Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Wednesday 5 June 2024

Afternoon (Time: 2 hours 30 minutes)

Paper reference **9DT0/01**

Design and Technology (Product Design)

Advanced

COMPONENT 1

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen (HB pencil may be used for questions that require drawing and 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.*

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.*
- For questions requiring mathematics, you must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

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 chisel. The chisel blade is manufactured from carbon steel.

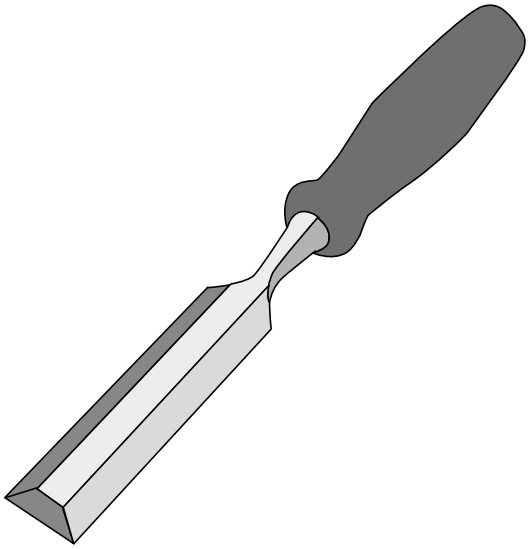

Figure 1

(a) During manufacture the chisel blade becomes work hardened.

Name **two** heat treatment processes that are used to restore the metal's mechanical properties making it tougher and less brittle.

(2)

1

2

(b) Explain **two** reasons why carbon steel is used for the blade of the chisel.

(4)

1

2

(c) The chisel has a polypropylene handle.

Explain **one** benefit of using polypropylene for the chisel handle.

(3)

(Total for Question 1 = 9 marks)

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2 Figure 2 shows a hot melt glue gun.

Figure 2

Hot melt glue is widely used in furniture manufacturing and packaging.

(a) Give **two** benefits of using hot melt glue.

(2)

1

2

(b) A manufacturer currently uses 500 glue sticks per week but is planning to increase production by 30%.

Cost of glue sticks: £9.44 per pack of 16

Percentage of waste glue: 12%

Calculate the annual cost of waste glue over a 52 week period at the increased level of production.

Give your answer in pounds to 2 decimal places.

Show all of your workings.

(5)

Answer £

(Total for Question 2 = 7 marks)

3 Figure 3 shows a table leg that has been turned from a square section of mahogany on a wood lathe.

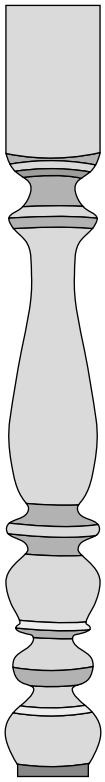

Figure 3

(a) Explain **one** property of mahogany that makes it a suitable material for turning on a wood lathe.

(2)

(b) Describe, using labelled sketches, how a square section of mahogany would be prepared and then turned into a cylinder, using a wood lathe.

(4)

(c) Explain **two** reasons why mahogany might **not** be considered a sustainable material.

(6)

1

2

(Total for Question 3 = 12 marks)

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4 Manufacturers use many methods to facilitate production efficiency, sustainability and quality.

(a) Manufacturers often utilise standardised parts and bought-in components when designing and manufacturing consumer products.

Give **three** benefits of using standardised parts and bought-in components.

(3)

1

2

3

(b) Lean manufacturing utilises just-in-time (JIT) systems.

Outline the benefits of a just-in-time (JIT) system.

(6)

(c) Six Sigma is used in manufacturing to identify and remove the causes of defects.

Reducing costs is one of the five value targets used in Six Sigma.

Give **two** other value targets used in Six Sigma.

(2)

1

2

(d) Discuss how a circular economy will reduce the impact of manufacturing activity on the environment and promote sustainability.

(9)

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(Total for Question 4 = 20 marks)

5 A contractor has been asked to paint the floor of a design and technology workshop.

Figure 4 shows the floor plan of the design and technology workshop.

All dimensions are in metres (m)

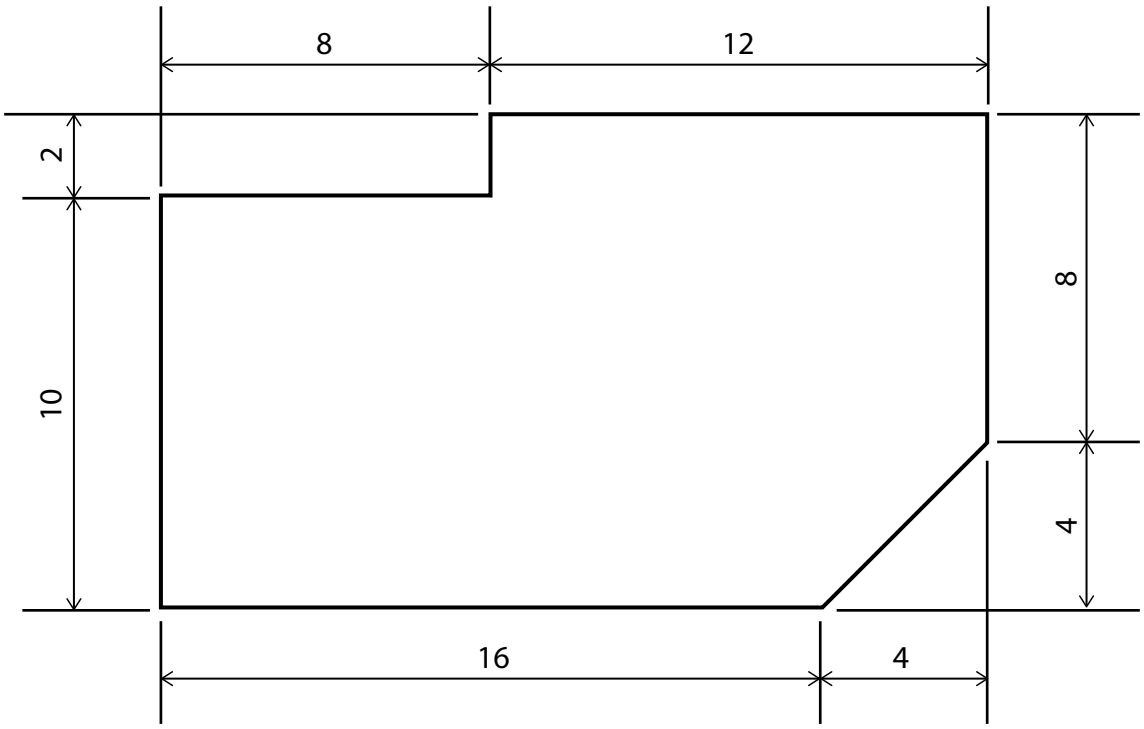


Figure 4

(a) Calculate the area of the design and technology workshop floor.

Give your answer to **one decimal place**.

(5)

Answer ..... m^2

(b) The floor paint is only supplied in 5 litre cans.

A 5 litre can costs £48.00.

One litre of paint will cover 12 m^2 for each coat.

Two coats are required.

Calculate the overall cost of the cans of paint required to complete the painting of the floor.

(3)

Answer £

(Total for Question 5 = 8 marks)

6 Figure 5 shows a bandsaw used by a manufacturer of consumer products.

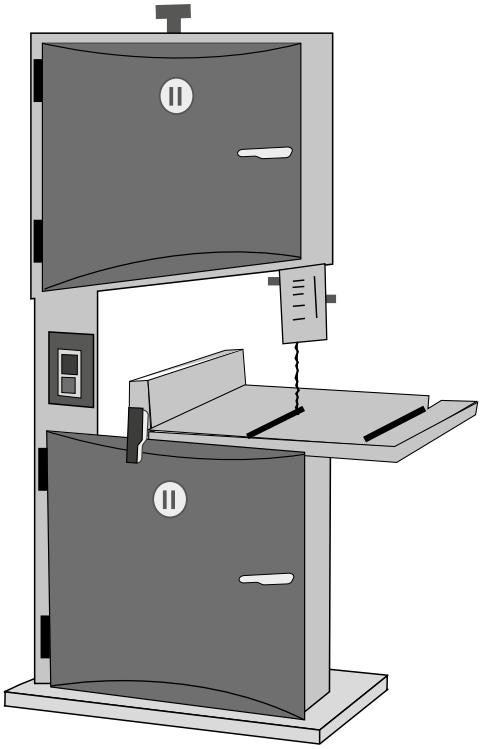


Figure 5

(a) One safe working practice when operating a bandsaw would be to wear personal protective equipment (PPE).

Give **two** other safe working practices when operating a bandsaw.

(2)

1

2

(b) The manufacturer embraces user centred design when developing new products.

User centred design considers user needs, wants and values.

Explain **two** other considerations of user centred design that help to ensure that products are fit for purpose.

(6)

1

2

(c) Manufacturing companies comply with a wide range of health and safety legislation and regulations to protect workers.

Discuss the consequences for a company of non-compliance with health and safety legislation and regulations.

(6)

(d) The level of risk, including severity and likelihood, is one part of a risk assessment.

Give **two** other parts of a risk assessment.

(2)

1

2

(e) The table below shows the total budget spent on various aspects of Health and Safety by a manufacturing company.

Training	Signage	Risk assessment	PPE	Safety equipment
£27,000.00	£8,260.00	£15,500.00	£18,375.00	£42,000.00

The cost of PPE is increasing by 12%.

Calculate what percentage of the Health & Safety budget is spent on PPE after the increase is applied.

(3)

Answer %

(Total for Question 6 = 19 marks)

7 Figure 6 shows the net (development) for a chocolate box.

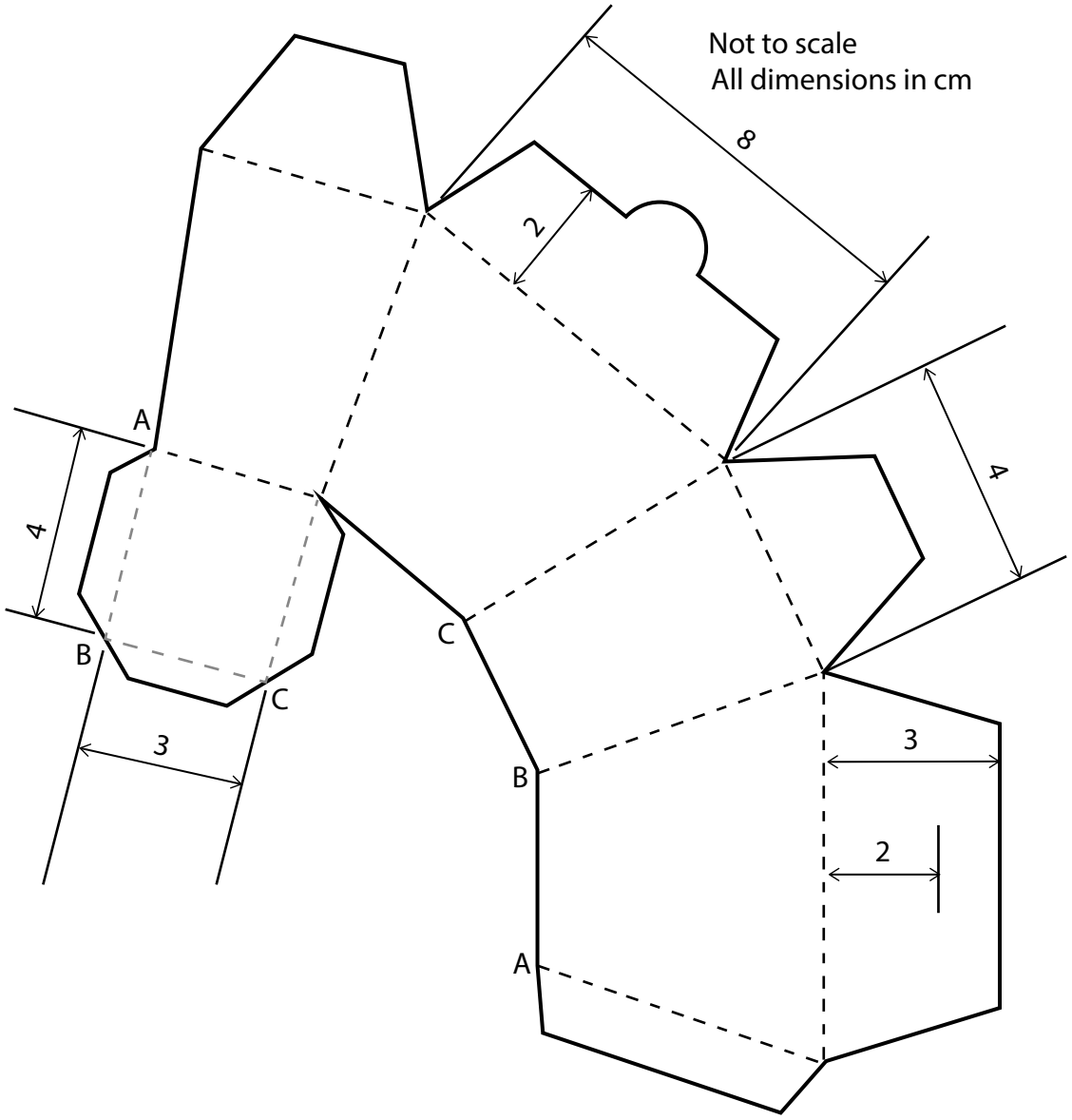


Figure 6

Draw an accurate isometric projection of the chocolate box.

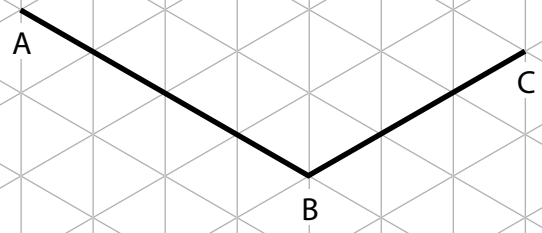
Use the isometric grid provided Starting with Lines A–B and B–C as your baselines.

Each segment of the grid equals 1 cm.

The height of the assembled box is 10 cm.

Dimensioning of the isometric projection is not required.

(6)



(Total for Question 7 = 6 marks)

8 Figure 7 shows a hotel elevator lobby in a building designed and constructed during the Art Deco period.

(Source: https://encrypted-tbn0.gstatic.com/s?q=tbn:ANd9GcRJAp8OUNbjdjYb86or3qknDThmuJO8VFd5vmLxARUH7SIok8cFxk52hx24Xp6XPAm_Vj8&usqp=CAU)

Figure 7

Discuss how the interior design of the hotel elevator lobby was influenced by Art Deco philosophies.

(9)

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(Total for Question 8 = 9 marks)

9 Discuss how innovation management is used when developing and introducing new consumer products.

(9)

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(Total for Question 9 = 9 marks)

10 Photo-chromic glass is one type of smart material that reacts to ultraviolet (UV) light.

Reactive glass is another form of modern smart material.

Explain **two** benefits and **one** drawback of reactive glass.

Benefit 1

Benefit 2

Drawback 1

(Total for Question 10 = 9 marks)

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11 Figure 8 shows a 'spinning' bike used for indoor group exercise classes.

Figure 8

- Main frame in welded mild steel with a powder coated finish
- Four height adjustable feet at ground contact points
- Seat adjustable vertically and horizontally
- Handlebars adjustable for height
- Digital liquid crystal display showing revolutions per minute (RPM), power output in Watts, distance travelled, heart rate and effort level
- Tension/effort level adjustment
- Stainless steel flywheel – weight 22 kg
- Overall weight – 64 kg
- User height range 1.50 m to 1.95 m
- Maximum user weight – 135 kg
- Cost £1,150.00

Evaluate how the designer of the 'spinning' bike has addressed ergonomics and user requirements for group exercise activities.

(12)

(Total for Question 11 = 12 marks)

TOTAL FOR PAPER = 120 MARKS