

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: KNOWLEDGE OF MACHINES

Machines consist of fixed and moving parts that modify mechanical energy and transmit it in a more useful form. A simple machine, such as a lever, a pulley, or an inclined plane; alters the magnitude or direction, or both, of an applied force. Complex machines have internal energy systems; such as electric motors, steam engines, turbines, combustion engines, solar energy systems, nuclear systems; that combine with levers, inclined planes and/or screws to enable the machine to perform their intended function/s.

Initially students learn about simple machines such as levers, inclined planes and screws and how when combined with mechanical components they are able to achieve a mechanical advantage and motion. This should progress to students learning how to explain the functionality of complex machines using technical language, diagrams and symbols; and being able to evaluate such machines in terms of their energy efficiency in order to suggest ways of improving this.

	LEVEL 6	LEVEL 7	LEVEL 8
LO	<i>Demonstrate understanding of basic concepts related to machines</i>	<i>Demonstrate understanding of advanced concepts related to machines</i>	<i>Demonstrate understandings of complex concepts related to machines</i>
TEACHER GUIDANCE	<p>To support students to understanding basic concepts related to machines at level 6, teachers could:</p> <ul style="list-style-type: none"> • Provide opportunity for students to explain the purpose of levers, inclined planes and screws. • Provide opportunity for students to explain the purpose of a range of mechanical components within a range of machines. • Guide students to explain the advantages and disadvantages of pneumatic and hydraulic systems. • Guide students to understand how a range of machines provide mechanical advantage and motion. • Guide students to discuss why particular levers, inclined planes and screws, and mechanical components were selected to ensure mechanical advantage and motion in across a range of machines. 	<p>To support students to understanding advanced concepts related to machines at level 7, teachers could:</p> <ul style="list-style-type: none"> • Provide opportunity for students to explore efficiencies of machines (eg, block and tackle, chain block, pneumatic or hydraulic jack, and turntable) and explain their safe use. • These machines should include two or more mechanical components (eg, cams and followers; pivots and linkages; gears; belt or chains and sprockets; shafts and bearings) Guide students to explain how mechanical components combine to provide the desired mechanical advantage, and relative motion between input and output in a range of machines. • Guide students to discuss for a range of machines how mechanical advantage was obtained by combining mechanical components, the relative motion between input and output for the machines, and efficiency(s) obtained. Note: a machines efficiency is determined by the ratio of the energy delivered (or work done) by a machine to the energy needed (or work required) to operate it (i.e. output energy/input energy). 	<p>To support students to understanding complex concepts related to machines at level 8, teachers could:</p> <ul style="list-style-type: none"> • Guide students to explain how complex machines work, using technical language, diagrams and symbols as appropriate. • Support students to discuss how components enable complex machines to achieve their function/s. • Support students to discuss the energy efficiency of complex machines and how this impacts on the requirements for the machine's energy system. • Provide opportunity for students to evaluate the energy efficiency of complex machines and determine possible ways of increasing their energy efficiency.
INDICATORS	<p>Students can:</p> <ul style="list-style-type: none"> • explain the purpose of levers, inclined planes and screws • explain the purpose of a range of mechanical components • explain the advantages and disadvantages of pneumatic and hydraulic systems • explain how a machine provides the mechanical advantage and motion • discuss why particular levers, inclined planes and screws, and mechanical components were selected to ensure the mechanical advantage and motion in machines. 	<p>Students can:</p> <ul style="list-style-type: none"> • describe the efficiencies of machines in relation to their safe application • explain how mechanical components combine to provide the desired mechanical advantage, and relative motion between input and output in a range of machines • discuss why mechanical components were combined to provide the mechanical advantage, relative motion between input and output, and efficiency desired in a range of machines. 	<p>Students can:</p> <ul style="list-style-type: none"> • explain how complex machines work, using technical language, diagrams and symbols as appropriate • discuss how the components enable complex machines to achieve their function/s • discuss the energy efficiency of complex machines and how this impacts on the requirements for the machine's energy system • evaluate the energy efficiency of complex machines and justify possible ways of increasing their energy efficiency.
AS	<p>AS91062 Construction & Mechanical Technologies 1.25 <i>Demonstrate understanding of basic concepts related to machines</i></p>	<p>AS91349 Construction & Mechanical Technologies 2.25 <i>Demonstrate understanding of advanced concepts related to machines</i></p>	<p>AS91625 Construction & Mechanical Technologies 3.25 <i>Demonstrate understanding of complex machines</i></p>
	Level 1 Construction & Mechanical standards & assessment resources	Level 2 Construction & Mechanical standards & assessment resources	Level 3 Technology achievement standards & assessment resources DRAFT