

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

C600U10-1



S24-C600U10-1



TUESDAY, 18 JUNE 2024 – MORNING

DESIGN AND TECHNOLOGY

Component 1

DESIGN AND TECHNOLOGY IN THE 21st CENTURY

2 hours

ADDITIONAL MATERIALS

You will need basic drawing equipment, coloured pencils and a calculator for this examination.

Section A

Section B

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	10	
2.	10	
3.	15	
4.	20	
5.	20	
6.	25	
Total	100	

C600U101
01

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer questions 1 to 5 and any **one** question 6.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

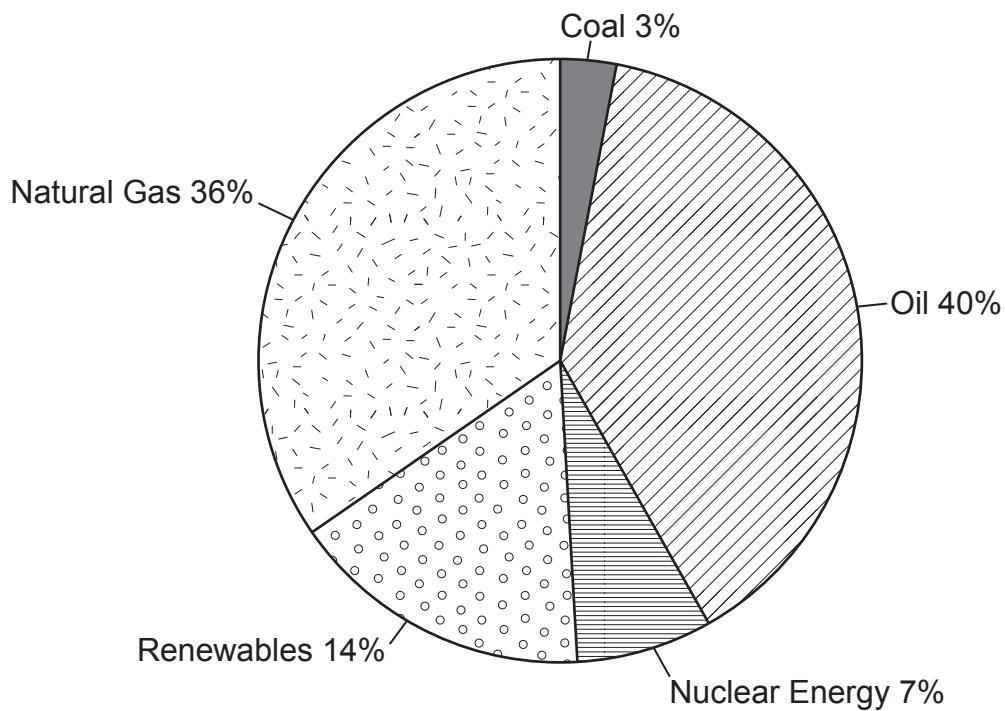


JUN24C600U10101

SECTION AAnswer **all** questions

This question is about Design and Technology and our world.

1. (a) The pie chart below shows the United Kingdom's (UK's) energy consumption by fuel type.

UK Energy Consumption by Fuel Type

- (i) State the least consumed fuel type.

[1]

- (ii) Calculate the total percentage of non-renewable energy sources consumed.
Show all workings.

[3]



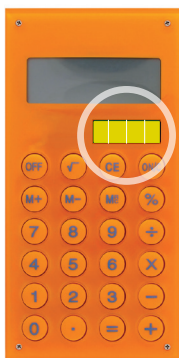
- (iii) Give **one** reason why the UK needs to decrease its use of oil as an energy source.

[1]

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- (b) The products shown below use photovoltaic (PV) cells to function.



- (i) Describe how the photovoltaic cells works.

[2]

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- (ii) Explain why products with small photovoltaic cells have not been popular with consumers.

[3]

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This question is about materials technology.

2. (a) The products below are made with a breathable and waterproof membrane material.



- (i) State **one** reason why these products need to be breathable.

[1]

- (ii) In the space below, draw and label a diagram that shows how the breathable and waterproof membrane material functions.

[4]



- (b) The picture below shows a geotextiles material used for outdoor building construction and maintenance.



- (i) Put a tick (✓) in the table below to indicate whether the following statements are true or false. 2 × [1]

Statement	True	False
Geotextiles can be woven.		
Geotextiles can be made from synthetic and natural materials.		

- (ii) Discuss how geotextiles are benefiting the outdoor and construction industry. [3]

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This question is about electronic systems, programmable components and mechanical devices.

3. (a) The image below is of a modern record player.



- (i) State the type of motion the record will take when being played. [1]

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- (ii) State the meaning of rpm. [1]

R P M

- (iii) Put a tick (✓) in the grid below to indicate which record speed would take longer to play. [1]

	33rpm	45rpm
Record		

- (iv) Calculate the number of times a 45rpm record will rotate in 4 minutes. Show all workings. [2]

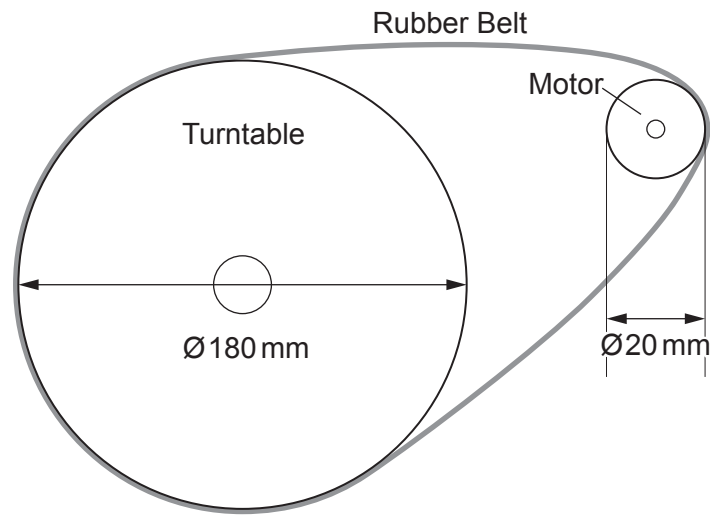
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- (b) The image below is of the record player's pulley and belt drive.



- (i) Calculate the velocity ratio of the driven pulley.
Show all workings.

[2]

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- (ii) Describe the differences between a simple gear train and a pulley and belt drive.

[4]

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- (c) Technology push and market pull help product development.

Discuss why products that download or stream music have increased in popularity over recent years. [4]

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This question is about materials.

4. (a) The image below shows a child's puzzle made from a laminated board.



- (i) Describe how a laminated board is formed.

[2]

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- (ii) Explain, using an example, how the aesthetics of the puzzle can be improved. [2]

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- (b) The images below show a cuff bracelet made from aluminium with a decorative finish applied.



- (i) Identify **two** properties that make aluminium a suitable metal for the cuff bracelet. 2 × [1]

Property 1:

Property 2:

- (ii) Unfinished aluminium can be affected by oxidation. Describe how oxidation affects the appearance of aluminium. [2]

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- (c) The picture below shows two drinking cups made from different polymers.



Polypropylene (PP)

Melamine
formaldehyde (MF)

- (i) Put **one** tick (✓) in the table below to identify whether each polymer is thermoforming or thermosetting.

 $2 \times [1]$

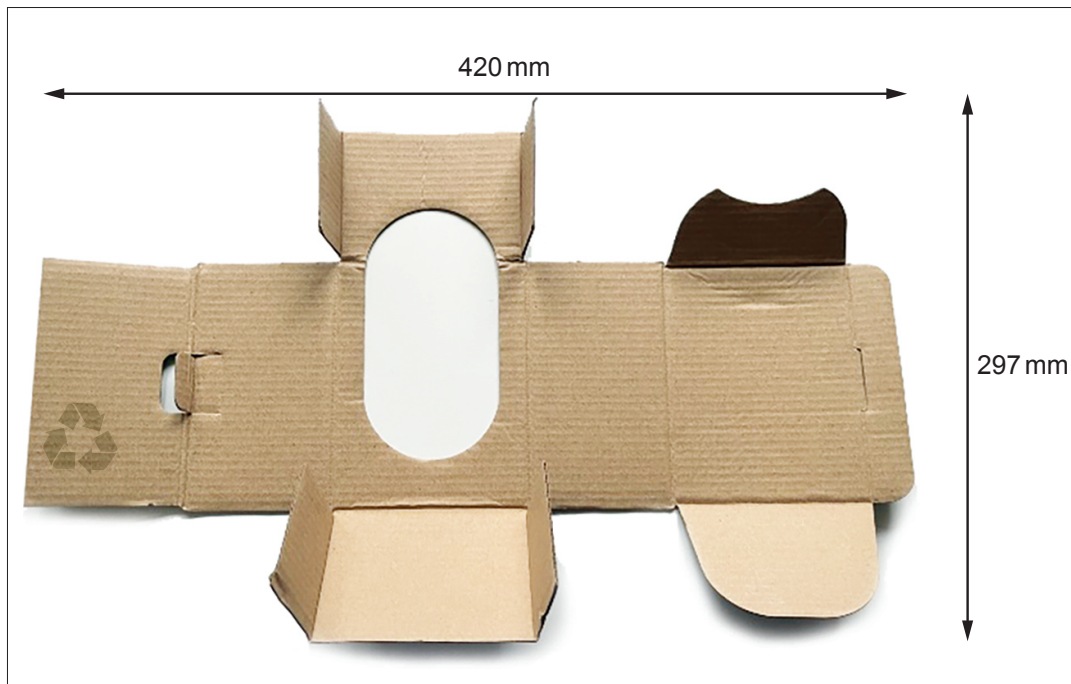
	Thermoforming	Thermosetting
Polypropylene (PP)		
Melamine formaldehyde (MF)		

- (ii) Discuss the properties of polypropylene (PP) and melamine formaldehyde (MF) that make them suitable materials for the drinking cups.

[6]



- (d) The image below shows corrugated cardboard packaging used to store a drinking cup.



- (i) State the correct ISO size the packaging would be cut from. [1]

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- (ii) State the meaning of the logo pictured below that is printed on the packaging. [1]



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- (iii) Describe why corrugated cardboard is a suitable material for the packaging of the drinking cup. [2]

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5. Carefully study the images of kit products below and select **one** kit product to refer to when answering the questions (a) to (c). Place a tick (✓) in the box of your selected product.

		
Fabric sew kit ☐	Cardboard build kit ☐	Plastic build kit ☐
		
Metal build kit ☐	Radio systems build kit ☐	Timber build kit ☐

- (a) (i) State a suitable target market for your selected product.

[1]

- (ii) Describe **two** problems the target market selected in 5(a)(i) above could have when constructing and using the kit product chosen.

2 × [2]

Problem 1:

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Problem 2:

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- (iii) The kit's product designer produced a working drawing.
Describe the information the designer would include in the working drawing. [4]

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- (b) (i) Systems thinking is a creative design strategy.
Describe the importance of systems thinking when improving products. [2]

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- (ii) Analyse how user testing benefits product development. [4]

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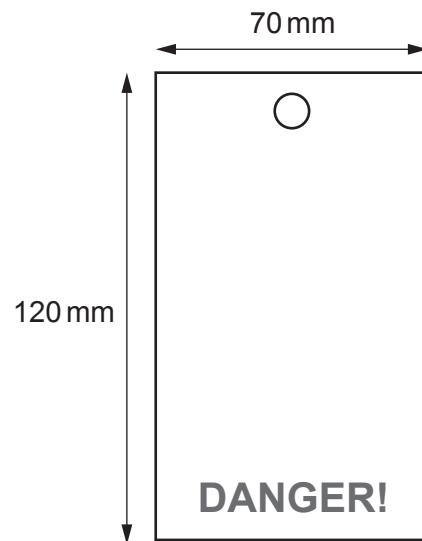
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- (c) The diagram below is of a swing tag that is attached to each of the kit products.



The swing tags are laser cut from card sheets that measure $4\text{ m} \times 2\text{ m}$.
Calculate the maximum number of swing tags that can be cut from 12 card sheets.
Show all workings.

[5]

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SECTION B: OPTIONAL QUESTIONS

Choose **ONE** topic area only.

Place a tick (✓) in **one** of the boxes below to show which topic you are answering.

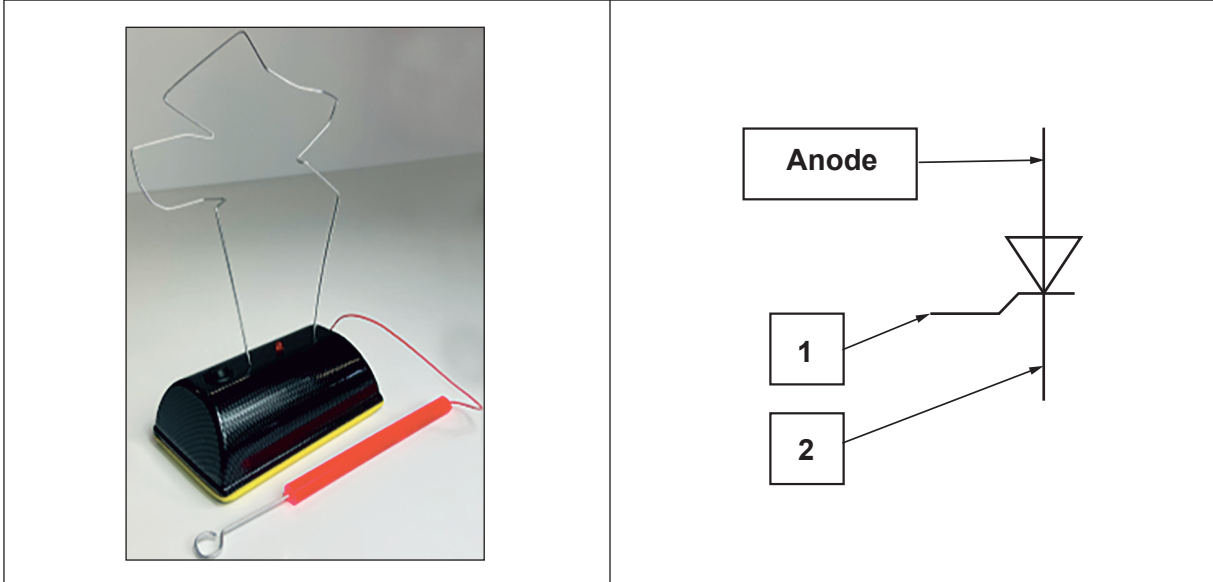
		Pages
Electronic systems, programmable components and mechanical devices	☐	18–21
Papers and boards	☐	22–26
Natural and manufactured timber	☐	28–31
Ferrous and non-ferrous metals	☐	32–35
Thermosetting and thermoforming plastics	☐	36–39
Fibres and textiles	☐	40–43

Now answer all parts of your chosen topic.



6. Electronic systems, programmable components, and mechanical devices.

(a) The picture below shows a steady hand game. The game contains a thyristor circuit.



(i) Give the names of pins labelled 1 and 2 on the thyristor symbol above. $2 \times [1]$

1. 2.

(ii) Describe **one** advantage of using a thyristor in the steady hand game. $[2]$

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- (iii) The image below shows a piece of hand-held equipment used to remove the excess wire from a populated circuit board.



State the correct name of the equipment shown.

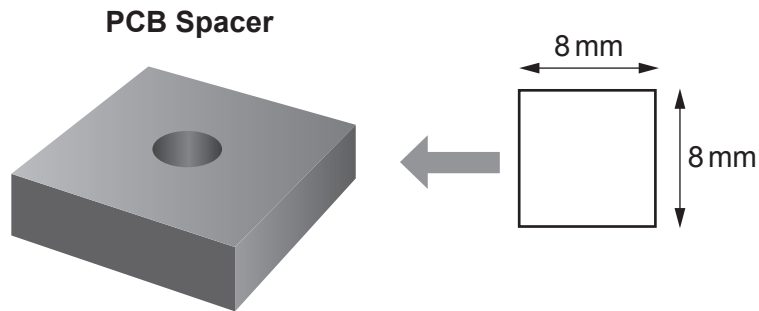
[1]

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- (iv) Precise soldering is important when populating the pre-drilled PCB for the steady hand game. In the space below, use words and sketches to show how a resistor would be soldered onto a circuit board precisely and securely. [4]



- (b) The steady hand game circuit board is lifted from its casing using 4 spacers. The material required for each spacer measures 8 mm^2 .



- (i) Each spacer needs a profile tool path allowance of 1.5 mm. Calculate the length of one spacer with the profile tool path allowance. [1]
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- (ii) The spacers are to be cut from a piece of plastic that is 110 mm wide. Calculate the length of plastic needed to manufacture 200 steady hand game spacers. Show all workings. [4]
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- (c) In commercial manufacture, PCBs are cut using a CNC machine. Analyse the advantages and disadvantages of cutting PCBs using a CNC machine.

[5]

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- (d) Discuss how designers can improve and extend the life of electronic products to lessen their impact on our environment.

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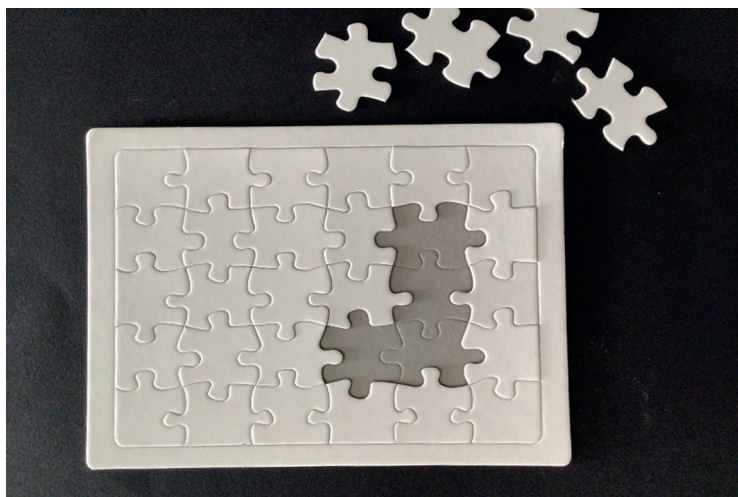
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6. Papers and Boards

- (a) The product below is a blank puzzle for children to design their own pictures or patterns by drawing and colouring them in.



- (i) Papers, boards and card are available in many different types. In the table below, give an example of a paper and a board. 2 × [1]

	Example
Paper	
Board	

- (ii) Papers, boards and card can have surface finishes applied for different purposes. Describe **one** advantage of applying a surface finish on papers, board and card. [2]

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- (iii) The image below shows a piece of hand-held equipment that is used to cut cardboard.



State the correct name of the equipment shown.

[1]

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- (iv) Accuracy is important when cutting cardboard.

In the space below, use words and sketches to show how the puzzle frame pictured below can be marked out and cut precisely and accurately using hand tools and equipment.

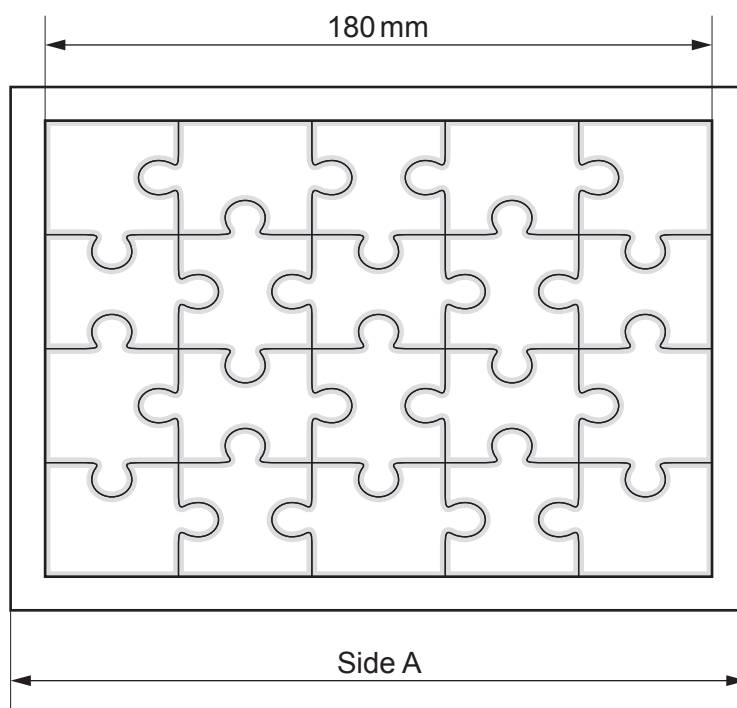
[4]



Blank space for drawing and writing.



- (b) The 20-piece puzzle below fits into a frame that has a 10 mm border.

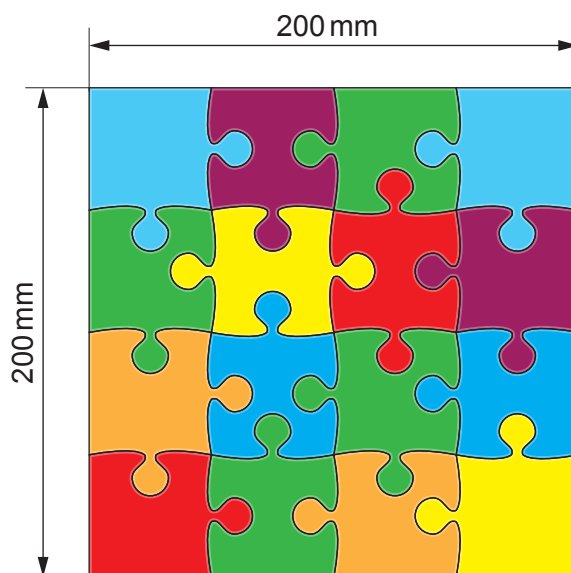


- (i) Calculate the length of side A on the diagram.

[1]



- (ii) A die cutter is used to cut the 16-piece puzzle below from a cardboard roll. The cardboard roll is 1 metre wide.



Calculate the length of cardboard roll needed to manufacture 500 puzzles in metres.

Show all workings.

[4]

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- (c) In commercial design and manufacture, prototypes of card puzzles may be laser cut. Analyse the advantages and disadvantages of laser cutting card. [5]

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- (d) Discuss how designers can improve and extend the life of papers, boards and card products to lessen their impact on our environment. [6]

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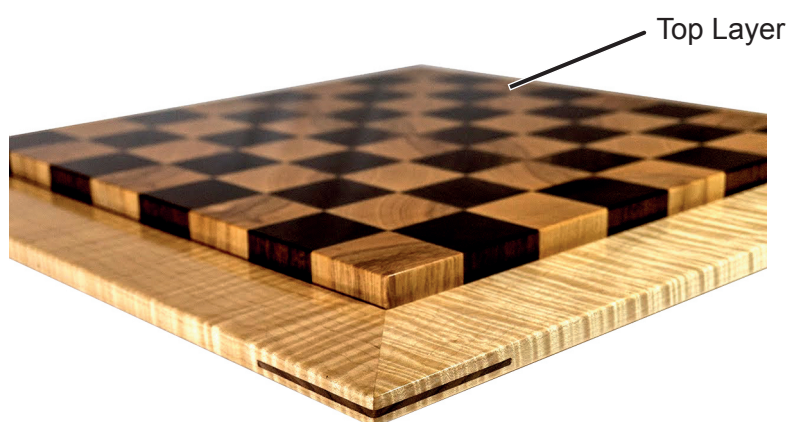
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6. Natural and manufactured timber

- (a) The picture below shows a chessboard.



- (i) The top layer of the chessboard is made from reused hardwoods and softwoods. In the table below, give an example of a hardwood and a softwood. $2 \times [1]$

	Example
Hardwood	
Softwood	

- (ii) Wood fibres can be compressed and glued together to make manmade boards. Other than cost, describe **one** advantage of using manmade boards. [2]

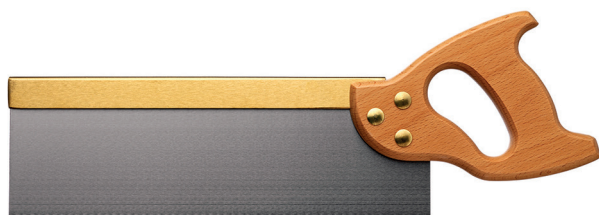
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- (iii) The image below shows a piece of hand-held equipment used to cut the wooden squares of the chessboard.



State the correct name of the equipment shown.

[1]

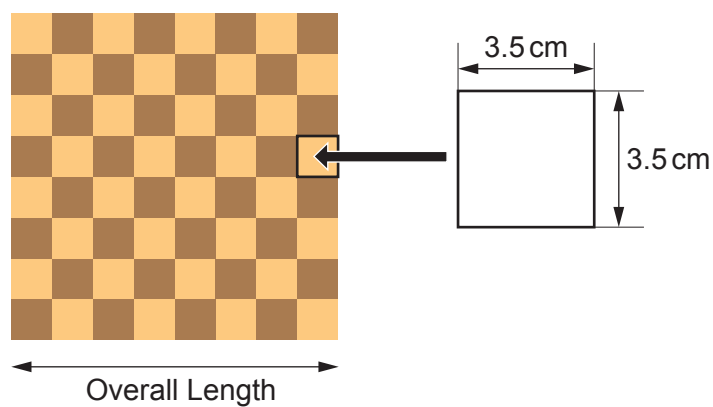
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- (iv) Precise construction is important when producing the chessboard. In the space below, use words and sketches to show how the chessboard's top layer is constructed.

[4]

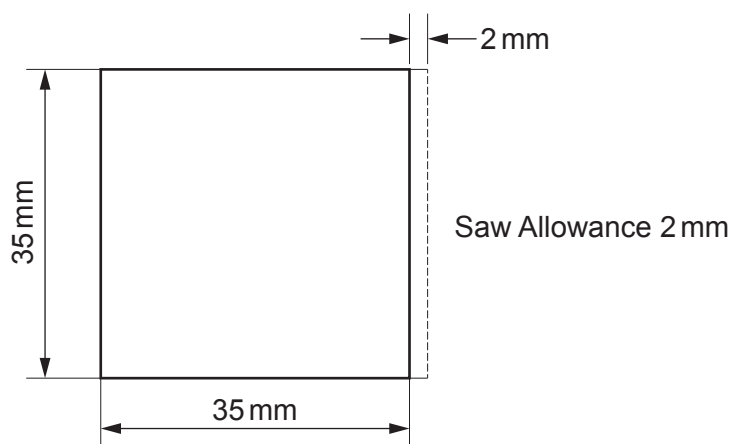


- (b) The chessboard is made from 64 equally sized squares of wood. The sides of each wooden square measures 3.5 cm.



- (i) Calculate the overall length of the chessboard. [1]

- (ii) The squares of the chessboard are cut from lengths of wood that are 3.5 cm wide. An allowance of 2 mm needs to be included for the saw blade.



Calculate the total length of hardwood and softwood needed to manufacture 25 chessboards.
Show all workings

[4]



- (c) In commercial manufacture, timbers can be laser cut. Analyse the advantages and disadvantages of laser cutting timbers. [5]

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- (d) Discuss how designers can improve and extend the life of wooden products to lessen their impact on our environment. [6]

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6. Ferrous and non-ferrous metals

(a) The chess set shown below includes chess pieces manufactured from recycled metals.

- (i) The metals used for the chess pieces are made from ferrous and non-ferrous metals. In the table below, give an example of a ferrous and a non-ferrous metal.

2 × [1]



	Example
Ferrous	
Non-ferrous	

- (ii) Metals can be combined to produce an alloy. Describe **one** advantage of using an alloy. [2]

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- (iii) The image below shows a piece of machinery used to manufacture the chess pieces.



State the correct name of the machine shown.

[1]

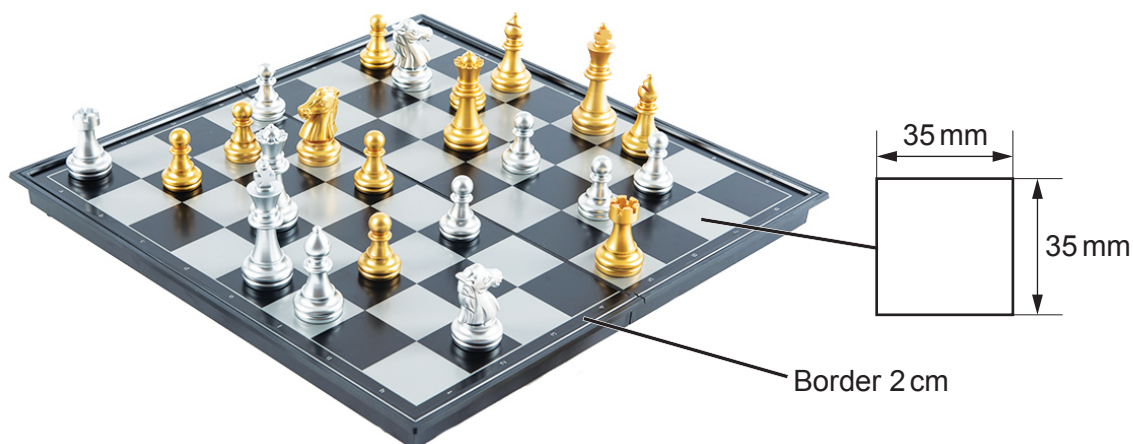
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- (iv) Precise construction is important when producing chess pieces. In the space below, use words and sketches to show how one of the chess pieces could be manufactured using the machine shown. [4]



- (b) The chessboard is made from 64 equally sized squares. The sides of each square measure 3.5 cm. There is also a 2 cm border around the edge of the board.



- (i) The chessboard is fixed together to make a complete chessboard. Calculate the length of the chessboard including the frame. [1]

- (ii) The chess pieces will be manufactured from a length of metal rod. The 16 small chess pieces each require 3 cm of rod and the 16 larger pieces each require 5 cm of rod. An allowance of 35 mm is required for each piece.

Calculate the total length of metal rod needed to manufacture each set of 32 chess pieces. [4]

Show all workings.



- (c) In commercial manufacture, chess pieces can be CNC machined. Analyse the advantages and disadvantages of CNC machining the chess pieces. [5]

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- (d) Discuss how designers can improve and extend the life of metal products to lessen their impact on our environment. [6]

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6. Thermosetting and thermoforming plastics

- (a) The product pictured below is a stand for a mobile phone.



The phone stand is made from a thermoforming polymer. Polymers can also be classed as thermosetting polymers.

- (i) In the table below, state the name of a thermoforming and a thermosetting polymer. 2 × [1]

	Polymer Example
Thermoforming	
Thermosetting	

- (ii) Thermosetting polymer resins can be combined with fibres. Describe **one** advantage of adding fibres to a thermosetting polymer. [2]

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- (iii) The image below shows a hand-held tool used to shape the edges of sheet polymers.



State the correct name of the equipment shown.

[1]

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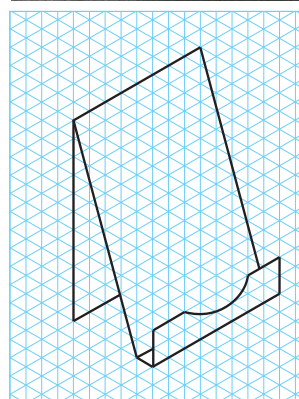
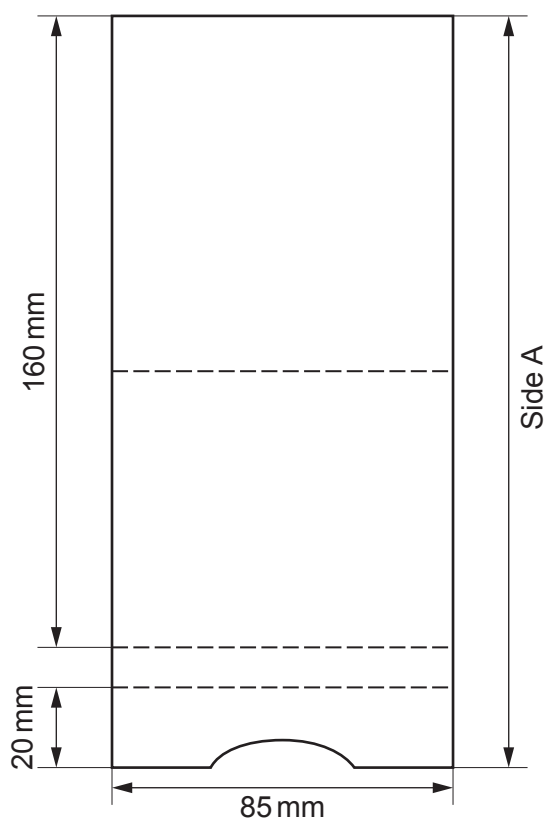
- (iv) Accuracy is important when line bending sheet polymers.

In the space below, use words and sketches to show how the sheet polymer phone stand can be bent precisely and accurately.

[4]



(b) The design of the phone stand is shown below:



The phone stand has been designed to hold a mobile phone with a thickness of 10 mm.

(i) Calculate the length of side A.

[1]

(ii) One sheet of polymer that fits the laser cutter is 600 mm × 600 mm.
Calculate how many sheets would be needed to laser cut 84 phone stands.
Show all workings.

[4]



- (c) In commercial manufacture, sheet polymer products can be laser cut. Analyse the advantages and disadvantages of laser cutting sheet polymers.

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- (d) Discuss how designers can improve and extend the life of polymer products to lessen their impact on our environment.

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6. Fibres and textiles

- (a) The products pictured below have been covered in recycled fabric made from sewn patchwork shapes.



- (i) The fabrics used for the patchwork shapes are made from either synthetic or natural fibres. In the table below, name an example of a synthetic and a natural fibre. 2 × [1]

	Fibre Example
Synthetic	
Natural	

- (ii) Synthetic fibres can be blended with natural fibres. Describe **one** advantage of fibre blending. [2]

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- (iii) The image below shows a piece of hand-held equipment used to cut the fabric patchwork shapes.



State the correct name of the equipment shown.

[1]

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- (iv) Precise sewing is important when producing patchwork fabric. In the space below, use words and sketches to show how two square patchwork shapes would be sewn together precisely and securely.

[4]



- (b) The front of the cushion is made from 16 equally sized squares of sewn fabric. Each square measures 9 cm^2 .



- (i) Each patchwork square needs a seam allowance addition of 1.5 cm.
Calculate the length of **one** patchwork square with seam allowance added. [1]

- (ii) The patchwork squares are to be cut from fabric that is 240 cm wide.
Calculate the length of fabric needed to manufacture 400 patchwork cushion fronts.
Show all workings. [4]



- (c) In commercial manufacture, fabric patchwork shapes are laser cut. Analyse the advantages and disadvantages of laser cutting fabric.

[5]

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- (d) Discuss other ways designers can extend the life of textile products to lessen their impact on our environment.

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