



International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

Design Technology

Higher and Standard level

Specimen papers 1, 2 and 3

For first examinations in 2016

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**DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 1**

SPECIMEN PAPER

1 hour

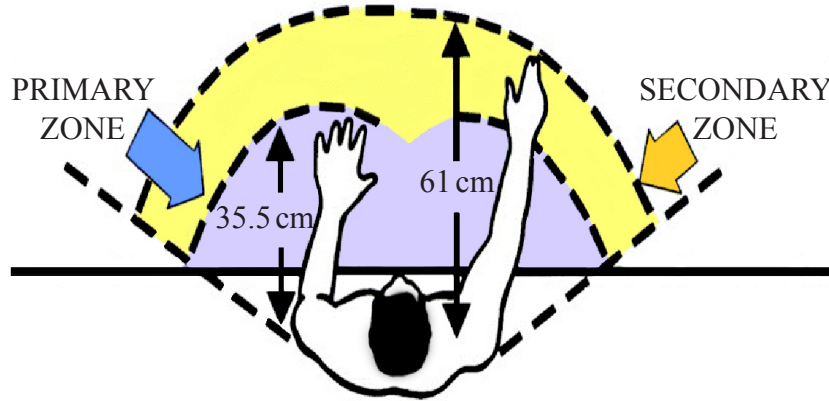
INSTRUCTIONS TO CANDIDATES

- 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]*.

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1. **Figure 1** shows the workspace in front of a person. The primary zone is the area within easy reach of the hands. The secondary zone can be reached by involving arm movement.

Figure 1: Laying out a workstation in front of a person



[Source: adapted from <http://ergonomicedge.wordpress.com>]

Which object would be best located in the primary zone?

- A. Display screen
- B. Mouse
- C. Stapler
- D. Heavy file

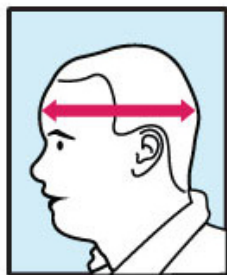
2. **Figure 2** shows a safety helmet which is produced in a range of sizes (XXS, XS, S, M, L, XL) and also has an adjustable head band to ensure that it fits properly. **Figure 3** shows the sizing of safety helmets and the measurement (in centimetres) that needs to be taken to identify the appropriate helmet size required.

Figure 2: A safety helmet with adjustable head band



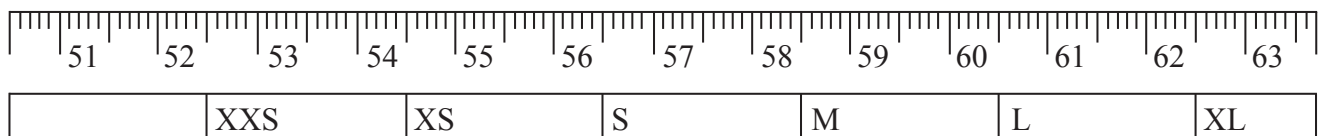
[Source: www.istockphoto.com]

Figure 3: Sizing of safety helmets



Helmet Sizing

Carefully measure around your head, above the ears. Take the measurement, in or centimetres, referring to the chart for correct, hat/helmet size. Do not guess your size, helmets must fit snugly and securely before engaging in any activity.



[Source: adapted from <http://rallysport.ca>]

Which helmet size would be required for a person whose head circumference is 57.5 cm?

- A. XXS
- B. XS
- C. S
- D. M

3. Which scale has units of equal size and would be suitable for use as a temperature scale?
 - A. Nominal
 - B. Ordinal
 - C. Interval
 - D. Ratio

4. What is a disadvantage for a government commissioning a nuclear energy plant?
 - A. High set-up costs
 - B. High running costs
 - C. High carbon emissions
 - D. Continuity of supply

5. Which phrase best reflects the philosophy of the circular economy?
 - A. Cradle to cradle
 - B. Cradle to grave
 - C. Made to be made again
 - D. Take, make, dispose

6. Which phrase reflects the life cycle analysis of a product?
 - A. Cradle to cradle
 - B. Cradle to grave
 - C. Cradle to gate
 - D. Cradle to site

- 7. At which stage of the product life cycle would user attitudes and behaviours be likely to have greater impact than those of the designer or the manufacturer?
 - A. Production
 - B. Distribution, including packaging
 - C. Utilization
 - D. Disposal

- 8. What aspect of eco-design does design for repair and maintenance optimize?
 - A. Production
 - B. Initial lifespan
 - C. Impact during use
 - D. End of life options

- 9. What would **not** necessarily be reduced by a manufacturer adopting a dematerialization strategy?
 - A. Depletion of natural resources
 - B. Waste to landfill
 - C. Energy consumption
 - D. Product efficiency

10. Which combination of intangible and tangible is reflected by a conceptual model?

	Intangible	Tangible
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

- 11. What is the advantage of using freehand drawings in the design process?
 - A. They are quick to produce and would be used for design development.
 - B. They can be used as working drawings for design realization.
 - C. They show details and dimensions and can be used for production.
 - D. They show the sequence of assembly of a product.

- 12. The Jack system provides a library of digital humans (**Figure 4**). Jack was developed to facilitate the development of the design of the NASA space shuttle. Jack is now used in a range of military applications for example, simulating maintenance and other tasks.

Figure 4: A digital human library



[Source: www.plm.automation.siemens.com]

What are the benefits of a digital human library in the simulation of maintenance tasks?

- I. Dangerous tasks can be modelled virtually.
 - II. Humans of different sizes and weights can be used.
 - III. Human considerations relating to maintenance tasks can be considered early in the design process.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

13. **Figure 5** shows a lens made of photochromic material which has been partially exposed to sunlight. Photochromic lenses contain silver halides that react to ultraviolet light to darken the lens. The silver halides can be dispersed throughout the lens or can be produced as a single layer by dipping the lens in a bath of silver halide.

Figure 5: Photochromic lens partially exposed to sunlight



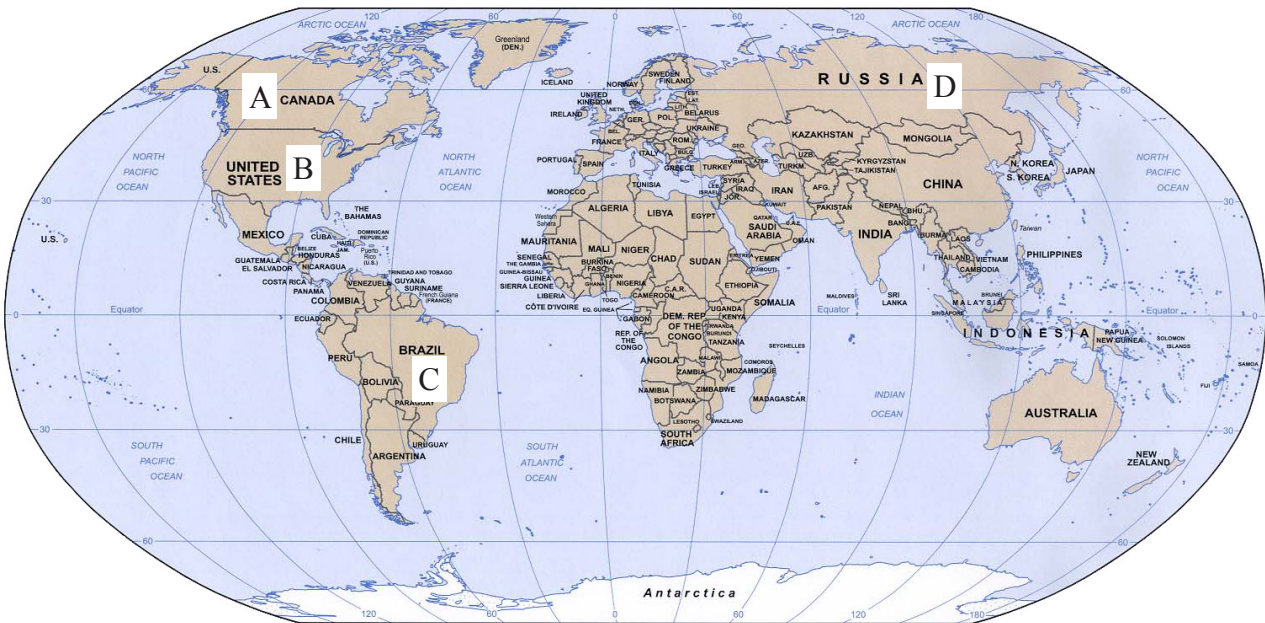
[Source: <http://upload.wikimedia.org>]

What is a disadvantage of distributing silver halides throughout lenses of variable thickness?

- A. They are more expensive.
- B. The lenses will darken evenly.
- C. The thicker parts of the lens will darken more than the thinner parts.
- D. The frame will snap back into shape if they are bent out of shape in use.

14. Figure 6 shows a map of the world.

Figure 6: A map of the world



[Source: adapted from www.lib.utexas.edu]

In which region of the world does high demand for hardwood timber result in the depletion of ancient forests with major implications for global warming?

15. What is **not** true of assembly line production?
- A. Less skilled labour is required.
 - B. It is suited to batch production.
 - C. It results in more uniform products.
 - D. It achieves greater efficiency.
16. Which scale of production is used for craft-produced bread?
- A. One off
 - B. Batch
 - C. Mass customization
 - D. Mass production

17. Which intellectual property (IP) symbol is equivalent to a brand?
- A. Patent
 - B. ©
 - C. ®
 - D. SM
18. Which of Rogers' characteristics of diffusion of innovation relates to the perception that the innovation is more satisfactory than items that already exist in the same class of products?
- A. Relative advantage
 - B. Compatibility
 - C. Observability
 - D. Complexity
19. Which innovation stakeholder is likely to make the greatest contribution to putting an innovation into the marketplace and making it a success?
- A. Designer
 - B. Product champion
 - C. Lone inventor
 - D. Entrepreneur

20. The publishers Phaidon have identified a collection of 999 design classics. Design classic 063 in the Phaidon collection is the paperclip (**Figure 7**) that was first patented in the United States by Samuel B Fray in 1867.

Figure 7: A paperclip



[Source: www.guardian.co.uk]

Which of Phaidon's definitions of classic design best fit the paperclip?

- I. Objects that are innovative in their use of materials and unite technological advances with beautiful design.
 - II. Objects characterized by simplicity, balance and purity of form.
 - III. Objects that are perfect in their design and have remained unchanged since their creation.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
21. What is true of patents?
- I. They are used to protect intellectual property.
 - II. They have a limited lifespan.
 - III. They are valid globally.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

22. What is likely to change that provides a major challenge for the designers of products for the global marketplace?
- I. Task
 - II. User
 - III. Environment
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
23. What is a fictional character used in user research to represent non-users of a potential product?
- A. Persona
 - B. Secondary persona
 - C. Anti-persona
 - D. Scenario
24. Which aspect of the four pleasure framework reflects the sensual pleasure from the sound of a well-engineered car door closing?
- A. Socio-pleasure
 - B. Physio-pleasure
 - C. Psycho-pleasure
 - D. Ideo-pleasure

25. What is true of the United Nations Environment Programme (UNEP) International Resource Panel's definition of decoupling?
- I. Economic growth and environmental impact are disconnected
 - II. More resources are used per unit of economic output
 - III. Reduced environmental impact per unit of resource
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
26. Which group of people might break laws to express their views on the environment?
- A. Eco-warriors
 - B. Eco-champions
 - C. Eco-fans
 - D. Eco-phobes
27. Which of Datschefski's principles relates to the use of renewable energy by a sustainable product?
- A. Cyclic
 - B. Solar
 - C. Safe
 - D. Super-efficient
28. Which term relates to the uninterrupted availability of energy sources at an affordable price?
- A. Energy security
 - B. Peak oil
 - C. Renewable energy
 - D. Global dimming

- 29.** What is true of product families?
- I. They are a group of products based on a common platform.
 - II. They can facilitate the introduction of products with new features to the marketplace.
 - III. They can reduce production and marketing costs.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
- 30.** Which aspect of a design specification relates to the pioneering nature of a design?
- A. Patentability
 - B. Technical novelty
 - C. Environmental sustainability
 - D. Social sustainability
- 31.** Which price setting strategy takes account of critical price points in consumers' minds?
- A. Cost-plus pricing
 - B. Competitor-based pricing
 - C. Product line pricing
 - D. Psychological pricing
- 32.** What is a major disadvantage of just in time (JIT) production?
- A. Reduced storage requirements
 - B. Reduced inventory costs
 - C. Increased risk reliance on suppliers
 - D. Increased flexibility in responding to fluctuations in demand

- 33. What is a major focus of lean production?
 - A. Reducing waste
 - B. Reducing cost
 - C. Reducing time
 - D. Reducing labour

- 34. Which scale of production is consistent with computer-integrated manufacturing?
 - A. Craft
 - B. Mechanization
 - C. Batch
 - D. Automation

- 35. When do quality assurance and quality control take place relative to product manufacture?

	Quality assurance	Quality control
A.	Before	Before
B.	Before	After
C.	After	Before
D.	After	After

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

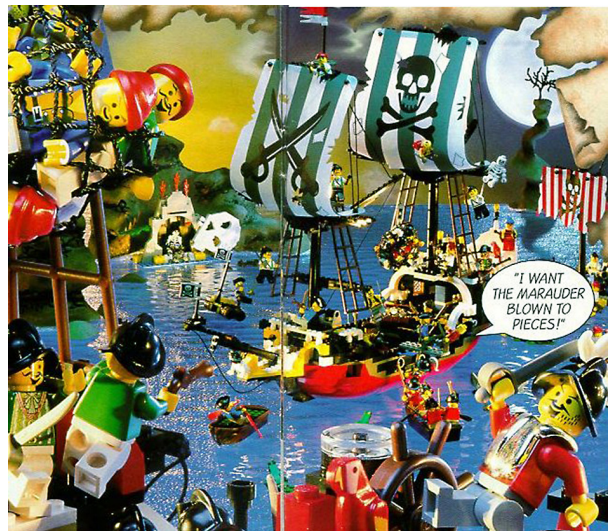
LEGO® is an extremely popular children’s construction toy and a design classic based on interlocking bricks (Figure 8). LEGO pieces are made of acrylonitrile butadiene styrene (ABS) and produced by injection moulding to precise sizes. LEGO offers a wide range of products based on themes, for example, space, robots and pirates (Figure 9). New LEGO products take around twelve months to develop in three stages: first, identifying market trends through designers going to toyshops and interviewing children; second, designing and developing the new product using 3D modelling software to generate CAD drawings from initial design sketches and third, prototyping using stereolithography. Prototypes are evaluated by the design team and in focus groups with parents and children. Designs are modified in line with the feedback obtained.

Figure 8: LEGO® bricks



[Source: <http://en.wikipedia.org>]

Figure 9: LEGO® set based on a pirates theme



[Source: <http://images.wikia.com>]

36. Which combination of toughness and plastic type characterizes the ABS plastic used for the manufacture of LEGO bricks?

	Toughness	Plastic type
A.	Low	Thermoplastic
B.	Low	Thermoset
C.	High	Thermoplastic
D.	High	Thermoset

37. Which advantage of injection moulding contributes to the precision manufacturing of Lego bricks?
- A. High production rates
 - B. Close tolerances on small intricate parts
 - C. Very little post-production work is required
 - D. Waste material can be recycled
38. What is **not** true of stereolithography for the production of the prototypes of the new Lego design?
- A. It is an additive process.
 - B. It involves a ultraviolet light-sensitive resin.
 - C. It is a cheap process.
 - D. It is good for producing items with smooth surfaces and fine detail.
39. What is likely to be a higher priority for the target audience (children) for Lego products than for the target market (their parents)?
- A. Fun
 - B. Health and safety
 - C. Cost
 - D. Educational value
40. Which market research strategies would require prototypes of the new Lego design?
- I. User trial
 - II. User research
 - III. Expert appraisal
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
-



MARKSCHEME

SPECIMEN PAPER

DESIGN TECHNOLOGY

Higher Level

Paper 1

1.	<u>B</u>	16.	<u>B</u>	31.	<u>B</u>	46.	<u>-</u>
2.	<u>C</u>	17.	<u>C</u>	32.	<u>C</u>	47.	<u>-</u>
3.	<u>C</u>	18.	<u>A</u>	33.	<u>A</u>	48.	<u>-</u>
4.	<u>C</u>	19.	<u>D</u>	34.	<u>D</u>	49.	<u>-</u>
5.	<u>C</u>	20.	<u>C</u>	35.	<u>B</u>	50.	<u>-</u>
6.	<u>B</u>	21.	<u>A</u>	36.	<u>C</u>	51.	<u>-</u>
7.	<u>D</u>	22.	<u>C</u>	37.	<u>B</u>	52.	<u>-</u>
8.	<u>D</u>	23.	<u>C</u>	38.	<u>C</u>	53.	<u>-</u>
9.	<u>D</u>	24.	<u>B</u>	39.	<u>A</u>	54.	<u>-</u>
10.	<u>C</u>	25.	<u>B</u>	40.	<u>B</u>	55.	<u>-</u>
11.	<u>A</u>	26.	<u>A</u>	41.	<u>-</u>	56.	<u>-</u>
12.	<u>D</u>	27.	<u>B</u>	42.	<u>-</u>	57.	<u>-</u>
13.	<u>C</u>	28.	<u>A</u>	43.	<u>-</u>	58.	<u>-</u>
14.	<u>C</u>	29.	<u>D</u>	44.	<u>-</u>	59.	<u>-</u>
15.	<u>A</u>	30.	<u>A</u>	45.	<u>-</u>	60.	<u>-</u>



**DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 1**

SPECIMEN PAPER

45 minutes

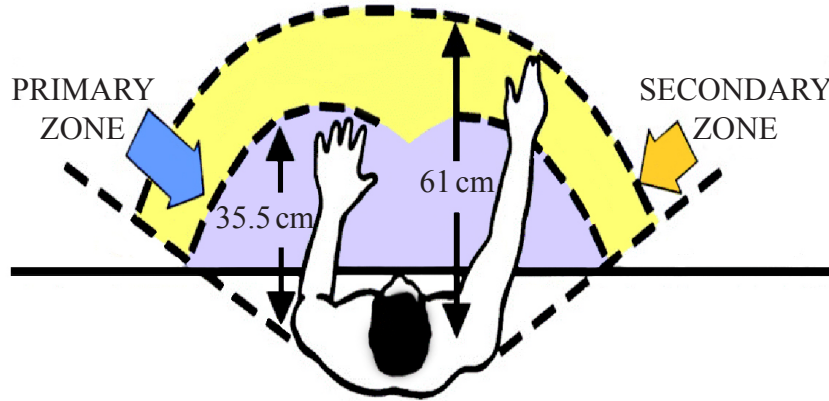
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1. **Figure 1** shows the workspace in front of a person. The primary zone is the area within easy reach of the hands. The secondary zone can be reached by involving arm movement.

Figure 1: Laying out a workstation in front of a person



[Source: adapted from <http://ergonomicedge.wordpress.com>]

Which object would be best located in the primary zone?

- A. Display screen
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- C. Stapler
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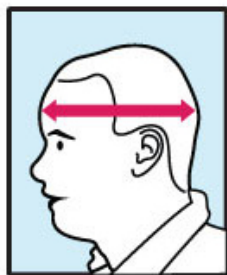
2. **Figure 2** shows a safety helmet which is produced in a range of sizes (XXS, XS, S, M, L, XL) and also has an adjustable head band to ensure that it fits properly. **Figure 3** shows the sizing of safety helmets and the measurement (in centimetres) that needs to be taken to identify the appropriate helmet size required.

Figure 2: A safety helmet with adjustable head band



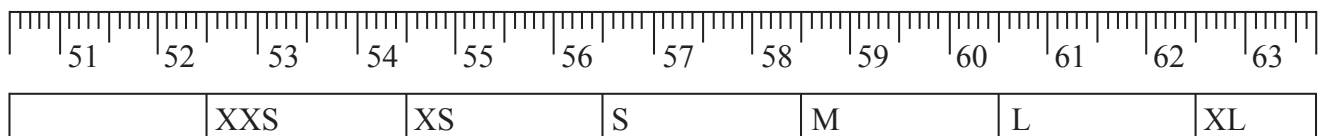
[Source: www.istockphoto.com]

Figure 3: Sizing of safety helmets



Helmet Sizing

Carefully measure around your head, above the ears. Take the measurement, in centimetres, referring to the chart for correct, hat/helmet size. Do not guess your size, helmets must fit snugly and securely before engaging in any activity.



[Source: adapted from <http://rallysport.ca>]

Which helmet size would be required for a person whose head circumference is 57.5 cm?

- A. XXS
- B. XS
- C. S
- D. M

3. Which part of the human information processing system converts a nerve impulse from the brain into an action?
 - A. Sensory processes
 - B. Central processes
 - C. Motor processes
 - D. Output

4. Which consideration in the design of an open-plan office would have an impact on an employee's thermal comfort by influencing the rate of evaporation of sweat from the skin?
 - A. Air temperature
 - B. Radiant heat from heat sources, for example, electrical equipment
 - C. Air velocity
 - D. Humidity

5. Which phrase best reflects the philosophy of the circular economy?
 - A. Cradle to cradle
 - B. Cradle to grave
 - C. Made to be made again
 - D. Take, make, dispose

6. Which phrase reflects the life cycle analysis of a product?
 - A. Cradle to cradle
 - B. Cradle to grave
 - C. Cradle to gate
 - D. Cradle to site

7. Which combination of incremental and radical reflects the addition of an end-of-pipe technology to a manufacturing system?

	Incremental	Radical
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

8. A design objective for a greener washing powder would be to?

- A. Increase corporate profit
- B. Reduce environmental impact
- C. Increase the product's effectiveness
- D. Reduce the amount of product used

9. What aspect of eco-design does design for repair and maintenance optimize?

- A. Production
- B. Initial lifespan
- C. Impact during use
- D. End of life options

10. Which would be facilitated by the use of modular design as part of a company's eco-design strategy?
- I. Ease of maintenance
 - II. Design for reuse
 - III. Design for recycling
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
11. Which green design strategy is related to the use of materials from obsolete products to create new products?
- A. Reuse
 - B. Recycle
 - C. Repair
 - D. Recondition
12. Which combination of intangible and tangible is reflected by a conceptual model?

	Intangible	Tangible
A.	No	No
B.	No	Yes
C.	Yes	No
D.	Yes	Yes

- 13.** What is the advantage of using freehand drawings in the design process?
- A. They are quick to produce and can be used for design development.
 - B. They can be used as working drawings for design realization.
 - C. They show details and dimensions and can be used for production.
 - D. They show the sequence of assembly of a product.
- 14.** Which scale would be used for a prototype?
- A. 1:1
 - B. 1:10
 - C. 1:100
 - D. 1:1000
- 15.** Which rapid prototyping technique involves the use of a laser?
- I. Selective laser sintering (SLS)
 - II. Stereolithography
 - III. Laminated object manufacture (LOM)
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

16. A horseshoe (**Figure 4**) is made by beating heated metal into shape and then cooling it very quickly by dipping into cold water – a process called quenching.

Figure 4: A horseshoe



[Source: <http://en.wikipedia.org>]

What is the effect of beating and quenching the heated metal during the manufacture of the horseshoe?

- I. Hardening of the metal
 - II. Smaller grain size
 - III. Larger grain size
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
17. Which parts of a stress-strain curve correspond to the elastic limit?
- A. Yield point
 - B. Fracture point
 - C. Ultimate tensile strength
 - D. Plastic region

18. Which generation of robots are able to recognize speech?

- A. First
- B. Second
- C. Third
- D. Fourth

19. Which combination of volume of production and individuality of product is achieved by automation?

	Volume of production	Individuality of product
A.	Low	Low
B.	Low	High
C.	High	Low
D.	High	High

20. **Figure 5** shows a lens made of photochromic material which has been partially exposed to sunlight. Photochromic lenses contain silver halides that react to ultraviolet light to darken the lens. The silver halides can be dispersed throughout the lens or can be produced as a single layer by dipping the lens in a bath of silver halide.

Figure 5: Photochromic lens partially exposed to sunlight



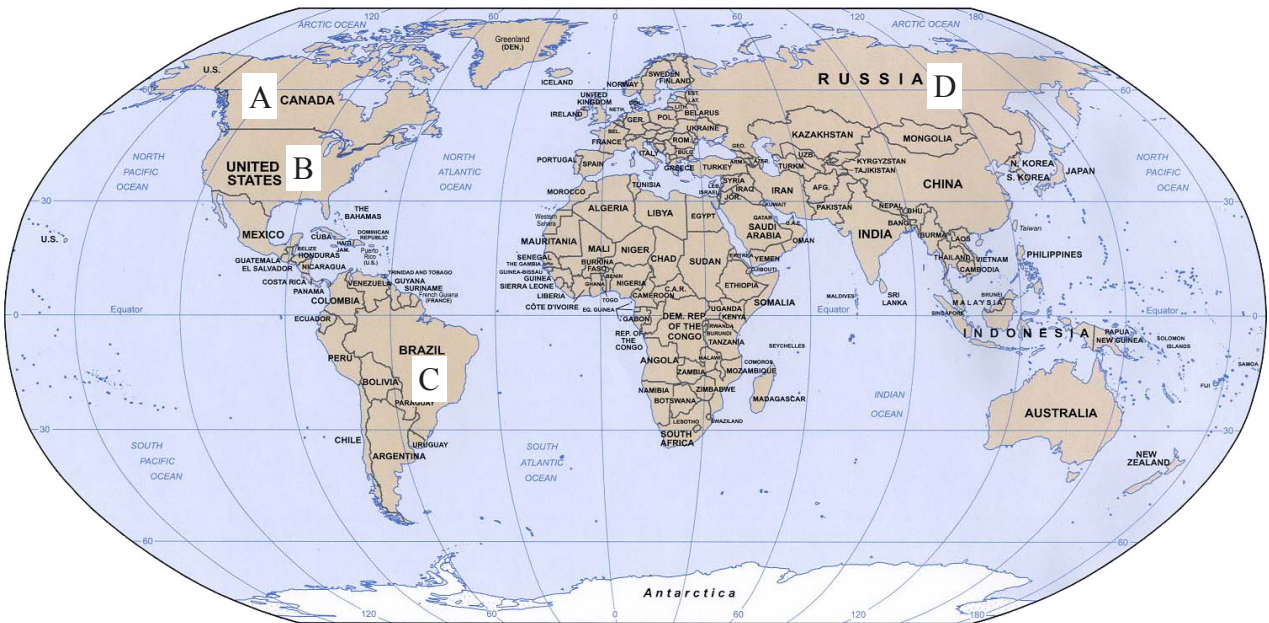
[Source: <http://upload.wikimedia.org>]

What is a disadvantage of distributing silver halides throughout lenses of variable thickness?

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21. Figure 6 shows a map of the world.

Figure 6: A map of the world



[Source: adapted from www.lib.utexas.edu]

In which region of the world does high demand for hardwood timber result in the depletion of ancient forests with major implications for global warming?

22. What is **not** true of assembly line production?
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23. Which scale of production is used for craft-produced bread?
- A. One off
 - B. Batch
 - C. Mass customization
 - D. Mass production

24. Which of Rogers' characteristics of diffusion of innovation relates to the perception that the innovation is more satisfactory than items that already exist in the same class of products?
- A. Relative advantage
 - B. Compatibility
 - C. Observability
 - D. Complexity
25. At which stage of the product life cycle would sales of a product be slow and profitability low?
- A. Launch
 - B. Growth
 - C. Maturity
 - D. Decline
26. What is **not** an example of a disruptive innovation?
- A. Digital photography
 - B. Light emitting diodes (LEDs)
 - C. Wikipedia
 - D. Solar panels

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

The publishers Phaidon have identified a collection of 999 design classics. Design classic 063 in the Phaidon collection is the paperclip (**Figure 7**) that was first patented in the United States by Samuel B Fray in 1867. Paperclips are made by bending steel (an alloy of iron and carbon) wire.

Figure 7: A paperclip



[Source: www.guardian.co.uk]

27. Which of Phaidon’s definitions of classic design best fit the paperclip?
- I. Objects that are innovative in their use of materials and unite technological advances with beautiful design.
 - II. Objects characterized by simplicity, balance and purity of form.
 - III. Objects that are perfect in their design and have remained unchanged since their creation.
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III
28. Which mechanical property is important in producing wire for the manufacture of the wire for the paperclips?
- A. Malleability
 - B. Conductivity
 - C. Density
 - D. Ductility

- 29.** What is true of patents?
- I. They are used to protect intellectual property.
 - II. They have a limited lifespan.
 - III. They are valid globally.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
- 30.** What is a defined as a mixture that contains at least one metal?
- A. Metallic ore
 - B. Alloy
 - C. Smart material
 - D. Grain
-



MARKSCHEME

SPECIMEN PAPER

DESIGN TECHNOLOGY

Standard Level

Paper 1

- | | | | | | | | |
|-----|----------|-----|----------|-----|----------|-----|----------|
| 1. | <u>B</u> | 16. | <u>A</u> | 31. | <u>-</u> | 46. | <u>-</u> |
| 2. | <u>C</u> | 17. | <u>A</u> | 32. | <u>-</u> | 47. | <u>-</u> |
| 3. | <u>C</u> | 18. | <u>C</u> | 33. | <u>-</u> | 48. | <u>-</u> |
| 4. | <u>D</u> | 19. | <u>C</u> | 34. | <u>-</u> | 49. | <u>-</u> |
| 5. | <u>C</u> | 20. | <u>C</u> | 35. | <u>-</u> | 50. | <u>-</u> |
| 6. | <u>B</u> | 21. | <u>C</u> | 36. | <u>-</u> | 51. | <u>-</u> |
| 7. | <u>C</u> | 22. | <u>A</u> | 37. | <u>-</u> | 52. | <u>-</u> |
| 8. | <u>B</u> | 23. | <u>B</u> | 38. | <u>-</u> | 53. | <u>-</u> |
| 9. | <u>D</u> | 24. | <u>A</u> | 39. | <u>-</u> | 54. | <u>-</u> |
| 10. | <u>A</u> | 25. | <u>D</u> | 40. | <u>-</u> | 55. | <u>-</u> |
| 11. | <u>B</u> | 26. | <u>D</u> | 41. | <u>-</u> | 56. | <u>-</u> |
| 12. | <u>C</u> | 27. | <u>C</u> | 42. | <u>-</u> | 57. | <u>-</u> |
| 13. | <u>A</u> | 28. | <u>D</u> | 43. | <u>-</u> | 58. | <u>-</u> |
| 14. | <u>A</u> | 29. | <u>A</u> | 44. | <u>-</u> | 59. | <u>-</u> |
| 15. | <u>D</u> | 30. | <u>B</u> | 45. | <u>-</u> | 60. | <u>-</u> |

**DESIGN TECHNOLOGY
HIGHER LEVEL AND STANDARD LEVEL
PAPER 2**

Candidate session number

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SPECIMEN PAPER

1 hour 30 minutes

Examination code

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is permitted for this paper.
- The maximum mark for this examination paper is [50 marks].



SECTION A

Answer **all** questions. Write your answers in the boxes provided.

1. Current legislation requires universities to provide access for wheelchair users to halls of residence and the rooms where students live. Design teams work to maximize the number of wheelchair accessible rooms and ensure full access to all features of the rooms for wheelchair users.

Figure 1: Plan view of a university room layout
all dimensions are in mm

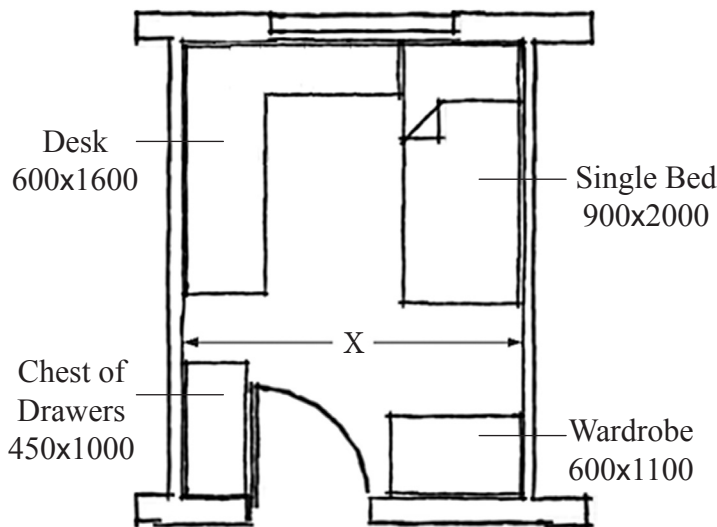


Figure 2: Existing university wardrobe

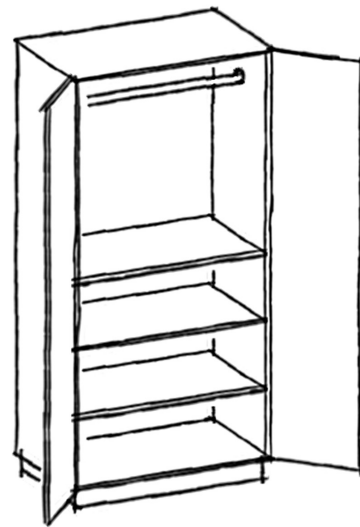
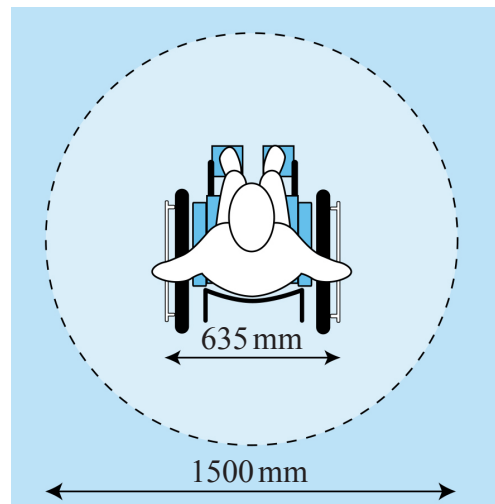


Figure 3: Basic manual wheelchair with arms and foot rests



[Source: www.etac.com]

Figure 4: Basic manual wheelchair turning circle



[Source: adapted from www.portsmouth.gov.uk]

(This question continues on the following page)



20EP02

(Question 1 continued)

- (a) (i) State **one** reason why door openings for manual wheelchair users must be more than 65 cm. [1]

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- (ii) Calculate the **minimum** dimension “X” required for the room in **Figure 1** for wheelchair access. [2]

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- (b) (i) Outline **one** feature of the wheelchair in **Figure 3** that may prevent users from pulling up to/rolling under a standard desk. [2]

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- (ii) Describe **one** physiological factor related to the design of the seat for wheelchair users. [2]

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(Question 1 continued)

- (c) (i) Outline the relevance of collecting primary data to inform the redesign of the university's rooms for wheelchair accessibility. [2]

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- (ii) Explain **one** feature designers need to modify for the wardrobe in **Figure 2** to be accessible for wheelchair users. [3]

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(This question continues on page 6)



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Answers written on this page
will not be marked.



20EP05

Turn over

(Question 1 continued from page 4)

Many wheelchairs are designed for specialist purposes. The wheelchairs shown in **Figure 5** are designed for basketball and rugby players. **Figure 6** shows the side and rear views of a Hammer sports wheelchair.

Figure 5: Basketball wheelchairs



[Source: www.wheelchairbasketball.ca]

Figure 6: Side and rear views of a Hammer sports wheelchair



Bucket seat



Tilted wheel

Extra wheel

[Source: www.1800wheelchair.ca]

(This question continues on the following page)



(Question 1 continued)

- (d) (i) Outline **one** way a larger wheel diameter assists an athlete in the sports wheelchair shown in **Figure 5**. [2]

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- (ii) Outline **one** benefit of having the front of the wheelchair seat higher up than the back of the seat on the sports wheelchair in **Figure 6**. [2]

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- (e) (i) Outline **one** benefit of the additional rear wheels shown in **Figures 5 and 6**. [2]

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- (ii) Outline **one** benefit of tilting the large wheels of sports wheelchairs. [2]

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2. **Figure 7** below shows a printer-scanner-fax machine.

Figure 7: A printer-scanner-fax machine



[Source: www.brother.fr]

(a) Describe how the printer-scanner-fax machine shown in **Figure 7** meets the criteria for converging technology. [2]

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(b) Outline **one** advantage of converging technologies for the environment. [2]

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3. Explain how the use of “design for the environment” software assists designers in choosing materials. [3]

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4. Discuss why the use of thermoplastic renders a product green but not sustainable. [3]

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SECTION B

Answer **one** question. Write your answers in the boxes provided.

- 5. The screen, shown in **Figure 8**, is a flexible screen developed for smart phones. This flexibility is achieved by replacing the layers of glass in conventional screens with a new plastic material. The screen has been developed so electronic products that use it can bend without breaking.

Figure 8: Flexible smart phone screen



[Source: www.behance.net]

- (a) Outline **one** advantage of electronic products that use this flexible screen other than flexibility. [2]

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(Question 5 continued)

(b) Explain **one** advantage of flexible screens for outdoor advertising.

[3]

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(c) Explain **two** ways smart phones can utilize a flexible screen.

[6]

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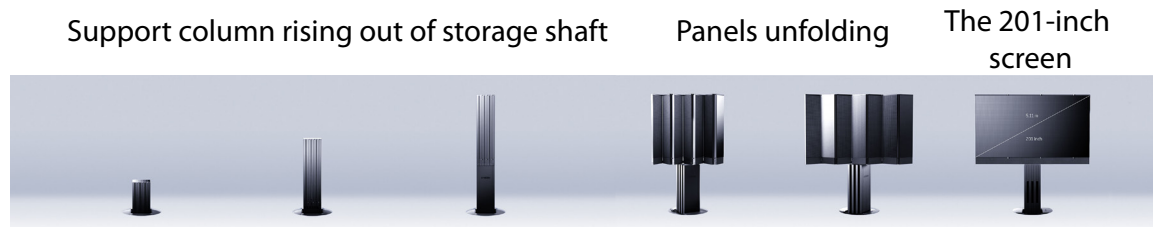
- 6. The C SEED 201, shown in **Figure 9**, is an outdoor TV (television) by Porsche Design Studio. When the TV is not being watched, it is stored underground in a waterproof shaft. The touch of a button on the TV’s remote control opens the lid of the storage shaft. A pillar-shaped support column then rises to as high as 4.6 metres. Once the stand reaches its set height, seven large screen panels unfold to form the 201-inch TV, in less than a minute, as shown in **Figure 10**.

Figure 9: The C SEED 201 outdoor TV



[Source: www.justluxe.com]

Figure 10: Stages of assembling the C SEED 201 outdoor TV



[Source: www.cseed.tv]

- (a) Outline why the C SEED 201 outdoor TV is a combination of both radical and incremental design. [2]

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20EP13

Turn over

(Question 6 continued)

- (b) Explain the innovation strategy behind the C SEED 201 name. [3]

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- (c) Explain **two** ways virtual prototypes assist the design development of this TV. [6]

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- 7. Cotton towel, paper towels, warm air hand dryers and jet-air hand dryers are used in different public places.

Figure 11: Cotton towel dryer



[Source: www.libertyhygiene.com]

Figure 12: Paper towel dispenser



[Source: http://trade.indiamart.com]

**Figure 13:
Push button
warm air hand dryer**



[Source: www.xpblocker.com]

**Figure 14:
Automatic
warm air hand dryer**



[Source: www.bradleycorp.com]

**Figure 15:
Automatic jet air hand dryer**



[Source: http://blog.coverall.com]

- (a) Outline **one** possible driver for the invention of hand dryers to replace paper towel dispensers. [2]

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(Question 7 continued)

- (b) Discuss the relationship between form and function to the design of the opening for hands in the jet air hand dryer shown in **Figure 15**. [3]

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- (c) Discuss **two** issues why the cotton towel dryer shown in **Figure 11** is not suitable for large-scale use. [6]

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will not be marked.



20EP19

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20EP20



MARKSCHEME

SPECIMEN PAPER

DESIGN TECHNOLOGY

Higher Level and Standard Level

Paper 2

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their team leader (TL) through Scoris™, by e-mail or telephone – if through Scoris™ or by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader through Scoris™ or by e-mail at any time if they have any problems/queries regarding marking. For any queries regarding the use of Scoris™, please contact emarking@ibo.org.

If you have any queries on **administration** please contact:

Sue Blackhurst
Subject Operations
IB Assessment Centre
Peterson House
Malthouse Avenue
Cardiff Gate
Cardiff CF23 8GL
GREAT BRITAIN

Tel: +(44) 29 2054 7777

Fax: +(44) 29 2054 7778

E-mail: sue.blackhurst@ibo.org

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.
3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**
4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use Scoris™ annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.
5. Personal codes/notations are unacceptable.
6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, use the “ZERO” annotation to award zero marks. Where a candidate has not attempted the part question, use the “SEEN” annotation to show you have looked at the question. Scoris™ will apply “NR” once you click complete.
7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. Scoris™ will only award the highest mark or marks in line with the rubric.
8. Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp “SEEN” on any additional pages that are blank or where the candidate has crossed out his/her work.
9. There is no need to stamp an annotation when a candidate has not chosen an option. Scoris™ will apply “NR” once you click complete.
10. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the “CON” stamp.

Subject Details: Design Technology HL and SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A (total **[30 marks]**) **ONE** question in Section B **[20 marks]**. Maximum total = **[50 marks]**.

1. A markscheme often has more marking points than the total allows. This is intentional.
2. Each marking point has a separate line and the end is shown by means of a semicolon (;).
3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.
4. Words in brackets () in the markscheme are not necessary to gain the mark.
5. Words that are underlined are essential for the mark.
6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.
7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect).
8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking indicate this by adding **ECF** (error carried forward) on the script.
10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

SECTION A

1. (a) (i) *Award [1] for stating one reason why the door openings for manual wheelchair users must be more than 65cm.*
enough room is needed for arms, hands of wheelchair users;
extra space if wheelchair user is carrying anything wider than the wheelchair; **[1 max]**
- (ii) *Award [1] for calculation and award [1] for a correct answer [2 max].*
 $600 + 1500 + 900; = 3000 \text{ mm};$ **[2 max]**
- (b) (i) *Award [1] for stating one wheelchair feature that may prevent users from pulling up to/rolling under a standard desk and [1] for a reason why [2 max].*
armrests;
fixed wheelchair armrests prevent users from pulling up to/rolling under desk;

footrest;
floor to knee height is affected by the height of footrest above the floor; **[2 max]**
- (ii) *Award [1] for stating one physiological factor related to the design of the seat for wheelchair users and [1] for a brief description [2 max].*
comfort;
seat must provide good postural support;
since wheelchair users may have to sit in the same position for long periods of time;

proper padding/cushioning;
for pressure relief/avoid sores; **[2 max]**
- (c) (i) *Award [1] for stating one relevance of collecting primary data to inform the redesign of the university's rooms for wheelchair accessibility and [1] for a brief explanation [2 max].*
feedback regarding the relationship between a wheelchair user and the room, with its equipment/furniture, may only be obtained through primary data;
feedback is different if secondary data on individual aspects of the room or the wheelchair user are looked at individually; **[2]**

- (ii) *Award [1] for stating one feature designers need to modify for the wardrobe in Figure 2 to be accessible for wheelchair users and [1] for each of two points of explanation [3 max].*
wheelchair users have a lower reach;
top rail is inaccessible for them;
designers need to add a mechanism to pull down the top rail;
- a wheelchair limits clearance in front of a closet;
making it more difficult to open closet doors/remain clear of door's swing;
designers need to install bi-fold/sliding doors instead of out swinging doors;
- wheelchairs limit how close users may get to the closet;
wheelchair users approach the closet parallel and twist sideways to reach within;
increasing the height and depth of the recess at the front of the closet (toe-kick space) allows them to roll up straight; [3 max]
- (d) (i) *Award [1] for stating one way a larger wheel diameter assists athletes on the sports wheelchair and [1] for a reason why [2 max].*
less effort is required;
since fewer rotations are needed to cover the same distance;
- easy to grab the wheel;
due to increased height/surface area; [2 max]
- (ii) *Award [1] for stating one benefit of having the front of the wheelchair seat higher up than the back of the seat on the sports wheelchair and [1] for a reason why [2 max].*
greater degree of stability;
athletes are less likely to fall out of seat during games; [2]
- (e) (i) *Award [1] for stating one benefit for the additional rear wheels and [1] for a reason why [2 max].*
anti-tip/balance/stability;
prevents wheelchair from falling backward; [2]
- (ii) *Award [1] for stating one benefit of tilting the large wheels of sports wheelchairs and [1] for a reason why [2 max].*
wider base;
provides extra side to side stability/makes it less likely for wheelchair to tip over sideways;
- hands and fingers are protected;
from contact with other wheelchairs during group sports;
- quicker turning;
as athletes have better access to a wheel's hand rim; [2 max]

2. (a) *Award [1] for each of two points in a description of how the printer-scanner-fax machine meets the criteria for converging technology [2 max].*
one machine;
combines three functions; *[2]*
- (b) *Award [1] for stating one advantage of converging technologies for the environment and [1] for a brief explanation [2 max].*
fewer products/ less need to purchase three separate products;
less materials, energy and resources are used up/more resources are conserved;
less waste/pollution manufacture; *[2 max]*
3. *Award [1] for stating how the use of “design for the environment” software assists designers in choosing materials and [1] for each of two distinct correct points in an explanation [3 max].*
designers use “design for the environment” software to identify the effects of their material choices on the environment;
and compare it with similar/alternative materials;
in order to impact as little as possible on the environment; *[3]*
4. *Award [1] for stating why the use of thermoplastic renders a product green but not sustainable and [1] for each of two distinct correct points in an explanation [3 max].*
plastic may be recycled/reused thus it is green;
creating plastic raw material causes environmental problems so it is not sustainable;
plastic is not a renewable resource thus it is not sustainable; *[3]*

SECTION B

5. (a) *Award [1] for stating one advantage of electronic products that use a flexible screen and [1] for a brief explanation [2 max].*
lower density;
without the glass screens are more lightweight;
- plastic layers are thinner than glass;
electronic products become slimmer; *[2 max]*
- (b) *Award [1] for stating one advantage of flexible screens for outdoor advertising and [1] for each of two distinct correct points in an explanation [3 max].*
advertising space no longer needs to be flat;
screens can go round uneven surfaces *eg* poles, columns;
increasing opportunities/advertising space; *[3]*
- (c) *Award [1] for each of three distinct correct points in a discussion of two ways in which smart phones can utilize a flexible screen. [3 max per way, 6 max].*
curved displays;
screens can curve on the sides/back of a rectangular smart phone;
or take a totally different shape by wrapping around arms and wrists *eg* wrist phones;
- compact sizes;
screens can be bent/rolled;
to reduce the size of smart phones when not in use; *[6]*
- (d) *Award [1] for each of three distinct correct points in an explanation of how relative advantage, trialability and observability impact on the rate of consumer adoption of flexible screen based smart phones [3 max per aspect, 9 max].*
relative advantage:
adoption rates are affected by the degree to which consumers perceive the attributes of flexible screen based smart phone as better than the phones they supersede;
the main attribute of such phones is flexibility;
the more consumers who view this as a positive attribute the higher the rate of adoption;
- trialability:
A flexible screen based smart phone that is trialable prior to purchase represents less uncertainty/risk to consumers;
gives them more confidence to adopt the new phone;
limited base trials of such smart phones may be provided via marketing/promotion campaigns;
- observability:
The more the advantages/positive effects of flexible screen based smart phones are visible to consumers the more quickly they will spread;
smart phones are highly visible products;
and may be observed in a number of different situations *eg* when socializing, through advertising and innovative marketing campaigns; *[9]*

6. (a) *Award [1] for each point in an outline of why the C SEED 201 TV is a combination of both radical and incremental design [2 max].*
the way it is stored and opened is a radical approach;
but it is an incremental development of existing TV screens; [2]
- (b) *Award [1] for stating the innovation strategy behind the C SEED 201 name and [1] for each of two distinct correct points in an explanation [3 max].*
analogy;
eyes see images on TV thus the letter “C”;
the TV rises from its shaft and unfolds like a seed grows into a tree/plant; [3]
- (c) *Award [1] for stating each of two ways virtual prototypes assist the design development of this TV and [1] for each distinct point in an explanation of each way [3 max per way, 6 max].*
virtual prototypes may be used for FEA testing;
FEA shows how the support column, panels and screen behave under different stresses;
to modify critical high stress areas eg when the column is rising, panels are unfolding and when the screen is fully open;

virtual prototypes provide a realistic simulation;
to communicate how the TV rises and unfolds clearly;
and allow for different types of feedback/evaluation; [6]
- (d) *Award [1] for each of three distinct points in an explanation of how safety, convenience and technology specification may have influenced the design of this TV [max 3 per aspect, 9 max].*
safety:
pillar should not rise if there is something on top of the storage shaft;
screen should automatically fold in adverse weather conditions eg strong winds and high temperature;
remote control should be equipped with a safety lock for activating the storage shaft;
column and screen structure must be stable;

technology:
high screen resolution to ensure perfect pictures even on bright days;
distortion free sound in different weather conditions;
fold/unfold screen mechanism;
raising and lowering the column;
waterproof storage shaft;

convenience:
TV is stored out of sight until needed;
short time to raise, unfold/fold and lower the TV;
screen should rotate sideways;
column height should adjust to raise and lower the screen as needed; [9 max]

7. (a) *Award [1] for stating one possible driver for the invention of hand dryers to replace paper towel dispensers and [1] for a brief explanation.*
sustainability;
desire to save resources/save trees/reduce waste;
- constructive discontent;
dissatisfaction with using paper to dry hands; **[2 max]**
- (b) *Award [1] for each of three distinct points in a discussion of the relationship between form and function to the design of the opening for hands in the jet air hand dryer [3 max].*
the opening is tilted outward and rounded for easy entry of hands;
the length of opening allows both hands to fit in side by side;
the width of opening is enough for a wide variety of hand thicknesses;
the channel in which hands are placed in is deep enough to take the 95th percentile of hand length; **[3 max]**
- (c) *Award [1] for stating each of two issues why the cotton towel hand dryer is not suitable for large-scale use and [1] for each of two distinct points of discussion per issue [3 max per issue, 6 max].*
size of towel roll;
limits the available amount of clean towels;
allowing less users to dry their hands because of hygiene issues;
- laundry;
cotton towels must be periodically changed and washed;
leading to higher consumption of valuable resources *eg* water and energy; **[6]**
- (d) *Award [1] for each of three distinct points in a comparison of paper towels and warm air hand dryers in relation to convenience, sustainability and hygiene [3 max per aspect, 9 max].*
convenience:
paper towels may be used to dry hands outside restrooms;
paper towels are not noisy;
paper towels are more convenient when drying other body parts *eg* face;
hands may not be dry enough within the automatic time limit of warm air hand dryers;
- sustainability :
warm air hand dryers save trees;
paper towels create waste unless recycled;
paper towels require packaging, waste/trash bins and bin liners;
paper towels can be made from recycled materials;
warm air hand dryers consume energy;
- hygiene:
some warm air hand dryers require users to push a button which may expose them to germs;
air blowing on hands may blow away bacteria on others in the restroom;
used paper towels pile up in waste/trash bins inside restrooms; **[9 max]**
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**DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 3**

Candidate session number

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SPECIMEN PAPER

1 hour 30 minutes

Examination code

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions.
- Write your answers in the boxes provided.
- A calculator is permitted for this paper.
- The maximum mark for this examination paper is [40 marks].

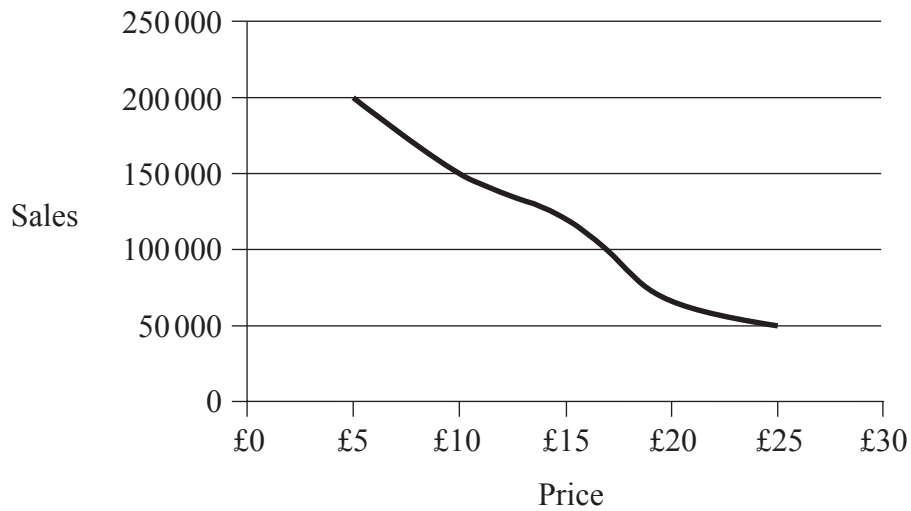


08EP01

SECTION A

1. A company which manufactures a range of computer accessories is considering future strategies in product development and the management of the production process. The company has used the graph in **Figure 1** to try and decide on its pricing policy for products and Kaizen has been discussed as a possible strategy to improve production.

Figure 1: Graph of predicted sales compared to price



- (a) Outline the type of pricing strategy depicted in **Figure 1**. [2]

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- (b) Outline how the pricing strategy shown in **Figure 1** is influenced by production costs. [2]

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(This question continues on the following page)



(Question 1 continued)

(c) Outline cost-plus pricing.

[2]

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(d) Explain how the concept of Kaizen helps to improve the efficiency of the production process.

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08EP03

Turn over

2. **Figure 2** shows the Panasonic NN-CT870WBPQ microwave/convection oven designed for the domestic sector. It can be used either as a microwave oven or a conventional oven/grill. **Figure 3** shows the Panasonic NE1856 microwave oven designed for commercial use in fast food outlets, cafes *etc.* **Table 1** shows some of the specifications for each oven. [1]

Figure 2:
NN-CT870WBPQ domestic microwave oven



Figure 3:
NE1856 commercial microwave oven



[Source: www.panasonic.co.uk]

Table 1: Specifications for each oven

Domestic microwave oven	Commercial microwave oven
1000 w power output for microwave	1800 w power output
Convection cooking range 100–250 °C	Programmable touch pads with 3 power levels
1500 w radiant grill	Stainless steel body
Auto sensor programs to calculate cooking times	Easy to clean interior with removable ceiling plate
Child lock feature	Two ovens can be stacked on top of each other safely
White painted (enamelled) body	Clear digital display

[Source: www.panasonic.co.uk]

(This question continues on the following page)



(Question 2 continued)

- (a) Describe the function of a usability laboratory in assisting with the design development of the microwave oven in **Figure 2**. [2]

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- (b) Outline how empathic design may help with the design of the microwave oven in **Figure 3**. [2]

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- (c) Explain how the requirements of the market sectors for each of the microwave ovens shown in **Figures 2 and 3** impact on the design of each oven. [6]

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SECTION B: Case Study

Royal Philips Electronics is a major global manufacturer of lighting, electronics, electrical and medical equipment. Philips has included sustainability as an integral part of its corporate strategy since 2002. In its Sustainability Report (2005) the company states that sustainable development is a priority for the board of management based on the “triple bottom line” of economic, social and environmental responsibilities. The Sustainability Report states that socially and environmentally responsible behaviour contributes to sustained profitable growth which is why sustainable thinking and acting is embedded in all the daily activities of the company.

Philips is also committed to supporting social and community activities across the globe. For example, in 2012 Philips and the Dutch Football Association (KNVB) established a three year partnership built around the creation of 90 solar community light centers across the African and South American continents. The light centers are approximately 1000m² and lit by highly-efficient solar-powered LED lighting. They provide an area of light for rural communities without electricity so creating opportunities for social, sporting and economic activities in the evening (Figure 4).

Figure 4: Philips Community Light Center



[Source: www.philips.com]

Philips adopted a systematic strategy to take into account environmental issues in 1994 starting with a green design approach which has developed into sustainable design and sustainable innovation policies. The policies encompass setting targets for its different product divisions although it is not expected that each division will meet targets at the same rate. This is in recognition that the targets are more difficult to achieve for some divisions than others and may be dependent on the products and services provided. The design teams in each division are expected to take into account the green focus areas of: weight; hazardous substances; energy consumption; recycling; disposal and packaging, with improvement to be made in at least two of these green focus areas.



As part of its sustainability vision, Philips sees the markets of the developing world as both an economic opportunity and a way to meet its social and environmental responsibilities. To do this Philips asked its employees to come up with innovative business ideas that address the needs of the poor which involve partnerships between local Philips businesses and other organizations based on innovation in products and services. An example is the SimplyHealthy@Schools project which is a global community programme established by Philips to help underprivileged school children live healthier lives. Employees of the company engage children in the “Healthy Heroes Toolkit” which shows them how they can improve their health. In 2012 Philips employees travelled to over 100 schools in 37 countries to support this project.

- 3. (a) Outline the influence of timescale on Philips’ strategy to move from a green design approach to a sustainable design approach. [3]

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- (b) Outline why Philips’s corporate strategy for triple bottom line sustainability is a top-down approach. [3]

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MARKSCHEME

SPECIMEN PAPER

DESIGN TECHNOLOGY

Higher Level

Paper 3

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their team leader (TL) through Scoris™, by e-mail or telephone – if through Scoris™ or by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader through Scoris™ or by e-mail at any time if they have any problems/queries regarding marking. For any queries regarding the use of Scoris™, please contact emarking@ibo.org.

If you have any queries on **administration** please contact:

Sue Blackhurst
Subject Operations
IB Assessment Centre
Peterson House
Malthouse Avenue
Cardiff Gate
Cardiff CF23 8GL
GREAT BRITAIN

Tel: +(44) 29 2054 7777

Fax: +(44) 29 2054 7778

E-mail: sue.blackhurst@ibo.org

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.
3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**
4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use Scoris™ annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.
5. Personal codes/notations are unacceptable.
6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, use the “ZERO” annotation to award zero marks. Where a candidate has not attempted the part question, use the “SEEN” annotation to show you have looked at the question. Scoris™ will apply “NR” once you click complete.
7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. Scoris™ will only award the highest mark or marks in line with the rubric.
8. Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp “SEEN” on any additional pages that are blank or where the candidate has crossed out his/her work.
9. There is no need to stamp an annotation when a candidate has not chosen an option. Scoris™ will apply “NR” once you click complete.
10. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the “CON” stamp.

Subject Details: Design Technology HL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions. Maximum total = **[40 marks]**

1. A markscheme often has more marking points than the total allows. This is intentional.
2. Each marking point has a separate line and the end is shown by means of a semicolon (;).
3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.
4. Words in brackets () in the markscheme are not necessary to gain the mark.
5. Words that are underlined are essential for the mark.
6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.
7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect).
8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking indicate this by adding **ECF** (error carried forward) on the script.
10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

SECTION A

1. (a) *Award [1] for stating the pricing strategy depicted in Figure 1 and [1] for a brief explanation [2 max].*
demand pricing;
volume of sales based on the correlation between price and demand; [2]
- (b) *Award [1] for each correct distinct point in an outline of how the pricing strategy shown in Figure 1 is influenced by production costs [2 max].*
account needs to be taken of the variation in costs of production at different levels of sales;
break-even point for each level of sales needs to be calculated in order to choose the price which will provide the greatest profit; [2]
- (c) *Award [1] for each correct distinct point in an outline of cost-plus pricing [2 max].*
estimating the average cost of producing and marketing a product;
then adding a mark-up to make a profit; [2]
- (d) *Award [1] for each distinct point in an explanation of how Kaizen helps to improve the efficiency of the production process [4 max].*
Kaizen focuses on continuous improvement of the production process;
it involves all employees and the supply chain;
by improving efficiency it aims to reduce waste;
so is complementary to a philosophy of lean production; [4]

2. (a) *Award [1] for each distinct point in a description of the function of a usability laboratory in assisting with the design development of the microwave oven in Figure 2 [2 max].*
to observe/test users carrying out pre-determined tasks with the oven;
to provide data/research into how users interact with the oven which can underpin design ideas; [2]
- (b) *Award [1] for each correct distinct point in an outline of how empathic design may help with the design of the microwave oven in Figure 3 [2 max].*
the designers can be in contact/empathize with potential users of the oven;
in order to gain a better understanding of the users' thoughts/needs/values/beliefs; [2]
- (c) *Award [1] for each distinct point in a discussion of how the requirements of the market sectors for each of the microwave ovens shown in Figures 2 and 3 impact on the design of each oven [3 max per market sector, 6 max].*
commercial oven:
durability important as it will be used many times a day/stainless steel body for durability;
it must be easy to clean as it is likely to be used by different users in one location who may be busy/rushed causing many food spills;
the oven has a large grab handle which will be easy to grip even with wet hands;
the controls are large and simple to interpret/use;
aesthetics are less important than function;
- domestic oven:
aesthetics important so it looks good in the kitchen;
white colour so it fits in with other white goods in the kitchen;
small push-button controls which are delicate to use/small number of users will learn the functions;
integrated push button door control which lies flush with the surface/integrated design;
child lock feature for safety for families with small children;
multi-function use so suitable for small kitchens/people who do not cook often/
do not cook large meals; [6 max]

SECTION B

3. (a) *Award [1] for each of three correct distinct points in an outline of the influence of timescale on Philips' strategy to move from a green design approach to a sustainable design approach [3 max].*
sustainable design takes longer to implement than green design;
as it focuses on all aspects of the design cycle;
rather than just one green focus area; [3]
- (b) *Award [1] for each of three correct distinct points in an outline of why Philips's corporate strategy for triple bottom line sustainability is a top-down approach [3 max].*
the corporate strategy was decided by executives/Board of Management as the way forward for the company;
targets have been imposed on each division of the company in line with this strategy;
although employees are given the opportunity to contribute to the strategy with ideas they do not have a choice to ignore it; [3]
- (c) *Award [1] for each of five correct distinct points in an explanation of how Philips promotes ethical consumerism [5 max].*
Philips has a responsibility to shareholders to make a profit but strategies for innovation also focus on improving the lives of poor people in developing countries;
who do not have the income/resources to be consumers of Philips products;
Philips sustainability strategy is embedded in the design brief for all products;
so it promotes ethical consumerism across the total customer base;
even if customers do not care about sustainability issues; [5]

- (d) *Award [1] per distinct point in a discussion of three issues which Philips is likely to have considered when incorporating sustainable design and sustainable innovation into their corporate strategy [3 max per issue, 9 max].*

resistance from employees;

who do not fully understand the concepts/are reluctant to embrace the concepts;

and resent the targets set for sustainability;

complexity of products;

Philips designs and manufactures a wide range/diverse range of products;

some of which are more suitable for redesign taking into account sustainability factors than others;

consumer reaction;

many consumers will not be aware/are not interested in sustainability issues;

they just want value for money in a competitive market;

Philips has to incorporate its sustainability strategy without pricing itself out of its traditional markets;

reaction of shareholders;

Philips is a global company with a diverse shareholder base;

shareholders may not share the vision of the board of management;

especially if profits suffer because of it;

changing political/economic climates;

governments/organizations can change policy/legislation relating to sustainability;

and it may be difficult for Philips to adapt its strategy to satisfy new targets/legislation;

pioneering strategy to sustainability by Phillips;

but other companies may imitate their sustainable products without having to spend much money on R&D;

meaning that they can sell similar products more cheaply;

difficulty of choosing which community projects to support;

there are so many worthy projects worldwide that Philips can only support a small percentage of them;

there is a possibility of alienating some market sectors by failing to support projects within the sector which have been presented to the company;

[9 max]
