Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Higher level
Paper 1

Friday 13 November 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]**.

8815–6201

1. What would be a constraint on the design brief for a new car (automobile)?

A. Complies with relevant safety legislation

B. Is fuel-efficient

C. Is suitable for a wide target market

D. Is ergonomically designed

2. Why is the design cycle often seen as difficult to interpret?

A. Because it is sequential

B. Because it is iterative

C. Because it is linear

D. Because it has different stages

3. Which ideas generating technique requires teamwork?

A. Analogy

B. Adaptation

C. Brainstorming

D. Attribute listing

4. Which model is most appropriate for representing a new retail development to the general public?

A. Graphical model

B. Physical model

C. Algorithm

D. Scale model

5. In which cycle(s) is the designer most influential?

	Design cycle	Product cycle
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

6. What is often **not** a characteristic of a lone inventor?

A. Business-like

B. Creative

C. Determined

D. Tenacious

7. Which combination of manufacturer resistance and consumer resistance may make a “take back” policy for washing machines difficult to implement?

	Manufacturer resistance	Consumer resistance
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

8. **Figure 1** shows ballpoint pens produced by injection moulding.

Figure 1: Ballpoint pens produced by injection moulding

[Source: "4 Bic Cristal pens and caps" by Carlos Delgado. Licensed under CC BY-SA 3.0 via Commons – "4 Bic Cristal pens and caps" by Carlos Delgado. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:4_Bic_Cristal_pens_and_caps.jpg#/media/File:4_Bic_Cristal_pens_and_caps.jpg]

Which considerations would have been important in the design of the product shown in **Figure 1**?

I. Design for materials

II. Design for process

III. Design for disassembly

A. I and II

B. I and III

C. II and III

D. I, II and III

9. What is defined as: "a mixture of two or more substances with one acting as the matrix or glue"?

A. Compound

B. Molecule

C. Alloy

D. Composite

10. What is responsible for metals being very good electrical and thermal conductors?

A. The sharing of electrons between atoms

B. The movement of free electrons

C. The release of an electric charge on impact

D. The molecules are not tightly packed

11. Which plastic material would be most suitable for making foam cushions?

A. Polypropene

B. Polyethene

C. Polyurethane

D. Polyvinyl chloride

12. Which property of a material would enable it to be used in the development of a sensor for an airbag in a car?

A. Electro-rheostatic

B. Magneto-rheostatic

C. Piezoelectric

D. Shape memory alloy

13. Which combination of “elastic” and “plastic” characterizes a thermoset?

	Elastic	Plastic
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

14. What are superalloys resistant to?

I. High temperature

II. Oxidation

II. Creep

A. I and II

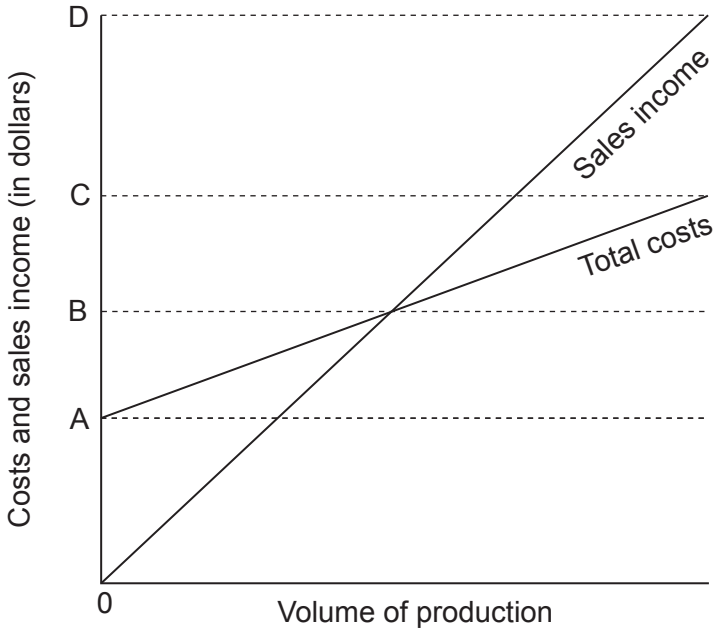
B. I and III

C. II and III

D. I, II and III

15. **Figure 2** shows a graph of costs and sales income (in dollars) against volume of production.

Figure 2: Costs and sales income (in dollars) against volume of production



What in **Figure 2** represents the fixed costs of developing a product?

A. A

B. B–A

C. C–B

D. D–C

16. Which scale of production offers the most flexibility?

A. Craft

B. Mechanization

C. Automation

D. Mass customization

17. What is a major consideration for just-in-case (JIC) manufacturing but not for just-in-time (JIT)?

A. Energy costs

B. Storage

C. Distribution

D. Workforce

18. What best describes the product life cycle for fashion and planned obsolescence?

	Fashion	Planned obsolescence
A.	Unpredictable product cycle	Unpredictable product cycle
B.	Unpredictable product cycle	Predictable product cycle
C.	Predictable product cycle	Unpredictable product cycle
D.	Predictable product cycle	Predictable product cycle

19. Which percentile will be considered by a mass-produced clothing manufacturer?

A. 5th

B. 50th

C. 95th

D. 5th–95th

20. What best describes the individuals involved in a user trial and an expert appraisal?

	User trial	Expert appraisal
A.	Non-specialist	Non-specialist
B.	Non-specialist	Specialist
C.	Specialist	Non-specialist
D.	Specialist	Specialist

21. Which evaluation tests require a functional prototype?

I. User trial

II. Field trial

III. Performance test

A. I and II

B. I and III

C. II and III

D. I, II and III

22. What type of energy is released by the combustion of fossil fuels?

A. Chemical potential energy

B. Electromagnetic potential energy

C. Thermal energy

D. Kinetic energy

23. What is an advantage of nuclear power?

A. Low commissioning costs

B. High energy density

C. Waste product storage issues

D. Safety considerations

24. How is the Young's modulus of a material calculated?

A. $\frac{\text{design load}}{\text{normal maximum load}}$

B. $\frac{\text{stress}}{\text{strain}}$

C. $\frac{\text{force}}{\text{area}}$

D. $\frac{\text{change in length}}{\text{original length}}$

25. Which condition would enable the use of a low factor of safety in a design context?

A. It is difficult to predict the normal maximum load

B. Relevant properties of the materials are well understood

C. Serious consequences would result from failure of the design

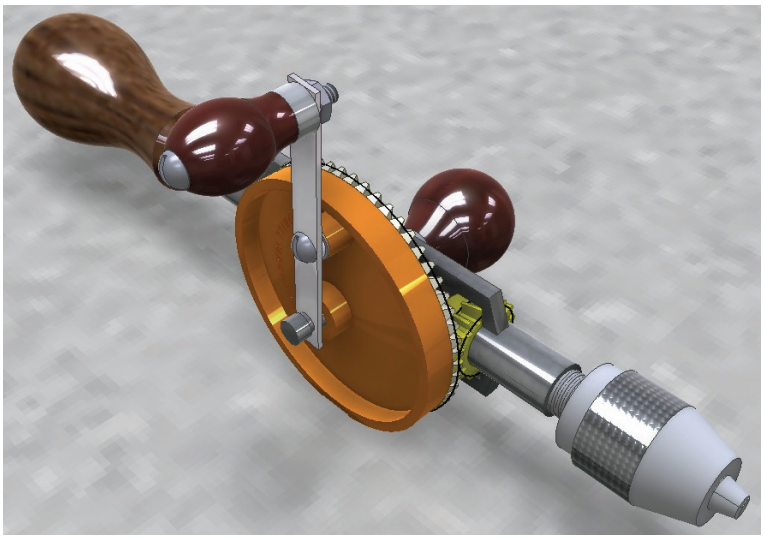
D. The product is difficult to maintain

26. What is true of the mass and weight of an object on the Earth and on the Moon?

	Mass	Weight
A.	Same	Same
B.	Same	Different
C.	Different	Same
D.	Different	Different

27. **Figure 3** shows a hand drill comprising two interlocking gears. The large gear to which the handle is attached has 64 teeth. The small gear which turns the drill bit has 16 teeth.

Figure 3: A hand drill



[Source: Image courtesy of Admir Sijamija.]

How many times will the gear holding the drill bit turn for each turn of the large gear?

A. 0.25

B. 1

C. 4

D. 80

28. What type of motion is exemplified by a clock pendulum?

A. Reciprocating motion

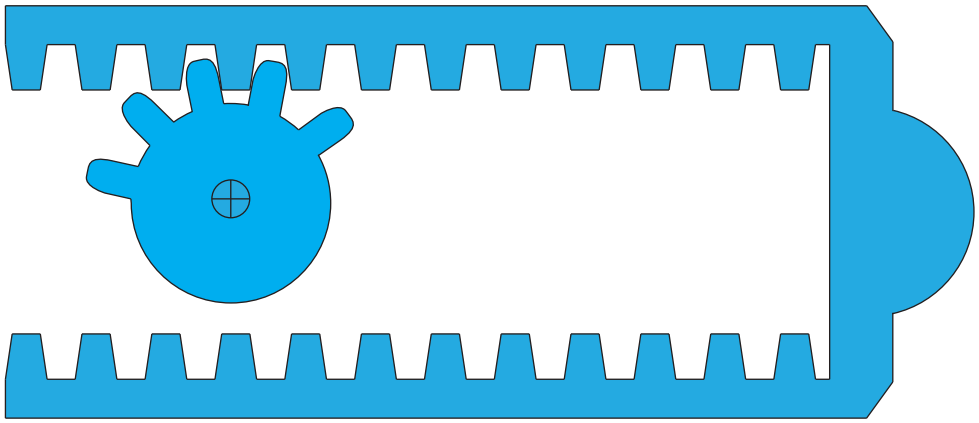
B. Linear motion

C. Horizontal motion

D. Oscillating motion

29. Which conversion of motion would the mechanism shown in **Figure 4** achieve?

Figure 4: A mechanism to convert one type of motion to another



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

A. Rotational motion to linear motion

B. Vertical motion to horizontal motion

C. Rotational motion to reciprocating motion

D. Rotational motion to irregular motion

30. What is a major consideration in using a thermoplastic resin rather than a thermosetting resin as an adhesive in joining the parts of a product?

A. Bonding time of the adhesive

B. Temperature of operation of the product

C. Preparation of surfaces

D. Health and safety

31. Why is polyethylene terephthalate widely used in the blow moulding of soft drinks containers?

I. It is a strong stiff material

II. It is a thermoplastic

III. It is a thermoset

A. I and II

B. I and III

C. II and III

D. I, II and III

32. What is the main advantage of high-pressure die casting?

A. Low capital costs

B. Slow production rates

C. Dimensional accuracy

D. The need for finishing

33. Which triple bottom line considerations are not directly related to carrying capacity?

I. Environmental sustainability

II. Economic sustainability

III. Social sustainability

A. I and II

B. I and III

C. II and III

D. I, II and III

34. What is part of an active solar design for a building but not a passive solar design?

A. Thermal mass

B. Appropriate solar orientation

C. Natural convection

D. A pump

35. Which factor does not affect the heat flow through a material?

A. Area

B. Thickness

C. Temperature difference

D. Human activities

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

A homeowner has decided to reduce the environmental impact of his home by installing several systems, including: a rainwater harvesting system; double glazing units with low emissivity glass; a wood burning stove; solar panels charging batteries to operate lights and low voltage appliances. **Table 1** shows typical *U* values for different glazing standards.

Table 1: Typical *U* values for different glazing standards in W/m^2/$^\circ$C)

Single glazing	5.6
Double glazing (with air cavity)	2.8
Double glazing (with argon gas cavity)	2.6
Double glazing with low emissivity glass (with air cavity)	1.8
Double glazing with low emissivity glass (with argon gas cavity)	1.5

36. Which combination of "heat flow" and "*U* value" reduces heat loss from a building?

	Heat flow	***U* value**
A.	Low	Low
B.	Low	High
C.	High	Low
D.	High	High

37. Installation of which systems would reduce the environmental impact of the home but would not reduce its carbon emissions?

I. Rainwater harvesting

II. Double glazing units

III. Wood burning stove

A. I and II

B. I and III

C. II and III

D. I, II and III

38. Which system relates to resource efficiency rather than energy efficiency?

A. A rainwater harvesting system

B. A wood burning stove

C. Solar panels charging batteries to operate lights and low voltage appliances

D. Double glazing units with low emissivity glass

39. Which factor relates to the *U* value of the building envelope?

A. Area

B. Thickness

C. Thermal conductivity

D. Temperature difference

40. What would be the reduction in heat loss on a day when the internal air temperature is 20°C and the external air temperature is 10°C, if the home owner were to replace a 5 m^2 single glazed window with a double glazed window unit fitted with low emissivity glass (with air cavity)?

A. 90 Watts

B. 140 Watts

C. 190 Watts

D. 280 Watts