# Technological Products

Technological products are material (tangible) objects that have been designed by people and developed through technological practice to serve particular functions.

In every technological product there is a crucial relationship between the (chemical) composition and structure of the materials used and their performance properties.

For this reason, technologists need to be able to evaluate different materials and select the most suitable for their purpose.

They also need to understand how existing materials can be modified or new materials formulated, and how choice of materials impacts on the design, development, maintenance, and disposal of technological products.

## Indicators of progression

Level 1

**Achievement objective**

Students will:

Understand that technological products are made from materials that have performance properties.

**Teacher guidance**

To support students to develop understanding of technological products at level 1, teachers could:

* provide students with a range of technological products and encourage them to explore these through such things as: using, ‘playing’, dismantling and rebuilding as appropriate
* guide students to identify the materials that the products explored are made from
* provide opportunity for students to discuss that performance properties of materials refer to such things as thermal and electrical conductivity, water resistance, texture, flexibility, colour etc.
* provide students with the opportunity to explore common materials and guide them to identify their performance properties
* provide students with a range of technological products to explore and guide them to identify ways in which materials have been manipulated to make the product. For example, in a wooden toy the wood has been shaped, sanded and painted; In a sandwich, the bread dough has been shaped, cooked and sliced; in a cushion the fabric has been cut and sewn together.

**Indicators**

Students can:

* identify materials that technological products are made from
* identify performance properties of common materials
* identify how the materials have been manipulated to make the product.

Level 2

**Achievement objective**

Students will:

Understand that there is a relationship between a material used and its performance properties in a technological product.

**Teacher guidance**

To support students to develop understanding of technological products at level 2, teachers could:

* guide students to understand that performance properties of materials refer to such things as thermal and electrical conductivity, water resistance, texture, flexibility, colour etc.
* provide students with the opportunity to research and experiment with a range of materials and guide them to describe how their performance properties relates to how they could be useful. For example, a material that was water and UV resistant, durable, and easily cleaned could be useful for outdoor furnishings
* provide students with the opportunity to research and experiment with a range of materials and guide them to describe how particular materials can be manipulated.
* provide students with a variety of technological products to explore and encourage them to explore these through such things as: using, ‘playing’, dismantling and rebuilding as appropriate
* guide student to describe the relationship between the materials selected and their performance properties. For example, a school lunch box is made of plastic because plastic can be molded into different shapes, and is hard, durable, lightweight and easily cleaned.

**Indicators**

Students can:

* describe the performance properties of a range of materials and use these to suggest things the materials could be used for
* describe feasible ways of manipulating a range of materials
* suggest why the materials used in particular technological products were selected.

Level 3

**Achievement objective**

Students will:

Understand the relationship between the materials used and their performance properties in technological products.

**Teacher guidance**

To support students to develop understanding of technological products at level 3, teachers could:

* provide students with the opportunity to discuss that performance properties of materials can be measured objectively and subjectively.

Subjective measurement is reliant on people’s perception (tasty, evokes a sense of natural beauty, warm and inviting etc) where as objective measurement is not (conductivity, UV resistance etc). The fitness for purpose of a product relies on the material providing appropriate performance properties to ensure the product is technically feasible and acceptable (safe, ethical, environmentally friendly, economically viable, etc -as appropriate to particular products)

* provide students with a variety of technological products to explore and guide them to identify the performance properties of all the materials used, and to explain if these could be measured objectively or subjectively
* provide students with a variety of technological products and guide them to explain how properties combine to make the product both technically feasible and socially acceptable.

**Indicators**

Students can:

* describe the properties of materials used in particular products that can be measured objectively
* describe the properties of materials used in particular products that can be measured subjectively
* describe how the properties combine to ensure the materials allow the product to be technically feasible and socially acceptable.

Level 4

**Achievement objective**

Students will: Understand that materials can be formed, manipulated, and/or transformed to enhance the fitness for purpose of a technological product.

**Teacher guidance**

To support students to develop understanding of technological products at level 4, teachers could:

* provide students with the opportunity to discuss what is meant by materials being formed, manipulated and transformed.

Forming refers to bringing two or more materials together to formulate a new material resulting in a different overall composition and structure to that of the original materials. This results in different performance properties. For example: mixing flour, water and salt to make dough; mixing wood fibres, resin and wax to make MDF; glass fibre and a polymer resin combined to form fiberglass or fibre reinforced polymer (FRP). Manipulating materials refers to ’working’ existing materials in ways that do not change their properties as their composition and structure is not altered. For example: cutting; molding; bending; jointing; gluing; painting. Transforming refers to changing the structure of an existing material to change some of its properties, but in terms of its composition, it remains the same material. For example: felting; beating an egg white; steaming timber to soften its fibres and allow it to be manipulated (bent)

* guide students to understand that for materials to be selected for use in a technological product, their performance properties must align with the desired specifications of the product.
* guide students to recognise that during development of a product, specifications are established that will require the manipulation, and in some cases, transformation and formation, of materials.
* provide students with a variety of technological products to explore and guide students to identify examples of when materials needed to be manipulated, transformed and/or formed to enable material linked specifications of the product to be met and contribute to the product’s fitness for purpose.
* provide students with a scenario outlining technical and acceptability specifications for a product and support them to explore and research materials to determine what material would be suitable and how they could be manipulated and/or transformed to meet product specifications
* support students to communicate material related
* details effectively. Material related details include such things as what materials would be feasible and how they would need to be formulated, manipulated and/or transformed. Effective communication uses specialised language and symbols.

**Indicators**

Students can:

* describe examples to illustrate how the manipulation of materials contributed to a product’s fitness for purpose
* describe examples to illustrate how the transformation of materials contributed to a product’s fitness for purpose
* describe examples to illustrate how the formulation of new materials contributed to a product’s fitness for purpose
* communicate, using specialised language and drawings, material related details that would allow others to create a product that meets both technical and acceptability specifications.

Level 5

**Achievement objective**

Students will:

Understand how materials are selected, based on desired performance criteria.

**Teacher guidance**

To support students to develop understanding of technological products at level 5, teachers could:

* guide students to understand that the composition of materials determines what performance properties it exhibits. Composition relates to such things as the type and arrangement of particles that make up the material.
* support students to analyse examples of how materials have been selected to gain insight into how this selection relies on understanding the composition of the materials available and using this knowledge to help decide which materials in combination would provide the best ‘fit’ with the product specifications

Examples should include the material selection practices of technologists.

**Indicators**

Students can:

* discuss examples to illustrate how the composition of materials determines performance properties
* explain the link between specifications of a product and the selection of suitable materials for its construction
* discuss examples to illustrate how decisions about material selection take into account the composition of the material and the specifications of the product.

Level 6

**Achievement objectives**

Students will:

Understand how materials are formed, manipulated, and transformed in different ways, depending on their properties, and understand the role of material evaluation in determining suitability for use in product development.

**Teacher guidance**

To support students to develop understanding of technological products at level 6, teachers could:

* provide students with the opportunity to research and experiment with a range of materials to develop understandings of how the composition and structure of materials impacts on how they can be manipulated and/or transformed, or combined to formulate a new material.
* guide students to understand that material evaluation enables decisions to be made about how a material would support, or not, the fitness for purpose of particular technological products, and decrease the probability of a product malfunction.
* support students to analyse examples of how materials have been evaluated to determine their suitability for use in particular technological products

Examples should include the material evaluation practices of technologists.

**Indicators**

Students can:

* explain how the composition and structure of different materials enables them to be manipulated in specific ways
* explain how the composition and structure of materials determines the ways they can be transformed
* explain how the composition and structure of materials impacts on how they can be combined to formulate a new material
* describe the role of material evaluation in determining material suitability for use in a technological product
* discuss examples to illustrate how material evaluation informed the selection of materials in particular product development.

Level 7

**Achievement objective**

Students will:

Understand the concepts and processes employed in materials evaluation and the implications of these for design, development, maintenance, and disposal of technological products.

**Teacher guidance**

To support students to develop understanding of technological products at level 7, teachers could:

* support students to understand that material evaluation enables decisions to be made about what material would be optimal to ensure the fitness for purpose of particular technological products
* support students to explore a range of subjective and objective evaluative procedures used to identify the suitability of materials for different uses
* support students to describe the underpinning concepts and processes related to subjective and objective evaluative procedures
* support students to understand the selection of appropriate material evaluation procedures relies on understanding the composition and structure of materials, how their properties can be enhanced through manipulation or transformation, the performance criteria required by technological products and an understanding of the physical and social context within which the technological product will be situated
* support students to identify and analyse examples of how materials have been evaluated to allow material selection decisions that maximise
* the potential fitness for purpose of particular technological products and to gain insight into how material evaluation procedures can be used to identify product maintenance and disposal implications and therefore inform design, development and post production care decisions

Examples should include the material evaluation practices of technologists.

**Indicators**

Students can:

* discuss a range of subjective and objective evaluative procedures used to determine the suitability of materials and describe the underpinning concepts and processes involved in particular procedures
* discuss examples of material evaluation procedures undertaken to support material selection decisions and justify the appropriateness of these procedures
* discuss examples to explain how material evaluation impacted on design and development decisions
* discuss examples to explain how material evaluation impacted on maintenance and disposal decisions.

Level 8

**Achievement objective**

Students will: Understand the concepts and processes employed in materials development and evaluation and the implications of these for design, development, maintenance, and disposal of technological products.

**Teacher guidance**

To support students to develop understanding of technological products at level 8, teachers could:

* support students to understand that material evaluation enables decisions to be made about what material would be optimal to ensure the fitness for purpose when taking into account both the technical feasibility and social acceptability of the product.
* support students to critically analyse a range of subjective and objective evaluative procedures used to justify material suitability and to explain the underpinning concepts and processes involved in these procedures
* support students to understand why the selection of appropriate material evaluation procedures relies on understanding the composition and structure of materials, how their properties can be enhanced through manipulation or transformation, the performance criteria required by technological products and an understanding of the physical and social context within which the technological product will be situated.
* support students to understand that the development of new materials relies on understanding: existing materials including their advantages and limitations; new material composition and structure possibilities; formulation procedures; future requirements, needs and desires; and an awareness that new evaluative procedures may need to be developed to determine the suitability of new materials
* support students to identify and analyse examples where new materials have been developed, including past and contemporary examples, to gain insight into how material formulation and subsequent evaluation procedures are used to address performance, maintenance and disposal implications and inform design and development decisions

Examples should include material development (including formulation procedures) and evaluation practices of technologists.

**Indicators**

Students can:

* discuss examples of the formulation of new materials and explain the underpinning concepts and processes involved in their development
* discuss examples of evaluation procedures undertaken to determine the suitability of new materials and explain the underpinning concepts and processes involved in particular evaluations
* discuss examples of past material developments and explain how these impacted on product design, development, manufacturing, maintenance and disposal
* discuss examples of contemporary material developments and suggest probable implications for future technological product design, development, manufacturing, maintenance and disposal.