

CONSTRUCTION AND MECHANICAL TECHNOLOGIES: KNOWLEDGE OF STRUCTURES

A structure refers to framework that is used to support a load(s). A framework is comprised of structural members that are assembled using pin or fixed joints. The integrity of a framework is reliant on the strength, weight, material and profile of its structural members; the combination and means of joining structural members; and the safety factors applied to the structure.

Knowledge within this component includes understanding of how pin jointed structural members transfer forces when a framework is subjected to gravitational loads; how safety factors are applied to ensure a frameworks integrity; and calculating using vector diagrams the magnitude, direction and type of force acting on pin jointed structural members in a framework.

Initially students learn what is meant by tension, compression, shear and torsion; how safety factors are applied in the design of frameworks; how structural members and pin joints transfer forces in a framework; and how the integrity of a framework is established. This should progress to students learning how to: use technical language, diagrams and symbols to explain structural members and materials used in structural systems such as buildings, bridges, cranes; explain the way structural members and materials enable a structural system achieve structural integrity through withstanding known loads; and evaluate the structural integrity of a structural system; and determine ways of increasing the structural integrity of a structural system.

	LEVEL 6	LEVEL 7	LEVEL 8
LO	<i>Demonstrate understandings of basic structures</i>	<i>Demonstrate understandings of advanced structures</i>	<i>Demonstrate understandings of complex structures</i>
TEACHER GUIDANCE	<p>To support students to understanding basic structures at level 6, teachers could:</p> <ul style="list-style-type: none"> • Ensure students are aware that frameworks are designed to withstand loads of a greater capacity than they are placed under. • Provide opportunity for students to understand the causes and effects of internal forces within frameworks. That is, the relationship between tension, compression, bending, shear and torsion in structural framework members, and how material selection (i.e. composition, profile) is used to address this (eg, round pipe rather than solid round is used when members subjected to a compressive force). • Provide opportunity for students to understand how 'safety factor' is applied across different framework structure contexts (eg, bridges, cranes, trusses) • Provide opportunity for students to understand the structural members that form a framework (eg, Posts, beams, struts, ties) and how they are joined (eg, fixed, pin joint, moving) across different framework structure contexts. • Provide opportunity for students to understand how pin jointed structural members in a framework transfer forces due to gravity load to ensure the frameworks integrity is maintained. 	<p>To support students to understanding advanced structures at level 7, teachers could:</p> <ul style="list-style-type: none"> • Provide opportunity for students to understand how, where and why pin and moving joints are used in frameworks across different framework structure contexts (eg, bridges, cranes, trusses). • Provide opportunity for students to explain, using vector diagrams, the magnitude, direction and type of force acting on pin jointed structural members when a framework is subjected to known gravitational loads. • Provide opportunity for students to explain how structural members combine to resist loads and transfer forces within a pin jointed framework to ensure the frameworks is maintained in equilibrium. • Provide opportunity for students to understand how 'safety factor' is applied across different framework structure contexts (eg, bridges, cranes, trusses) to ensure a frameworks integrity is maintained. 	<p>To support students to understanding complex structures at level 8, teachers could:</p> <ul style="list-style-type: none"> • Provide opportunity for students to understand how dynamic loads (such as those resulting from changes in temperature, wind and earth movement, end use) impact on the design of structural systems (such as buildings, bridges, cranes, vehicles, appliances). • Provide opportunity for students to use technical language, diagrams and symbols to explain structural members and materials used in structural systems, and how these systems withstand known loads. • Provide opportunity for students to understand how the selection of structural members and materials enables structural systems to achieve integrity in terms of withstanding known loads across a range of differing structural systems. • Provide opportunity for students to evaluate structural systems and discuss, with justifications, possible ways of increasing the structural integrity of structural systems across a range of differing structural systems.
INDICATORS	<p>Students can:</p> <ul style="list-style-type: none"> • explain what is meant by tension, compression, shear and torsion • explain the safety factors applied to a framework • explain how structural members and pin joints transfer forces in a framework. • discuss how the integrity of a framework is established. 	<p>Students can:</p> <ul style="list-style-type: none"> • describe where pin and moving joints are used on frameworks • describe the effects of loads when fixed joints are used in frameworks • describe the effects of load on pin jointed frameworks using vector diagrams • explain the types of forces which can act on pin jointed structural members when a frameworks is placed under known gravitational loads • explain how structural members combine to resist loads and transfer forces within a pin jointed framework • explain structural member profiles and forms and why they are used in a framework • explain how structural members combine to resist loads and transfer forces within pin jointed framework • explain how safety factors are determined and discuss how they have been applied to ensure the integrity of a framework. 	<p>Students can:</p> <ul style="list-style-type: none"> • use technical language, diagrams and symbols to explain structural members and materials used in a structural system, and how the system withstands known loads • discuss how the selection of structural members and materials enables a structural system to achieve structural integrity in terms of withstanding known loads • evaluate the structural integrity of a structural system. • discuss, with justification, possible ways of increasing the structural integrity of a structural system.
AS	<p>AS91061 Construction and Mechanical Technologies 1.24 <i>Demonstrate understanding of basic concepts related to structural frameworks</i></p>	<p>AS91348 Construction and Mechanical Technologies 2.24 <i>Demonstrate understanding of advanced concepts related to structural frameworks</i></p>	<p>AS91624 Construction and Mechanical Technologies 3.24 <i>Demonstrate understanding of a structural system</i></p>
	Level 1 Construction & Mechanical standards & assessment resources	Level 2 Construction & Mechanical standards & assessment resources	Level 3 Technology achievement standards & assessment DRAFT