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Queensland Curriculum and Assessment Authority

Engineering 2025 v1.2

IA3: Sample assessment instrument

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

Student name	sample only
Student number	sample only
Teacher	sample only
Issued	sample only
Due date	sample only

Marking summary

Criterion	Marks allocated	Provisional marks
Symbolising and Communicating	7	
Determining and Generating	9	
Synthesising and Evaluating	9	
Overall	**25**	

Conditions

Technique	Extended response — Engineered solution
Unit	Unit 4: Machines and mechanisms
Topic/s	Topic 1: Machines in society Topic 2: Machines, mechanisms and control Topic 3: Materials
Duration	Approximately 10 hours of class time
Mode / length	Written and visual: up to 10 A4 pages including • up to 2000 words • images, graphs, calculations and diagrams
Individual / group	Individual
Other	Students can develop their responses in class time and their own time

Context

A food processing company currently uses one production line to deposit various food products into either round or hexagonal glass jars. The company has decided to increase its output capacity by introducing an additional production line running 1.5 m above the existing production line. Both production lines will be fed by the existing jar-feeder line. Each line will fill 30 glass jars with product per minute.

The company requires a mechanism that will evenly distribute glass jars from the jar-feeder line to each production line. Each production run will only fill either round or hexagonal jars during that run. Requirements for the glass jar distribution system:

- dimensions of round glass jars
  - outside diameter — 75 mm
  - overall height — 150 mm
- hexagonal glass jars are the same height and hold the same volume as round glass jars
- the shape and size of the screw lid area of the jar are irrelevant to the development of the glass jar distribution system
- empty glass jars have a mass of 250 g
- glass jars have smooth exterior surfaces
- glass jars need to be raised 1.5 m from the existing jar-feeder line to the new production line
- use a scale of 1:1 for virtual prototypes and 1:10 for physical prototypes.

Task

Your task is to develop and propose an engineered solution in response to the glass jar distribution system problem using logic control technology to meet the food processing company's requirements. In your response, document the problem-solving process used to develop and propose an engineered solution. Include pictures, sketches and/or CAD drawings of the virtual or physical prototype glass jar distribution mechanism to provide performance data concerning that part of the system that evenly distributes glass jars to each production line from the existing jar-feeder line.

To complete this task, you must:

- symbolise and explain ideas and the solution to the machine and/or mechanism problem using, e.g. annotated sketching, drawings including basic drawing standards (hand or CAD), logic and/or electrical circuit diagrams, force diagrams, graphs, tables and/or schemas
- determine success criteria, considering the identified elements, components and features, and their relationship to the structure of the machine and/or mechanism problem
- synthesise engineering mechanics, materials science, control technologies, technology and research information and ideas to propose a possible real-world solution to the machine and/or mechanism problem
  - evaluate and refine a solution using success criteria and refine solution using data, including test materials and processes
  - calculate using mechanics concepts and principles to propose prototype and real-world solution performance

  - evaluate prototype solution performance data and the reliability of the prototype solution
  - resolve uncertainties to refine the prototype solution
  - evaluate the real-world solution using success criteria and prototype performance data
- generate the prototype solution for testing, including
  - virtual and/or physical prototyping processes, e.g. 3D modelling and simulation, scaled modelling, 3D printing, laser cutting or manual processes
  - annotations on photographs or screen captures of the prototype solution prior to and after testing
  - performance of destructive or non-destructive testing of the prototype solution to provide performance data to determine the feasibility of the real-world machine and/or mechanism solution
- recommend and justify modifications to the real-world solution to the machine and/or mechanism problem
- communicate
  - the development of ideas and the solution for the machine and/or mechanism problem using written and visual features, e.g. PMI (plus, minus, interesting) charts, sketches, drawings, diagrams, graphs, tables and/or schemas
  - data using diagrams, tables and/or spreadsheets.

Checkpoints

☐ Term 3 Week 3: You are required to submit a draft demonstrating success criteria determined from the problem, the development of ideas, and an indication of a proposed solution.

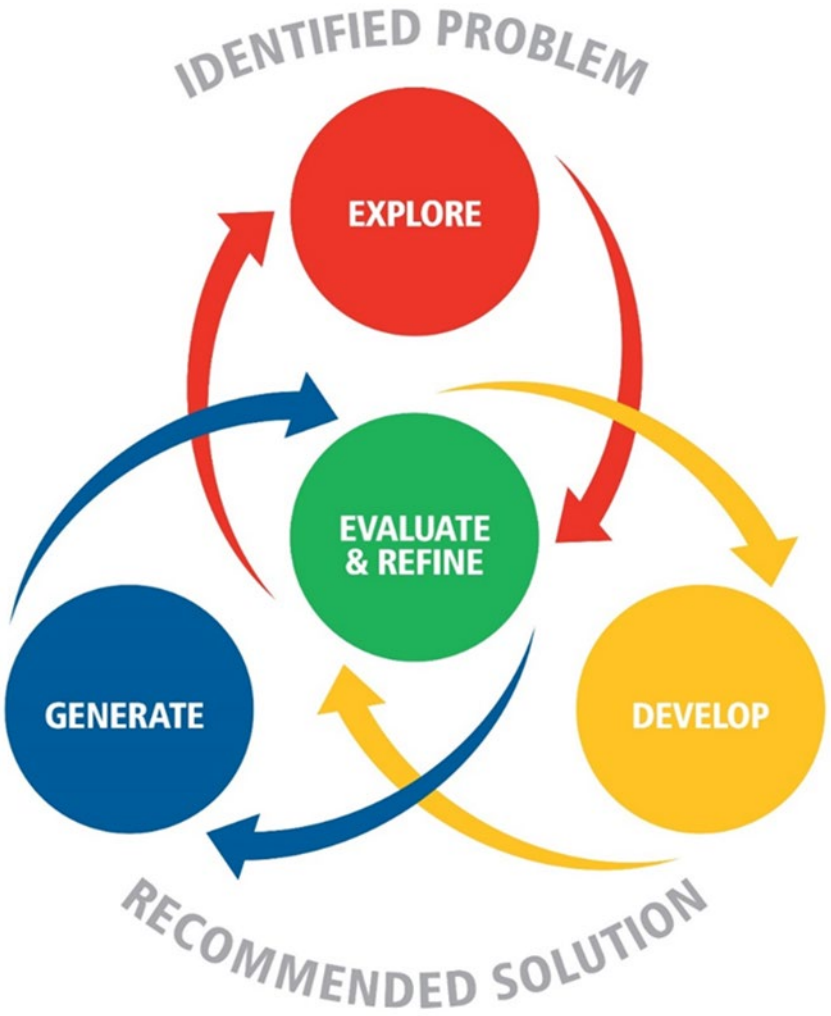
Authentication strategies

- You will be provided class time for task completion.
- Your teacher will collect and annotate a draft.
- You must acknowledge all sources.
- You must submit a declaration of authenticity.
- Your teacher will conduct interviews or consultations as you develop the response.
- Your teacher will ensure class cross-marking occurs.
- You will provide documentation of your progress at the indicated checkpoint.

Scaffolding

You are required to document how you apply the problem-solving process in response to the real-world-related machines and/or mechanisms problem.

The problem-solving process in Engineering



Your response should include the following conventions:

- headings that organise and communicate your thinking throughout the iterative phases of the problem-solving process
- a table of contents
- a reference list and a recognised system of in-text referencing.

Instrument-specific marking guide (IA3): Engineered solution response (25%)

Symbolising and Communicating	Marks
The student response has the following characteristics:	
• adept symbolisation and discerning explanation of ideas and a solution in relation to machines and/or mechanisms with – sketches and drawings – tables and graphs – diagrams and/or schemas • discerning decision-making about, and proficient use of – written and visual features to communicate about a solution – language for a technical audience – grammatically accurate language structures – referencing conventions	6–7
• effective symbolisation and considered explanation of ideas and a solution in relation to machines and/or mechanisms with – sketches and/or drawings – tables and/or graphs – diagrams and/or schemas • effective decision-making about, and fluent use of – written and visual features to communicate about a solution – language for a technical audience – grammatically accurate language structures – referencing conventions	4–5
• competent symbolisation and appropriate explanation of some ideas and a solution in relation to machines and/or mechanisms with – sketches and/or drawings – tables and/or graphs – diagrams and/or schemas • appropriate decision-making about, and use of – written and visual features to communicate about a solution – suitable language – grammatically accurate language structures – referencing conventions	2–3
• inconsistent symbolisation or superficial explanation of aspects of ideas or a solution in relation to machines and/or mechanisms • inconsistent decision-making about, and inconsistent use of – written and visual features – grammar and language structures – referencing conventions	1
The student response does not satisfy any of the descriptors above.	0

Determining and Generating	Marks
The student response has the following characteristics:	
• astute determination of essential success criteria for the machines and/or mechanisms problem • proficient generation of a machines and/or mechanisms prototype solution • provide valid performance data to critically determine the feasibility of the machines and/or mechanisms real-world solution	8–9
• reasoned determination of effective success criteria for the machines and/or mechanisms problem • effective generation of a machines and/or mechanisms prototype solution • provide valid performance data to effectively determine the feasibility of the machines and/or mechanisms real-world solution	6–7
• logical determination of appropriate success criteria for the machines and/or mechanisms problem • adequate generation of a machines and/or mechanisms prototype solution • provide relevant performance data to determine the feasibility of the machines and/or mechanisms real-world solution	4–5
• reasonable determination of some success criteria for the machines and/or mechanisms problem • partial generation of a machines and/or mechanisms prototype solution • provide elements of performance data to partially determine the feasibility of the machines and/or mechanisms solution	2–3
• statements about some success criteria for the machines and/or mechanisms problem • generation of elements of a machines and/or mechanisms prototype solution	1
The student response does not satisfy any of the descriptors above.	0

Synthesising and Evaluating	Marks
The student response has the following characteristics:	
• coherent and logical synthesis to propose a possible machines and/or mechanisms solution of ideas and the relevant – engineering mechanics – materials science – control technologies – technology – research information • critical evaluation of ideas and a solution using success criteria • discerning refinement of a solution using success criteria to make astute recommendations for enhancements justified by data and research evidence	8–9
• logical synthesis to propose a possible machines and /or mechanisms solution of ideas and the relevant – engineering mechanics – materials science – control technologies – technology and/or research information	6–7

Synthesising and Evaluating	Marks
• reasoned evaluation of ideas and a solution using success criteria • effective refinement of a solution using success criteria to make considered recommendations for enhancements justified by data and research evidence	
• simple synthesis to predict a possible machines and /or mechanisms solution of ideas and – engineering mechanics – materials science – control technologies – technology and/or research information • feasible evaluation of ideas and a solution using some success criteria • adequate refinement of a solution using some success criteria to make fundamental recommendations for enhancements justified by data and research evidence	4–5
• rudimentary synthesis to propose a machines and/or mechanisms solution of partial engineering mechanics, materials science, control technologies, technology or research information, or ideas • superficial evaluation of ideas or a solution using some success criteria • superficial refinements of a solution to make elementary recommendations for enhancements	2–3
• unclear combinations of information or ideas • identification of a change about an idea or the solution	1
The student response does not satisfy any of the descriptors above.	0