Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number | | | | | |

Candidate Number | | | | |

Friday 12 June 2020

Morning (Time: 2 hours 30 minutes) | Paper Reference **9DT0/01**

Design and Technology (Product Design)

Advanced
Component 1

You must have:
a calculator and a ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen (HB pencil may be used for questions that require drawing or sketching).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- For questions requiring mathematics, you must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

Answer ALL questions. Write your answers in the spaces provided.

1 Figure 1 shows a fabric canopy for use in a garden. It is supported on aluminium legs and anchored with nylon cords.

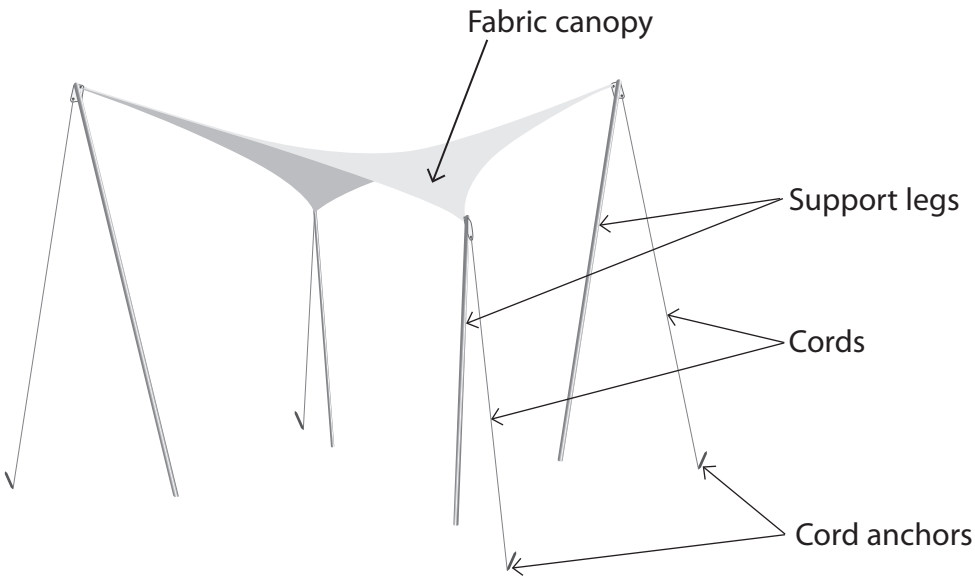

Figure 1

(a) The fabric canopy is made from polyester because it is lightweight, waterproof and durable.

Give **two** further characteristics of polyester fabric that make it a suitable material for the canopy.

(2)

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(b) The cords are made from nylon.

Explain **two** working properties of nylon that make it a suitable material for the cords.

(4)

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(c) The support legs are made from aluminium tube.

Explain **one** advantage of using aluminium tube rather than solid oak poles for the support legs.

(3)

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(Total for Question 1 = 9 marks)

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2 Figure 2 shows a drinks carton made from foil-lined board.

Figure 2

(a) One of the reasons foil-lined board has been selected for the drinks carton is because it has appropriate strength.

State **two** further working properties of foil-lined board that make it a suitable material for the drinks carton.

(2)

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(b) Figure 3 shows a different type of drink carton.

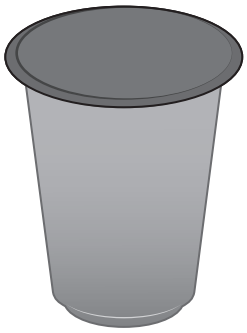

Figure 3

The base is 5 cm diameter ($r = 2.5$ cm).

The top is 8 cm diameter ($R = 4$ cm).

The capacity of the carton is 500 cm^3 ($V = 500\ cm^3$).

Calculate the height (h) of the carton, in cm using the formula:

$$V = \frac{1}{3}\pi h(R^2 + Rr + r^2)$$

$\pi = 3.142$

Give your answer to 3 significant figures.

Show all of your workings.

(5)

Answer ..... cm

(Total for Question 2 = 7 marks)

3 Smart and modern materials are often used in consumer products.

(a) Explain **one** way that thermo-chromic materials could improve the safety of consumer products.

(2)

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(b) Figure 4 shows a pair of spectacles with a shape memory alloy (SMA) frame.

© Daleen Loest/Shutterstock

Figure 4

Explain **two** benefits of using shape memory alloy (SMA) for spectacle frames.

(6)

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(Total for Question 3 = 8 marks)

4 Figure 5 shows a front wing panel for a mass produced car.

The wing is manufactured from sheet steel and attached to the steel supporting structure of the car.

Figure 5

(a) Name **three** joining methods that could be used to attach the steel front wing panel to the steel supporting structure of the car during assembly.

(3)

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(b) The mass produced steel front wing panel is produced using an automated machine process.

Figure 6 shows the steel supplied in roll form.

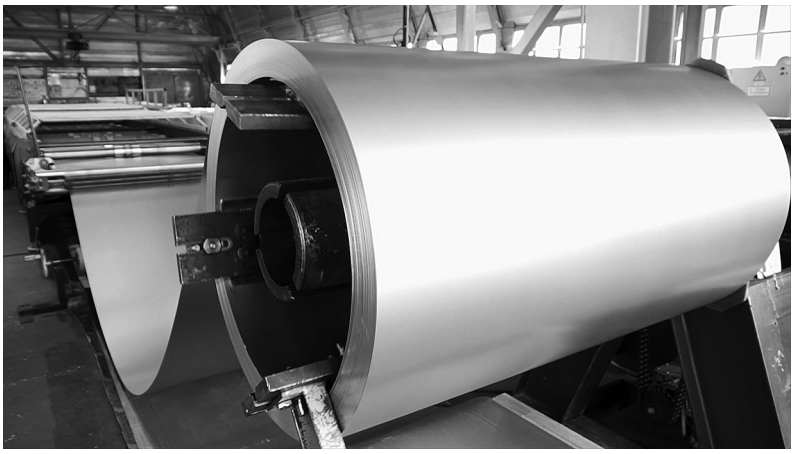

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Figure 6

Outline the process used to form the front wing panel from the steel roll.

(6)

(c) Steel is sometimes treated in order to improve its working properties.

Describe, using annotated sketches, the process of case hardening a one-off product in a school workshop.

(6)

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(d) Figure 7 shows a table of tensile failure load results for a batch of steel.

Failure load in Newtons (N)	Number of failures
380	3
390	9
400	6
410	4
420	3

Figure 7

Calculate each of the following, using the data shown in Figure 7.

Show all of your workings.

(i) The modal failure load of the steel.

(1)

Answer .....

(ii) The median failure load of the steel.

(2)

Answer .....

(iii) The mean failure load of the steel.

(4)

Answer .....

(Total for Question 4 = 22 marks)

5 Quality is an important issue in the manufacturing of consumer products.

One disadvantage of quality control systems is the high set-up cost.

(a) Give **two** further disadvantages of quality control systems.

(2)

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(b) Built-in obsolescence affects both consumers and manufacturers.

Evaluate the effects that built-in obsolescence has on manufacturers.

(9)

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(Total for Question 5 = 11 marks)

6 (a) Protecting the intellectual property rights of designers, inventors and companies has both advantages and disadvantages.

Give **two** disadvantages of patenting designs.

(2)

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(b) When manufacturing consumer products, companies can use various project management strategies.

Explain **two** ways Six Sigma can improve manufacturing processes.

(6)

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(c) Despite the use of quality assurance systems consumers still occasionally receive faulty goods.

Discuss how consumer rights legislation provides protection to the consumers who receive faulty goods.

(6)

(d) Give **two** ways that a product can be sustainably disposed of at the end of its useful life.

(2)

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2 .....

(e) Figure 8 shows a table of temperatures at different times of the day.

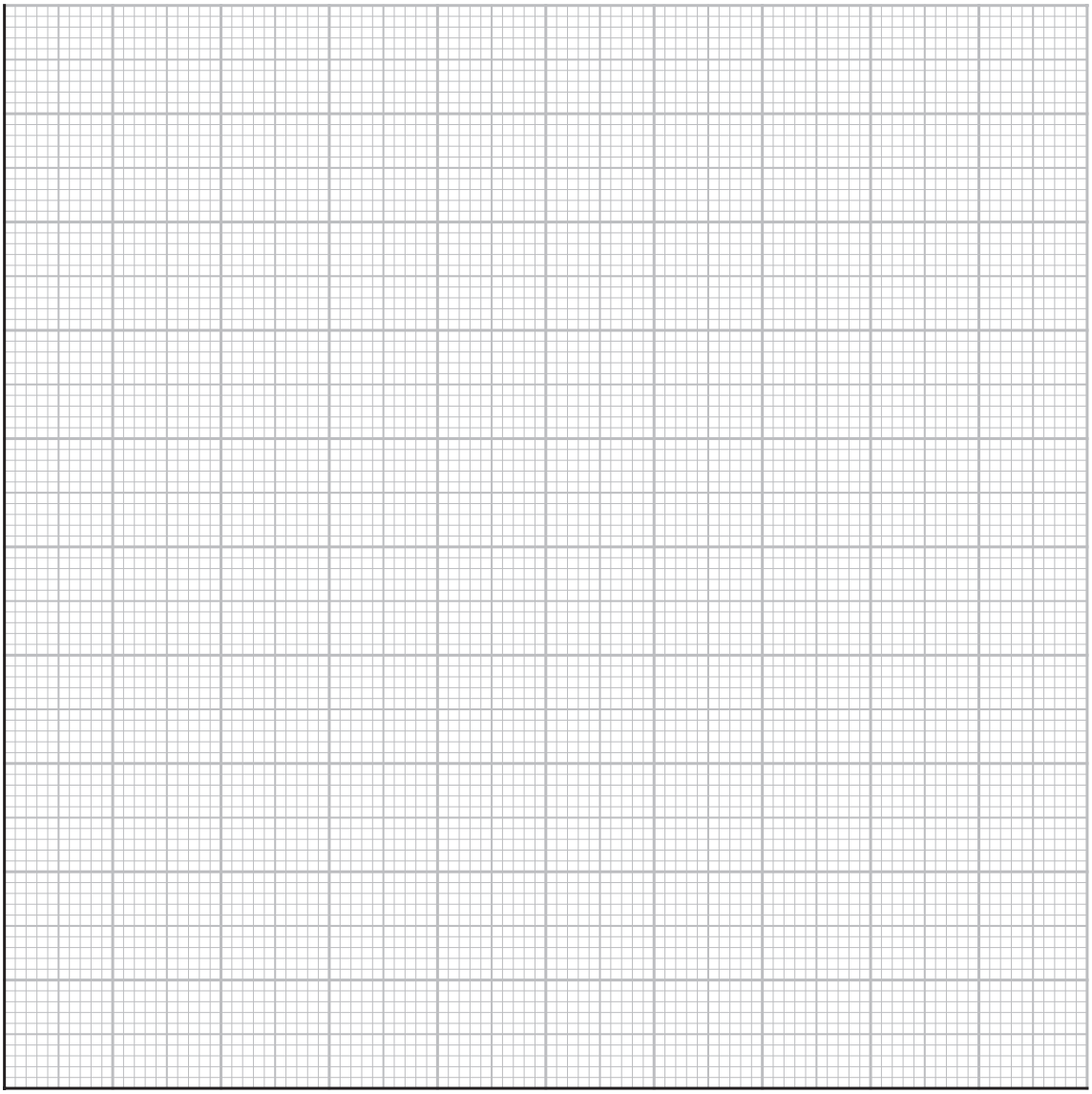
12 noon	1 pm	2 pm	3 pm	4 pm	5 pm
17 °C	18 °C	18 °C	17 °C	16 °C	15 °C

Figure 8

A paint manufacturer will only guarantee their product if it is applied at a temperature above 12 °C.

Produce and extrapolate a line graph to represent the table and estimate the time when painting will have to stop.

(3)



Answer .....

(Total for Question 6 = 19 marks)

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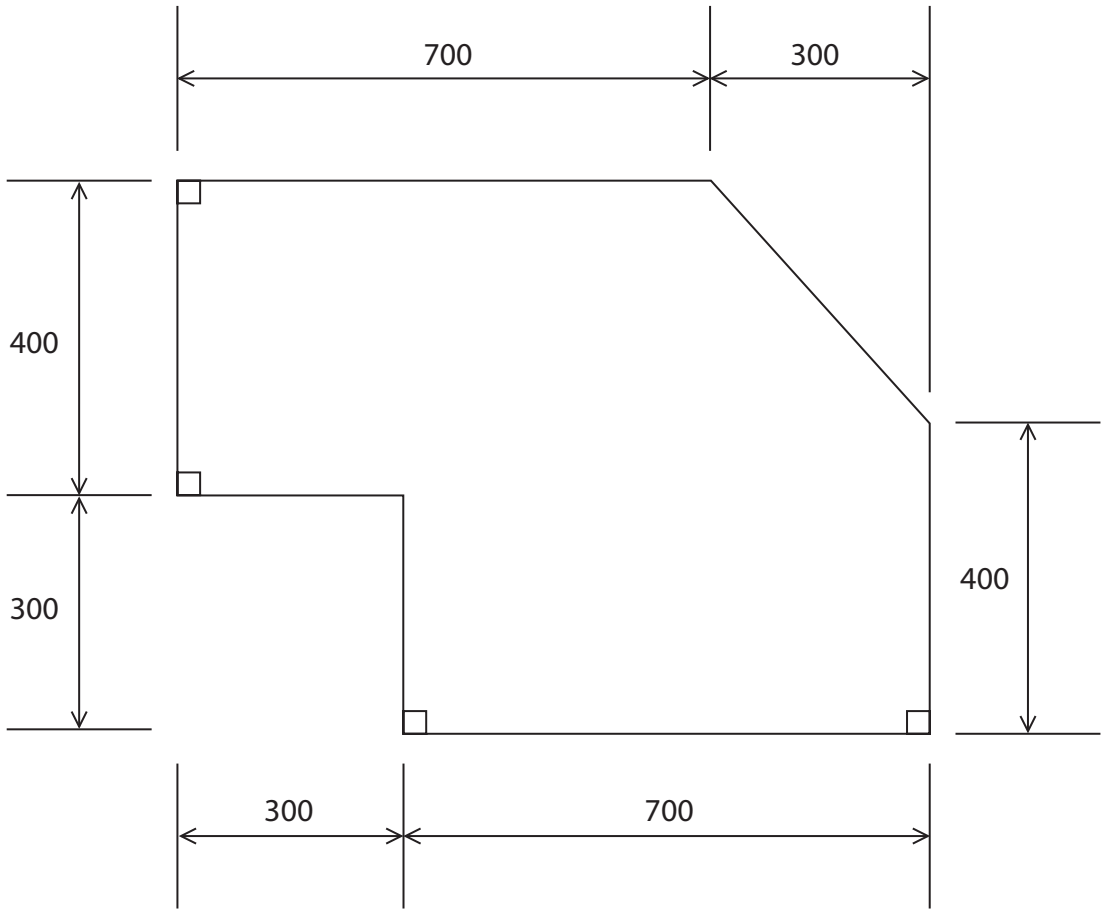
QUESTION 7 BEGINS ON THE NEXT PAGE.

7 Health and safety regulations limit the weight of components that may be lifted without mechanical assistance.

Figure 9 shows a drawing of a component made from 6 mm thick mild steel plate.



All dimensions in mm

Figure 9

6mm thick mild steel plate weighs 47.1 kg/m^2

Calculate the weight of the component shown in Figure 9.

Show all of your workings.

Give your answer in kg.

(5)

Answer ..... kg

(Total for Question 7 = 5 marks)

8 Figure 10 shows an office building designed and constructed during the Art Deco period.

Figure 10

Discuss how the design of the office building was influenced by Art Deco philosophies.

(9)

(Total for Question 8 = 9 marks)

9 (a) Quality control and efficiency are key issues in modern manufacturing.

Discuss the use of computer-aided testing within quality control systems for a high volume manufacturer.

(9)

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(b) Value and value stream are the first two stages of lean manufacturing.

Explain the **three** further stages of lean manufacturing.

(9)

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(Total for Question 9 = 18 marks)

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QUESTION 10 BEGINS ON THE NEXT PAGE.

10 Figure 11 shows a modern lightweight travel suitcase.

Figure 11

Specification:
Main body – polypropylene.
Capacity – 123 litres.
Size – 790 mm × 530 mm × 310 mm.
Weight – 3.7 kg.
4 wheels – twin 360° rotating.
3 handles – (top, side and retractable).

Evaluate the functionality of the suitcase for use by holidaymakers, with reference to the specification.

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(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 120 MARKS

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