OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

General Certificate of Secondary Education

A544

Design and Technology:
Industrial Technology

Unit A544: Technical aspects of designing and making

Specimen Paper

Time: 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do not write in the bar codes.
- Do not write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- Your Quality of Written Communication is assessed in questions marked with an asterisk (*).
- The total number of marks for this paper is 60.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
TOTAL	

This document consists of **9** printed pages and **3** blank pages.

  [Turn over

Section A

Answer **all** questions.

1 Fig. 1 shows a fixing plate made in the school workshop from 50 x 3 BDMS.

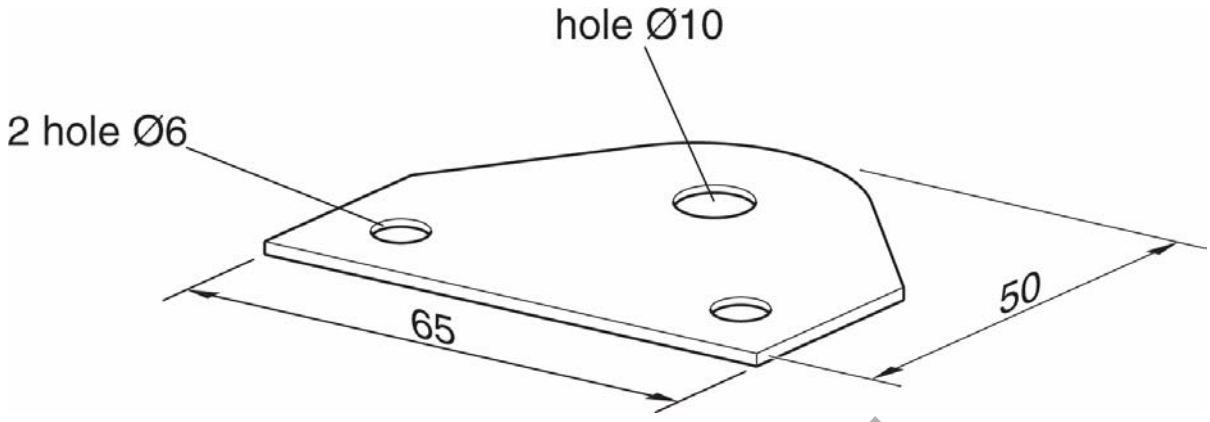
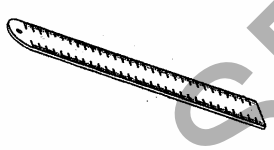
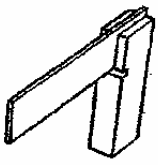
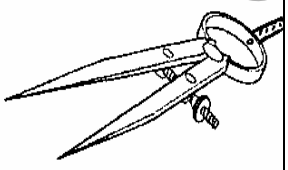
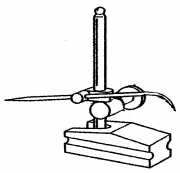


Fig. 1

(a) State what the letters BDMS stand for.

B …… D …… M …… S …… **[1]**

(b) Complete the table below by adding the correct name for each of the marking out tools shown. The first one has been done for you.

Tool	Name	Tool	Name
	Odd legged calipers		
			
			

[5]

(c) **(i)** Name **three** cutting tools you would use in the school workshop to make the fixing plate shown in Fig. 1.

1. ..... **[1]**

2. ..... **[1]**

3. ..... **[1]**

(ii) Give **one** way of removing the sharp edges from the fixing plate after it has been made.

.....

..... **[1]**

(d) Name **two** industrial processes that could be used to produce the fixing plate in large quantities.

1. ..... **[1]**

2. ..... **[1]**

Total [12]

2 Fig. 2 shows a display stand made from 2mm sheet brass.

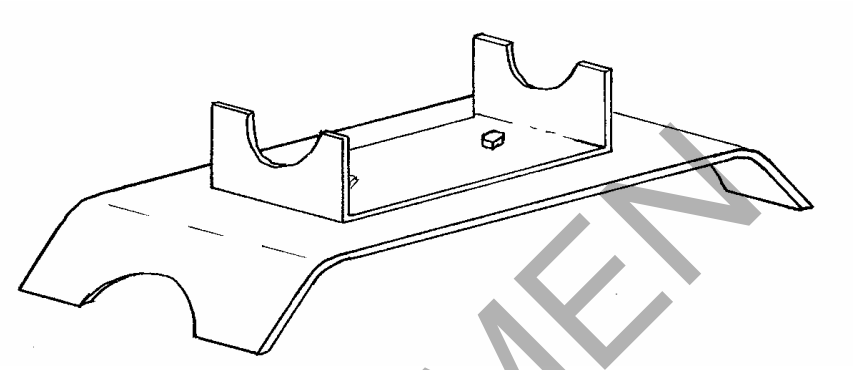


Fig. 2

(a) Brass is described as a non-ferrous alloy.

(i) Explain what is meant by the term “non-ferrous alloy”.

.....

.....

.....

..... **[2]**

(ii) Name and describe the workshop process used to soften the brass before bending the two parts of the display stand into shape.

Name of process ..... **[1]**

Description .....

.....

..... **[2]**

(b) The two parts of the display stand are fixed together using nuts and bolts.

(i) Give **three** pieces of information needed when buying nuts and bolts.

1. ..... **[1]**

2. ..... **[1]**

3. ..... **[1]**

(ii) Name **one** method of preventing nuts from coming loose.

..... **[1]**

(c) The use of nuts and bolts is a **temporary** fixing method.

Name **three** methods of **permanently** fixing the two parts of the display stand together.

1. ..... **[1]**

2. ..... **[1]**

3. ..... **[1]**

Total [12]

3 Fig. 3 shows a belt pulley from the drive mechanism of a model car.

The pulley is to be made on a centre lathe from Ø20 aluminium alloy bar.

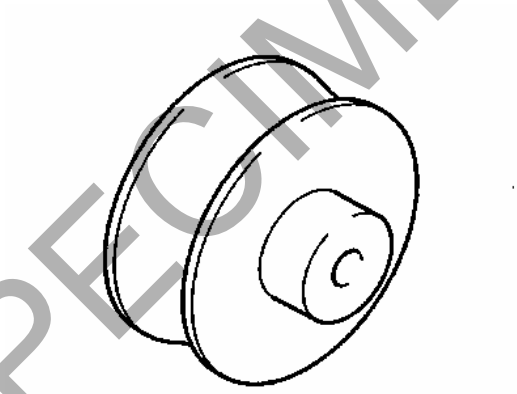
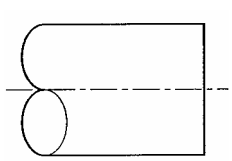
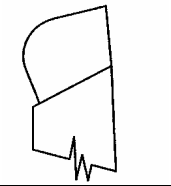
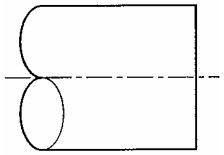
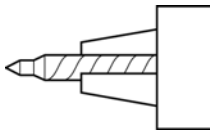
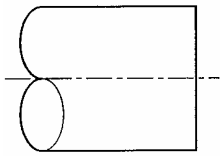
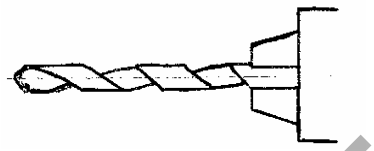
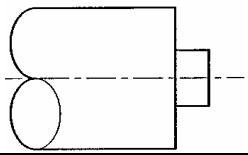
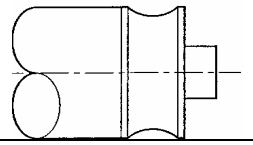
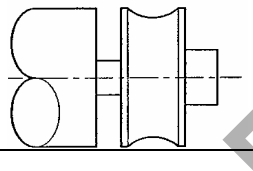


Fig. 3

(a) Give **one** reason why aluminium alloy is a suitable metal for making the pulley.

..... **[1]**

(b) Complete the table below to show the sequence of operations for making the pulley on the centre lathe.

Stage	Tool Shape	Process
		Facing - off
		
		Drilling Ø4 hole
		
		Turning profile of pulley
		

[6]

(c) Describe how the Ø4 hole in the pulley can be produced so that it is smooth and accurately sized.

.....

..... **[2]**

(d) It is decided to mass produce the pulleys in plastic rather than aluminium alloy.

The pulleys could be produced by injection moulding or by turning on a CNC lathe.

Evaluate why injection moulding would be more suitable than CNC turning for mass producing the plastic pulleys.

.....

.....

.....

.....

..... **[3]**

Total [12]

Section B

Answer **all** questions

4 Fig. 4 shows a projector trolley for use in school classrooms

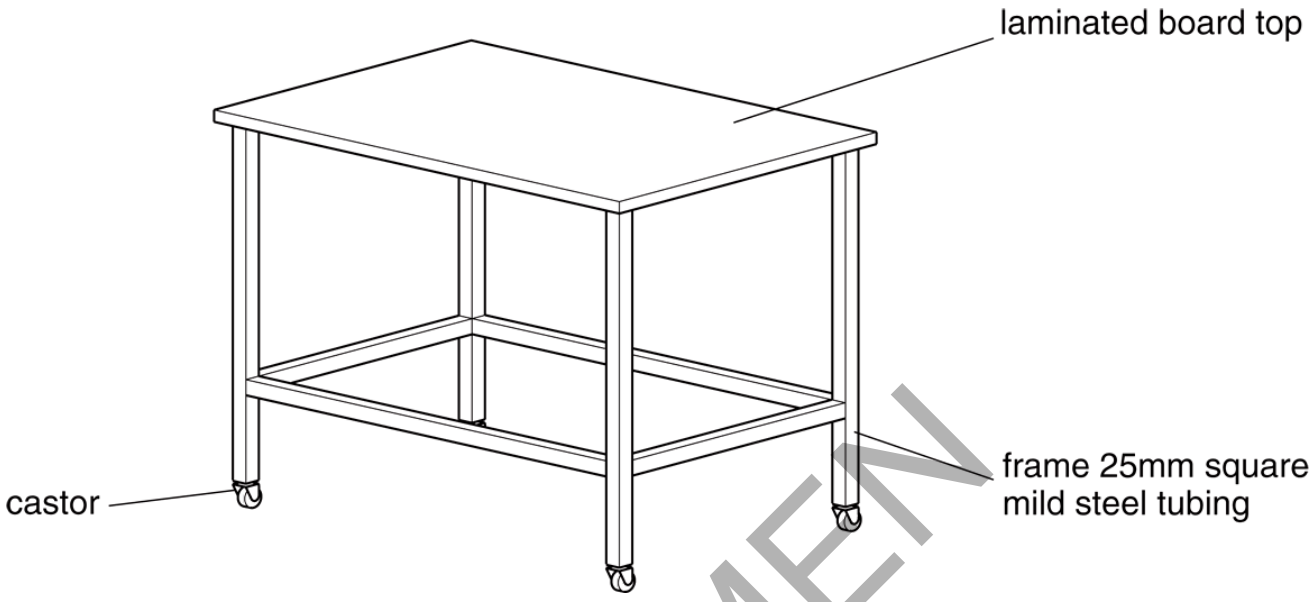


Fig.4

The projector trolley has been designed using CAD.

(a) Give **three** benefits to the designer of using CAD.

Benefit 1.....

..... **[1]**

Benefit 2 .....

..... **[1]**

Benefit 3 .....

..... **[1]**

(b) Describe how a "rapid prototyping" system can be used in the design and development of a new product.

.....

.....

.....

..... … **[3]**

(c) Name **two** suitable processes for joining the parts of the mild steel frame shown in Fig. 4

1. ..... **[1]**

2. ..... **[1]**

(d) Fig. 5 shows the component parts of one of the castors for the trolley. All of the components are made from mild steel.

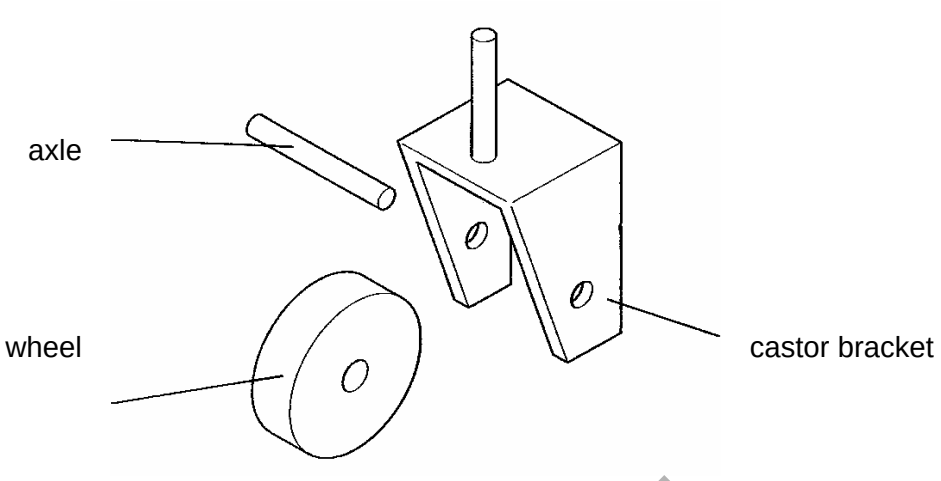


Fig. 5

Use sketches and notes to show how the castor can be completed so that:

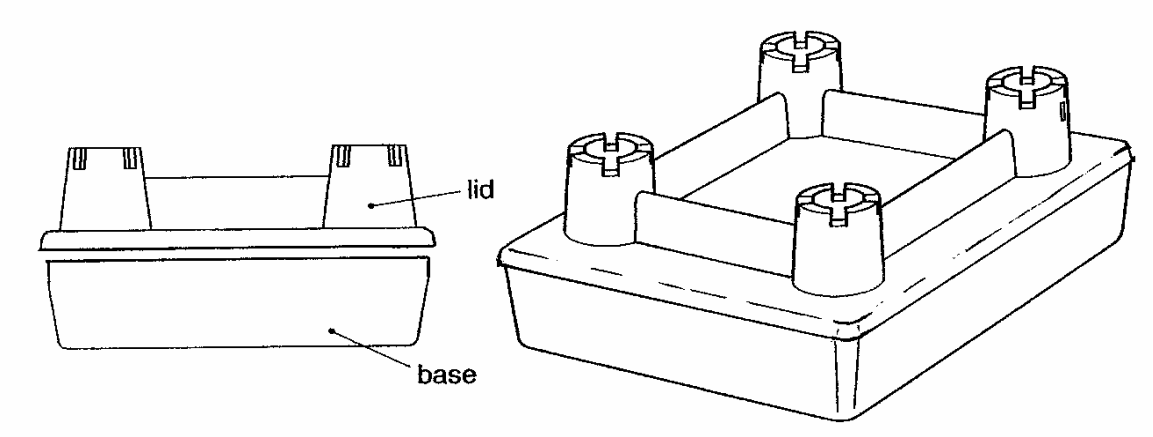
- the wheel runs centrally in the castor bracket and cannot move from side to side;
- the axle is fixed securely in the castor bracket.
- Friction between the wheel and axle is kept to a minimum.

You may add or modify components in your design.

[4]

Total [12]

5 Fig. 6 shows a novelty storage box designed for young children.



(a) Both parts of the box are vacuum formed in 3mm thick High Impact Polystyrene (HIPS).

Give **two** reasons why HIPS is a suitable material for the box.

Reason 1 .....

..... **[1]**

Reason 2 .....

..... **[1]**

(b)* Discuss why the manufacturer has chosen to produce 500 novelty storage boxes using the vacuum forming process.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

Many products are now made using 'Smart' materials.

(c) **(i)** Explain what is meant by the term 'Smart' material.

.....

.....

..... **[2]**

(ii) Describe **one** specific example of how a 'Smart' material has been used in a product.

.....

.....

..... **[2]**

Total [12]

Paper Total [60]

BLANK PAGE

BLANK PAGE

BLANK PAGE

OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

General Certificate of Secondary Education

DESIGN AND TECHNOLOGY A544

INDUSTRIAL TECHNOLOGY

Unit A544: Technical aspects of designing and making

Specimen Mark Scheme

The maximum mark for this paper is **60**.

Section A		
Question Number	**Answer**	**Max Mark**
1(a)	**State what the letters BDMS stand for.** Bright Drawn Mild Steel	**[1]**
(b)	**Complete the table below by adding the correct name for each of the marking out tools shown. The first one has been done for you.** xxxxxxx Scriber (Steel) Rule Try Square Dividers Surface gauge/Scribing block (5x1)	**[5]**
(c)(i)	**Name three cutting tools you would use in the school workshop to make the fixing plate shown in Fig. 1.** hacksaw; bench shear; file; drill; laser cutter (3x1)	**[3]**
(ii)	**Give one way of removing the sharp edges from the fixing plate after it has been made.** emery cloth; linisher; smooth file	**[1]**
(d)	**Name two industrial processes that could be used to produce the fixing plate in large quantities.** presswork/stamping; laser cutting (2x1)	**[2]**
2(a)(i)	**Explain what is meant by the term "non-ferrous alloy".** Explanation to include reference to mixture of metals (1) no iron content (1)	**[2]**
(ii)	**Name and describe the workshop process used to soften the brass before bending the two parts of the display stand into shape.** Annealing Heat to (dull) red (1); leave to cool(1) (2x1)	**[3]**
(b)(i)	**Give three pieces of information needed when buying nuts and bolts.** material; thread; length; head; quantity (3x1)	**[3]**

Question Number	Answer	Max Mark
(ii)	**Name one method of preventing nuts from coming loose.** thread sealant/loctite; locking/spring washer; lock nuts; self locking/nyloc nut	[1]
(c)	**Name three methods of permanently fixing the two parts of the display stand together.** riveting; (soft) soldering; silver/hard soldering; brazing (3x1)	[3]
3(a)	**Give one reason why aluminium alloy is a suitable metal for making the pulley.** Candidate evaluates the product to identify lightness; easy to form/machine; corrosion resistant	[1]
(b)	**Complete the table below to show the sequence of operations for making the pulley on the centre lathe.** xxxxxxxxxxx centre drilling xxxxxxxxxxx xxxxxxxxx knife edge/acute angled cutting tool turn down (boss) to size round nose/forming tool xxxxxxxxx parting tool parting off (6x1)	[6]
(c)	**Describe how the Ø4 hole in the pulley can be produced so that it is smooth and accurately sized.** Description to include drilling undersize (1) and use of reamer (1)	[2]
(d)	**Evaluate why injection moulding would be more suitable than CNC turning for mass producing the plastic pulleys.** Shows limited understanding of injection moulding and CNC turning [0-1 mark] Shows some understanding of injection moulding and CNC turning with some analysis of the suitability. Basic conclusion may be drawn. [2 marks] Shows detailed understanding of injection moulding and CNC turning and analyses most of the issues concerning suitability. Appropriate conclusions are drawn. [3 marks]	

Question Number	Answer	Max Mark
	Evaluation may include reference to: material wastage from machining; higher level of production; multi-impression moulds; faster; material costs involved; initial set up expensive.	[3]

Section B		
Question Number	**Answer**	**Max Mark**
4(a)	**Give three benefits of using CAD when designing products.** ability to make changes easily; ability to save and share drawings; animation/2D modeling; potential to apply to CAM/3D modeling; can be done anywhere (laptop/PDA); no hard copy needed (3x1)	**[3]**
(b)	**Describe how a "rapid prototyping" system can be used in the design and development of a new product.** Description to include reference to importing CAS design (1) to rapid prototyping m/c and process (rapid-pro; stereolithography; 3D printing) used (1) to produce a 3D model of product. (1)	**[3]**
(c)	**Name two suitable processes for joining the parts of the mild steel frame together.** Brazing/Hard Soldering Welding (2x1)	**[2]**
(d)	**Use sketches and notes to show how the castor can be completed so that:** • **the wheel runs centrally in the castor bracket and cannot move from side to side;** • **the axle is fixed securely in the castor bracket.** • **friction between the wheel and axle is kept to a minimum.** **You may add or modify components in your design.** spacers/sleeves/bushes; washers and pins/circlips; (for centralising) (1) threads, nuts and washers; circlips/split pins; (for securing) (1) use of bearing race; self lubricating or lubricated plain bush; (1) suitable sketching and annotation (1)	**[4]**

Question Number	Answer	Max Mark
5(a)	**Give two reasons why HIPS is a suitable material for the box.** Candidate evaluates the use of the storage boxes in order to identify: impact resistant therefore safe in use; self colour/no paint needed therefore safe in use; thermoplastic therefore easy to mould into complex shapes; (2x1)	**[2]**
(b)*	**Discuss why the manufacturer has chosen to produce 500 novelty storage boxes using the vacuum forming process.** Level 1 (0-2 marks) Shows limited understanding of vacuum forming and why the manufacturer would have chosen this process. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised. Errors of grammar, punctuation and spelling may be intrusive. Level 2 (3-4 marks) Shows some understanding of how effective vacuum forming could be when manufacturing products in such quantities with some analysis of the issues involved. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation Level 3 (5-6 marks) Shows detailed understanding of how effective vacuum forming could be when manufacturing products in such quantities and analyses most of the issues involved. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar. Discussion may include consideration of the following issues: • Speed of process/output • Minimal waste • Set up costs relatively low • Mould can be made from easily shaped materials • Relatively quick to re-tool for different products • Product design limited to shape with no under cuts • Must be able to be formed from a flat sheet of material • Surface definition not as precise as other plastic moulding processes eg injection moulding	**[6]**

Question Number	Answer	Max Mark
(c)(i)	**Explain what is meant by the term 'Smart' material.** Explanation to include reference to the reaction of a material (1) used and the effect produced in a specific product (1)	**[2]**
(ii)	**Describe one specific example of how a 'Smart' material has been used in a product.** Description to include reference to the 'Smart' material (1) used and the effect produced in a specific product (1)	**[2]**
	Paper Total	**[60]**

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)	1			**1**
1(b)	5			**5**
1(c)(i)	3			**3**
1(c)(ii)	1			**1**
1(d)	2			**2**
2(a)(i)	2			**2**
2(a)(ii)	3			**3**
2(b)(i)	3			**3**
2(b)(ii)	1			**1**
2(c)	3			**3**
3(a)	1			**1**
3(b)	6			**6**
3(c)	2			**2**
3(d)			3	**3**
4(a)	3			**3**
4(b)	3			**3**
4(c)	2			**2**
4(d)	4			**4**
5(a)	2			**2**
5(b)*			6	**6**
5(c)(i)	2			**2**
5(c)(ii)	2			**2**
Totals	**51**		**9**	**60**