Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level and standard level
Paper 2

31 October 2025

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

Candidate session number

1 hour 30 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

8825–6503

23 pages

Section A

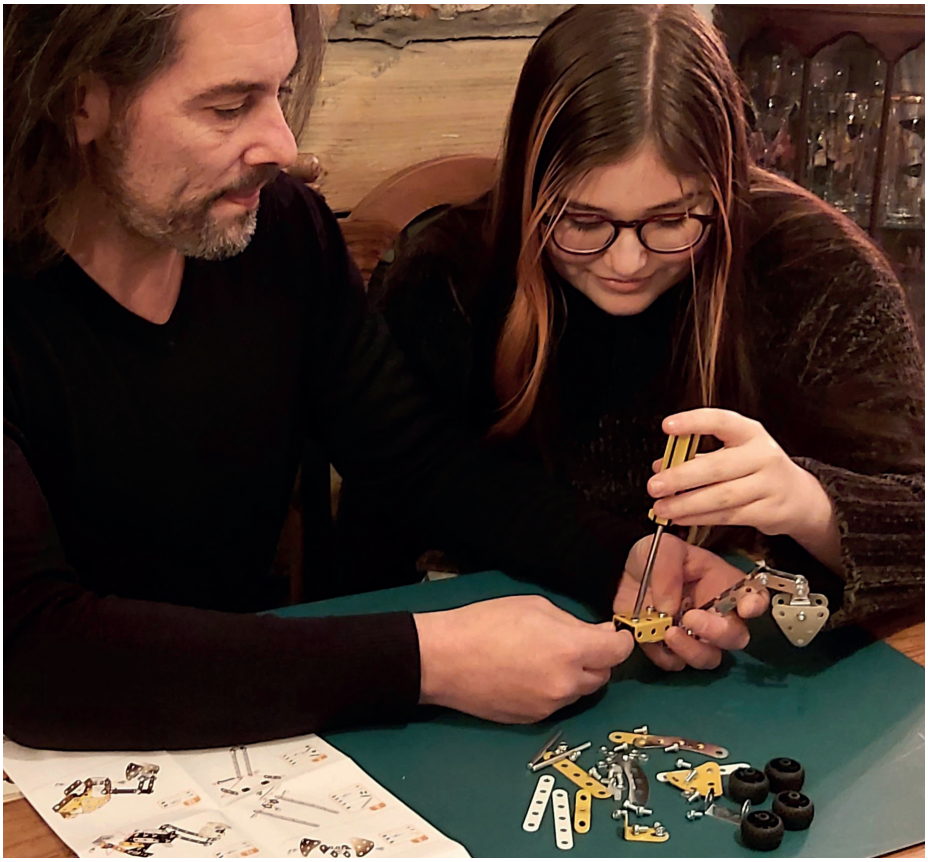
Answer **all** questions. Answers must be written within the answer boxes provided.

1. Meccano is a classic educational toy that consists of reusable parts, plates and joining components for the creation of 3D mechanical objects (see **Figure 1a**, **Figure 1b** and **Figure 2**). Meccano parts are designed to last for many years.

The original prototype was created in 1891 by Frank Hornby. The first and earliest physical prototype was designed by Hornby as a toy to occupy his children whilst he worked.

Currently the Meccano parts are prototyped using computer aided design (CAD) systems used to build virtual prototypes of the Meccano parts and analyse the parts for a range of users.

Figure 1a: Parent and child constructing Meccano



(This question continues on the following page)

(Question 1 continued)

Figure 1b: Partially constructed Meccano model

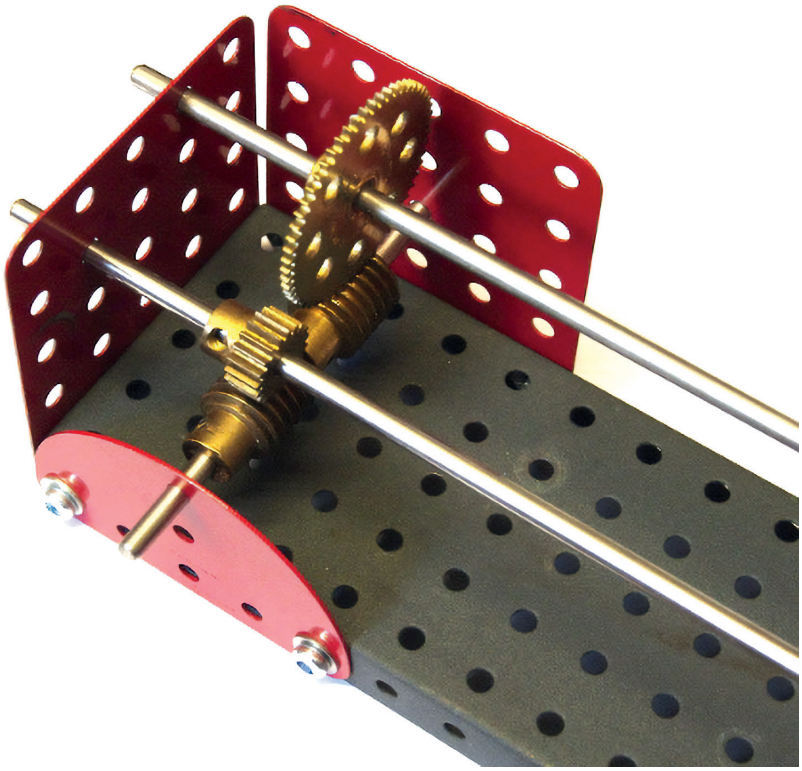
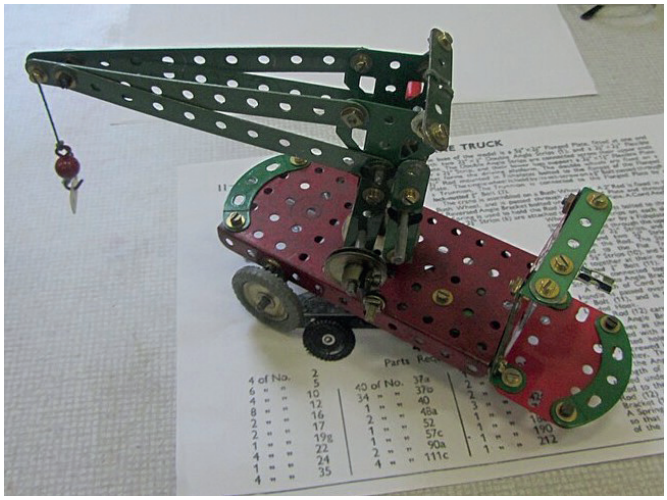


Figure 2: An early Meccano model of a mechanical crane



(This question continues on the following page)

(Question 1 continued)

(a) (i) State **one** benefit of the use of physical models for designers. [1]

. . . . . .

. . . . . .

(ii) List **two** advantages of Meccano designers using computer aided design (CAD) models over physical models. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) (i) Outline how the ability to create endless constructions using the Meccano parts reduces waste or pollution. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(ii) Meccano has been sold as a product that can be used by children and young people.

State which aspect of human factor design is considered when using a screwdriver to fix one Meccano metal plate to another. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 1 continued)

(c) (i) List **two** reasons why only a small number of inventions become innovations. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(ii) Frank Hornby held the following roles of product champion, inventor and entrepreneur in the invention and innovation of Meccano.

Discuss **one** disadvantage of this for each role. [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

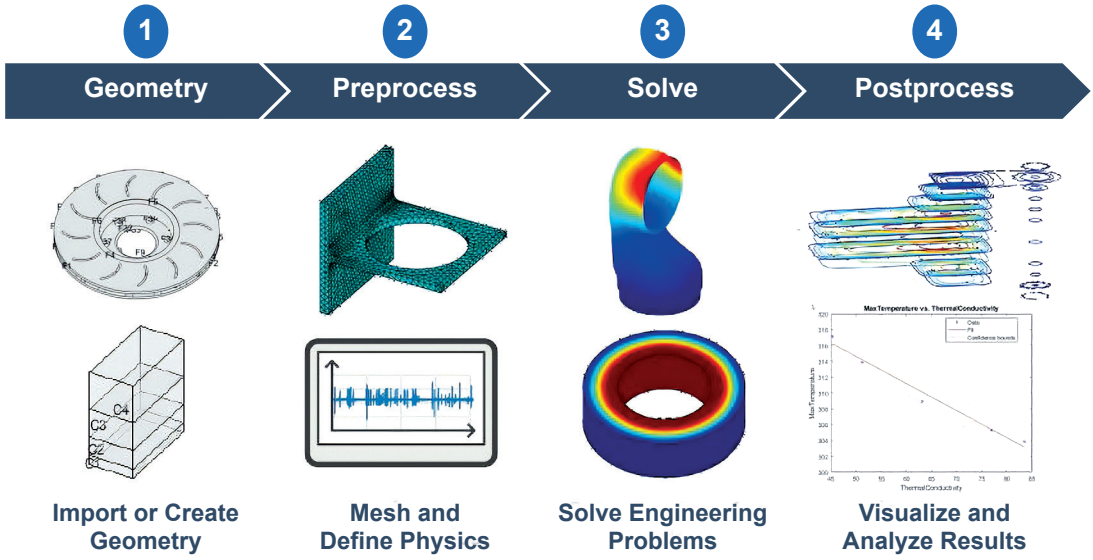
. . . . . .

. . . . . .

(This question continues on the following page)

(Question 1 continued)

Figure 3: A typical finite element analysis (FEA) workflow used as part of a CAD system analysis



[Source: The MathWorks, Inc. (2025). Finite Element Analysis, Natick, Massachusetts: The MathWorks, Inc. https://www.mathworks.com/discovery/finite-element-analysis.html.]

(d) (i) Meccano is often referred to as a classic or iconic educational toy of its time.

Define the term *classic design*. [1]

. . . . . .

. . . . . .

(ii) Explain how technology push may have aided Meccano product development via the inclusion of electronic additions to the kits. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 1 continued)

(e) (i) Outline **one** advantage why finite element analysis (FEA) would have been used in the design of the modern versions of Meccano (see **Figure 3**). [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(ii) Explain why the hardness of the Meccano metal plates are improved by alloying. [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

2. **Figure 4** shows an emergent technology in the form of a “self-driving” wheelchair called the DAAV wheelchair. The wheelchair, designed by a ‘Swisstech’ design company, was created to give users more independence within an airport.

The DAAV wheelchair drives the user automatically to the gate, small adjustments can be made to speed and direction by movements of the user’s hand, shoulders or torso.

Figure 4: Self-drive DAAV wheelchair

(This question continues on the following page)

(Question 2 continued)

(a) List **two** advantages of adjustability over a range of sizes in the design of wheelchairs for users. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) Designers can understand more about the usability of a designed product when they study human factors.

Outline how understanding of human factors has informed the development of the self-driving wheelchairs. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

3. The Little Sun was designed to support the 1.1 billion people around the world who still live without access to electricity.

Figure 5a: A child with the Little Sun solar lamp

The Little Sun is a solar-powered product that has been designed to be weatherproof, with a focus on the sustainability of the product. It is powered by the sun in the daytime and can be used as a light source to study at night.

Little Sun designers claim that the product can be easily disassembled and maintained by a person of any age.

Figure 5b: The Little Sun solar lamp being used by students

(This question continues on the following page)

(Question 3 continued)

Explain why the Little Sun solar lamp was designed for disassembly. [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

4. The innovative shoe pictured in **Figure 6** is designed by shoe brand Vivobarefoot.

The shoe is made from BioCir, a compostable material used as part of an additive printing technique generated by a 3D scan resulting in individually printed objects.

Figure 6: A BioCir compostable shoe

Discuss **one** advantage of using an additive rather than a subtractive manufacturing technique. [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Section B

Answer **one** question. Answers must be written within the answer boxes provided.

5. The 1946 Ray and Charles Eames radio (**Figure 7a**) is a minimal rounded cube with simple retro styling, operated by intuitive dials and buttons. The Eames designers considered the simple shape, size and scale of the radio for ease of handling and included clip-on front plates (**Figure 7b**) to change the aesthetics and sound.

Eames cared about the ecological impact of their products using small amounts of raw materials such as walnut wood veneer around the side panels whilst being mindful of the amount of energy used for manufacture.

The original Eames radio was not mass produced, however new designers Vitra and Revo have recently reintroduced it to produce their own 21st century digital version retaining the iconic product's design style, shape and minimalist appeal.

The detailed clip-on panels from the original version (**Figure 7b**) can be reused and fitted to newer 21st century versions of the radio (**Figure 7c**).

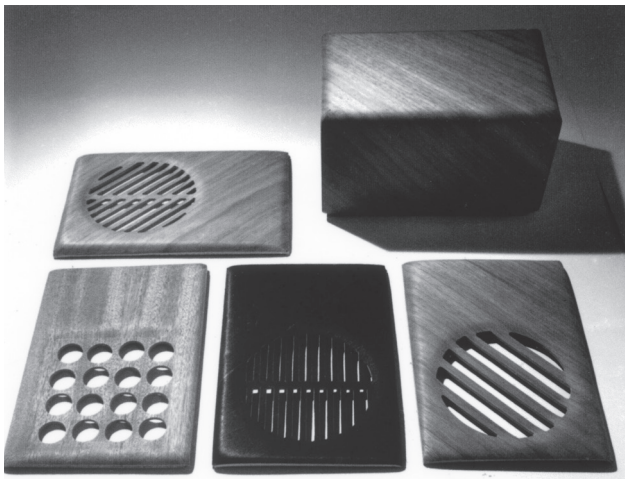
Figure 7a: Original version of the Charles and Ray Eames Radio (1946)

[Source: **© 2026 Eames Office, LLC. All rights reserved.**]

(This question continues on the following page)

(Question 5 continued)

Figure 7b: Selection of original version clip-on front panels



[Source: **© 2026 Eames Office, LLC. All rights reserved.**]

Figure 7c: Vitra and Revo 21st century version of the Eames radio

[Source: © Vitra. With permission from Vitra International AG.]

(a) Outline how physiological data may have been collected during the design of the Vitra 21st century digital version of the radio (**Figure 7c**). [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) Discuss how **two** design features of the original Eames Radio have contributed to its aesthetics and function? [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 5 continued)

(c) Eames designed his products to be modular.

Explain **three advantages** and **three disadvantages** of using modular innovation for a user. [6]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 5 continued)

(d) Eames was innovative when considering eco-values within his products.

Explain how the design of the latest version of the Eames Radio has considered materials, pollution **and** energy. [9]

6. Bond Touch bracelets are a new product range that use haptic technology to communicate with loved ones who live at a distance (see **Figure 8a**).

Using web-based technology, the Bond Touch bracelet is worn on the wrist, and it works by users touching the bracelet's module. The receiver feels the digital vibration on their wrist through their Bond Touch bracelet no matter how far apart they are. This touch feedback is designed to mimic the subtle nuances of a gentle touch, providing a comforting and reassuring sensation and making them feel closer to each other.

The Bond Touch bracelet designers wanted to trial the bracelet before use and therefore produced the prototypes for the Bond Touch bracelet using selective laser sintering (SLS).

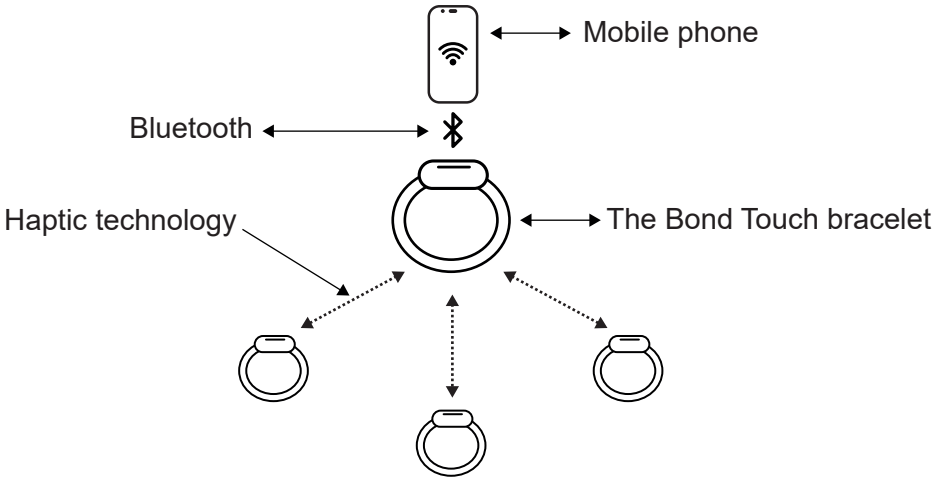
Copyright, trademarks and patents are important for new product designs however sometimes, new entrepreneurs may be too overly confident that their design is unique, this whole area can be confusing, complex and can take a large amount of time.

Figure 8a: Image of the Bond Touch® bracelet

(This question continues on the following page)

(Question 6 continued)

Figure 8b: Diagram of three Bond Touch® bracelets connected via mobile Bluetooth



Connection is possible to three different Bond Touch bracelets.

(a) Outline why SLS was used for the Bond Touch bracelet. [2]

. . . . . .
. . . . . .
. . . . . .
. . . . . .

(b) The Bond Touch bracelet was designed using dematerialization principles.

Explain why dematerialization was an important consideration of the design of the Bond Touch bracelet. [3]

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 6 continued)

(c) Suggest **two** drivers for invention for the Bond Touch bracelet. [6]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 6 continued)

(d) Explain why some designers do **not** protect their intellectual property (IP) with patents, trademarks **and** copyright. [9]

7. Designers are becoming more conscious of nature-based technologies, and how the design of products can affect the ecology of the environment.

The designers of BIOPODs used dematerialization strategies throughout the design cycle to create Biopods using mycelium. BIOPODs are made entirely from bio-based materials and function as miniaturized wetland ecosystems.

Mycelium is made by growing mushrooms on wood chips. Once cultivated, the mycelium forms a sponge-like material that is tough and naturally water-resistant. The mycelium fabric holds great potential as it is easy to regrow and only takes a short amount of time before it can be utilized.

Figure 9a: BIOPODs cleaning waterways

(This question continues on the following page)

(Question 7 continued)

Figure 9b: Air-dried BIOPOD top view

BIOPOD designers have been tasked with designing new ways of adding colour to make the pods more attractive and are examining various ways to introduce the properties of smart materials to mycelium.

(a) Outline **one** advantage of using composite materials. [2]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) Discuss whether mycelium is a renewable or non-renewable resource. [3]

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 7 continued)

(c) Explain how BIOPODs demonstrate the concept of dematerialization in product design.

Focus specifically on reduced material use and biodegradability. [6]

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(This question continues on the following page)

(Question 7 continued)

(d) Photochromic material could be being considered by the designers as a new smart material option to further develop the BIOPODs.

Explain **four positive and four negative** considerations to using photochromic smart material in the BIOPODs. [9]

Disclaimer:

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB. Any trademarks™ or registered® trademarks included are used for illustrative purposes only, and use does not imply any affiliation with or endorsement by the International Baccalaureate.

References:

Figure 1b: With permission from Meccano Spares.

Figure 2: Oxyman. https://commons.wikimedia.org/wiki/File:Hand_operated_workshop_crane_in_Meccano.jpg. Licensed under CC BY 2.0 https://creativecommons.org/licenses/by/2.0/deed.en. Source adapted.

Figure 3: The MathWorks, Inc. (2025). Finite Element Analysis, Natick, Massachusetts: The MathWorks, Inc. https://www.mathworks.com/discovery/finite-element-analysis.html.

Figure 6: With permission from Vivobarefoot.

Figure 7a: **© 2026 Eames Office, LLC. All rights reserved.**

Figure 7b: **© 2026 Eames Office, LLC. All rights reserved.**

Figure 7c: © Vitra. With permission from Vitra International AG.

Figure 8a: With permission from Bond Touch.

Figure 9a: With permission from BIOPOD Co.

Figure 9b: With permission from BIOPOD Co.

24EP24