Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Standard level
Paper 1

2 November 2023

Zone A morning | **Zone B** morning | **Zone C** morning

45 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[30 marks]**.

8823 – 6202

17 pages

1. Which of the following anthropometric considerations apply to the sandal shown in **Figure 1**?

Figure 1: Sandal

I. Reach
II. Range of sizes
III. Adjustability

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

2. What is the percentile used to determine distance D (floor to handle) in supermarket shopping carts, such as the one shown in **Figure 2**?

Figure 2: A supermarket shopping cart

[Source: 3DMAVR / Shutterstock.com]

A. 5th

B. 50th

C. 95th

D. 5th–95th

3.

Figure 3: A kitchen tool

[Source: FreeImages.com/geezerpk]

Surface texture is added to kitchen tool handles (**Figure 3**) to improve…

A. aesthetics.

B. tolerances.

C. grip.

D. alertness.

4. Anthropometrics is the study of a human's…

A. relationships with objects, systems and environments.

B. body measurements.

C. bodily tolerances.

D. abilities and senses.

5. What is a major challenge for resource management in the 21st century?

A. Development of renewable and sustainable resources

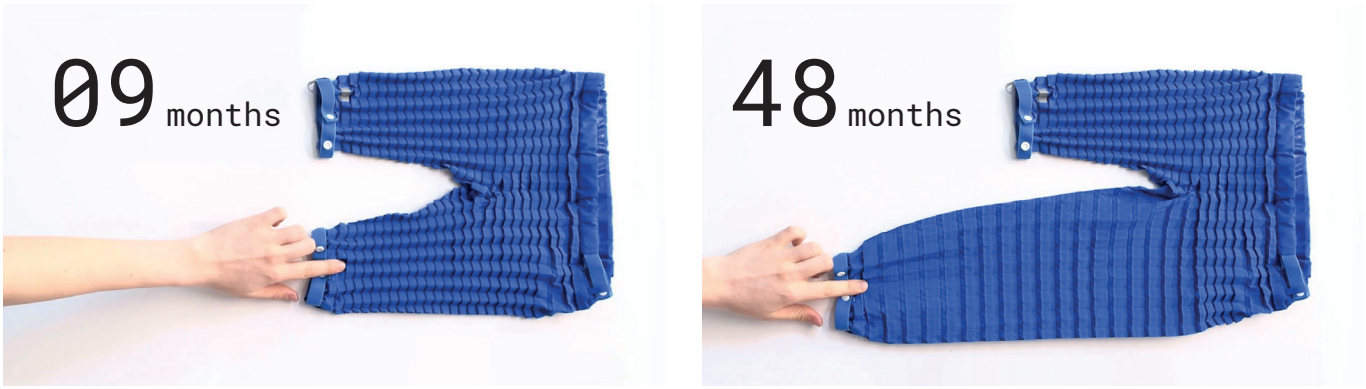
B. Installation of end-of-pipe technologies

C. Dematerialization of complex designs

D. Increased reconditioning

6. Petit Pli® is a company that designs clothes for children as they grow. This means the child can wear the same pair of trousers (pants) from 9 months up to 4 years (48 months), see **Figure 4**.

Figure 4: Petit Pli® trousers



This is an example of…

A. reduce.

B. re-engineering.

C. repairing.

D. recycling.

7. What is the main advantage of hydrogen fuel cell-powered trains compared to electric-powered trains?

A. Zero CO_2 emissions

B. Lower set-up costs

C. Faster transportation

D. Recharge ability

8. In green design, the prevention principle refers to…

A. providing absolute proof of environmental damage.

B. remedying environmental harm that has been done.

C. waiting for environmental damage to occur.

D. the avoidance of environmental hazards.

9. 31 % of plastic waste ends up in landfills, 39 % is incinerated (burned) and only 30 % is recycled. The ideal waste mitigation strategy to combat this problem is:

A. Dematerialization

B. Circular economy

C. Re-engineering

D. Reconditioning

10.

Figure 5: A combined coffee pot and toaster

The combined coffee pot and toaster shown in **Figure 5** is an example of…

A. process innovation.

B. reconditioning.

C. converging technology.

D. bio-mimicry.

11. **Figure 6** shows a 3D printed guitar body that was manufactured as a single part.

Figure 6: A 3D printed guitar body

Which of the following would be the best method to 3D print the guitar body?

A. Stereolithography (SLA)

B. Selective laser sintering (SLS)

C. Laminated object manufacturing (LOM)

D. Fused deposition modelling (FDM)

12. Aesthetic models may be used to evaluate…

A. density.

B. strength.

C. texture.

D. hardness.

13. Accurate safety testing of a new car design using finite element analysis (FEA) is best performed using a…

A. virtual prototype.

B. surface computer aided design (CAD) model.

C. scale model.

D. physical prototype.

14. Which mechanical property is most relevant to pins such as the ones shown in **Figure 7**?

Figure 7: Examples of pins

[Source: FreeImages.com/SteveTaint]

[Source: FreeImages.com/antkevyv]

A. Compressive strength

B. Toughness

C. Elasticity

D. Density

15. **Figure 8** shows an innovative footwear solution using smart material technology. The sole of the shoe charges mobile devices when in use.

Figure 8: Smart footwear

Which smart material property releases an electrical discharge when deformed by the walking action of the user?

A. Shape memory alloy

B. Piezoelectricity

C. Thermoelectricity

D. Electro-rheostatic

16. Which of the following scales of production is most suited to the manufacture of plastic drinks bottles such as those shown in **Figure 9**?

Figure 9: Plastic drinks bottles

A. One-off production

B. Batch production

C. Continuous flow

D. Mass customization

17. Teams of robots are used in car manufacturing to achieve…

A. faster production.

B. a larger working envelope.

C. machine to machine (M2M) communication.

D. a higher load capacity.

18. Metal physical properties can be modified by:

I. Alloying
II. Work hardening
III. Tempering

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

19. Which of the following materials is used to make swimming suits?

A. Silk

B. Cotton

C. Wool

D. Lycra®

20. Trademarks protect:

A. Brands

B. Inventions

C. Literary works

D. Product aesthetics

21. Sir James Dyson was dissatisfied with existing vacuum cleaners that lost suction when dust was trapped in their bags. At a factory he saw how sawdust was removed from the air by industrial extraction systems (cyclones). He was inspired to engineer the cyclone technology and produce the world's first bagless vacuum cleaner, see **Figure 10**.

Figure 10: Dyson's cyclone technology

[Source: ©Dyson Technology Limited 1992 – 2023]

Which strategy for innovation applies to Dyson's cyclone technology?

A. Constructive discontent

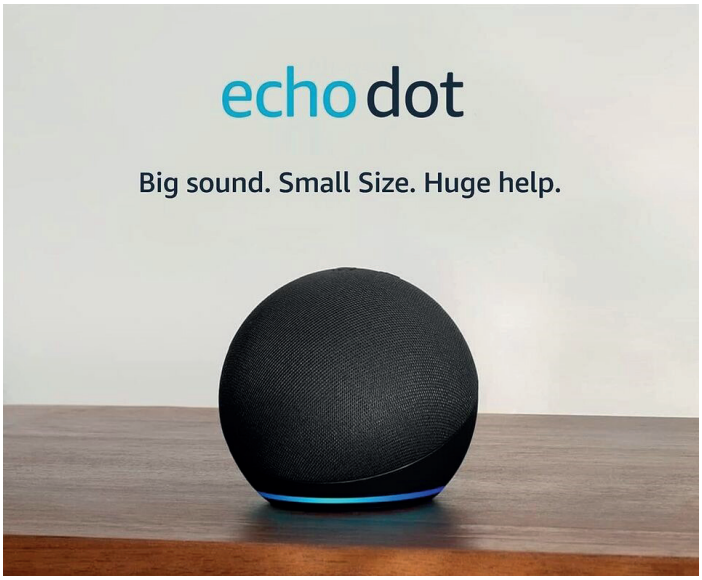
B. Chance

C. Technical curiosity

D. Adaptation

22. The Echo Dot features the Alexa virtual assistant which enables users to carry out tasks such as controlling lighting, playing music, checking the weather or setting an alarm.

Figure 11: The Echo Dot



Complex products, such as the Echo Dot shown in **Figure 11**, have most likely been developed by:

A. Multidisciplinary teams

B. Lone inventors

C. Product champions

D. Entrepreneurs

23. At which stage of a product's life cycle are sales consistent?

A. Introduction

B. Growth

C. Maturity

D. Decline

24. In 1913, Henry Ford introduced the assembly line for the production of the Model T Ford car.

Figure 12: The Model T Ford

Which characteristic has contributed the **most** to the Model T Ford, see **Figure 12**, reaching classic design status?

A. Defies obsolescence

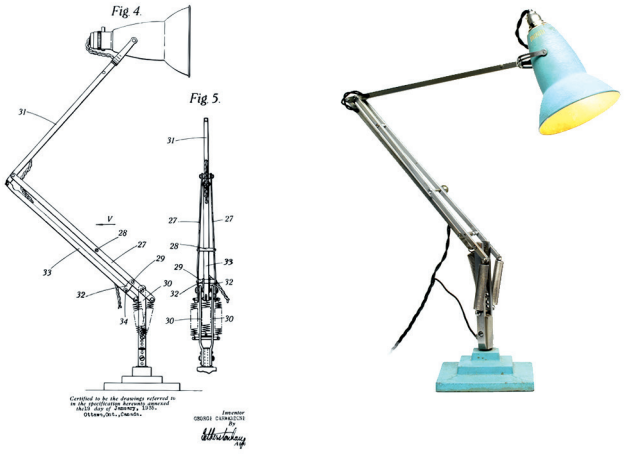
B. Mass production

C. Ubiquitous

D. Dominant design

25. When working on the design of a suspension system for cars, George Carwardine invented a mechanism that could be easily set in a number of positions. This led him to design the Anglepoise Lamp, see **Figure 13**.

Figure 13: The Anglepoise Lamp



Which of the following best applies to the design of this lamp?

A. Form follows function

B. Function follows form

C. Psychological function

D. Retro-styling

26. Which of the following statements best applies to classic designs?

A. Values form over function

B. Has a timeless appeal

C. Are the result of multidisciplinary teamwork

D. Rarely retro-styled

Questions 27–30 relate to the following case study. Please read the case study carefully and answer the questions.

Figure 14 and **Figure 15** show the N30 wireless mouse, inspired by the Nintendo® games controller shown in **Figure 16**, which was popular in the 1980s.

Figure 14: N30 wireless mouse

Removed for copyright reasons

Figure 15: How the N30 wireless mouse works

Removed for copyright reasons

Figure 16: Nintendo® games controller

Daniel Jansson, who designed the mouse, describes it as functional, nostalgic and joyful. The mouse offers a better website navigation experience with page up, page down, upward and forward buttons on the side.

27. Which type of plastic was most likely used for the casing of the N30 wireless mouse?

A. Polyethylene terephthalate (PET)

B. Low-density polyethylene (LDPE)

C. Acrylonitrile butadiene styrene (ABS)

D. Polyvinyl chloride (PVC)

28. Which of the following design for manufacture (DfM) strategies has the greatest impact on how well the mouse can be recycled at the end of its life?

A. Design for materials

B. Design for process

C. Design for assembly

D. Design for disassembly

29. Which manufacturing technique was most likely used in the commercial production of the navigation buttons on the mouse?

A. Vacuum forming

B. Rotational forming

C. Injection moulding

D. Blow moulding

30. Which modelling technique would have enabled the designer to understand how accurately the buttons responded to being pressed?

A. Aesthetic model

B. Orthographic projection

C. Finite element analysis (FEA)

D. Instrumented modelling

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.

References:

Figure 1 Muralinath, n.d. *Indian Made Men's sandals – stock photo*. [image online] Available at: https://www.gettyimages.co.uk/detail/photo/indian-made-mens-sandals-royalty-free-image/1161700112?adppopup=true [Accessed 22 July 2022].

Figure 2 3DMAVR / Shutterstock.com.

Figure 3 geezerpk. Free veggie peeler stock photo. [image online] Available at: https://www.freeimages.com/photo/veggie-peeler-1459982 [Accessed 10 September 2020].

Figure 4 Images with permission from Petit Pli.

Figure 6 Image with permission from ODD Guitars.

Figure 7 Antkevyv, 2009. *Free set of knobs stock photo*. [image online] Available at: https://www.freeimages.com/photo/set-of-knobs-1148189 [Accessed 10 September 2020].

SteveTaint, 2006. *Free drawing pins 3 stock photo*. [image online] Available at: https://www.freeimages.com/photo/drawing-pins-3-1240402 [Accessed 10 September 2020].

Figure 8 Image with permission from Compound Footwear.

Figure 9 Bjørn Erik Pedersen. https://commons.wikimedia.org/wiki/File:Coca_Cola-flasker_i_et_kj%C3%B8leskap.jpg. Licensed under CC BY-SA 4.0 https://creativecommons.org/licenses/by-sa/4.0/deed.en. Image adapted.

Figure 10 ©Dyson Technology Limited 1992 – 2023.

Figure 11 Echo Dot (5th Gen). https://www.amazon.com/All-New-release-Smart-speaker-Charcoal/dp/B09B8V1LZ3. Image by Amazon.com, Inc.

Figure 12 ModelTMitch. https://commons.wikimedia.org/wiki/File:1925_Ford_Model_T_touring.jpg. Licensed under CC BY-SA 4.0 DEED https://creativecommons.org/licenses/by-sa/4.0/deed.en.

Figure 13 Image with permission from Anglepoise.

Figure 16 [*Nintendo Entertainment System NES Controller*] 2016. [image online] Available at: https://commons.wikimedia.org/wiki/File:Nintendo-Entertainment-System-NES-Controller-FL.jpg [Accessed 10 September 2020].