Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Standard level
Paper 1

Thursday 12 May 2016 (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]**.

2216 – 6202

15 pages

1. A designer is developing the design for a new wheelchair. As part of her research she takes measurements of people attending a health clinic.

What type of data is the designer generating?

A. Primary data

B. Secondary data

C. Psychological data

D. Marketing data

2. A designer was commissioned to develop a unisex bicycle **(Figure 1)**. The designer created three different frame sizes and set limits for the minimum and maximum heights of the seat and handlebars.

Figure 1: A unisex bicycle

[Source: www.giant-bicycles.com]

Which strategy was the designer using?

A. A range of sizes

B. Adjustability

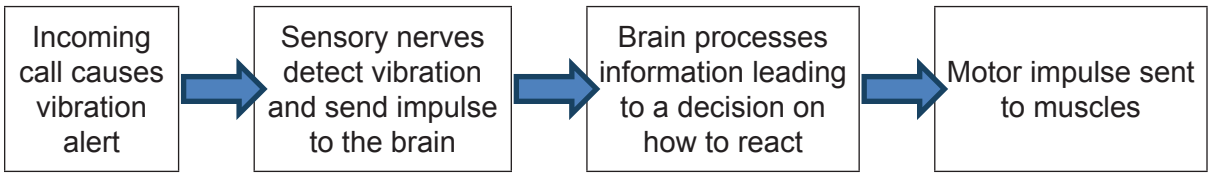
C. A combination of a range of sizes and adjustability

D. Mass customization

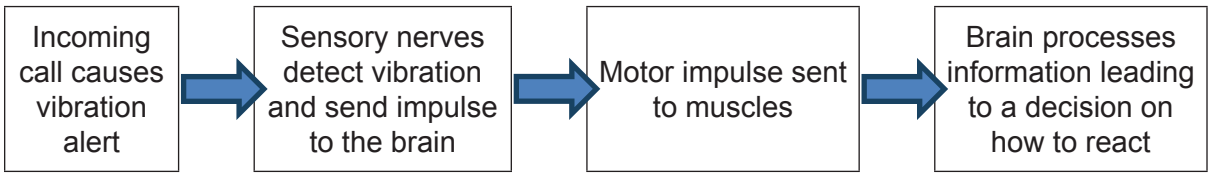
3. Designers need to be aware of the human information processing system (see **Figure 2**).

Figure 2: The human information processing system

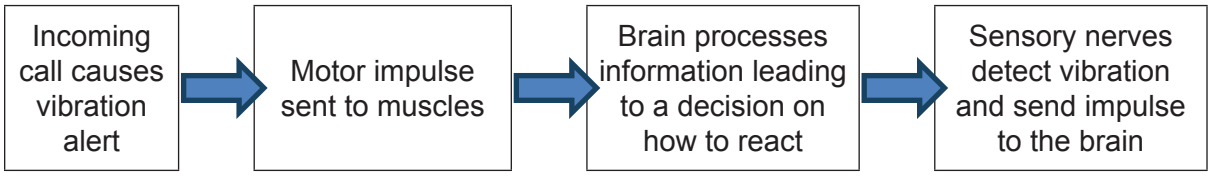
A.



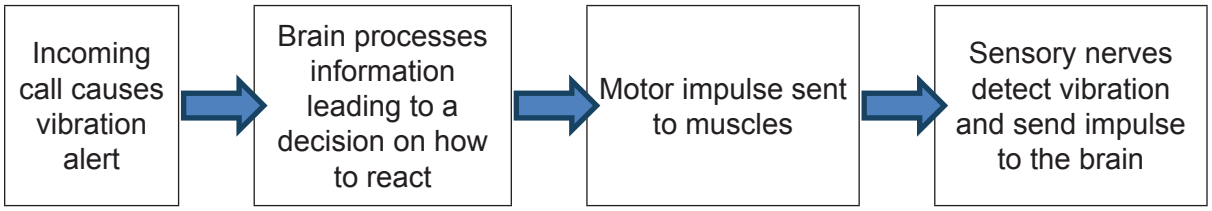
B.



C.



D.



Which flowchart in **Figure 2** correctly represents the sequence of events when a mobile phone vibrates in a person's pocket?

4. What is a physiological factor that should be considered when designing a car seat for a child?

A. Alertness

B. Dematerialization

C. Convergence

D. Comfort

5. **Figure 3** shows a symbol widely used on plastic products made of polyethylene terephthalate (PETE).

Figure 3: A symbol used on plastic products made of polyethylene terephthalate (PETE)

[Source: www.dixiebits.com]

Which waste mitigation strategy does the symbol shown in **Figure 3** promote?

A. Repair

B. Reuse

C. Recycling

D. Reconditioning

6. What best describes the embodied energy within a product?

A. The energy consumed throughout the entire product life

B. The energy within a product's batteries

C. The energy required to recycle a product

D. The reduction in the amount of wasted energy achieved through clean production

7. Although new environmental legislation can be highly disruptive, it can sometimes lead to benefits for manufacturers.

What are the potential benefits of environmental legislation for a manufacturer?

I. Reduced energy costs

II. Reduced material costs

III. Reduced waste

A. I only

B. I and II

C. II and III

D. I, II and III

8. **Figure 4** shows a typical example of an office chair.

To design the chair the manufacturer decided to undertake life cycle analysis (LCA).

Figure 4: A typical office chair

[Source: https://en.wikipedia.org/wiki/Office_chair#/media/File:Desk_chair.jpg]

Which phases in the product lifecycle would the designer consider in undertaking LCA in relation to the design of the chair shown in **Figure 4**?

A. Marketing material, promotion, sales

B. Pre-production, production, distribution and packaging, utilization, disposal

C. Concept design, detail development, prototyping, manufacture

D. Density, conductivity, expansion, hardness

9. Which principles would help a designer to reduce the environmental impact of a product?

I. Mechanical principle

II. Precautionary principle

III. Prevention principle

A. I only

B. I and II

C. II and III

D. I, II and III

10. The consumption of which renewable energy source results in carbon emissions?

A. Wind

B. Solar

C. Nuclear

D. Biomass

11. What is both a driver and a barrier to clean technology adoption by manufacturers?

A. Market expectations

B. Legislation

C. Cost

D. Research and development

12. Which questions about a new product could be answered with a mock-up?

I. What will it look like?

II. Does it work?

III. Is it comfortable in your hand?

A. I and III

B. I and II

C. II and III

D. I, II and III

13. Which models are examples of graphical models?

A. Scale models

B. Mock-ups

C. Part and assembly drawings, including exploded diagrams

D. Prototypes

14. Validating a design in a usability laboratory is an example of a:

A. Restricted context

B. General context

C. Partial context

D. Total context

15. Which technology uses actuators to provide feedback?

A. Haptic technology

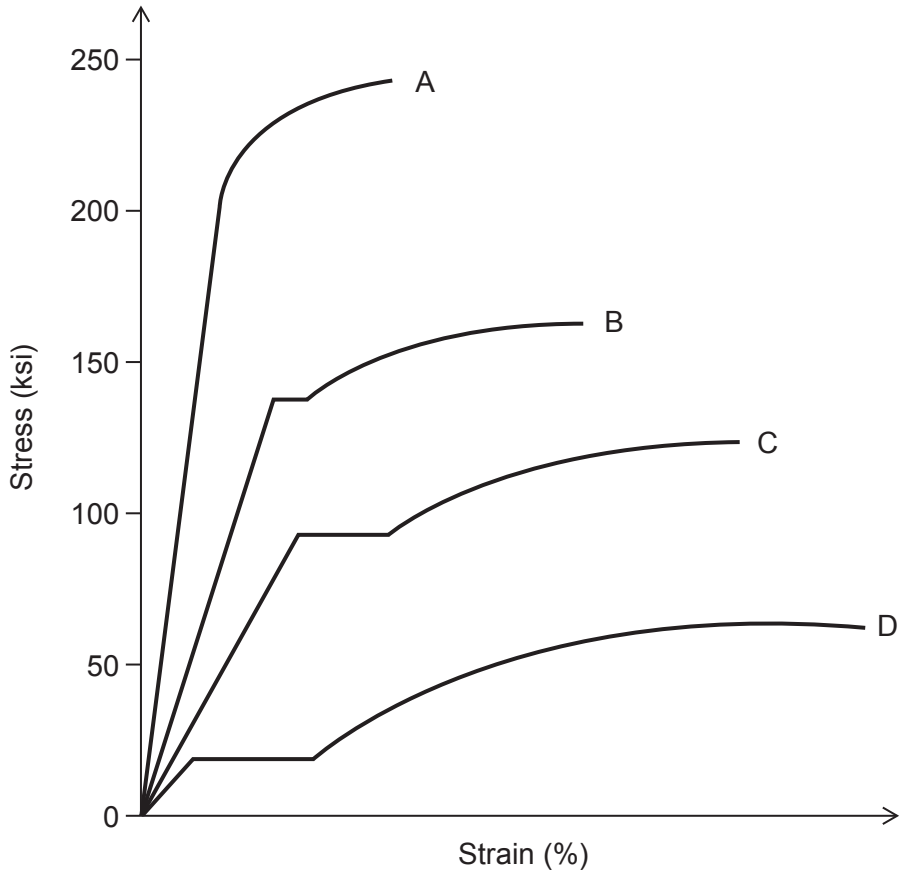
B. Motion capture

C. Virtual reality

D. Animation

16. **Figure 5** shows a comparative stress-strain diagram for four materials: A, B, C and D.

Figure 5: A comparative stress-strain diagram for four materials: A, B, C and D



[Source: © International Baccalaureate Organization 2016]

Which of the materials shown in **Figure 5** is the most ductile?

17. What is **not** a method for modifying the physical properties of a metal?

A. Tempering

B. Fabrication

C. Alloying

D. Work hardening

18. What is generally true of hardwoods compared to softwoods?

	Density	Resistance to damp environments
A.	Low	Low
B.	Low	High
C.	High	Low
D.	High	High

19. What is **not** a characteristic of glass?

A. It is a hard, solid material.

B. It has a crystalline structure.

C. It is inert and biologically inactive.

D. It is 100 % recyclable.

20. What is an advantage of thermosetting plastics over thermoplastics?

A. They are highly recyclable.

B. They are resistant to heat.

C. They are resistant to chemicals.

D. They are resistant to impact.

21. Which combination of absorbency and elasticity characterizes cotton fibres?

	Absorbency	Elasticity
A.	Low	Low
B.	Low	High
C.	High	Low
D.	High	High

22. **Figure 6** shows a sports shoe on the Nike ID website, an online store where customers can order sports shoes manufactured to their own specific requirements. The website allows users to change the colours of different materials and swap between a predefined set of logos and soles.

Figure 6: A sports shoe on the Nike ID website

Image removed for copyright reasons

What scale of production is illustrated by the product shown in **Figure 6**?

A. One-off

B. Continuous flow

C. Batch

D. Mass customization

23. What grants an inventor the right to exclude others from making, using, selling, offering to sell, and importing a product or service for a limited period of time?

A. Patent

B. ©

C. ®

D. ™

24. **Figure 7** shows a tablet PC.

Figure 7: A tablet PC

Image removed for copyright reasons
Please go to: https://en.wikipedia.org/wiki/Tablet_computer#/media/File:IFA_2010_Internationale_Funkausstellung_Berlin_18.JPG

The market for which technology was disrupted by the development of tablet PCs, such as the one shown in **Figure 7**?

A. Smartphone

B. Desktop personal computer

C. Mainframe computer

D. Laptop computer

25. Which individual is most likely to finance the development of a product?

A. An inventor

B. A product champion

C. An entrepreneur

D. A designer

26. **Figure 8** shows the Alessi Juicy Salif lemon squeezer designed in 1988 by Philippe Starck. It is made of PTFE-treated pressure-cast aluminium and polyamide. The Juicy Salif has become recognised as a design classic. The aim of the design was to present the Juicy Salif as high-quality silverware. Starck is rumoured to have claimed that the Juicy Salif "is not meant to squeeze lemons, it is meant to start conversations."

Figure 8: The Alessi Juicy Salif lemon squeezer designed by Philippe Starck

[Source: www.starck.com. Used with permission.]

What describes Philippe Starck's approach to the design of the product shown in **Figure 8**?

A. Retro-styling

B. Practical function

C. Compromise

D. Psychological function

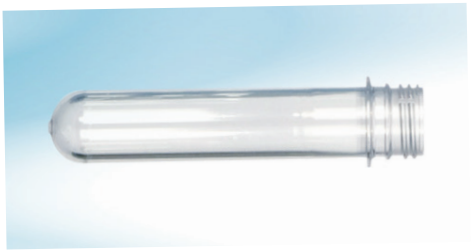
Questions 27–30 relate to the following case study. Please read the case study carefully and answer the questions.

The Coca-Cola® bottle, based on the shape of a cocoa bean, has become widely recognized as a design classic. It was designed by the Root Glass Company of Terre Haute, Indiana in 1915. Coca-Cola® bottles were originally made from glass but were later made from petroleum-based plastic – initially polyethylene terephthalate (PET). Since 2009, the Plantbottle™ (**Figure 9**) has been used for packaging Coca-Cola®. The Plantbottle™ is a PET container made with 30 per cent plant-based materials, including sugar cane extracts. Coca-Cola® PET bottles are made in two phases: phase 1 produces PET bottle preforms (**Figure 10**); phase 2 moulds the preforms into the final bottle shape. PET plastic bottles are currently made through a process that turns sugarcane into one component of PET plastic (**Figure 11**).

Figure 9: The Plantbottle™

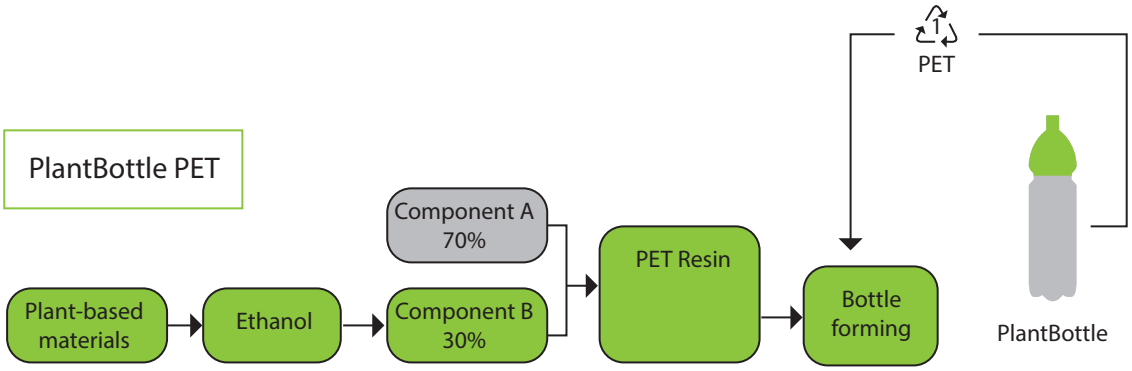
Image removed for copyright reasons

Figure 10: A PET bottle preform



[Source: https://upload.wikimedia.org/wikipedia/commons/d/d4/Plastic_bottle.jpg]

Figure 11: Production of Plantbottle™ plastic



[Source: © International Baccalaureate Organization 2016]

27. What best explains the Coca-Cola® bottle's recognition as a design classic?

A. The design united technological advance with beautiful design.

B. The design served as a standard of its time.

C. The design has resisted changes in taste and fashion.

D. The design was innovative in its use of materials.

28. Which physical property of a thermoplastic favours the use of thermoplastic rather than glass in the production of Coca-Cola® bottles?

A. Density

B. Melting point

C. Thermal expansion

D. Hardness

29. Which combination of moulding techniques would be used in each phase of producing Coca-Cola® PET bottles?

	Phase 1	Phase 2
A.	Blow moulding	Blow moulding
B.	Injection moulding	Blow moulding
C.	Blow moulding	Injection moulding
D.	Injection moulding	Injection moulding

30. What is a major advantage of using Plantbottle™ packaging for Coca-Cola® bottles?

A. Reduction in the volume of PET being sent to landfill

B. Reduction in the use of virgin petroleum-based resources

C. Increased recyclability of Plantbottle™ PET plastic

D. Increased use of non-renewable resources