OCR
Oxford Cambridge and RSA

Monday 13 May 2019 – Afternoon

AS Level in Design and Technology: Product Design

H006/01 Principles of Product Design

Time allowed: 1 hour 45 minutes

You may use:
- a scientific calculator
- a ruler
- pencils/pens
- geometrical instruments

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number ☐☐☐☐☐   Candidate number ☐☐☐☐

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in the questions marked with an asterisk (*).
- This document consists of **20** pages.

OCR is an exempt Charity

Turn over

2

Answer **all** the questions.

1 **Fig. 1** shows two views of a disposable razor. A razor is a handheld instrument with a set of sharp blades used to remove unwanted hair from the face or body.

Fig. 1
(not to scale)

(a) Analyse the disposable razor in **Fig. 1** to identify **three** design features that meet the needs of the intended user.

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[3]

3

(b) (i) Name a suitable thermoplastic material for the handle part A.

.... **[1]**

(ii) State **two** properties of the material you have identified in **part (b)(i)** that make it suitable for the handle part A. Justify **each** of your responses.

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[4]

(c) (i) Name a suitable manufacturing method for the handle part A.

.... **[1]**

(ii) State **two** reasons why the manufacturing method you have identified in **part (c)(i)** is suitable for forming the handle part A. Justify **each** of your responses.

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[4]

4

(d)* Discuss the impact that disposable products have on the environment.

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.... **[8]**

2 **Fig. 2.1** shows a book light.

Fig. 2.2 shows a diagram of the book light clipped into place on a book and the location of the light source in relation to the book.

Fig. 2.3 shows a diagram used to calculate the minimum beam angle.
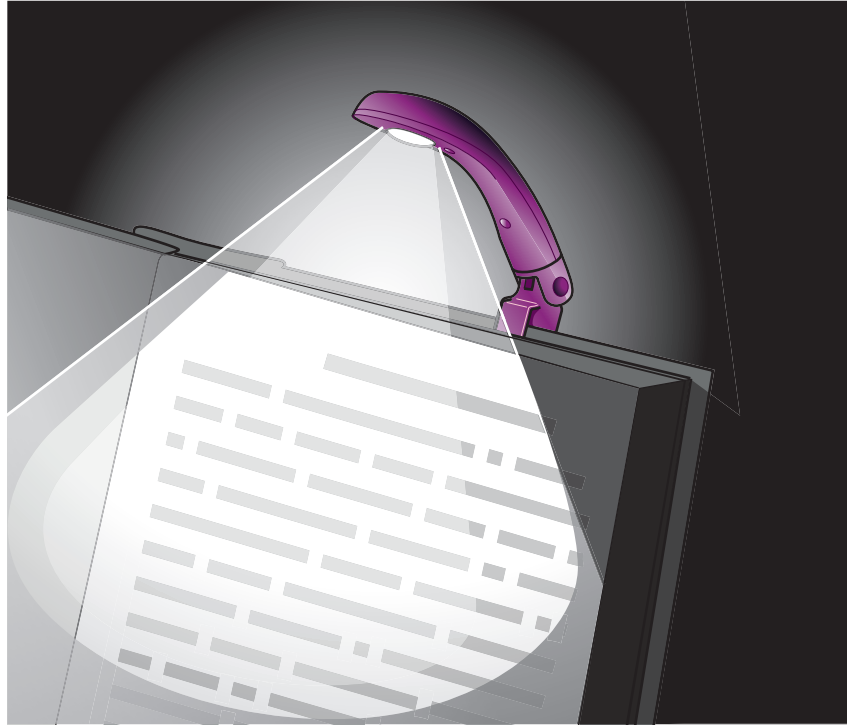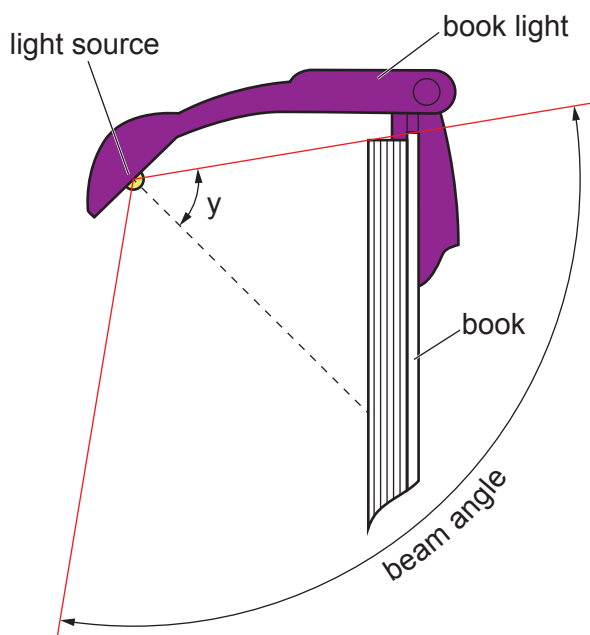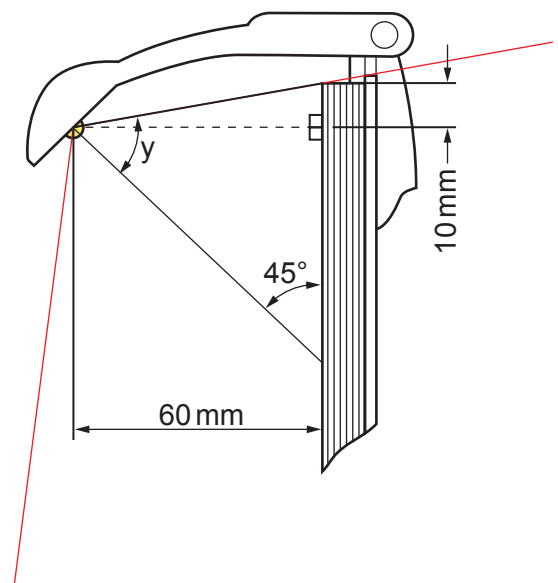

Fig. 2.1

Fig. 2.2

Fig. 2.3
(not to scale)

Turn over

6

The light source has a beam angle as shown in **Fig. 2.2**. The larger the beam angle the larger the area that is lit. The designer of the book light needs to calculate the minimum beam angle so that it lights the whole page. This is done by calculating angle y shown in **Fig. 2.3**.

(a) Using the information given in **Fig. 2.3**, calculate angle y to 1 decimal place. Show your working.

y ....°

[4]

(b) A shop buys 75 book lights at £3.00 per book light. The shop sells 92% of these book lights for £5.93 each and the remaining book lights are not sold.

Calculate the percentage profit that the shop makes on these book lights to 1 decimal place. Show your working.

Percentage profit ....%

[4]

(c) The book light is to be packaged in a cuboid-shaped cardboard box shown in **Fig. 2.4** with one rectangular window cut out.
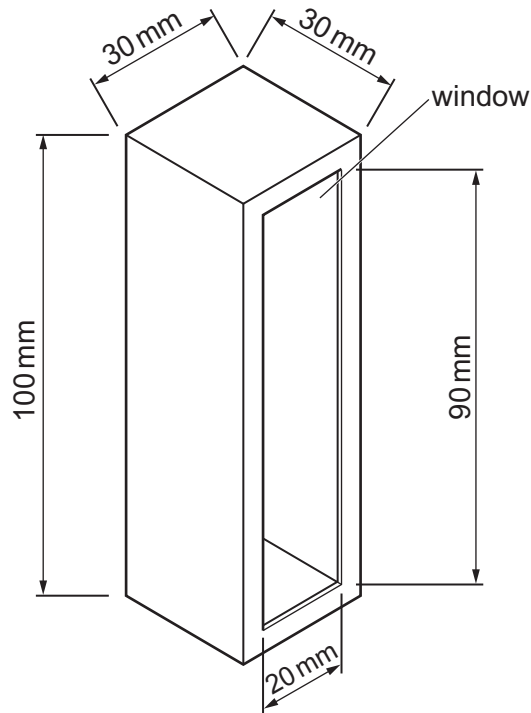
Fig. 2.4
(not to scale)

The manufacturer will print graphics on the external surface of the box.

(i) Calculate the external surface area in mm^2 of the cuboid-shaped cardboard box with one rectangular window cut out. Show your working.

External surface area ....mm^2

[2]

Turn over

8

(ii) Give **two** reasons why graphics are applied to the box. Justify **each** of your responses.

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[4]

3 **Fig. 3** shows the design of a shampoo bottle.
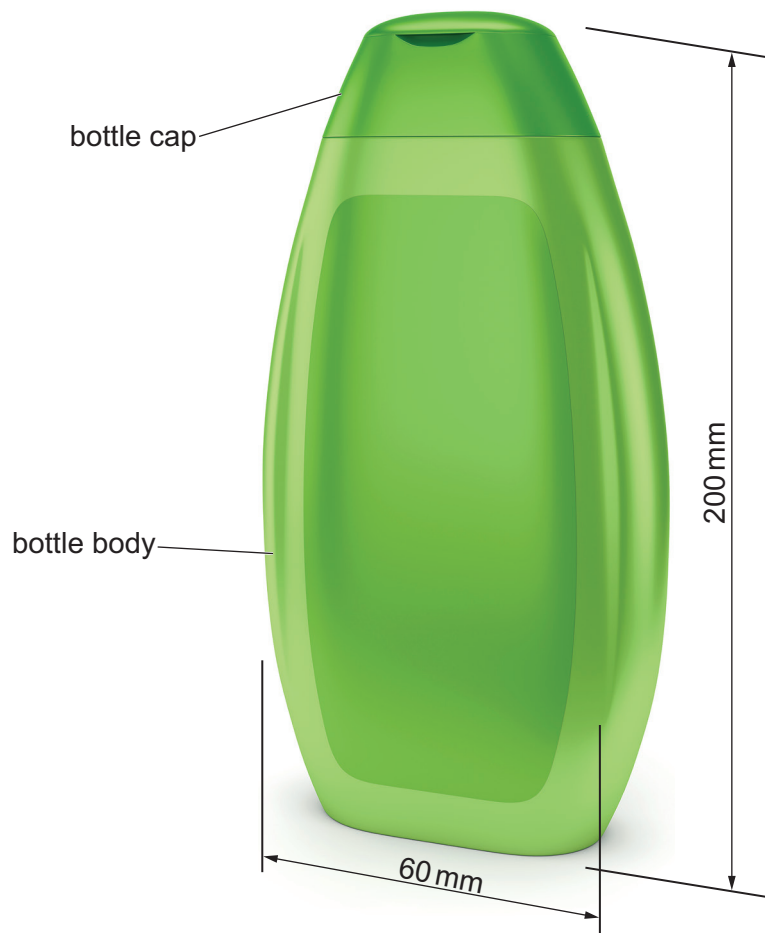
Fig. 3
(not to scale)

(a) A block model of the shampoo bottle is to be made in a school/college workshop.

   (i) Name a suitable material to create the block model.

     .... **[1]**

   (ii) State **two** reasons why the material you identified in **part (a)(i)** is suitable for the block model.

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     2 ....

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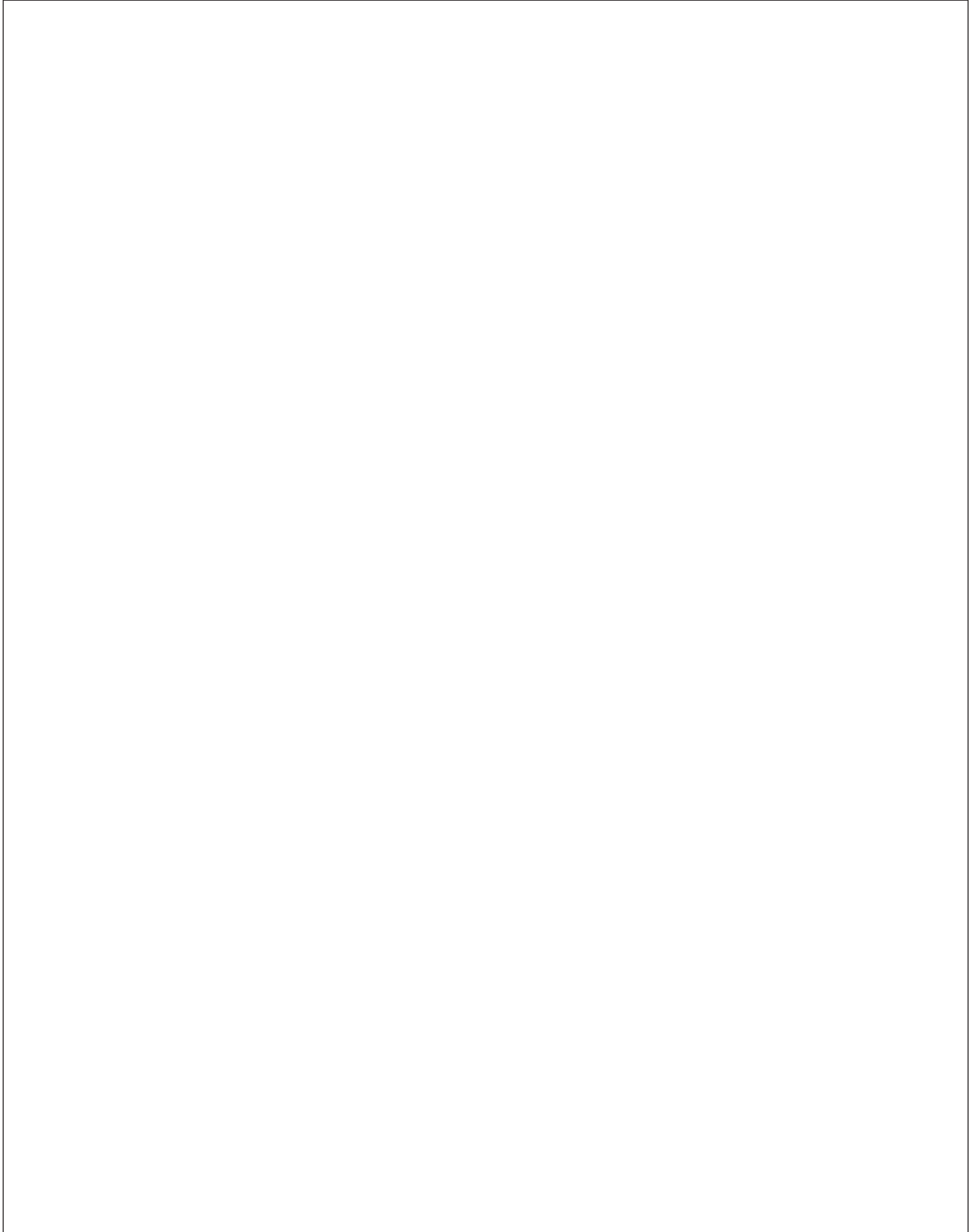
(b) Use annotated sketches and/or notes to show how you would make an actual size block model of the shampoo bottle shown in **Fig. 3** in the school/college workshop.

In your response you should include details of the processes that would be used. Identify any relevant equipment, tools and machinery.

[5]

(c) Use annotated sketches and/or notes to show how the hollow bottle body shown in **Fig. 3** would be manufactured as a batch of 100 000 from a **thermoplastic** material.

Identify any relevant materials, equipment and machinery.

[8]

12

(d) A 200 ml bottle of shampoo contains:

- 140 ml water
- 30 ml detergent
- 22 ml preservatives
- 8 ml other ingredients.

Calculate how much detergent is needed in a 500 ml bottle. Give your answer in ml.

Detergent ....ml

[1]

4   **Fig. 4** shows a cordless kettle and base that has been designed with user friendly features.

translucent colour
changing panel

stainless steel
body

base
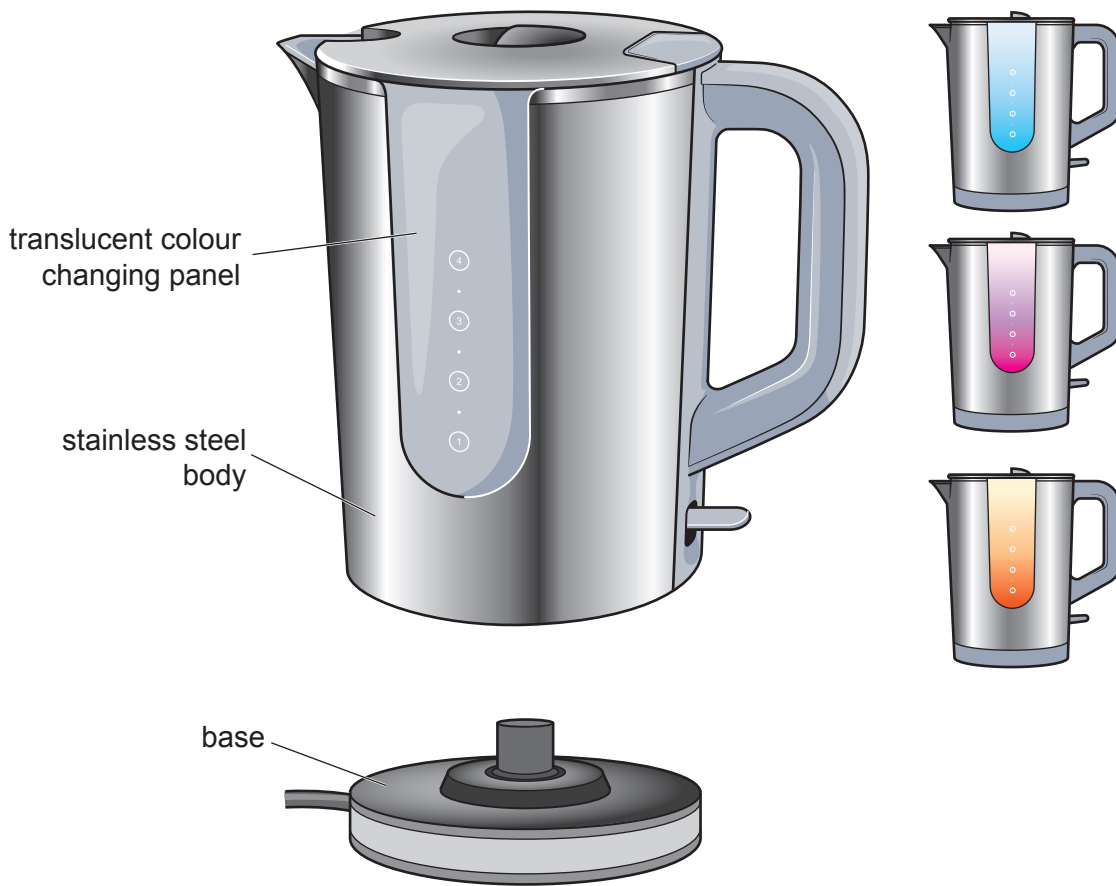
Fig. 4

(a) A smart material has been used in the manufacture of the translucent colour changing panel
of the kettle.

   (i)   Name a suitable smart material that could be used.

   .... **[1]**

   (ii)   State **one** way in which the smart material you have identified in **part (a)(i)** enhances the
         usability of the kettle.

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   .... **[1]**

(b) The kettle is placed on its base which connects it to the electrical supply. Give **two** advantages of having a separate base.

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[2]

(c) The base and the colour changing panel are two features that enhance usability. Identify **two other** features of the kettle that enhance usability. Justify **each** of your responses.

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[4]

(d) The kettle can hold a maximum of 1.75 litres of water.

The body of the kettle is a cylinder with a diameter 15 cm.

Calculate the maximum height, in cm, of the water in the kettle. Show your working.

Maximum height of the water ....cm

[3]

15

(e) Discuss the importance of using different strategies such as iterative designing and modelling to realise the successful final design of the kettle.

Refer to specific features of the kettle in your response.

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.... **[6]**

(f) State **one** modification that could be made to the kettle to make it more suitable for the elderly. Justify your response.

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.... **[3]**

(g) Discuss the potential environmental impact of the use of smart technologies in products.

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.... **[6]**

5   Environmental incentives and directives have impacted consumer behaviour and influenced the design and manufacture of products.

(a) Describe **two** ways in which **users** have been impacted by environmental incentives and directives.

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[4]

(b)* Discuss how environmental incentives and directives have influenced the **design** and **manufacture** of products.

Use examples of products you are familiar with to support your response.

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.... **[8]**

END OF QUESTION PAPER

19

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).