Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level
Paper 1

Thursday 14 May 2015 (afternoon)

1 hour

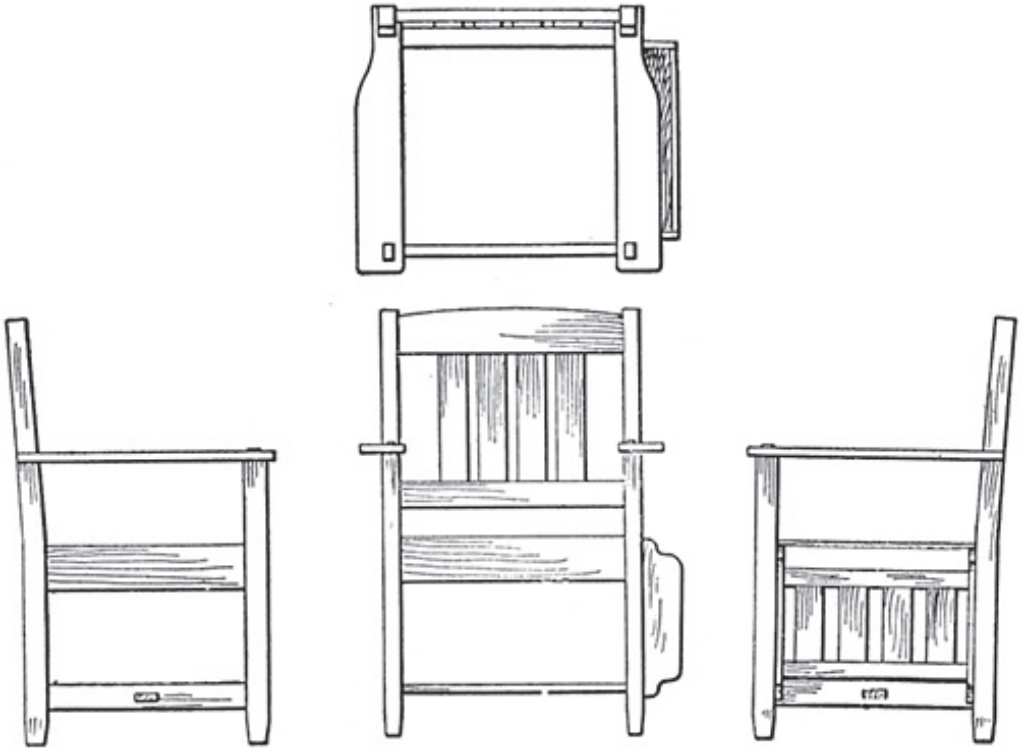
Instructions to candidates

- 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]**.

2215 – 6201

1. **Figure 1** shows a drawing of an armchair.

Figure 1: Drawing of an armchair



[Source: http://etc.usf.edu/clipart/52100/52103/52103_chair_o-p.htm.
Courtesy of the Florida Center for Instructional Technology (FCIT) at USF.]

What type of drawing is shown in **Figure 1**?

A. Orthographic drawing

B. Exploded isometric drawing

C. Isometric drawing

D. Perspective drawing

2. What describes the way a designer explores ideas through thought and action in the design cycle?

A. Linear

B. Cyclical

C. Sequential

D. Iterative

3. Which model would be **most** appropriate for communicating the design concept for a new shopping centre so that a local authority planning department can collect feedback from local residents?

A. Scale model

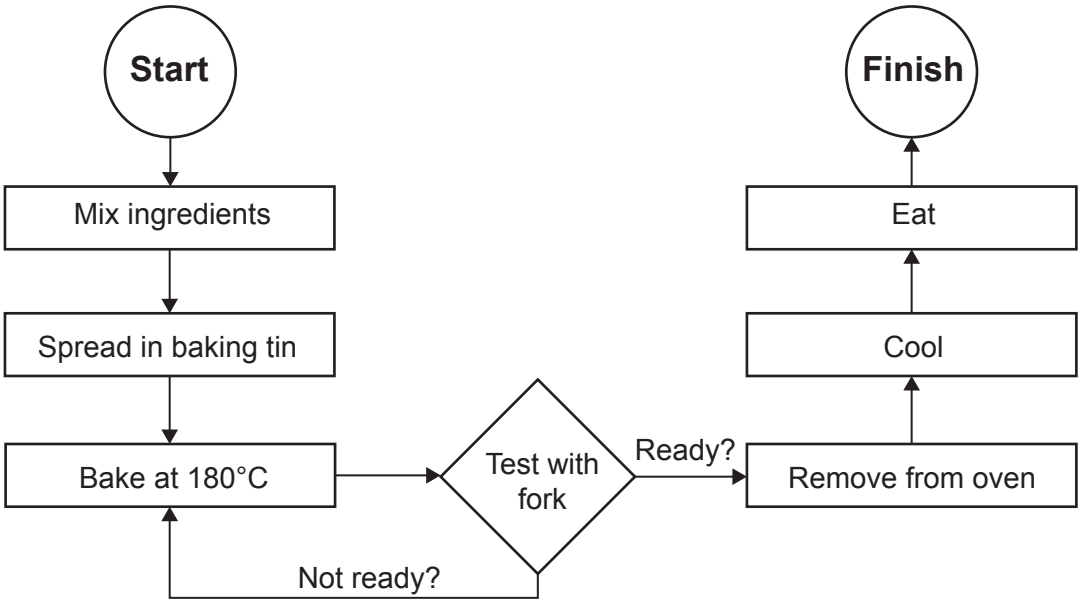
B. Surface model

C. Wire-frame model

D. Mathematical model

4. **Figure 2** shows a flowchart representing the process of making a cake.

Figure 2: A flowchart representing the process of making a cake



[Source: © International Baccalaureate Organization 2015]

Which step in the flow chart represents a decision?

A. Start

B. Baking at 180°C

C. Test with fork

D. Remove from oven and cool

5. Which of the following products is in the early stage of its product life cycle?

A. 4G mobile phone

B. CD player

C. DVD player

D. Video recorder

6. What is defined as a design that "contains those implicit features of a product that are recognised as essential by a majority of manufacturers and purchasers"?

A. Radical design

B. Dominant design

C. Product family

D. Incremental design

7. Adoption of which strategies would make disassembly of a product more economically viable at the end of its product life?

I. Minimizing the number of components

II. Designing parts for ease of fabrication

III. Using standard components and sub-assemblies

A. I and II

B. I and III

C. II and III

D. I, II and III

8. At which stage of the product life cycle does a designer have the most influence?

A. Pre-production

B. Production

C. Distribution

D. Use

9. What is described as “the smallest part of a chemical element that can exist”?

A. Atom

B. Molecule

C. Alloy

D. Composite

10. Which mechanical property is particularly important in selecting a material for extrusion?

A. Toughness

B. Stiffness

C. Tensile strength

D. Ductility

11. Which type(s) of glass is/are used to minimize the risk of personal injury if shattered?

	Laminated glass	**Toughened glass**
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

12. What term describes a fluid in which the viscosity can be changed by applying an electrical field?

A. Piezoelectric

B. Magneto-rheostatic

C. Electro-rheostatic

D. Shape memory alloys

13. Why is glass, for example, in the form of bricks and blocks, increasingly used as a structural material?

A. It is brittle

B. It is cheaper than bricks

C. It is strong in tension

D. It is strong in compression

14. Which combination of “rate of cooling” and “grain size” results in hardening of a metal?

	Rate of cooling	Grain size
A.	Slow	Small
B.	Slow	Large
C.	Rapid	Small
D.	Rapid	Large

15. Which materials cannot be shaped by casting?

I. Timber

II. Food

III. Textiles

A. I and II

B. I and III

C. II and III

D. I, II and III

16. How is batch production best defined?

A. A continuous flow of products

B. A small number of products

C. A set number of products

D. A large number of products

17. What makes the major contribution to the final cost of a “high tech” product, such as a mobile phone?

A. Manufacturing

B. Research and development

C. Design

D. Distribution

18. What is **not** a major consideration for the designer of the interior of a car in relation to the location of the hazard-warning-light control button?

A. Anthropometric data

B. Psychological data

C. Physiological data

D. Appropriate percentile values

19. Which combination of “quality” and “value for money” is important to consumers considering the purchase of a designer handbag?

	Quality	Value for money
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

20. Which evaluation strategy would be used at the early stage of the development of an energy-rich snack food?

A. Taste testing

B. Physical modelling

C. Market testing

D. Experimenting

21. At which stage in the product life cycle of a tablet PC would feedback from consumers be most useful in the development of the next generation of the product?

A. Launch

B. Growth

C. Maturity

D. Decline

22. Which combination of “reduced physical size” and “increased capacity” reflect the major challenges for the design of batteries for electrical vehicles?

	Reduced physical size	Increased capacity
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

23. Which strategies would be appropriate for the challenge of maintaining continuity of energy supply for industrial and domestic use into the future?

I. More efficient use of energy

II. Use of alternative energy sources

III. Reduced consumption of energy

A. I and II

B. I and III

C. II and III

D. I, II and III

24. **Figure 3** shows a stress/strain curve for a ductile material.

Figure 3: A stress/strain curve for a ductile material

Removed for copyright reasons

Into which region of the curve would the material need to be to produce wire?

A. 0–A

B. A–B

C. B–C

D. C–D

25. Which formula would be used to calculate the factor of safety of a structure?

A. Design load/normal maximum load

B. Force/area

C. Change of length/original length

D. Load/deflection

26. What is achieved using a rack-and-pinion gear?

A. Alters the axis of rotation

B. Changes rotational motion into linear motion

C. Increases the force and decreases the speed

D. Decreases the force and increases the speed

27. **Figure 4** shows a boy and his father on a see-saw.

Figure 4: A father and son on a see-saw

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What is true when the see-saw is in equilibrium?

I. Boy's mass $\times$ boy's distance from pivot $=$ father's mass $\times$ father's distance from pivot

II. The net moment is zero

III. Torque is zero

A. I and II

B. I and III

C. II and III

D. I, II and III

28. **Figure 5** shows a ramp to facilitate lifting a load. The ramp is 10 metres long and 2 metres high.

Figure 5: A ramp

[Source: © International Baccalaureate Organization 2015]

What is the mechanical advantage of using the ramp to load the van?

A. 5

B. 10

C. 20

D. 50

29. What type of motion is exhibited by a pendulum?

A. Linear

B. Oscillating

C. Rotary

D. Reciprocating

30. What is **not** true of high-pressure die casting?

A. High accuracy

B. High quality

C. Low cost

D. Low requirement for finishing operations

31. **Figure 6** shows a plastic doll which is made of a flexible thermoplastic. The doll has a hollow body.

Figure 6: A moulded thermoplastic doll

[Source: "Kaart als model van de werkelijkheid" by Nijeholt from nl. Licenced under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Kaart_als_model_van_de_werkelijkheid.JPG#/media/File:Kaart_als_model_van_de_werkelijkheid.JPG]

What moulding technique would have been use to produce the doll shown in **Figure 6**?

A. Blow

B. Injection

C. Rotational

D. Compression

32. Into which category of advanced manufacturing technique does filament winding fall?

A. Forming

B. Joining

C. Moulding

D. Casting

33. Trams are being installed in several major cities in the UK, for example in Edinburgh (see **Figure 7**).

Figure 7: Installing a tram system in Edinburgh

[Source: https://upload.wikimedia.org/wikipedia/commons/f/f3/Building_the_tram_platforms_at_Meadowhall_-_geograph.org.uk_-_776603.jpg?uselang=en-gb]

What is true of the process of installation of the tram system?

A. Low capital costs

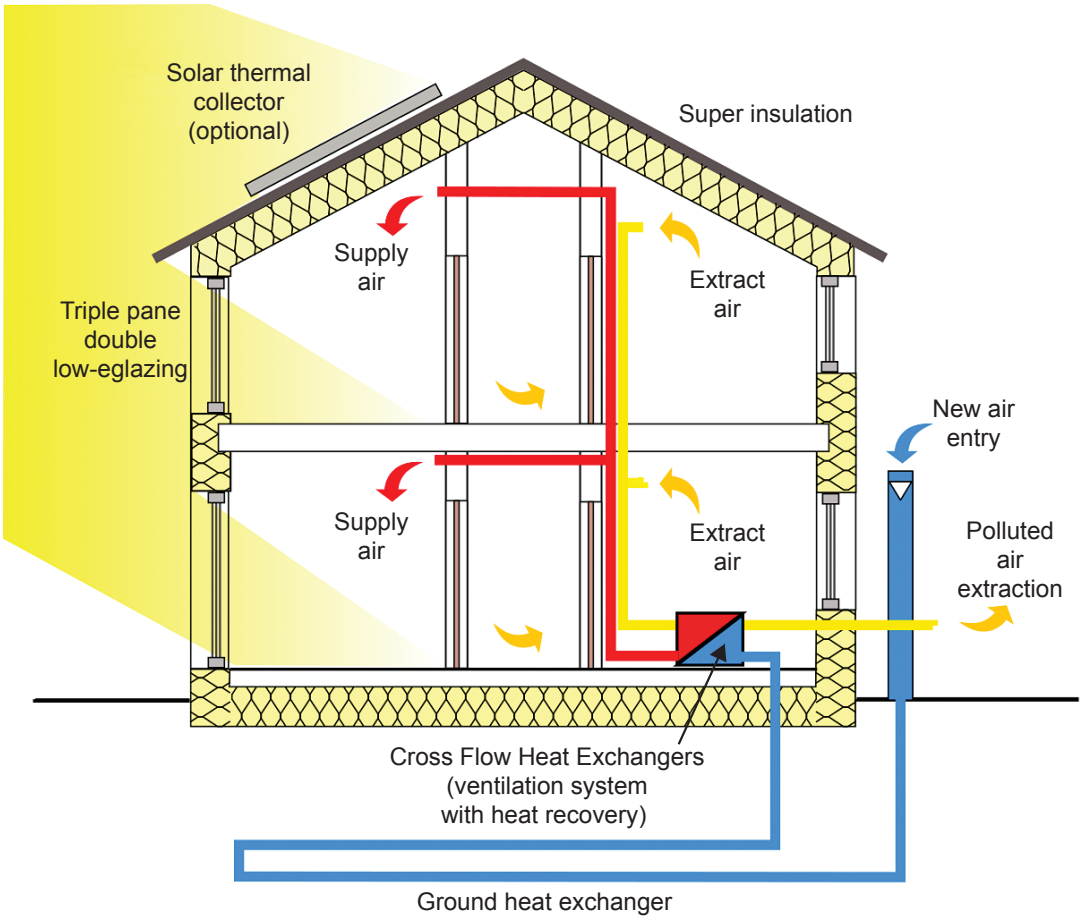
B. High energy efficiency

C. Cheaper travel opportunities

D. High levels of disruption to local residents and businesses

34. **Figure 8** shows the Passivhaus – a design for a sustainable house developed in the early 1990s by Professors Bo Adamson of Sweden and Wolfgang Feist of Gemany. The basic concept of the Passivhaus was to build a house with excellent thermal performance, exceptional airtightness and mechanical ventilation.

Figure 8: The Passivhaus



[Source: "Passive house scheme 1" by Passivhaus_section_en.jpg: Passivhaus Institutderivative work: Michka B (talk) – Passivhaus_section_en.jpg. Licensed under CC BY-SA 3.0 via Wikimedia Commons – https://commons.wikimedia.org/wiki/File:Passive_house_scheme_1.svg#/media/File:Passive_house_scheme_1.svg]

Which aspects of the design of the Passivhaus relate to reducing heat loss rather than increasing heat gain?

I. Double glazing

II. Ground heat exchanger

III. Super insulation

A. I and II

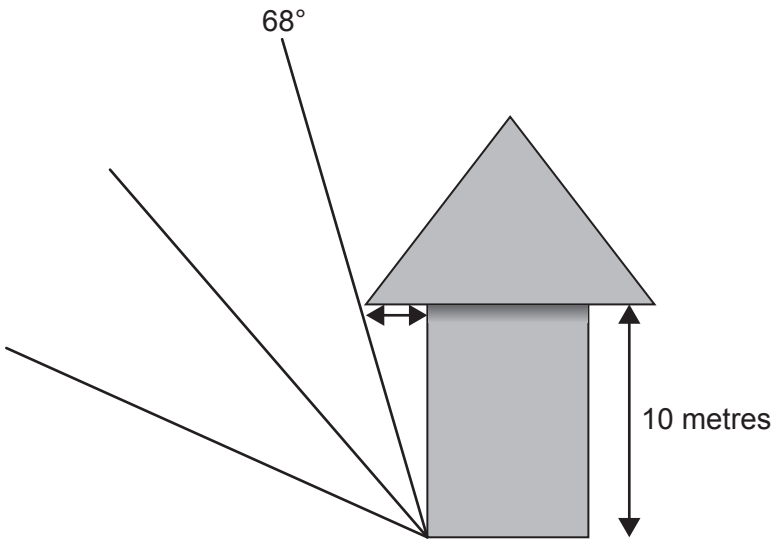
B. I and III

C. II and III

D. I, II and III

35. One aspect of passive solar design is to use design elements, such as roof overhangs, to shade windows and reduce solar heat gain particularly during summer. The solar altitude in Zagreb, Croatia during the summer solstice is 68 degrees.

Figure 9: Solar altitude



[Source: © International Baccalaureate Organization 2015]

Which equation represents the length of the overhang needed to shade the walls of a house in Zagreb at the summer solstice?

A. $\text{Sin } 22^{\circ} = \left(\frac{10}{x}\right)$

B. $\text{Sin } 22^{\circ} = \left(\frac{x}{10}\right)$

C. $\text{Tan } 22^{\circ} = \left(\frac{10}{x}\right)$

D. $\text{Tan } 22^{\circ} = \left(\frac{x}{10}\right)$

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

European legislation requires all new cars to meet minimum statutory safety standards to protect the occupants of cars and other road users, for example, pedestrians. **Figure 10** shows some of the tests designed by European New Car Assessment Programme (Euro NCAP) for pedestrian protection.
A legform test, for example, is used to test the damage to a pedestrian if his/her lower leg were hit by a car bumper. Bumpers can be designed to deform on impact.

Figure 10: Testing cars for pedestrian protection

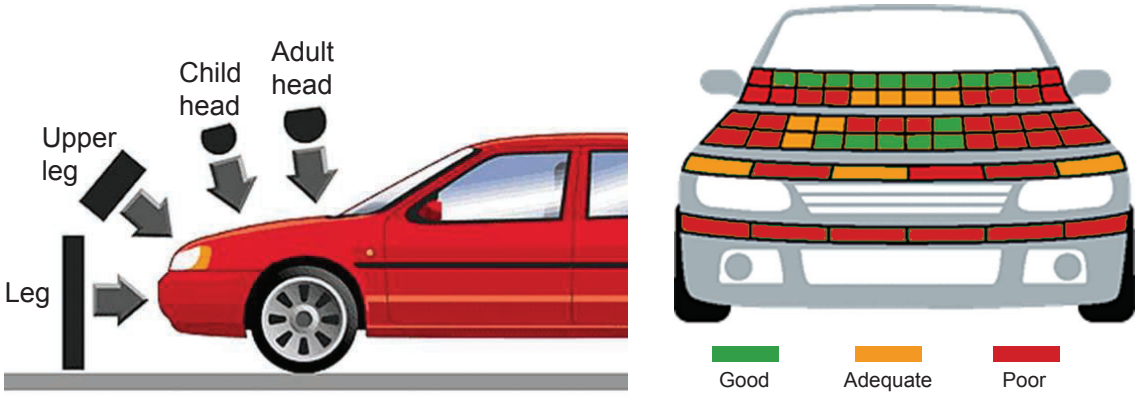


Figure 11: Crash test dummies

[Source: Courtesy of Euro NCAP.]

36. What is **not** true of the Euro NCAP tests?

A. They enable comparisons to be made between different vehicles

B. They provide reliable data which can be used to inform the design of the car

C. They are destructive tests

D. They are cheap

37. What sort of data would be generated by the Euro NCAP test?

	Quantitative data	Qualitative data
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

38. What are reasons for having different crash test dummies such as those in **Figure 11**?

I. To collect data for passengers of different weights and heights

II. To collect data for different types of impact

III. To collect data for different types of vehicle

A. I and II

B. I and III

C. II and III

D. I, II and III

39. What type of model is a crash test dummy?

A. Graphical model

B. Physical model

C. Mathematical model

D. Prototype

40. Which type of thinking would be employed by a designer considering data from a Euro NCAP test in redesigning a vehicle?

	Divergent	Convergent
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes