National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Exemplar for Internal Achievement Standard

Technology Level 2

This exemplar supports assessment against:

Achievement Standard 91349

Demonstrate understanding of advanced concepts related to machines

An annotated exemplar is an extract of student evidence, with a commentary, to explain key aspects of the standard. It assists teachers to make assessment judgements at the grade boundaries.

New Zealand Qualification Authority

To support internal assessment

	Grade Boundary: Excellence
1.	For Excellence, the student needs to demonstrate comprehensive understanding of advanced concepts related to machines. This involves discussing why mechanical components were combined to provide the mechanical advantage, the relative motion between input and output, and the efficiency desired in a machine. There is no student work currently available at this grade. A discussion would depend on the machine chosen of how mechanical components are combined to provide the desired mechanical advantage, the relative motion between input and output, and the desired efficiency. For example, for a drill press, the student could discuss why the components were combined the way they were to achieve a mechanical advantage. Discussion could consider other components that could have been used to achieve the same (or a better) mechanical advantage, including diagrams and/or photographs with annotations and calculations. Students also need to discuss the efficiency desired, in terms of the ratio between outputs achieved and input effort, that enable such things as the drill/router bit to rotate at such a speed to allow a hole or an edge to be made cleanly, and the table to be adjusted for different timbers or angle drilling. Additionally, the student may also discuss what happens when you try to cut a depth that is too great, and how variations in mechanical advantage and efficiencies are achieved. The discussion could account for changes in materials being used (e.g. the different thicknesses and types of timbers, metals or plastics), and the required effect (e.g. the size and profile of the hole).

	Grade Boundary: Merit
2.	For Merit, the student needs to demonstrate in-depth understanding of advanced concepts related to machines which involves: This involves explaining how mechanical components combine to provide the desired mechanical advantage, and the relative motion between input and output in a machine. There is no student work currently available at this grade. An explanation would depend on the machine chosen for how mechanical components are combined to provide the desired mechanical advantage, and the relative motion between input and output. For example, for a sewing machine, the student could include diagrams and/or photographs with annotations and calculations to explain the mechanical advantage achieved between inputs and different outputs. The student could explain how the rotary input motion from the electric motor which drives the machine is converted by components such as driveshafts, crankshafts, gears and pulleys, producing the final reciprocating motion required by the sewing machine needle.

	Grade Boundary: Achieved
3.	For Achieved, the student needs to demonstrate understanding of advanced concepts related to machines. This involves: • explaining how mechanical components are combined to form machines • describing the efficiencies of machines in relation to their safe application • explaining how mechanical components are combined to transfer work and motion in machines. There is no student work currently available at this grade. The way that students would demonstrate their understanding would depend on the machine(s) chosen. In order to explain how mechanical components are combined to form machines, the student should include annotated diagrams/photographs that identify the machine's components, the position of each component within the machine, and an explanation of how they work together to produce the desired output. To describe the efficiencies of a sewing machine or a selection of sewing machine components, the student could describe the transfer of energy from the upper driveshaft to the lower driveshaft, and describe the ratio (calculated by the output energy divided by input energy). A student could describe how the efficiencies of the connected driveshafts result in a safe transfer of energy. To explain, for a hydraulic jack, how mechanical components are combined to transfer work and motion, the student could use diagrams and notations. The student could explain how fixed and moving linkages and levers are connected to hydraulic pistons, and how this enables energy (work) and motion to be transferred from the input (lever) to the lifting piston in order to achieve the required output (lift).