AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

A-level

DESIGN AND TECHNOLOGY: PRODUCT DESIGN

Paper 1 Technical Principles

Wednesday 5 June 2024 Afternoon Time allowed: 2 hours 30 minutes

Materials

For this paper you must have:
- normal writing and drawing instruments
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 120.

For Examiner's Use	
Question	Mark
1–2	
3–4	
5	
6	
7–8	
9	
10–11	
12	
13–14	
15–16	
17–18	
19	
20–21	
TOTAL	

Do not write outside the box

Answer **all** questions in the spaces provided.

0 1 Give **three** reasons why cellulose acetate is used in packaging.

[3 marks]

Reason 1 _____

Reason 2 _____

Reason 3 _____

0 2 Analyse and evaluate the suitability of using acrylonitrile butadiene styrene (ABS) for the manufacture of a construction worker's helmet shown in **Figure 1**.

[6 marks]

Figure 1

_____

_____

_____

_____

_____

_____

_____

_____

Do not write outside the box

9

Turn over for the next question

Do not write outside the box

0 3 Identify the polymer stock form used for the following manufacturing processes.

[3 marks]

Injection Moulding _____

Vacuum Forming _____

Rotational Moulding _____

0 4 Explain why thermochromatic pigment has been used in the child's forehead thermometer shown in **Figure 2**.

[6 marks]

Figure 2

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

9

Do not write outside the box

0 5 . 1 A sheet of plywood today costs £85. It has increased in price by 38% over the past year.

Calculate the original price of the plywood sheet.

Show your working.

[3 marks]

Answer £ _____

0 5 . 2 I have a budget of £850 which allows me to buy 10 sheets of plywood.

Calculate how many sheets I would have been able to buy last year with £850.

Show your working.

[2 marks]

Answer _____ sheets

5

Do not write outside the box

0 6 Describe the process used to create the laser-cut plywood coaster shown in **Figure 3**.

[6 marks]

Figure 3

6

Do not write outside the box

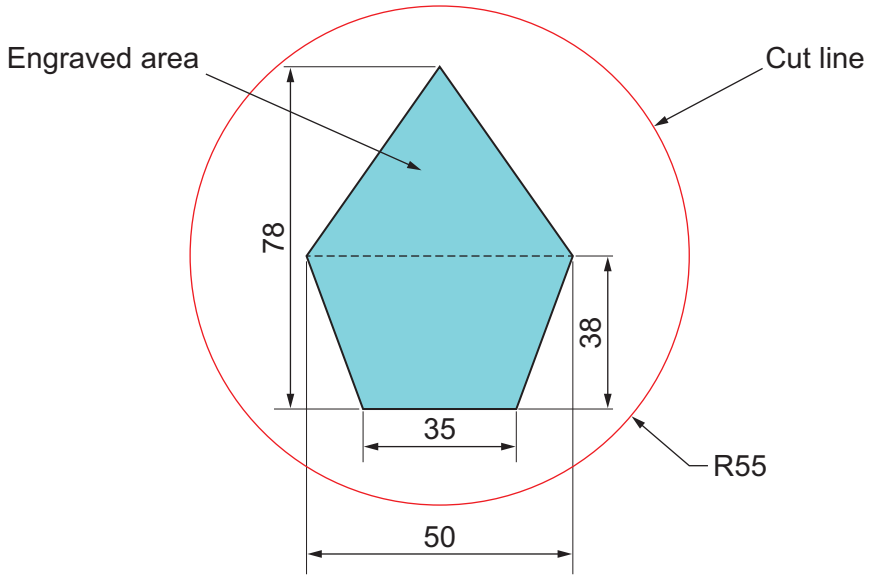
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 7 **Figure 4** shows a representation of a laser-engraved coaster.

Figure 4



Not drawn to scale
All dimensions in mm

Laser cutter settings	
Cutting speed	8 mm per second
Engraving speed	59 mm^2 per second

0 7 . 1 Calculate the total area of the shaded part of the coaster.

Show your working.

[3 marks]

Answer _____ mm^2

Do not write outside the box

0 7 . 2 Calculate the total time taken to engrave the shaded part of the coaster and to cut the circumference.

Show your working.

[4 marks]

Answer _____ seconds

0 8 Describe why pewter is often used for casting in a school workshop.

[6 marks]

13

Do not write outside the box

0 9 Explain why Plastazote foam is an appropriate material for the manufacture of the exercise mat shown in **Figure 5**.

[6 marks]

Figure 5

6

Do not write outside the box

1 0 Compare the following joining methods for attaching two thin sheets of aluminium:

- pop rivets
- nuts and bolts.

[6 marks]

Turn over for the next question

Do not write outside the box

1 1 Explain the benefits of a manufacturing simulation when making a component on a Computer Numerically Controlled (CNC) router.

[6 marks]

12

Do not write outside the box

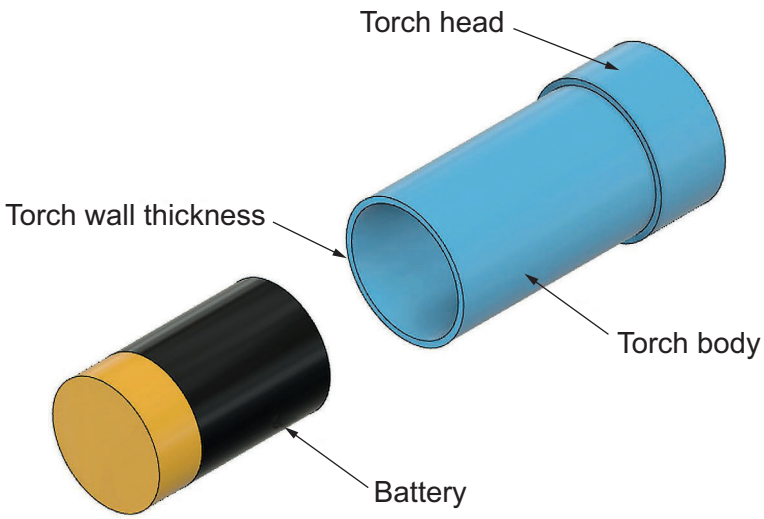
1 2 **Figure 6** shows a torch body and battery.

The volume of the battery is 30 772 mm^3

The length of the battery is 50 mm

The wall thickness of the torch body is 3 mm

Figure 6



Not drawn to scale

Calculate the external diameter of the torch body, assuming that the battery fits exactly.

[4 marks]

Answer _____ mm

4

1 3 **Figure 7** and **Figure 8** show dishwashing accessories.

Figure 7

Figure 8

	Figure 7	Figure 8
Method of manufacture	Injection moulded	Blow moulded
Handle texture	Over moulded with a Thermoplastic Elastomer (TPE)	Integrated during the moulding process

Do not write outside the box

Analyse and evaluate the method of manufacture used to create each of the textured surfaces on the two handles.

[6 marks]

Turn over for the next question

Do not write outside the box

1 4 Describe the techniques a company may use throughout design and manufacture to reduce material waste.

[6 marks]

12

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

1 5 **Figure 9** shows a pie chart that gives information about consumer activities relating to sustainability.

The number of people who said that they **reuse** a product is 350.

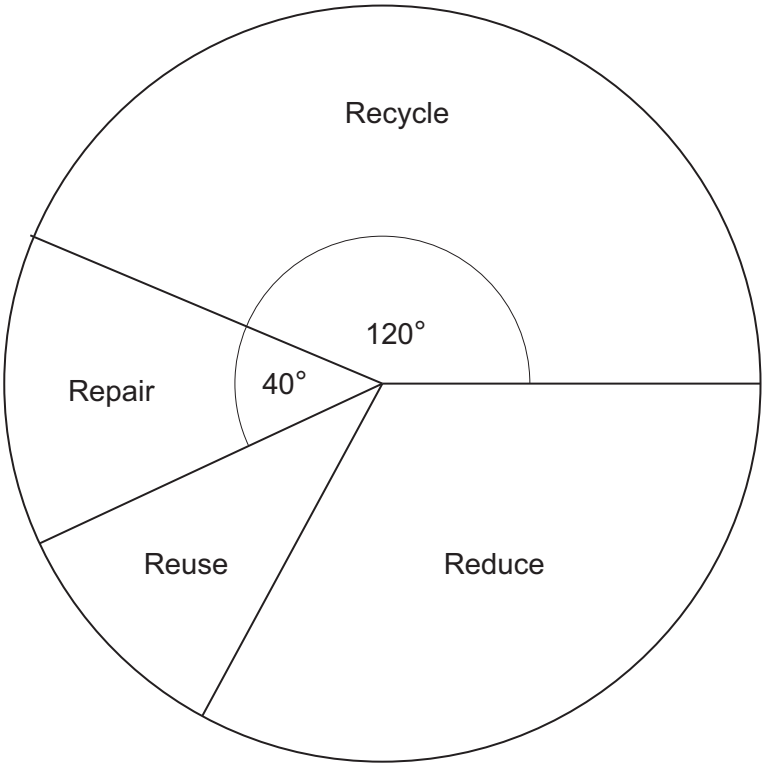
Three times as many people said that they have **reduced** their consumption compared with the number of people that **reuse** a product.

Calculate the number of consumers that **recycle** on a regular basis.

Show your working.

[4 marks]

Figure 9



Not drawn to scale

Do not write outside the box

Answer _____ consumers

1 6 State **four** measures that an employer may consider to ensure that they are meeting the Health and Safety at Work Act 1974.

[4 marks]

1 _____

2 _____

3 _____

4 _____

8

Turn over for the next question

Do not write outside the box

1 7 **Figure 10** and **Figure 11** show cookbook stands.

Figure 10

Figure 11

	Figure 10	**Figure 11**
Material	Cast Iron	Medium Density Fibreboard (MDF) and Beech
Method of manufacture	Sand Casting	CNC router and hand fabrication

Analyse and evaluate the two cookbook stands.

In your answer you should refer to:

- the materials used
- the manufacturing methods used.

[12 marks]

Do not write outside the box

Turn over for the next question

Do not write outside the box

1 8 Discuss the implications to a company of rebranding.

[9 marks]

21

Do not write outside the box

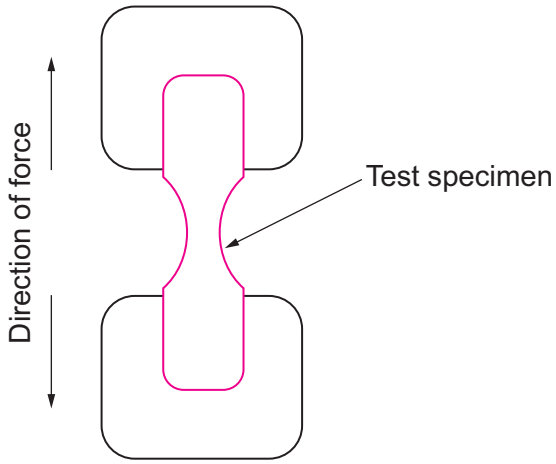
Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

1 9 . 1 **Figures 12**, **13** and **14** show graphical representations of material testing processes.

For each testing process, identify the material property being tested.

Figure 12

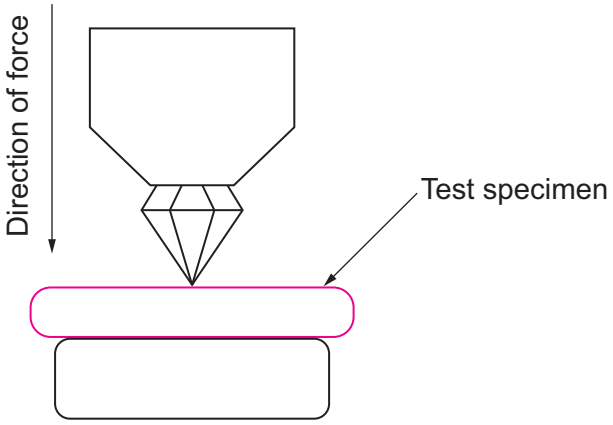


Material property being tested _____

[1 mark]

1 9 . 2

Figure 13



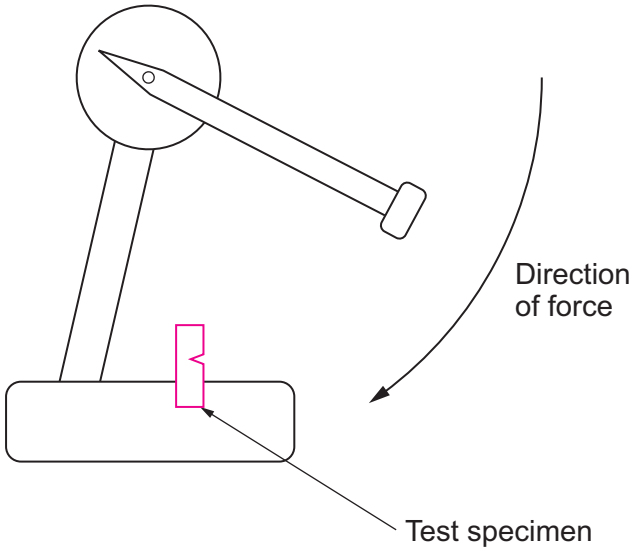
Material property being tested _____

[1 mark]

Do not write outside the box

1 9 . 3

Figure 14



Material property being tested _____

[1 mark]

3

Turn over for the next question

Do not write outside the box

2 0 Explain why the screen printing process is suitable for a low volume production run.

[6 marks]

Do not write outside the box

2 1 Explain the factors that should be considered before forming a curved piece of timber by steam bending.

[6 marks]

12

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED