edexcel

A Level Design and Technology

Sample Assessment Materials

Pearson Edexcel Level 3 Advanced GCE in Design and Technology

(Product Design) (9DT0)

First teaching from September 2017

First certification from 2019

Issue 1

Pearson

Edexcel, BTEC and LCCI qualifications

Edexcel, BTEC and LCCI qualifications are awarded by Pearson, the UK's largest awarding body offering academic and vocational qualifications that are globally recognised and benchmarked. For further information, please visit our qualification websites at www.edexcel.com, www.btec.co.uk or www.lcci.org.uk. Alternatively, you can get in touch with us using the details on our contact us page at qualifications.pearson.com/contactus

About Pearson

Pearson is the world's leading learning company, with 40,000 employees in more than 70 countries working to help people of all ages to make measurable progress in their lives through learning. We put the learner at the centre of everything we do, because wherever learning flourishes, so do people. Find out more about how we can help you and your learners at qualifications.pearson.com

References to third party material made in this sample assessment materials are made in good faith. Pearson does not endorse, approve or accept responsibility for the content of materials, which may be subject to change, or any opinions expressed therein. (Material may include textbooks, journals, magazines and other publications and websites.)

All information in this document is correct at time of publication.

Original origami artwork: Mark Bolitho
Origami photography: Pearson Education Ltd/Naki Kouyioumtzis

ISBN 978 1 4469 3318 3

Contents

Introduction	1
General marking guidance	3
Paper 1 Question paper	5
Paper 1 mark scheme	33

Introduction

The Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design) is designed for use in schools and colleges. It is part of a suite of AS/A Level qualifications offered by Pearson.

These sample assessment materials have been developed to support this qualification and will be used as the benchmark to develop the assessment students will take.

General marking guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme – not according to their perception of where the grade boundaries may lie.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification/indicative content will not be exhaustive. However different examples of responses will be provided at standardisation.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, a senior examiner must be consulted before a mark is given.
- Crossed-out work should be marked **unless** the candidate has replaced it with an alternative response.

Marking guidance for levels based mark schemes

How to award marks

The indicative content provides examples of how students will meet each skill assessed in the question. The levels descriptors and indicative content reflect the relative weighting of each skill within each mark band.

Finding the right level

The first stage is to decide which level the answer should be placed in. To do this, use a 'best-fit' approach, deciding which level most closely describes the quality of the answer. Answers can display characteristics from more than one level, and where this happens markers must use the guidance below and their professional judgement to decide which level is most appropriate.

Placing a mark within a level

After a level has been decided on, the next stage is to decide on the mark within the level. The instructions below tell you how to reward responses within a level. However, where a level has specific guidance about how to place an answer within a level, always follow that guidance. Statements relating to the treatment of students who do not fully meet the requirements of the question are also shown in the indicative content section of each levels based mark scheme. These statements should be considered alongside the levels descriptors.

Markers should be prepared to use the full range of marks available in a level and not restrict marks to the middle. Markers should start at the middle of the level (or the upper-middle mark if there is an even number of marks) and then move the mark up or down to find the best mark. To do this, they should take into account how far the answer meets the requirements of the level:

- If it meets the requirements fully, markers should be prepared to award full marks within the level. The top mark in the level is used for answers that are as good as can realistically be expected within that level
- If it only barely meets the requirements of the level, markers should consider awarding marks at the bottom of the level. The bottom mark in the level is used for answers that are the weakest that can be expected within that level
- The middle marks of the level are used for answers that have a reasonable match to the descriptor. This might represent a balance between some characteristics of the level that are fully met and others that are only barely met.

Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Design and Technology (Product Design)

Component 1

Sample assessment material for first teaching September 2017
Time: 2 hours 30 minutes

Paper Reference
9DT0/01

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 ▶

S53832A

1/1/1

S 5 3 8 3 2 A 0 1 2 8

Pearson

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

1 Figure 1 shows a chessboard and some chess pieces that are to be manufactured from plywood.

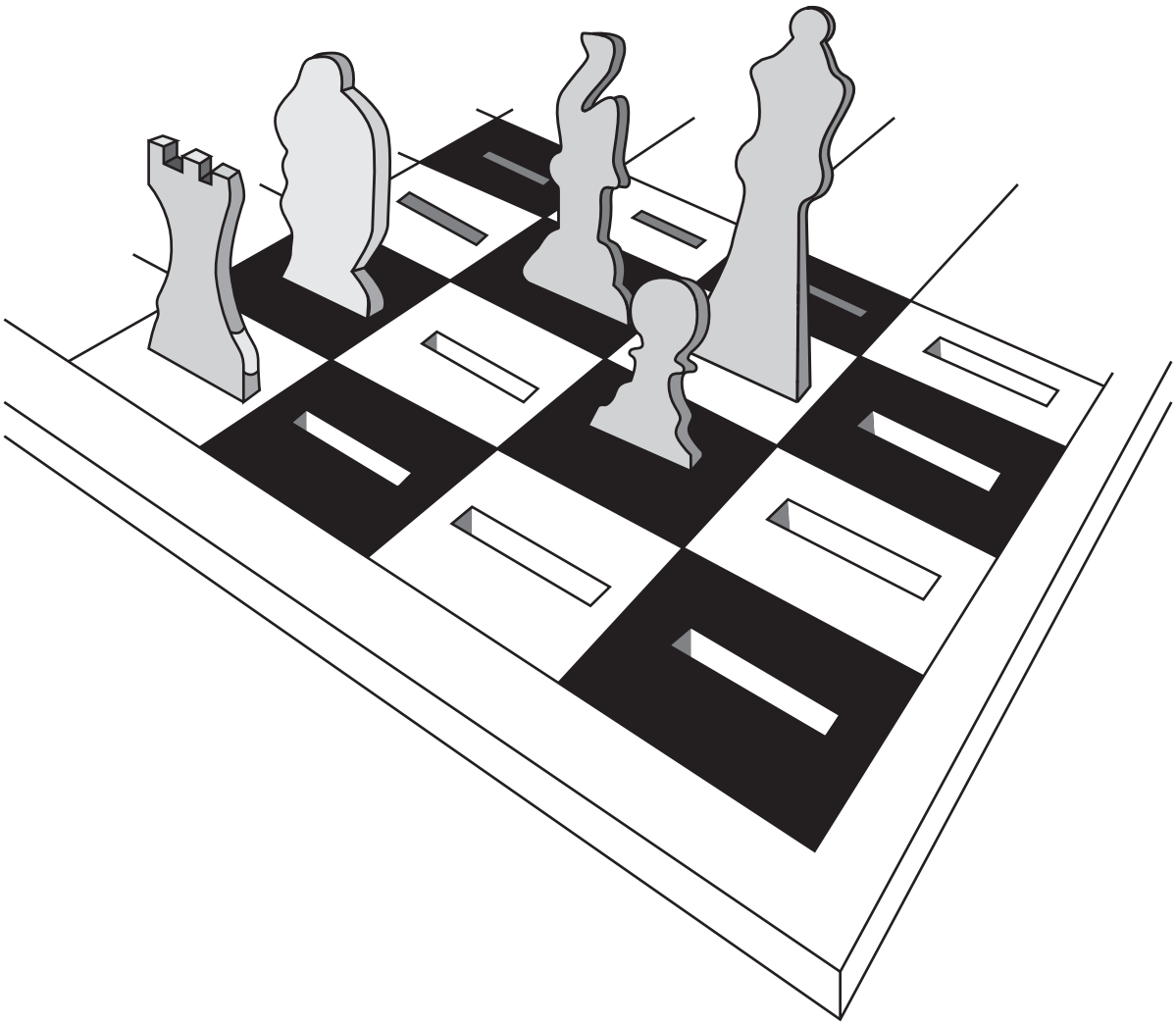


Figure 1

The chessboard will be made from a single piece of plywood and needs to have contrasting light and dark squares.

(a) Explain how a laser cutter could be used to achieve the contrasting squares.

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Explain **two** benefits, other than cost, of using plywood rather than solid wood for manufacturing the chess pieces.

(4)

1 .....

.....

.....

.....

2 .....

.....

.....

.....

The chess pieces could be made from acrylic.

(c) Explain **one** advantage of using acrylic rather than plywood for the chess pieces.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 1 = 9 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

2 Figure 2 shows a children's educational toy manufactured from mahogany.

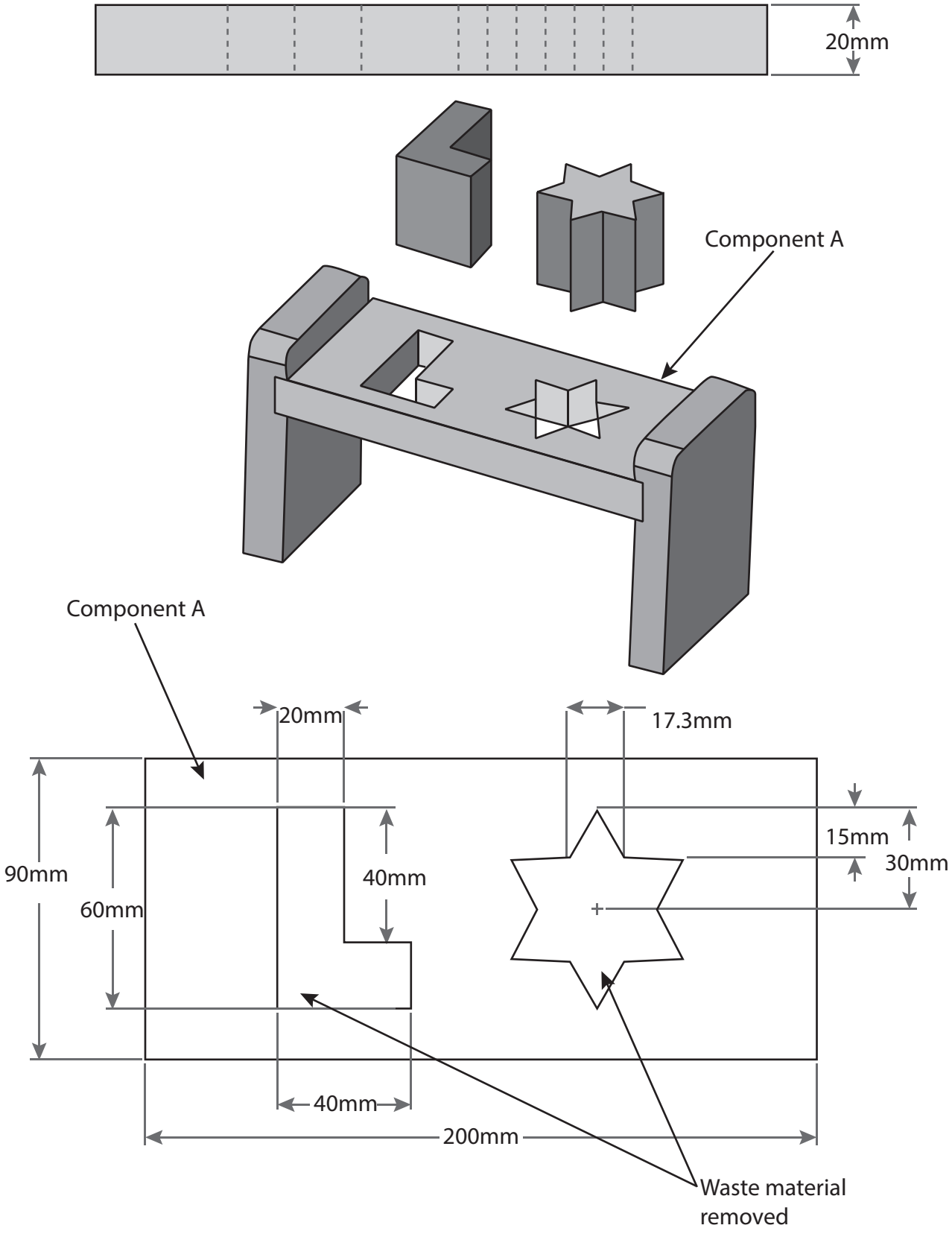


Figure 2

A ruler and pencil are two of the tools used to mark out the 'L' shape to be removed.

(a) Give **two** additional marking-out tools that could be used for the 'L' shape.

(2)

1 .....

2 .....

Waste material is removed from Component A to make the toy, as shown in Figure 2.

(b) Calculate the percentage of the original piece of mahogany that is removed as waste material.

Give your answer correct to 1 decimal place.

Show all of your workings.

(8)

Answer .....

(Total for Question 2 = 10 marks)

3 Die-casting is a common process used for making metal products.

(a) Explain **one** property of zinc that makes it a suitable material for die-casting.

(2)

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Describe, using labelled sketches, the process of die-casting.

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Figure 3 shows a child's toy bus, which has been commercially die cast.

The toy bus measures 70 mm long, 40 mm high and 2 mm wide.

(Source: © Soundsnaps/Shutterstock)

Figure 3

(c) Explain **two** advantages of using die-casting over sand casting to manufacture the body of the toy bus.

(6)

1 .....

.....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....

.....

(Total for Question 3 = 12 marks)

4 Figure 4 shows a selection of screwdriver bits that have been hardened and tempered.

(Source: © Yegor Larin/Shutterstock)

Figure 4

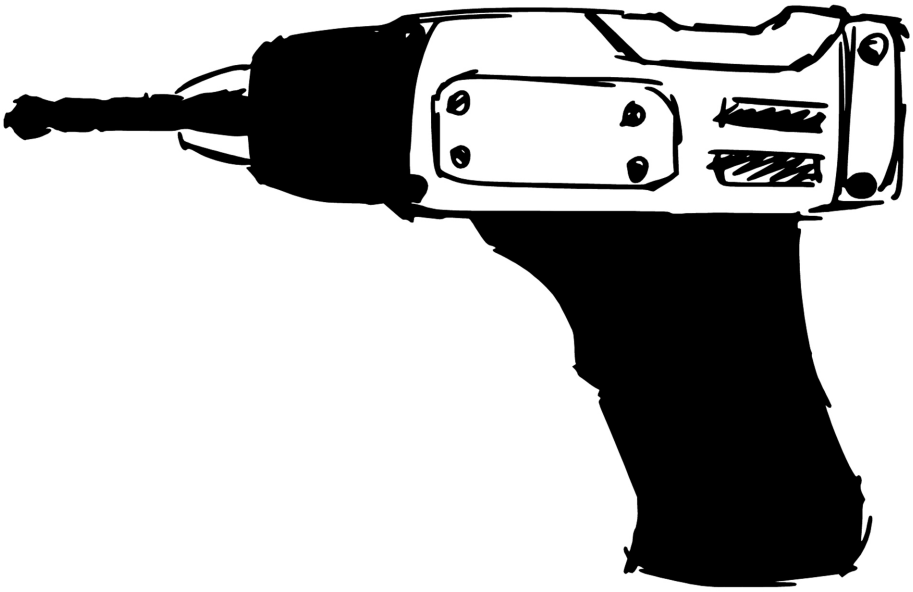
(a) (i) Describe the process used to harden the screwdriver bits.

(2)

(ii) Explain **one** reason why the screwdriver bits are tempered once they have been hardened.

(3)

Figure 5 shows the initial sketch for a new hand drill that is being developed.



(Source: © Les Perysty/Shutterstock)

Figure 5

In order to design the drill ergonomically, the designer must consider anthropometric data.

Figure 6 presents anthropometric data showing the hand-grip sizes of a sample of people.

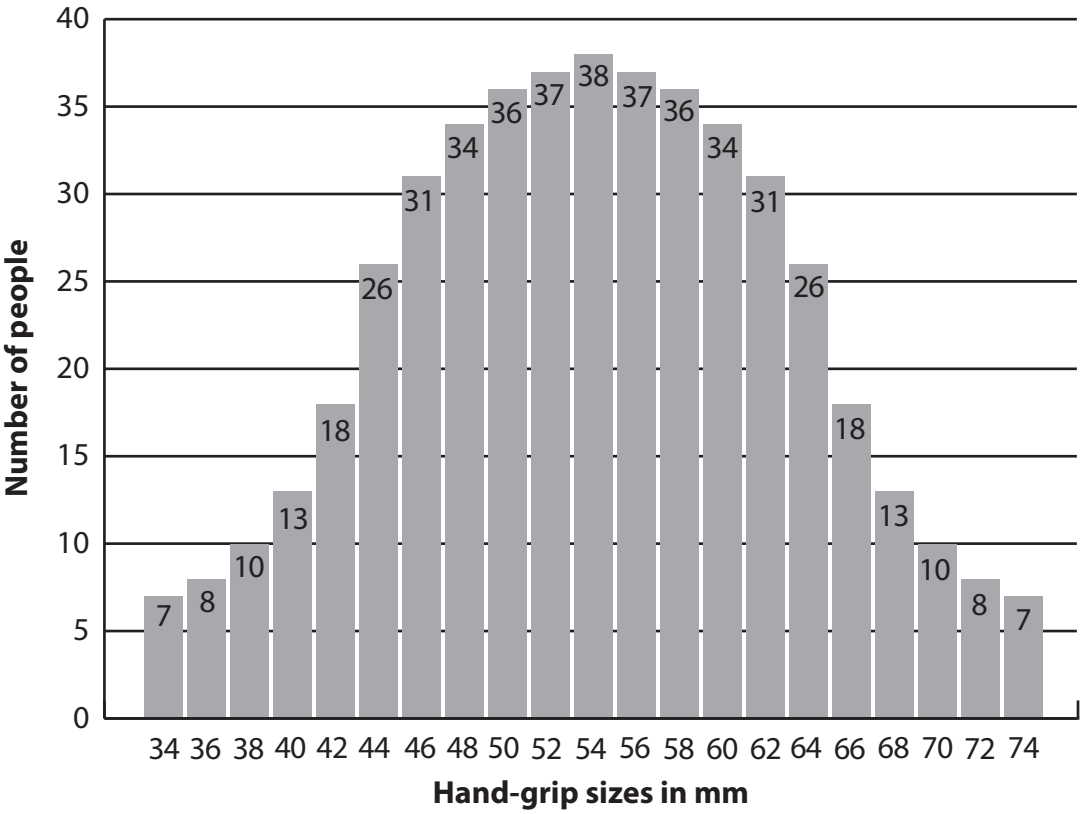


Figure 6

(b) (i) Calculate the number of sampled people capable of using the hand drill if it is designed to be suitable for 90 per cent of the sample.

Give your answer correct to the nearest whole number.

Show all of your workings.

(2)

Answer .....

The drill is being designed to be ergonomically suitable for hand-grip sizes that fall within the 5th to 95th percentile of the sample.

(ii) Calculate the minimum and maximum hand-grip sizes that the designer must consider.

Show all of your workings.

(3)

Answer .....

The design for the drill has been finalised.

(c) Explain **one** benefit to the designer of taking out a patent on the new drill design.

(2)

Figure 7 shows a parts drawing for both halves of the drill body.

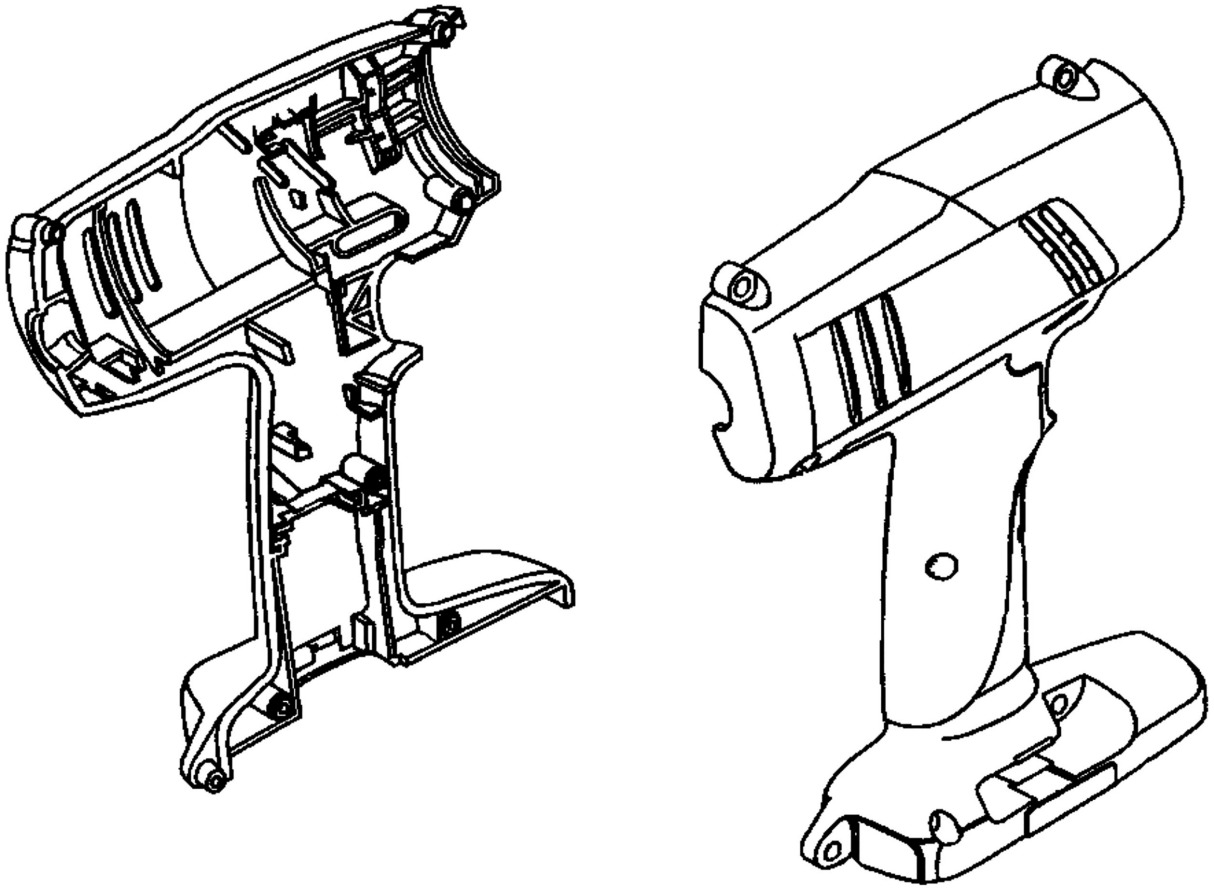


Figure 7

The design for the drill body has now been finalised and patented. It has been designed to be mass produced using injection moulding.

(d) Evaluate the decision to use injection moulding to create the drill body.

(9)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

The manufacturer would like the drill on the market as soon as possible and they have decided to use a critical path analysis project management strategy to achieve this.

(e) Outline the process of critical path analysis.

(4)

(Total for Question 4 = 25 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

5 Figure 8 shows a scooter.

Figure 8

The manufacturer of the scooter has ensured that it meets the requirements of the Consumer Rights Act 2015.

(a) State **two** requirements of the Consumer Rights Act 2015 that relate to the purchase or use of the scooter.

(2)

1 .....

.....

2 .....

.....

The scooter features rubber tyres.

(b) (i) Explain **two** performance characteristics of rubber that makes it a suitable material for the tyres of the scooter.

(6)

1 .....

.....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

The manufacturer is considering two design options for the scooter wheels:

– Solid wheels, which would need to be replaced when damaged.
– Pneumatic (air filled) wheels, which could be repaired when they get punctured.

(ii) Discuss the factors that need to be considered before deciding which option to produce.

(6)

The nuts and bolts used to assemble the scooter are standard parts.

(c) Give **two** benefits, other than cost, of using standardised parts.

(2)

A jig is required to hold the main upright at the correct angle while it is welded in place.

Figure 9 shows a schematic drawing to be used to calculate the correct angle of the jig.

Diagram not to scale

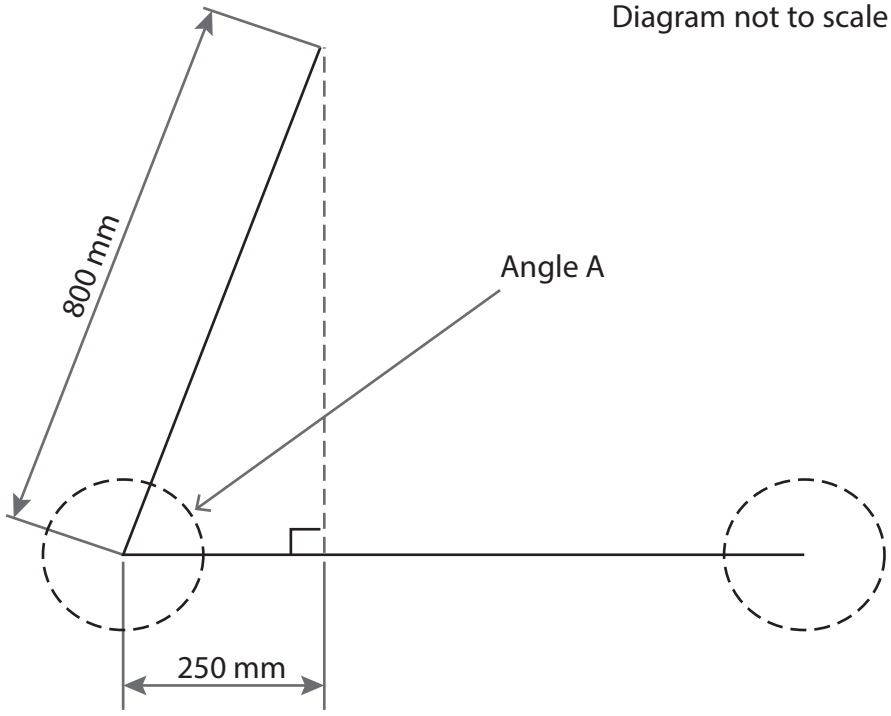


Figure 9

(d) Using the information in Figure 9, calculate Angle A in degrees.

Give your answer to 2 significant figures.

(3)

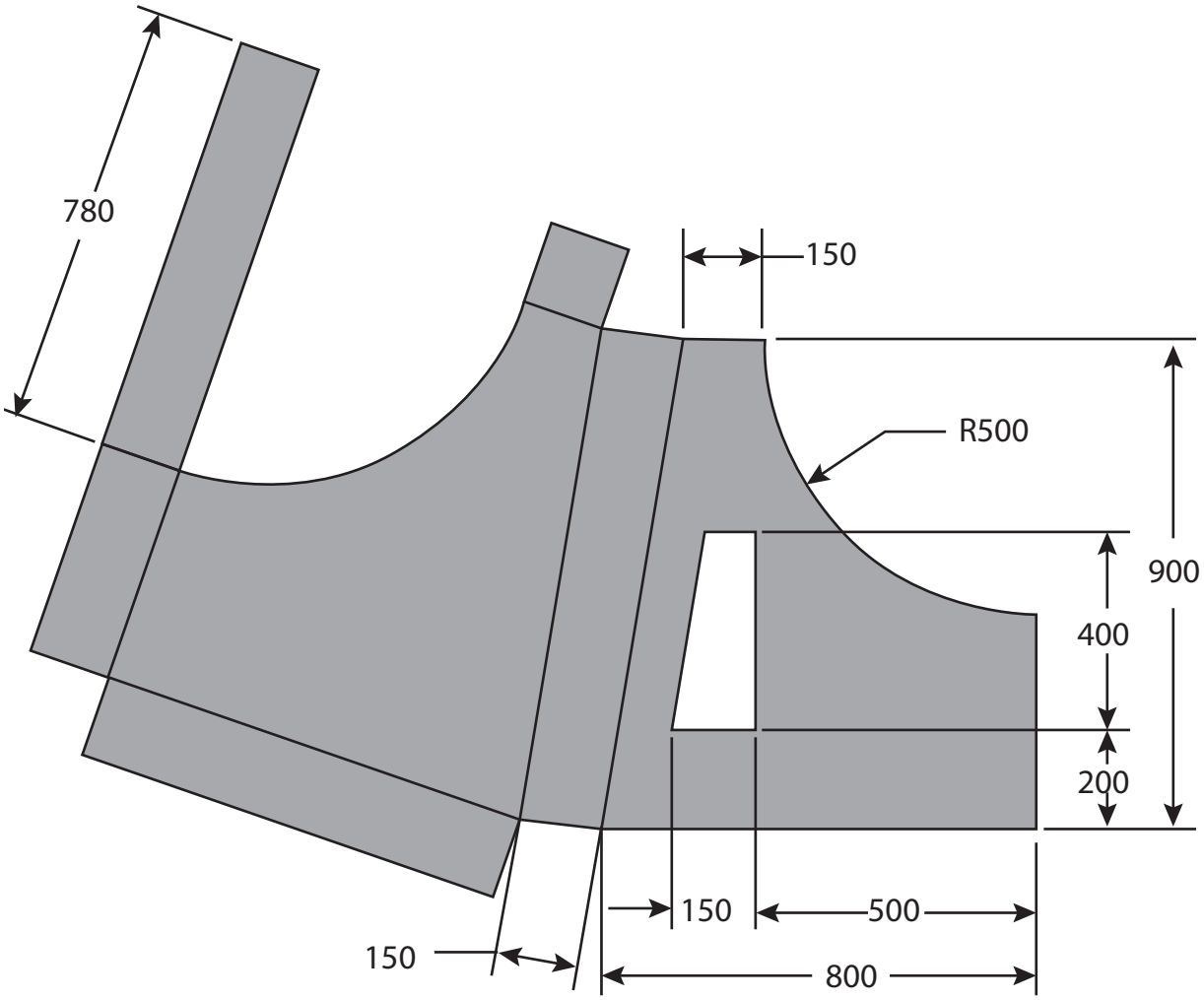
Answer .....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

A child-sized version of the scooter has been developed and is being marketed with a unique packaging design. Figure 10 shows the net (development) for the scooter packaging. The construction tabs have been omitted for clarity.

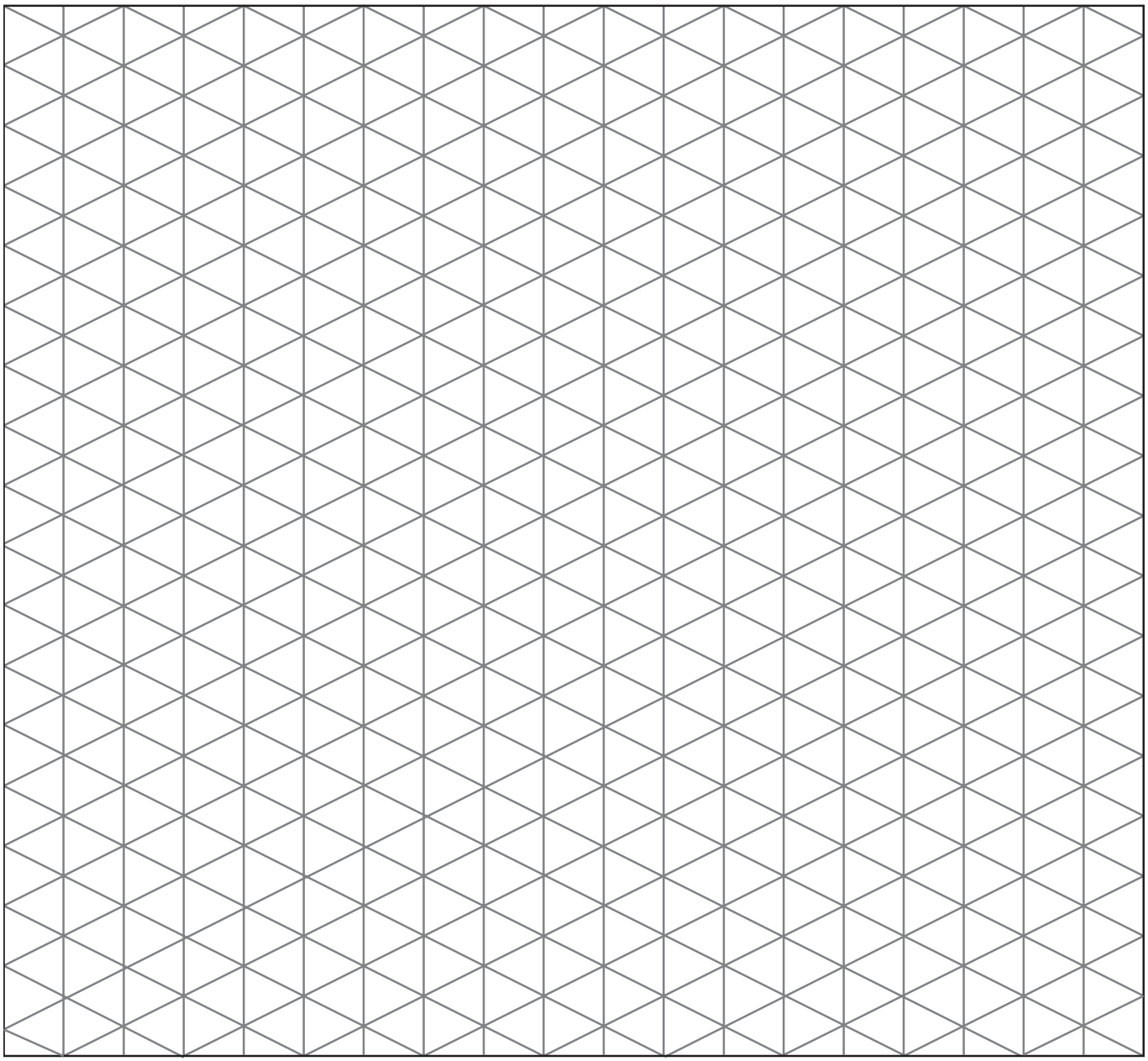


All dimensions are in mm

Figure 10

(e) Draw an accurate isometric view of the assembled box, to a scale of 1 : 10, on the grid provided.

(6)



10 mm isometric grid

(Total for Question 5 = 25 marks)

6 Figure 11 shows a chair produced during the Bauhaus Modernist period.

(Source: https://www.1stdibs.com/furniture/seating/chairs/mr-20-bauhaus-chair-ludwig-mies-van-der-rohe/id-f_2581042/)

Figure 11

Discuss how the design of the chair in Figure 11 was influenced by Bauhaus Modernist philosophies and the manufacturing technology available during the period.

(9)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 6 = 9 marks)

7 Figure 12 shows a smartphone.

Mobile phone design 2015

(Source: © Krystian Nawrocki/Istock)

Figure 12

(a) Explain **three** features in the design of the smartphone shown in Figure 12 that have been impacted by smart materials and the miniaturisation of components.

(9)

1 .....

.....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

3 .....

.....

.....

.....

.....

.....

(b) Explain **three** ways in which built-in obsolescence of smartphones has a positive or negative impact on society.

(9)

1 .....

.....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....

.....

3 .....

.....

.....

.....

.....

.....

(Total for Question 7 = 18 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

8 Figure 13 shows a vacuum cleaner.

(Source: © Ralf Juergen Kraft/Shutterstock)

Figure 13

The vacuum cleaner has been designed with a transparent collection tube.

Evaluate this design decision with reference to aesthetics and functionality.

(12)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 120 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Component 1 Mark scheme

Question number	Answer	Mark
1(a)	An explanation that includes identification of a method (1) and linked justification of that method (1). • The power/speed of the laser can be adjusted (1) graduations of burn/hatching can be used to achieve the contrast (1).	**(2)**

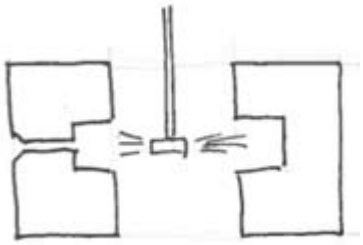
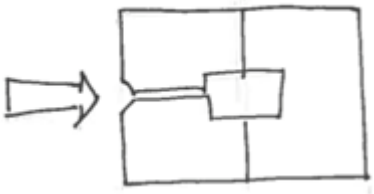
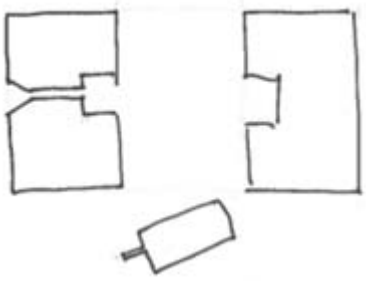
Question number	Answer	Additional guidance	Mark
1(b)	Any **two** explanations that include identification of a benefit (1) and linked justification of that benefit (1). • Plywood is a dimensionally stable material (1), which means it will not twist/warp/the figures will stay flat (1). • Plywood can be knot free (1), which means there is no chance of any bits falling out/which would result in a good quality product visually/ aesthetically/functionally (1). • Plywood has no short grain/has uniform strength (1) so small details will be less likely to break off.	Allow answers written in the negative referring to solid wood, e.g. solid wood is not a dimensionally stable material (1), which means it may twist/warp/figures will not stay flat (1).	**(4)**

Question number	Answer	Mark
1(c)	An explanation that includes identification of an advantage (1) and linked justifications of that advantage (1) + (1). • The edges of the acrylic will melt/won't change colour/won't burn if cut with the laser (1), therefore they will not require any additional surface/edge finishing (1), which speeds up manufacturing time/reduces manufacturing costs (1). • Acrylic is available in a wider range of colours/ pre-coloured/coloured throughout (1), therefore no colour/surface finishing needs to be applied (1), which reduces manufacturing time/reduces manufacturing costs (1). • Acrylic is self-finished (1), therefore no surface treatment is needed (1), which speeds up manufacturing time/reduces manufacturing costs (1). • Acrylic can be cast/injection moulded (1), therefore they will not require any additional surface/edge finishing (1), which speeds up manufacturing time/reduces manufacturing costs (1).	**(3)**

Question number	Answer	Additional guidance	Mark
2(a)	**Two** additional marking-out tools from: • marking-out knife/Stanley® knife/cutting knife/knife (1) • try square (1) • marking/mortise gauge (1) • sliding bevel (1).	Do not accept metalwork marking-out tools or tools that could not be used to mark out the 'L' shape (e.g. compass, scriber, centre punch).	**(2)**

Question number	Answer	Additional guidance	Mark
2(b)	In order for the candidate to solve the problem, they will need to recognise that each of the following stages are required. Stage 1: area of L shape = (60 × 20) + (20 × 20) (1) = 1600 mm^2 (1) Stage 2: area of star = $\frac{15 \times 17.3}{2}$ × 12 (1) = 1557 mm^2 (1) Stages 1 and 2 can be done in any order. Stage 3: total area of waste = 1600 + 1557 = 3157 mm^2 (1) Stage 4: area of component A = 200 × 90 = 18 000 mm^2 (1) Stages 3 and 4 can be done in any order. Stage 5: % waste = $\frac{100 \times 3157}{18\,000}$ (1) = 17.5% (1)	Accept alternative methods of correct working out. Error carried forward should be applied. Award full marks for correct answer only.	**(8)**

Question number	Answer	Additional guidance	Mark
3(a)	An explanation that includes identification of a property (1) and linked justification of that property (1). • Zinc has good fluidity when molten (1), which means it will flow readily into the die (1). • Zinc has a low melting point/changes quickly from solid to liquid (1), which results in less energy being used to melt it/which means you can use a range of materials for the die without melting it/can produce products more quickly (1).	Do not accept properties of zinc such as strength or conductivity that are unrelated to its suitability for die-casting.	**(2)**

Question number	Answer	Additional Guidance	Mark
3(b)	Labelled sketches that describe the process making reference to any **four** of the following points. • Die sprayed (1). • Molten metal shot into closed die (1). • Die/casting cooled (1). • Die is opened/casting removed (1). • Reference in graphic or label form to die being opened/closed/split (1).  die sprayed  molten metal shot into die  die/ casting cooled casting removed	If candidate uses only sketches, max 3 marks. If candidate uses only notes, max 3 marks.	**(4)**

Question number	Answer	Additional guidance	Mark
3(c)	Any **two** explanations that include identification of an advantage (1) and linked justifications of that advantage (1) + (1). • Using a permanent die is quicker than preparing a sand mould for each casting (1), which increases throughput/produce more in a given time (1) and means keeping up with high volume/commercial demand (1). • The surface quality of the cast item is much better than sand casting (1), therefore no additional surface finishing/secondary processing such as milling/grinding is required (1) to produce a bus that is suitable for being handled/played with/to get a commercial quality finish (1). • Die casting can create finer details/thinner sections (1) as a sand mould may collapse (1) when trying to cast a small-scale product like the bus (1).	Do not accept repeated justifications. Maximum of 4 marks for responses that give valid advantage and explanation, without specific link to the requirements for the bus and/or commercial production.	**(6)**

Question number	Answer	Additional guidance	Mark
4(a)(i)	A description of the process that makes reference to: • the screwdriver bits are heated up to around 900 °C/red hot/cherry red/critical temperature (1) and then quenched/cooled fast in water/oil (1).	Do not accept a general term of heating and cooling.	**(2)**

Question number	Answer	Mark
4(a)(ii)	An explanation that includes identification of a reason (1) and linked justifications of that reason (1) + (1). • As a result of hardening, the bits will become brittle (1) and tempering will make the screwdriver bits tough enough for use/reduces brittleness to the level required for the screwdriver bits (1), which means when they are subjected to forces they are less likely to break/shatter (1).	**(3)**

Question number	Answer	Additional guidance	Mark
4(b)(i)	A calculation that includes: (7 + 8 + 10 + 13 + 18 + 26 + 31 + 34 + 36 + 37) × 2 + 38 (sample is a symmetrical bell curve) = 478 (1) 478 × 0.9 = 430 (1)	Accept alternative methods of correct working out. Error carried forward should be applied. Award full marks for correct answer only.	**(2)**

Question number	Answer	Additional guidance	Mark
4(b)(ii)	A calculation that includes: Range of hand-grip sizes = 74 − 34 = 40 (1) 40 × 0.05 = 2 (1) 34 + 2 = 36 and 74 − 2 = 72 (1)	Accept alternative methods of correct working out. Error carried forward should be applied. Award full marks for correct answer only.	**(3)**

Question number	Answer	Mark
4(c)	An explanation that includes identification of a benefit (1) and linked justification of that benefit (1). • It will protect their design/feature/concept so no one else can copy it (1), therefore it is potentially worth more money/the inventor will have time to develop it/it will give the designer more recognition (1).	**(2)**

Question number	Indicative content	Mark
4(d)	**AO3 1a = 3 marks, AO3 1b = 6 marks** This question asks candidates to evaluate the choice to use injection moulding as a method of manufacture in the context of a drill body. Candidates should analyse the product in order to weigh up the potential advantages and disadvantages of injection moulding and give reasoned justification to qualify their judgements and conclusion. Candidates might refer to the following in their responses: • the drill body has a thin wall section/complex shape and profile • the body will be required in high volume • the design requires cores/bushes/inserts/ components/fastenings. • a range of colours can be offered • cost of mould/skilled labour required • speed of production • energy costs • environmental influences. Expansion that can be used to justify judgments relating to positive or negative points: • the form can be achieved with a highly complex mould • does not need any additional surface finishing • injection moulding process is capable of delivering the product to consistent level of quality time after time/suitable for high volume/the body will need to fit other components so must be same every time • cores/inserts/components/fastenings can easily be moulded into the drill body, which allows it to be produced in one process • the initial cost of the mould is expensive, requiring high volume to recoup costs • colour can be changed without need for additional moulds • a fast process allowing rapid volume production • the level of detail and craftsmanship/knowledge required to make the mould is expensive/limited number of people capable • if the process is 24/7 then it is more efficient than a costly start-up period each day, but this has to be weighed against 24/7 labour costs • ambient temperature/viscosity changes/mould temperature variations are all factors that can have an adverse effect on the moulding process and need careful monitoring/environmental control systems.	(9)

Level	Mark	Descriptor
	0	No rewardable content
Level 1	1–3	• Applies a basic understanding to deconstruct information, making limited connections between concepts. • Incomplete evaluation with unresolved conclusion that demonstrates limited synthesises of understanding. • Judgements are tentatively supported by evidence.
Level 2	4–6	• Applies a competent understanding to deconstruct information and provide some clear connections between concepts. • Imbalanced evaluation that synthesises some relevant understanding into a generally coherent conclusion. • Judgements are occasionally supported by relevant evidence.
Level 3	7–9	• Applies a thorough understanding to deconstruct information and provides logical connections between concepts throughout. • Balanced evaluation that synthesises relevant understanding into a well-developed conclusion. • Judgements are supported by relevant evidence throughout.

Question number	Answer	Mark
4(e)	Award **one** mark for each of the following stages of the process: • compile a list of all activities/work breakdown structure (1) • work out the length of time/duration required for each activity (1) • determine the relationships/links between the activities (1) • determine specific points of time in the process/milestones/deliverable items (1).	**(4)**

Question number	Answer	Additional guidance	Mark
5(a)	Any **two** requirements stated from: • products must take account of the description of the goods/do what it says it will do (1) • products must meet a specified standard (1) • the price of the products must be appropriate/relevant (1).	Accept any other correct requirement of the Consumer Rights Act 2015 or later which relate to the purchase or use of the scooter.	**(2)**

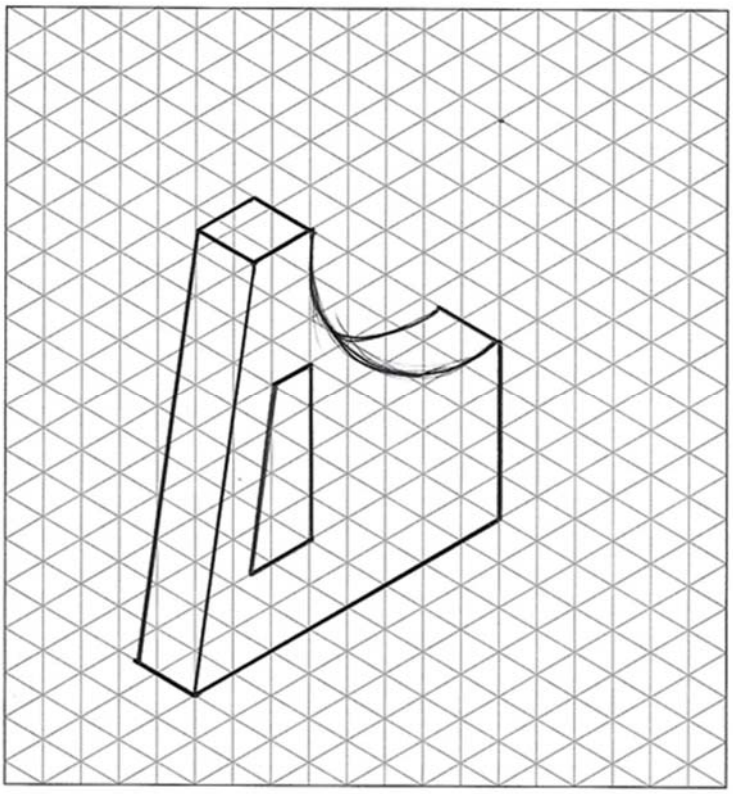
Question number	Answer	Mark
5(b)(i)	Any **two** explanations that include identification of a performance characteristic (1) and linked justifications of that performance characteristic (1) + (1). • Rubber has a high coefficient of friction/does not slip easily (1), which means that it will be very good at gripping surfaces (1), making it safer as you are less likely to slip and fall/slide when braking (1). • Rubber is hardwearing/durable (1), which means it will last longer (1), saving money on replacement tyres/less maintenance/upkeep required (1). • Rubber is flexible/has high elasticity (1), which means it will deform/give as the tyres go over small bumps/stones (1), making the ride much smoother/can be used on a wider range of surfaces (1).	**(6)**

Question number	Indicative content	Mark
5(b)(ii)	**AO4 1b = 3 marks, AO4 1c = 3 marks** This question is about considerations relating to repair versus replacement and asks candidates to discuss this in the context of scooter wheels. Creditworthy responses will make connections which show understanding of factors that need to be considered, going beyond general knowledge. Candidates might refer to the following in their responses: • Durability of materials and the potential frequency of need for replacement or repair in relation to predicted lifespan of the scooter • Expertise and access to tools and equipment required of each option • Availability of and/or compatibility of generic replacement wheels • The environmental impact of each option • Effects on the performance of the product • How the design of the scooter/wheel will be affected by allowing for removal of the wheels by consumers • The potential impact of frequent removal on connected elements/parts of the scooter wheels	**(6)**

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	• Superficial discussion that considers a narrow range of factors, demonstrating limited understanding. • Partial application of understanding to the context of the question.
Level 2	3–4	• Coherent discussion that makes some relevant links between a sufficient range of factors, demonstrating competent understanding. • Generally sound application of understanding to the context of the question.
Level 3	5–6	• Comprehensive discussion that makes effective links between a wide range of factors, demonstrating thorough understanding. • Considered and effective application of understanding to the context of the question.

Question number	Answer	Mark
5(c)	Any **two** benefits given from: • readily available (1) • specification data is already known/predetermined (1) • design decisions are simplified (1) • consumer can source replacements easily/quickly (1) • manufacturer does not need to stockpile/can order in when required (1) • time saved by buying in/not designing and making custom parts/components (1).	**(2)**

Question number	Answer	Additional guidance	Mark
5(d)	A calculation that includes: steps to show: $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ $\theta = \frac{\text{adjacent}}{\text{hypotenuse}} \cos^{-1}$ (1) $\theta = \frac{250}{800} \cos^{-1}$ (1) $\theta = 71.79^{o}$ given to 2 s.f. = 72^{o} (1)	Accept alternative methods of correct working out. Error carried forward should be applied. Award full marks for correct answer only.	**(3)**

Question number	Answer	Mark
5(e)	An isometric drawing that includes an image drawn with a ruler or free hand. Marks to be awarded for the following. Accurate setting out of the straight edges (angles and parallels to create correct shape) (1). Accurate setting out of the curved edge (elliptical not circular) (1). Correct scaling down of all the box dimensions (scale 1 : 10) (1). Correct box dimensions graphically represented (1). Correct window dimensions graphically represented (1). Correct placement of window (1). 	**(6)**

Question number	Indicative content	Mark
6	**AO3 1a = 3 marks AO4 1c = 3 marks, AO3 2c = 3 marks** Candidates should consider the design of the chair, showing understanding and the influence of modernist philosophy and the manufacturing technology of the period. Impacts: • shape • materials • manufacturing techniques • aesthetics • ergonomics • form/function • comfort. Candidates might refer to the following in their responses: • usefulness versus beauty/form is led by function • beautiful/artistic design for the masses • liberal upsurge in experimentation with art forms • 'total' work of art in which all arts could be brought together • heavy steel industry available for manufacture • use of new materials (steel tube) of the time was characteristic of the modernist style • mass production allowed beautiful design at a reasonable/affordable cost • rise of consumer products/standardised parts/exposed steel • new processes such as chroming allowed new/different finished to be applied • automation allowed processes to be completed more accurately and at a higher speed • new manufacturing techniques allowed new sections of material (e.g. tubing) to be produced, which led to an ability to form new shapes with less material but equal/sufficient strength.	**(9)**

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–3	• Applies a basic understanding to deconstruct information, making limited connections between concepts. • Partial application of understanding of technical factors to the context of the question. • Partial application of understanding of design theory to the context of the question.
Level 2	4–6	• Applies a competent understanding to deconstruct information and provide some clear connections between concepts. • Generally sound application of understanding of technical factors to the context of the question. • Generally sound application of understanding of design theory to the context of the question.
Level 3	7–9	• Applies a thorough understanding to deconstruct information and provides logical connections between concepts throughout. • Considered and effective application of understanding of technical factors to the context of the question. • Considered and effective application of design theory understanding to the context of the question.

Question number	Answer	Mark
7(a)	Any **three** explanations that include identification of a valid feature (1) and linked justifications of that feature (1) + (1). • The phone is thin (1) as developments in battery technology have allowed the miniaturisation of the battery pack (1) while maintaining battery life/reducing weight/less bulky to carry (1). • Increased functionality/storage capacity features, e.g. camera, torch, pay scan, etc. (1) due to miniaturisation of electronics (1) so the consumer can use it for a greater range of tasks/store more data, pictures, videos, music, games, etc. (1). • Smart materials have been used to develop the colour LCD screen (1) enabling clear/detailed/high-quality images (1), resulting in increased consumer appeal. • Smart material is used in the piezo-electric transducers (1), enables reasonable quality sound/music without the use of bulky speakers (1) so consumers can access their music anywhere (1). • The development of touch screen technology (1) has reduced the need for physical buttons/keyboards on the phone (1), allowing improved looks, clean aesthetic lines/leading to easier use of the phone /improved ergonomics (1).	**(9)**

Question number	Answer	Additional guidance	Mark
7(b)	Any **three** explanations that include identification of a valid impact (1) and linked justifications of that impact (1) + (1). • The increasing functionality of phones makes some tasks become more convenient/ easier/quicker for people to carry out, e.g. scan pay, communication, etc. (1), which saves people time (1) and allows them to carry out an increasing number of tasks 'on the go'/where ever they are (1). • Society is wealthier (1) as obsolescence causes consumers to continually replace out-dated/broken phones (1), which maintains employment levels in related industries (1). • Further encourages our 'throw away' society (1) as people are encouraged to discard fully functional phones for up-to-date models (1), causing people to value products less/compounding sustainability issues/ landfill/resource depletion, etc. (1). • Increased levels of dissatisfaction/depression/ debt (1) as some people can't afford to keep updating their phones (1) so feel rejected/ isolated/mocked by peers (1). • People lose social skills (1) as the lure of phones means people talk less when together (1), so people are less able to handle disagreement or confrontation appropriately/ become more inward looking/defensive/selfish (1). • Increasing communications technology increases the risk of threats to privacy (1), leading to people being inundated with unwanted information (1) and increasing levels of cyber bullying/new forms of criminal activity, etc. (1)	Accept rationalised negative alternatives to the positives stated in the mark scheme and vise versa. **Do not reward** explanation of environmental or economic impacts unless directly justified in terms of their social impact.	**(9)**

Question number	Indicative content	Mark
8	**AO3 1a = 4 marks, AO3 1b = 8 marks** This question asks candidates to evaluate the choice to use a transparent collection tube in the design of a vacuum cleaner. Candidates should analyse the product in order to weigh up the potential benefits and disadvantages of this design choice and give reasoned justification to qualify their judgements and conclusion. Points of analysis: • being clear impacts the function because you can see: o how full it is o the internal components o if it is working • being clear impacts the design aesthetics because: o you can see the internal workings o colour or detail can be used as a feature of the internal components o the overall look of the vacuum is affected by including a transparent element v a fully opaque design. Points of evaluation: • over time could become scratched and dirty, which will distract from the aesthetics • allows a quick visual check to see if the cleaner requires emptying • the visible dirt and dust collection will detract from the overall aesthetics • full level indicator can be included on the plastic tube • allows the user to see the performance of the suction action • fits in with the post-Modernist design aesthetics in terms of being unconventional and displaying the working design/they can be used as part of the aesthetic appeal • some consumers may prefer designs with fewer visible working parts/more traditional aesthetics • suction holes can be easily checked to see if they are blocked/need cleaning • the use of clear plastic may highlight imperfections during manufacturing • the transparent material will have an increased impact on the cost.	**(12)**

Level	Mark	Descriptor
	0	No rewardable material
Level 1	1–3	• Applies a basic understanding to deconstruct information, making limited connections between concepts. • Incomplete evaluation with unresolved conclusion that demonstrates limited synthesis of understanding. • Judgements are tentatively supported by evidence.
Level 2	4–6	• Applies a generally sound understanding to deconstruct information and provide some clear connections between concepts. • Imbalanced evaluation that synthesises some relevant understanding into a generally coherent conclusion. • Judgements are occasionally supported by relevant evidence.
Level 3	7–9	• Applies an effective understanding to deconstruct information and provide logical connections between concepts. • Balanced evaluation that synthesises relevant understanding into a considered conclusion. • Judgements are mostly supported by relevant evidence.
Level 4	10–12	• Applies a comprehensive understanding to deconstruct information and provides insightful connections between concepts throughout. • Thorough and balanced evaluation that synthesises relevant understanding into a well-developed conclusion. • Judgements are supported by pertinent evidence throughout.

edexcel

For information about Edexcel, BTEC or LCCI qualifications
visit qualifications.pearson.com

Pearson Education Limited. Registered in England and Wales No. 872828
Registered Office: 80 Strand, London WC2R 0RL
VAT Reg No GB 278 537121

ISBN 978-1-4469-3318-3