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**DESIGN TECHNOLOGY  
HIGHER LEVEL  
PAPER 1**

Tuesday 18 November 2014 (afternoon)

1 hour

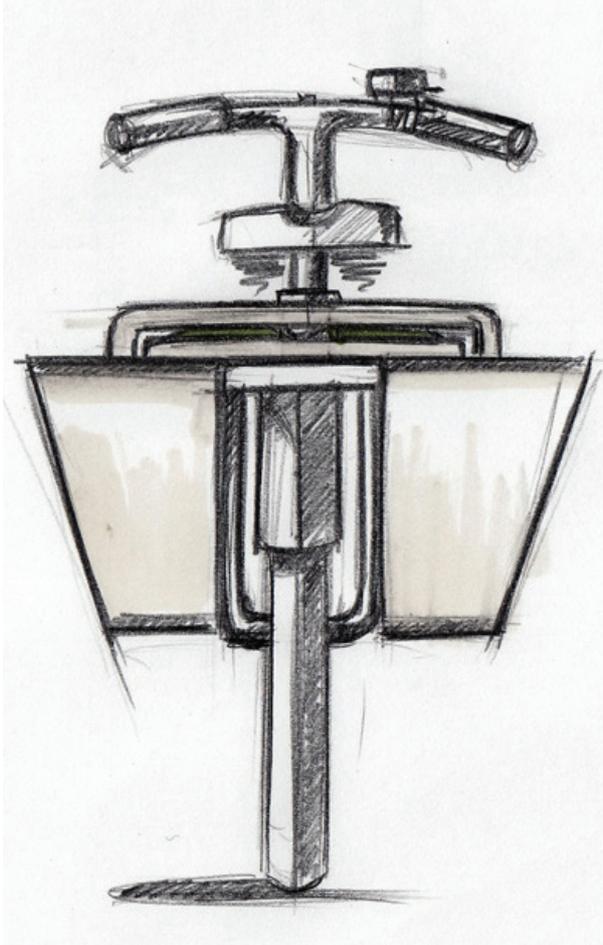
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**INSTRUCTIONS TO CANDIDATES**

- 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 *[40 marks]*.

1. **Figure 1** shows a freehand drawing developed during the early stages of the design development of a picnic basket which can be mounted on a bicycle as a pannier (**Figure 2**). The pannier can be unpacked and used as a picnic table (**Figure 3**).

**Figure 1: Freehand drawing**



**Figure 2: The bicycle-mounted picnic basket**



**Figure 3: The picnic basket unpacked into a picnic table**



[Source: <http://www.bloondesign.com/>]

What is a major advantage of using freehand drawings, such as **Figure 1**, with non-designers in the early stages of design development?

- A. They can be used as production drawings.
- B. They show the proposed solution in shape and form.
- C. They show the sequence of assembly of a product.
- D. They are easily understood.

2. What is meant by the “goal” in a design brief?
  - A. The target market
  - B. The initial prototype
  - C. The final specification
  - D. The final outcome
  
3. What is defined as: analysing a situation that would benefit from redesign and working out a strategy for improving it?
  - A. Analogy
  - B. Adaptation
  - C. Attribute listing
  - D. Constructive discontent
  
4. What term describes a product accepted as the market standard?
  - A. Invention
  - B. Innovation
  - C. Dominant design
  - D. Robust design
  
5. Which is often true of both a lone inventor and a product champion?
  - A. They have strong corporate influence.
  - B. They are creative.
  - C. They have business acumen.
  - D. They are strongly committed to the product.

6. What is least likely to be the impetus for green design?
- A. Consumer pressure
  - B. Profitability
  - C. Standards
  - D. Health and safety
7. What is true of an ecolabel?
- A. It indicates that a product meets the most recent environmental standard for a particular product category.
  - B. It indicates that a product covers all aspects of green design.
  - C. It provides information to guide consumer decision-making.
  - D. It is a mandatory international standard.
8. Which combination of “high environmental impact” and in the “global marketplace” identifies the types of product targeted by life cycle analysis?

	<b>High environmental impact</b>	<b>In the global marketplace</b>
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

9. What is a major advantage of reconditioning a computer?
- A. It makes it more energy-efficient.
  - B. It is as reliable as a new product.
  - C. It is easy to undertake.
  - D. It extends the product life.
10. What is defined as a mixture that contains at least one metal?
- A. Atom
  - B. Molecule
  - C. Alloy
  - D. Composite
11. Which plastic would be suitable for use in the production of the electrical socket shown in **Figure 4**?

**Figure 4: An electrical socket**



[Source: Australian dual switched power point” by Original uploader was Auspowerpoint at en.wikipedia - Transferred from en.wikipedia. Licensed under Public Domain via Wikimedia Commons—[http://commons.wikimedia.org/wiki/File:Australian\\_dual\\_switched\\_power\\_point.jpg#mediaviewer/File:Australian\\_dual\\_switched\\_power\\_point.jpg](http://commons.wikimedia.org/wiki/File:Australian_dual_switched_power_point.jpg#mediaviewer/File:Australian_dual_switched_power_point.jpg)]

- A. Urea-formaldehyde
- B. Polyethene
- C. Polyvinyl chloride
- D. Polyurethane

12. What is true of **both** composites **and** alloys?
- A. A wide variety of material groups can be combined.
  - B. The atomic structure is the same.
  - C. Materials are combined to improve selected material properties.
  - D. There is a fixed ratio of constituent materials.
13. Which material could be used to convert the force of an impact into an electrical charge for an airbag sensor in a car?
- A. Magneto-rheostatic
  - B. Electro-rheostatic
  - C. Piezoelectric
  - D. Shape memory alloy
14. Which property is consistent with free electrons flowing through a metal?
- A. High electrical conductivity.
  - B. High thermal expansivity.
  - C. High tensile strength.
  - D. High density.
15. Which material cannot be shaped by casting?
- A. Metal
  - B. Plastic
  - C. Timber
  - D. Ceramic

16. The Terracotta Army is a collection of over 8000 terracotta sculptures. Careful studies have shown that they would probably have been produced using just 8 different head moulds and clay would then have been added to produce individual facial features. **Figure 5** shows the faces of some of the soldiers.

**Figure 5: Faces of the terracotta soldiers**



[Source: [www.chinatourguide.com](http://www.chinatourguide.com)]

What scales of production would have been used for the head shapes and the facial features of the terracotta soldiers?

	<b>Head shapes</b>	<b>Facial features</b>
A.	Craft	Craft
B.	Batch	Craft
C.	Craft	Batch
D.	Batch	Batch

17. What is true of just-in-case (JIC) production but **not** just-in-time (JIT) production?
- A. Increased pressure on the workforce
  - B. Increased flexibility of the workforce
  - C. Reduced storage requirements
  - D. Reduced set-up costs
18. Which percentile range would be used for the commercial production of an adjustable ironing board?
- A. 5th–50th
  - B. 50th–95th
  - C. 5th–95th
  - D. 1st–99th
19. What is an impetus for planned obsolescence?
- A. Market pull
  - B. Technology push
  - C. Product reconditioning
  - D. Restyling
20. Which evaluation strategy is most likely to be carried out in a laboratory?
- A. Field trial
  - B. Performance test
  - C. User research
  - D. Expert appraisal

21. What will determine the minimum price for a cost-effective product?
- A. Demand for the product
  - B. Production costs
  - C. Competition
  - D. Perceived value
22. Which evaluation strategy would generate a “problem list” relating to product usability issues that would inform the redesign of a product?
- A. Literature search
  - B. Performance test
  - C. User trial
  - D. User research
23. Which of the following would be advantages for a government commissioning a nuclear power station?
- I. Low CO<sub>2</sub> emissions
  - II. Low capital costs
  - III. High efficiency energy production
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

24. **Figure 6** shows an off-shore wind energy generating system.

**Figure 6: An off-shore wind energy generating system**



[Source: [http://en.wikipedia.org/wiki/Offshore\\_wind\\_power#mediaviewer/File:DanishWindTurbines.jpg](http://en.wikipedia.org/wiki/Offshore_wind_power#mediaviewer/File:DanishWindTurbines.jpg)]

What is not an issue for an off-shore wind energy generating system?

- A. Capital costs
  - B. Maintenance costs
  - C. Visual pollution
  - D. Noise pollution
25. Which combination of force applied and extension characterizes a brittle material?

	<b>Force applied</b>	<b>Extension</b>
A.	Small	Small
B.	Small	Large
C.	Large	Small
D.	Large	Large

26. Which formula would be used to calculate the stress acting on a body?
- A.  $\frac{\text{Force}}{\text{area}}$
  - B.  $\frac{\text{Change in length}}{\text{original length}}$
  - C.  $\frac{\text{Load}}{\text{deflection}}$
  - D.  $\frac{\text{Design load}}{\text{normal maximum load}}$
27. Which consideration may **not** be carefully controlled as part of the factor of safety considerations on aeroplanes?
- A. Weight of luggage
  - B. Weight of cargo
  - C. Weight of passengers
  - D. Weight of the plane
28. What type of conversion of motion does a cam mechanism achieve?
- A. Converts rotary motion to linear motion
  - B. Converts vertical motion to horizontal motion
  - C. Converts rotary motion to reciprocating motion
  - D. Converts linear motion in one direction to linear motion in the opposite direction

29. **Figure 7** shows the Alessi Socrates corkscrew designed by Jasper Morrison.

**Figure 7: The Alessi Socrates corkscrew designed by Jasper Morrison**



[Source: <http://www.alessi.com>]

Which type of mechanism is used in the Alessi Socrates corkscrew?

- A. Toggle clamp
- B. Linkage
- C. Lever
- D. Bell crank

30. **Figure 8** shows shoes designed by Dutch designer Eric Hulleigie. The uppers of the shoes are produced using vacuum forming (**Figure 9**).

**Figure 8: The finished shoes**



**Figure 9: Vacuum forming the uppers of the shoes**



[Source: [www.designboom.com](http://www.designboom.com)]

What is a limitation of the vacuum forming process for producing the shoes shown in **Figure 9**?

- A. The amount of waste
- B. The expense of the process
- C. The complexity of the process
- D. The suitability of the process for volume production

31. Plastic bottles are generally made using a two-stage process. The first stage involves the production of a pre-form (**Figure 10**); the second stage shapes the pre-form into the final bottle.

**Figure 10: Plastic bottle pre-forms**



[Source: [www.cherryplastics.co.uk](http://www.cherryplastics.co.uk)]

Which moulding processes would be used for the production of the pre-forms and the final bottles?

	<b>Injection moulding</b>	<b>Blow moulding</b>
A.	Pre-form	Pre-form
B.	Pre-form	Final bottle
C.	Final bottle	Pre-form
D.	Final bottle	Final bottle

32. Which is a temporary joining technique?
- A. Use of screws
  - B. Use of pop rivets
  - C. Welding
  - D. Brazing
33. Which aspect of sustainability is most important to manufacturers?
- A. Economic
  - B. Social
  - C. Environmental
  - D. Triple bottom line

Please **do not** write on this page.

Answers written on this page  
will not be marked.

34. The frames of BLACKSTAR<sup>®</sup> bicycles (**Figure 11**) are made in Ghana from bamboo and sisal. The bicycles are sold in major cities around the world.

**Figure 11: Bamboo bike by BLACKSTAR<sup>®</sup>**



[Source: <http://blackstarbikes.nl>]

Why might the BLACKSTAR<sup>®</sup> bamboo bicycle be considered an appropriate technology in cities outside of Ghana?

- A. It creates jobs using local skills and labour.
  - B. Its use is not detrimental to the environment.
  - C. It uses local materials.
  - D. It has a long product life.
35. What is part of an active solar hot water system but **not** a passive solar hot water system?
- A. A solar collector
  - B. A storage tank
  - C. A back-up heating system
  - D. A pump

*Questions 36–40 relate to the following case study. Please read the case study carefully and answer the questions.*

Design student, Quentin Debaene, won the James Dyson Design Award for creating “a product which solves a problem of everyday life”. Quentin’s design was for the “Airblow 2050” – an invisible umbrella – which seeks to overcome the problems associated with the use of traditional umbrellas (**Figure 12**) – most of which relate to the use of the fabric. Through a process that Quentin referred to as ideation (**Figure 13**) he developed the design for the “Airblow 2050” (**Figure 14**) which uses a small motor in its handle to blow out air from the top of the tube and push the rain away, keeping its user dry.

**Figure 12: The problems with traditional umbrellas**

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Figure 12 is available on <http://www.coroflot.com/quentindebaene/DYSON-AIRBLOW-2050>  
(see “Are umbrella reall practical” drawing)

**Figure 13: Ideas for the Airblow 2050**

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Figure 13 is available on <http://www.coroflot.com/quentindebaene/DYSON-AIRBLOW-2050>  
(see “Ideation” sketch)

**Figure 14: The Airblow 2050**

Removed for copyright reasons

Figure 14 is available on <http://www.coroflot.com/quentindebaene/DYSON-AIRBLOW-2050>  
(see “Daily Life/While it is a very technological umbrella...” picture)

36. Which strategy would have provided the impetus for the design of the Airblow 2050?
- A. Constructive discontent
  - B. Analogy
  - C. Morphological synthesis
  - D. Attribute listing
37. Which stage of the IB design cycle corresponds to the process called “ideation” by Quentin Debaene in **Figure 13**?
- A. Identifying a need or opportunity
  - B. Analysing, researching and specifying requirements
  - C. Generating ideas and solutions
  - D. Testing and evaluating the chosen solution

- 38.** What was Quentin’s role in the development of the Airblow 2050?
- A. Lone inventor
  - B. Innovator
  - C. Product champion
  - D. Entrepreneur
- 39.** Which strategy would be most appropriate for the evaluation of the Airblow 2050?
- A. User trial
  - B. User research
  - C. Literature review
  - D. Performance testing
- 40.** What is the primary strategy adopted by Quentin for the Airblow 2050?
- A. Market penetration
  - B. Product development
  - C. Market development
  - D. Diversification
-