Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level and standard level
Paper 2

4 November 2024

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]**.

8824 – 6403

19 pages

Section A

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

1. Warwick Music Group, a major manufacturer of musical instruments, developed several innovative products, including the pTrumpet (**Figure 1**).

Figure 1: ABS pTrumpet developed by Warwick Music Group

The pTrumpet is made of recyclable injection moulded Acrylonitrile Butadiene Styrene (ABS) plastic and is available in a range of bright colours. The pTrumpet is significantly lighter and cheaper than typical brass metal trumpets, see **Figure 2**.

Figure 2: Traditional Brass trumpet

(a) (i) State the driver for invention used by Warwick Music Group. [1]

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(ii) Outline why biomechanics is important with the pTrumpet design. [2]

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(Question 1 continued)

(b) (i) List **two** ways that injection moulding contributes to the dematerialization of the ABS plastic pTrumpet shown in **Figure 1**. [2]

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(ii) Outline **one** reason why ABS plastic is easy to recycle. [2]

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(c) (i) Describe **one** mechanical property of ABS plastic that makes it suitable for the pTrumpet. [2]

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(ii) Explain how process innovation applies to the development of the pTrumpet. [3]

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(Question 1 continued)

The pTrumpet is made from several parts, as shown in **Figure 3**. The ABS plastic parts are individually manufactured using the injection moulding technique. An example of a split mould for one of the components is shown in **Figure 4**.

Figure 3: Separated Injection moulded ABS plastic parts

Figure 4: Split mould used for injection moulding

[Source: SpyroTheDragon / iStock.]

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(Question 1 continued)

(d) (i) State **one** driver for employing clean technology in using only injection moulding as the manufacturing method of the pTrumpet. [1]

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(ii) Outline **one** advantage of using injection moulding for the manufacturing of the ABS pTrumpet. [2]

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(e) (i) Outline why an ordinal scale is used to determine the comfort of users of the pTrumpet. [2]

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(ii) Explain **one** benefit of using conceptual modelling in the early parts of the design phase of the pTrumpet. [3]

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2. In 1933, Alfonso Bialetti invented the Bialetti Moka Express coffee maker. It is made from cast aluminium and uses a gas stove to heat and brew the coffee. It is estimated that 75 % of households in Italy own a Bialetti Moka Express coffee maker, see **Figure 5**.

Figure 5: Bialetti Moka Express coffee maker

(a) List **two** characteristics that make the Bialetti Moka Express coffee maker a design classic. [2]

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(b) Outline how Alfonso Bialetti, the designer of the Bialetti Moka Express coffee maker in **Figure 5**, has achieved a balance between form and function. [2]

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3. Explain the role of a product champion within an organization. [3]

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4. Explain how laminated object manufacture (LOM) is used in rapid prototyping. [3]

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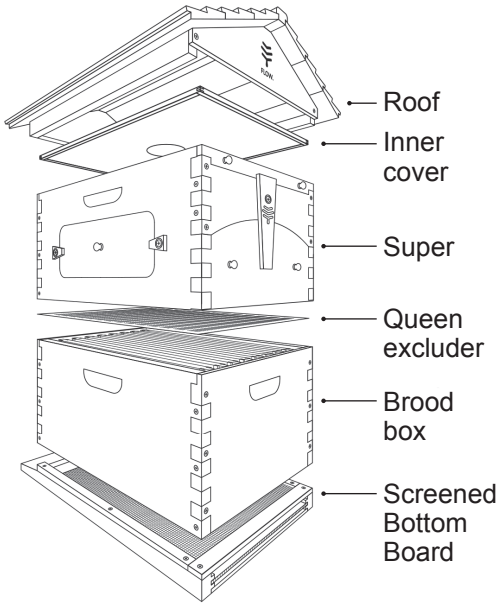
Section B

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

5. Flow is a small company that produces easy to use beehives. The Flow Hive Classic shown in **Figure 6** is a beehive using a patented technology to harvest honey from individual frames directly into a container without disturbing the bees. It is made in Australia from Araucaria, a locally sustainably-grown softwood which is made into plywood sheets. The final parts are cut using a precision laser.

Figure 6: Flow Hive Classic

Figure 7: Constructing the Flow Hive Classic



Flow also offer a range of products in different sizes and designs to suit different customer needs as shown in **Figure 8**. The Flow Hive products are flat-packed for transportation and self-assembly.

Figure 8: Flow Hive product versions

Flow Hive 2+

Flow Hive 2

Flow Hive Classic

(This question continues on the following page)

(Question 5 continued)

(a) Outline the type of graphic modelling used to communicate the construction of the Flow Hive Classic for the user as shown in **Figure 7**. [2]

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(b) Explain **one** advantage of Flow introducing new versions of the Flow Hive shown in **Figure 8**. [3]

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(Question 5 continued)

(c) Explain **two** reasons why Flow may not adopt life cycle analysis (LCA) as a strategy for reducing the environmental impacts of its various products. [6]

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(Question 5 continued)

(d) Explain how the density, compressive strength **and** aesthetic appeal make plywood suitable for the Flow Hive. [9]

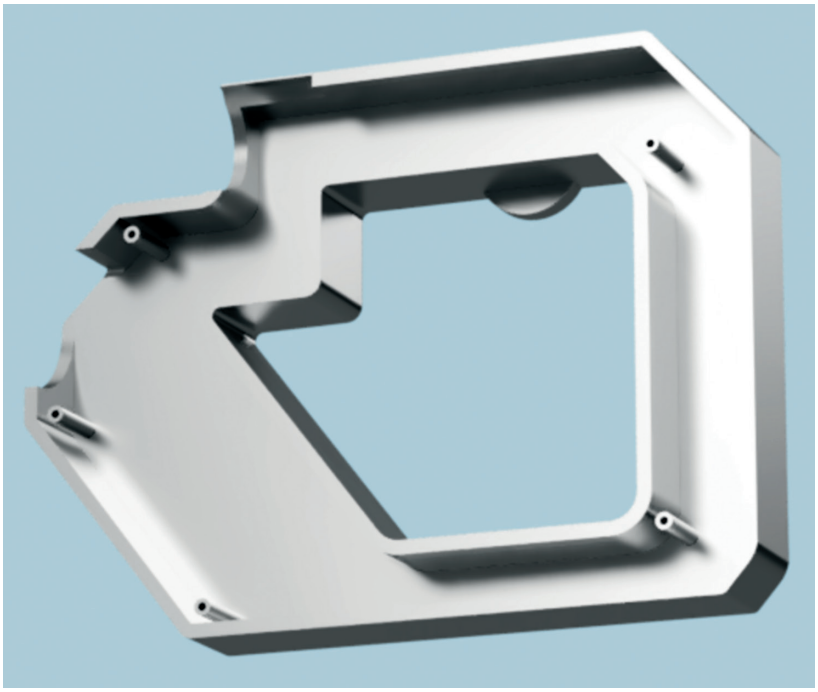
6. The Tricky Drill is a concept electric drill shown in **Figure 9** and **Figure 10** that uses ultrasonic waves to identify hidden water pipes, electric cables, and steel bars when drilling a hole in a wall. The Tricky Drill is lightweight and can save time as it is convenient and has built-in safety features such as a display panel which informs the user of any risks when drilling into a wall, see **Figure 10**.

The Tricky Drill outer shell will be made entirely from recycled alloys as shown in **Figure 11**.

Figure 9: Tricky Drill: Concept Electric Drill

Figure 10: Tricky Drill in use

Figure 11: Drill outer shell made from recycled alloys



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(Question 6 continued)

(a) Outline why solid modelling would have been used in the development of the Tricky Drill. [2]

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(b) Explain how the manufacture of the Tricky Drill alloy case addresses the green design objective of waste. [3]

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(Question 6 continued)

(c) Explain how compatibility **and** relative advantage will affect consumer adoption of an innovation such as the Tricky Drill. [6]

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(Question 6 continued)

(d) Explain how the use of anthropometric data can help improve the design of the Tricky Drill with respect to comfort, safety **and** performance. [9]

7. Solar power banks such as the BLAVOR, see **Figure 12**, are able to provide a way to keep mobile phones, cameras, and other electronic devices charged when in remote locations, see **Figure 13**.

Figure 12: BLAVOR power bank with folding solar panels

Removed for copyright reasons

Figure 13: The BLAVOR in a remote location

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The battery bank has wireless charging technology, two USB ports, a small compass, and a built-in flashlight. Four of the five expanding and folding solar panels are detachable, allowing the user to choose how many to bring on their outdoor trip.

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(Question 7 continued)

(a) Outline the target audience for the solar powered BLAVOR power bank. [2]

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(b) Explain the advantage of using solar power as a charging method for the BLAVOR power bank. [3]

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(Question 7 continued)

(c) Explain **two** advantages of automation as a production system for the BLAVOR power bank. [6]

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(Question 7 continued)

(d) Explain how aesthetic models, prototypes **and** instrumented models were used in the development of the solar powered BLAVOR power bank. [9]

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References:

Figure 1 With permission from pBone Music.

Figure 2 stockce, 2016. *Trumpet on white background – stock photo* [image online] Available at: https://www.gettyimages.co.uk/detail/photo/trumpet-on-white-background-royalty-free-image/528309768?phrase=Brass%2Btrumpet [Accessed 23 November 2023].

Figure 3 With permission from pBone Music.

Figure 4 SpyroTheDragon / iStock.

Figure 5 Photo by Elle Hughes on Unsplash.

Figure 6 With permission from Flow.

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