Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level and standard level
Paper 2

Thursday 5 May 2022 (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]**.

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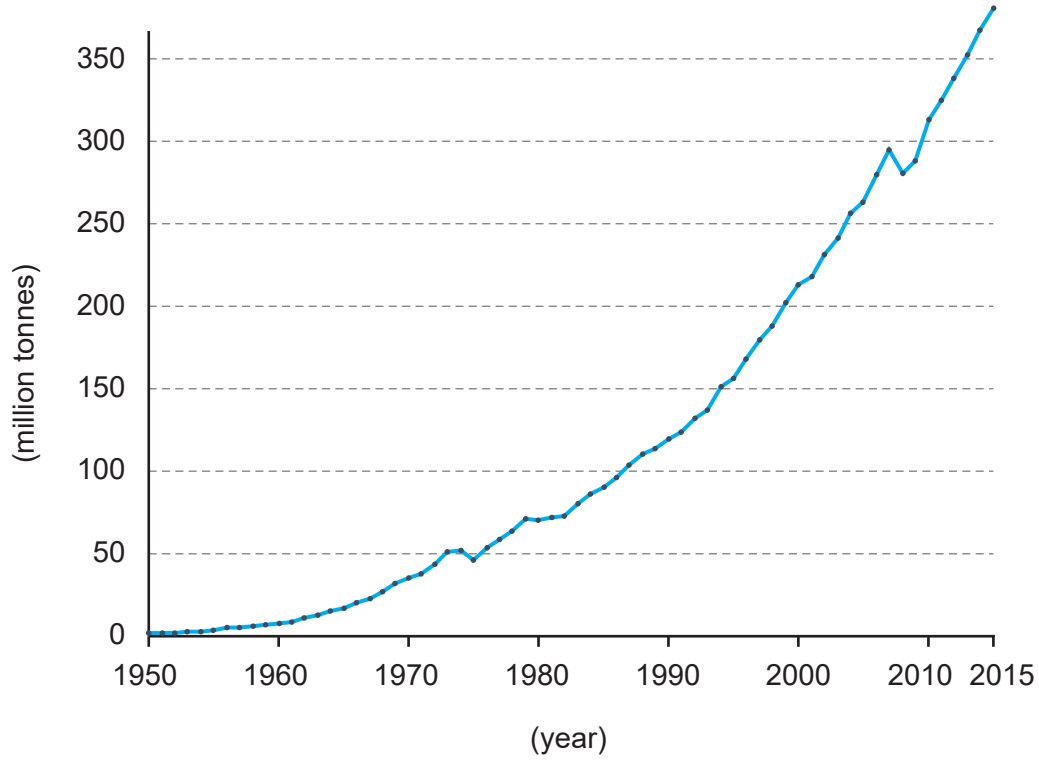
17 pages

Section A

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

1. **Figure 1** shows the rapid increase in global plastics production. Concerns have been raised about the environmental impact as vast quantities of discarded plastics are found in the oceans, like the Great Pacific Garbage Patch (GPGP).

Figure 1: World global plastics production (1950–2015)



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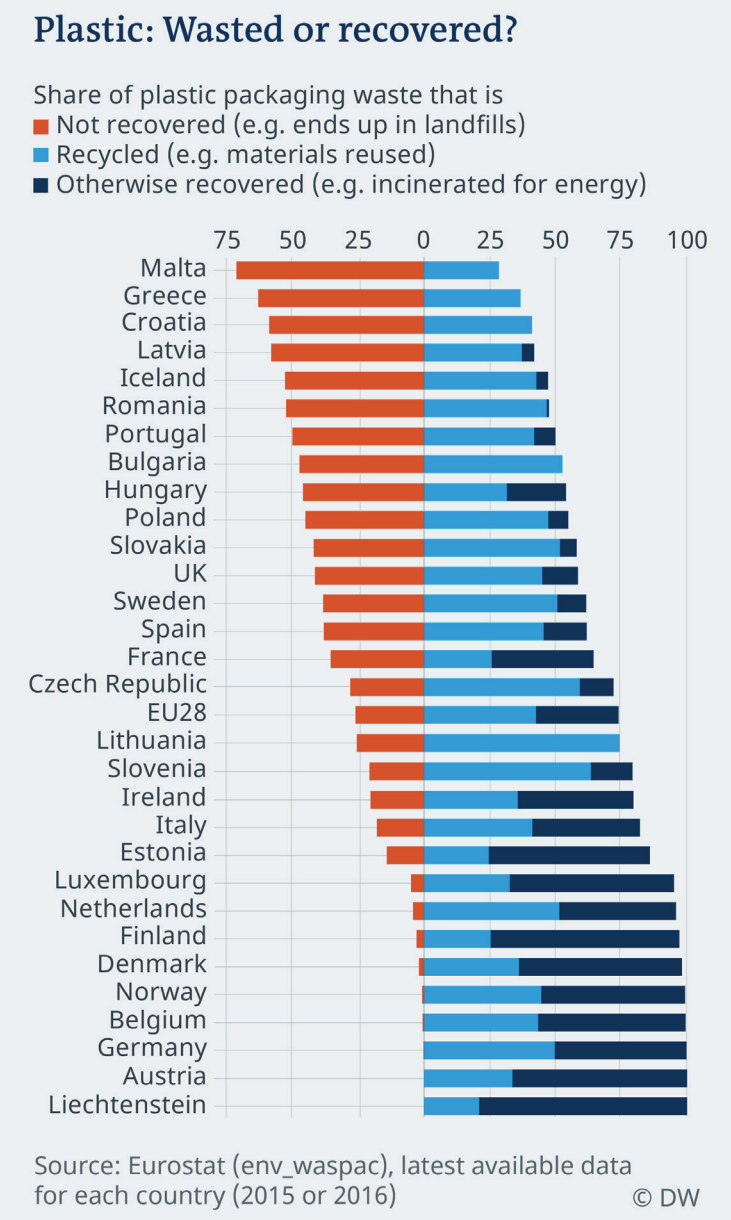
(Question 1 continued)

Some countries have developed strategies to recover these plastics. These strategies have been more successful in some countries than others. **Figure 2** compares the percentage of plastics recovered in European countries.

Figure 2: Plastic – wasted or recovered?



(a) (i) State the trend of plastic production between 1950 and 2015. [1]

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(Question 1 continued)

(ii) List **two** reasons why polyethylene terephthalate (PET) is often used for food packaging. [2]

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(b) (i) Outline **one** reason why products that are made of more than one material can be difficult to recycle. [2]

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(ii) List **two** reasons why some countries recycle a larger percentage of plastics than others. [2]

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(c) (i) Outline why thermoplastics tend to be easier to recycle than thermosetting plastics. [2]

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(Question 1 continued)

(ii) Explain **one** negative environmental impact of incinerating plastic waste. [3]

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Many governments have introduced legislation to ban single-use plastic straws. As a result many customers have started to use metal straws, see **Figure 3**.

Figure 3: Different types of straw

[Source: s-cphoto / iStock.]

(d) (i) State how the plastic straw gains its stiffness. [1]

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(Question 1 continued)

(ii) Outline **one** reason why the plastic straw is mass produced. [2]

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(e) (i) Outline **one** appropriate manufacturing method for making the plastic straw. [2]

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(ii) Explain how market pull has influenced the release of the metal straw. [3]

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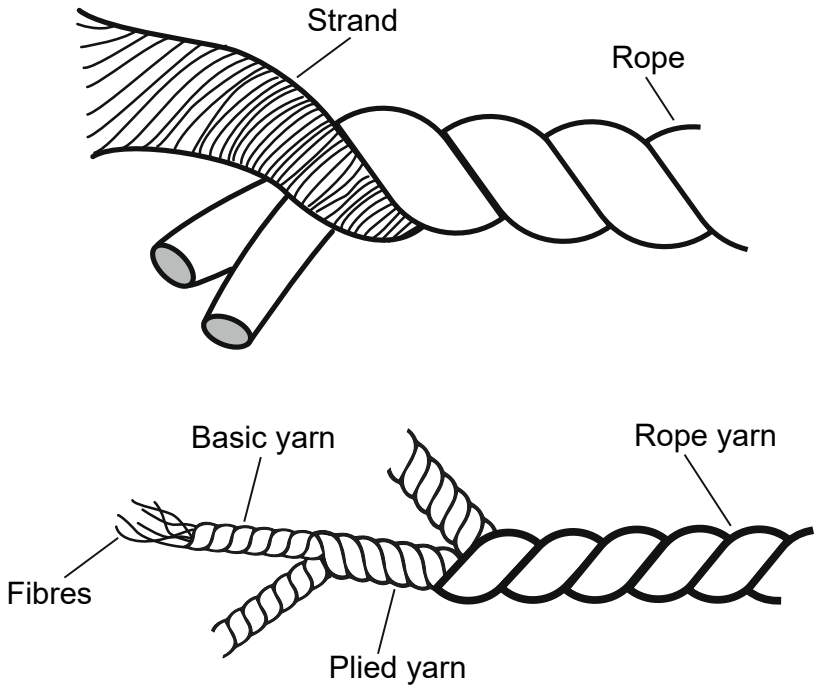
2. Ropes are used for a variety of purposes such as rock climbing, yachting and securing loads to trucks. **Figure 4** shows the internal structure of a rope.

Figure 4: The internal structure of rope



(a) Outline why fibres are important for the strength and flexibility of the rope. [2]

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(b) List **two** properties that enable rope to maintain its strength. [2]

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3. The recent developments in autonomous vehicles have led to a large increase in the number of patents. In the US there are 4300 patents that include the term “autonomous vehicle”. However, some patents have more value than others.

Explain **one** reason why some patents may have more commercial value than others. [3]

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4. Explain how copyright is used in the creative arts as a method of protecting intellectual property (IP). [3]

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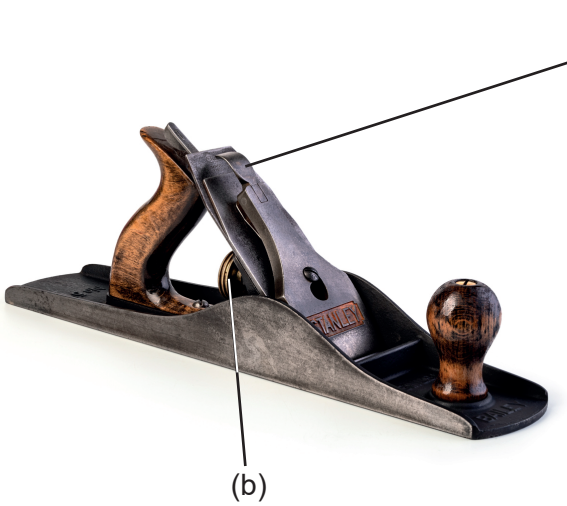
Section B

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

5. In 1858 Leonard Bailey produced the Bailey Wood Plane. The body of the plane was made from cast iron rather than timber. It also had a cam lever lock to secure the lever cap (a). In 1867 he added a longitudinal adjuster – a "Y" lever operated by a screw set vertically behind the cutting unit (b).

Despite the development of electric wood planes, the Bailey Wood Plane is still used in workshops today, see **Figure 5**.

Figure 5: Bailey Wood Plane



[Source: gresei / iStock.]

[Source: mamonovstanislav / 123RF.]

(a) List **two** properties that made cast iron a suitable material for the Bailey Wood Plane. [2]

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(Question 5 continued)

(b) Explain why the Bailey Wood Plane is an example of an innovation. [3]

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(c) Explain how the Bailey Wood Plane demonstrates omnipresence **and** dominant design. [6]

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(Question 5 continued)

(d) Explain why perspective drawings, orthographic drawings **and** exploded isometric drawings would be used in the design of the Bailey Wood Plane. [9]

6. In recent years there has been a move towards electric vehicles. An example of this is the electric motorcycle shown in **Figure 6**.

Figure 6: An electric motorcycle

(a) Outline why electric motorcycles are regarded as a green design. [2]

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(b) Discuss whether the development of the electric motorcycle is an example of technology push **or** technology transfer. [3]

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(Question 6 continued)

(c) Explain **two** reasons why the quiet nature of electric motorcycles may provide negative psychological factors in the popularity for consumers. [6]

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(Question 6 continued)

(d) Life cycle analysis (LCA) is a tool that assesses the impact of a product on the environment.

Explain how the environmental impact can be minimized during production, distribution **and** disposal of the electric motorcycle. [9]

7. Drones have become more widespread and can be used for leisure, business or military purposes. A drone is operated using a handset, see **Figure 7**.

Figure 7: A drone and its handset

(a) List **two** reasons why temporary joining techniques are used when a drone is assembled. [2]

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(b) Explain why finite element analysis (FEA) would be used in the development of the drone. [3]

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(Question 7 continued)

(c) Explain **two** ways that drones can become obsolete. [6]

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(Question 7 continued)

(d) Explain how the study of human factors can be used to improve the comfort, safety **and** performance of the handset that controls the drone. [9]

References:

Figure 1 Hannah Ritchie and Max Roser (2018) - “Plastic Pollution”. Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/plastic-pollution [Online Resource]. Source: based on Jambeck et al (2015) and Eriksen et al (2014). Icon graphics from Noun Project. Data is based on global estimates from Jambeck (2015) based on plastic waste generation rates, coastal pollution sizes, and waste management practices by country. This is a visualization from OurWorldDate.org, where you will find data and research on how the world is changing. License under CC-BY-SA by the authors Attribution 4.0 International (CC BY 4.0) https://creativecommons.org/licenses/by/4.0/ [Accessed 20 April 2020]. Source adapted.

Figure 2 © DEUTSCHE WELLE.

Figure 3 s-cphoto / iStock.

Figure 5 gresei / iStock.

mamonovstanislav / 123RF.

Figure 6 Cozmcrae. Evoke Urban S motorcycle in red Available at: https://en.wikipedia.org/wiki/File:Evoke_Urban_S_Red.jpg This file is made available under the Creative Commons CC0 1.0 Universal Public Domain Dedication https://creativecommons.org/publicdomain/zero/1.0/deed.en.

Figure 7 Pixabay.

Florian-Media, n.d. Drone handset. [image online] Available at: https://pixabay.com/nl/photos/afstandsbediening-4231492 [Accessed 27 April 2020].

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