understandings of forces. * Present the investigation question, clarifying student understanding of this where necessary. * Monitor students as they complete their predictions. Explain the importance of providing an explanation (justification) for their answers. |
| Section 1: Keeping the investigation fair | |
| **Student role**   * Participate in a discussion about the factors that have to be considered to ensure the investigation is a fair test. * Complete the table, i.e. what will change, what will be measured and what will be kept the same. | **Teacher role**   * Lead the discussion about the factors that have to be considered to ensure the investigation is a fair test, i.e. what will change, what will be measured and what will be kept the same. |
| Section 1: Method | |
| **Student role**   * Clarify your understanding of how the equipment is to be assembled (if necessary). * Clarify your understanding of the method (if necessary). * Assemble the equipment and conduct the investigation in a small group, following the teacher instructions. | **Teacher role**   * Ensure all students understand how the equipment is to be assembled. * Read the method and explain each step in the process clearly to students. Clarify student understanding where necessary. * Using your knowledge of the students’ personalities and abilities, place students in groups of three. * Discuss behavioural and safety expectations for the investigation (e.g. working safely, cooperating and sharing, listening to each other). * Provide each group with the necessary materials and equipment. * Support and guide students to assemble the equipment and conduct the investigation. |
| Section 1: Results | |
| **Student role**   * Measure the friction or distance. Record the data in the table provided in the *Student booklet*. * Identify the middle value from the multiple trials for each surface. Record in the *Student booklet*. * Use coloured pencils to create a column graph on the grid provided in the *Student booklet*. | **Teacher role**   * Support and guide students as they collect their measurements. Ensure that all students are recording their data in the table provided. * Read, explain and discuss with students why the middle value will be the best to use when drawing the column graph. * Provide students with coloured pencils to complete their column graphs. |
| Section 1: Discussion and conclusion | |
| **Student role**   * Clarify your understanding of the discussion questions in the *Student booklet* (if necessary). * Answer the discussion questions in the *Student booklet* and use the evidence from the results summary table and column graph to explain your decisions. * Clarify your understanding of the conclusion questions in the *Student booklet* (if necessary). * Complete the conclusion in the *Student booklet*. | **Teacher role**   * Read the discussion questions to students, clarifying understanding of these where necessary. * Monitor students as they complete the discussion questions. Reiterate the importance of using the evidence collected and recorded in the results summary table and column graph to provide an explanation (justification) for their answers. * Read the conclusion questions to the students. * Monitor students as they complete the conclusion. |
| Section 2: Applying your science knowledge | |
| **Student role**   * Clarify your understanding of the information and question in the ‘Applying your science knowledge’ section of the *Student booklet* (if necessary). * Select one of the photos and apply your science knowledge to complete the questions in the *Student booklet*. | **Teacher role**   * Read the information and questions to the students, clarifying understanding of these where necessary. * Monitor students as they complete the questions. Reiterate the importance of providing an explanation (justification) for their answers. |

## Make judgments

When making judgments about the evidence in student responses to this assessment, teachers are advised to use the task-specific standards provided. The development of these task-specific standards has been informed by the Queensland Year 4 standard elaborations. See [www.qsa.qld.edu.au/downloads/p\_10/ac\_sci\_yr4\_se.doc](http://www.qsa.qld.edu.au/downloads/p_10/ac_sci_yr4_se.doc).

### The Queensland standard elaborations for Science

The Queensland Year 4 standard elaborations for Science is a resource to assist teachers to make consistent and comparable evidence-based A to E (or equivalent) judgments. It should be used in conjunction with the Australian Curriculum achievement standard and content descriptions for the relevant year level.

The Queensland Science standard elaborations provide a basis for judging *how well* students have demonstrated what they know, understand and can do using the Australian Curriculum achievement standard.

The Australian Curriculum achievement standards dimensions of Understanding and Skills are used to organise the Queensland Science standard elaborations. Understanding and Skills in Science are organised as Understanding dimension and Skills dimension.

The valued features of Science drawn from the achievement standard and the content descriptions for Understanding dimension and Skills dimension are organised as:

* Science Understanding
* Science as a Human Endeavour
* Questioning and predicting
* Planning and conducting
* Processing and analysing data and information
* Evaluating
* Communicating.

#### Task-specific standards

Task-specific standards give teachers:

* a tool for directly matching the evidence of learning in the student response to the standards
* a focal point for discussing student responses
* a tool to help provide feedback to students.

Task-specific standards are not a checklist; rather they are a guide that:

* highlights the valued features that are being targeted in the assessment and the qualities that will inform the overall judgment
* specifies particular *targeted aspects* of the curriculum content and achievement standard
* aligns the valued feature, task-specific descriptor and assessment
* allows teachers to make consistent and comparable on-balance judgments about student work by matching the qualities of student responses with the descriptors
* clarifies the curriculum expectations for learning at each of the five grades (A–E or the early years equivalent)
* shows the connections between what students are expected to know and do, and how their responses will be judged and the qualities that will inform the overall judgment
* supports evidence-based discussions to help students gain a better understanding of how they can critique their own responses and achievements, and identify the qualities needed to improve
* encourages and provides the basis for conversations among teachers, students and parents/carers about the quality of student work and curriculum expectations and related standards.

#### Task-specific valued features

Task-specific valued features are the discrete aspects of the valued features of Science targeted in a particular assessment and incorporated into the task-specific standards for that assessment. They are selected from the Queensland Science standard elaborations valued features drawn from the Australian Curriculum achievement standard and content descriptions.

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| **Task-specific valued features for this assessment** | | |
| The following identifies the valued features for this assessment and makes explicit the understandings and skills that students will have the opportunity to demonstrate. This ensures that the alignment between what is taught, what is assessed and what is reported is clear. | | |
| Australian Curriculum achievement standard dimensions | Queensland standard elaborations valued features | Task-specific valued features |
| Understanding dimension | Science understanding | Application of knowledge about forces and friction to an everyday scenario  **Section 2: Applying your science knowledge** |
| Skills dimension | Questioning and predicting | Makes a prediction about the effect of friction  **Section 1: Prediction** |
| Planning and conducting | Collection and recording of data in the results tables and use of data to draw a column graph  **Section 1: Results** |
| Processing and analysing data and information | Use of data in the results tables and column graph to explain findings  **Section 1: Discussion** |
| Evaluating | Identification of factors that need to be considered to make the investigation fair  **Section 1: Keeping the investigation fair** |
| Communicating | Communication of ideas and findings in a variety of ways (short responses, tables, column graph)  **Sections 1 and 2** |

The task-specific standards for this assessment are provided in two models using the same task‑specific valued features:

* a matrix
* a continua.

#### Matrix and Continua

Task-specific standards can be prepared as a matrix or continua. Both the matrix and continua:

* use the Queensland standard elaborations to develop task-specific descriptors to convey expected qualities in student work — A to E or equivalent
* highlight the same valued features from the Queensland standard elaborations that are being targeted in the assessment and the qualities that will inform the overall judgment
* incorporate the same task-specific valued features i.e. make explicit the particular understanding / skills students have the opportunity to demonstrate for each selected valued feature
* provide a tool for directly matching the evidence of learning in the student response to the standards to make an on-balance judgment about student achievement
* assist teachers to make consistent and comparable evidence-based A to E or equivalent judgments.

##### Continua

The continua model of task-specific standards uses the dimensions of the Australian Curriculum achievement standard to organise task-specific valued features and standards as a number of reference points represented progressively along an A–E continuum. The task-specific valued features at each point are described holistically. The task-specific descriptors of the standard use the relevant degrees of quality described in the Queensland standard elaborations.

Teachers determine a position along each continuum that best matches the evidence in the students’ responses to make an on-balance judgment about student achievement on the task.

The continua model is a tool for making an overall on-balance judgment about the assessment and for providing feedback on task specific valued features.

##### Matrix

The matrix model of task-specific standards uses the structure of the Queensland standard elaborations to organise the task-specific valued features and standards A to E. The task-specific descriptors of the standard described in the matrix model use the same degrees of quality described in the Queensland standard elaborations.

Teachers make a judgment about the task-specific descriptor in the A to E (or equivalent) cell of the matrix that best matches the evidence in the students’ responses in order to make an on-balance judgment about how well the pattern of evidence meets the standard.

The matrix is a tool for making both overall on-balance judgments and analytic judgments about the assessment. Achievement in each valued feature of the Queensland standard elaboration targeted in the assessment can be recorded and feedback can be provided on the task-specific valued features.

## Use feedback

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| Feedback to students | Evaluate the information gathered from the assessment to inform teaching and learning strategies. Focus feedback on the student’s personal progress and the next steps in the learning journey.  The task-specific standards for this assessment can be used as a basis for providing feedback to students.  Offer feedback that:   * maximises the students’ opportunities to succeed in the assessment by providing feedback on investigations carried out during the term, specifically about: * making reasoned predictions * accurately collecting and recording data in tables and column graphs * using the data in tables and column graphs as evidence to give reasoned explanations for investigation findings * involves students in the process by providing opportunities to ask follow-up questions * focuses on each student’s personal progress relative to their previous achievements * identifies the characteristics of a high quality response that aligns with the descriptors in the task-specific standards. |
| Resources | For guidance on providing feedback, see the professional development packages titled:   * *About feedback* [www.qsa.qld.edu.au/downloads/p\_10/as\_feedback\_about.doc](http://www.qsa.qld.edu.au/downloads/p_10/as_feedback_about.doc) * *Seeking and providing feedback* [www.qsa.qld.edu.au/downloads/p\_10/as\_feedback\_provide.doc](http://www.qsa.qld.edu.au/downloads/p_10/as_feedback_provide.doc). |