



General Certificate of Secondary Education

Centre Number

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Candidate Number

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Engineering and Manufacturing

Unit 3
assessing
Materials, Processes and Systems



GEM31

[GEM31]

Assessment

TIME

2 hours.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all eleven** questions.

Answer **all** questions in Sections **A** and **B**.

Questions 1, 2, 3, 4 and 5 of Section A refer to the pre-release material, a copy of which has been provided for you.

You may use a calculator for this paper.

Quality of written communication will be assessed in Question 5.

INFORMATION FOR CANDIDATES

The total mark for this paper is **100**.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each part question.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Total Marks	
--------------------	--

(d) A one-off sample of the lighting system cover is manufactured using a machine similar to that shown in **Fig. 2**.

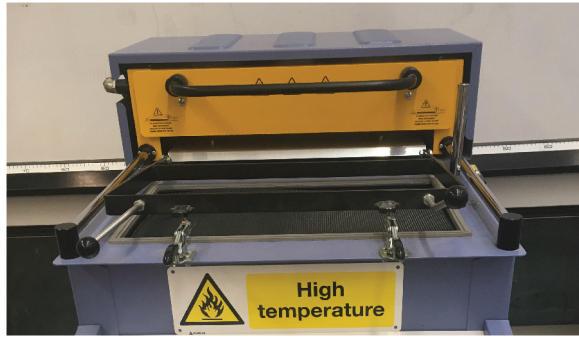


Fig. 2

(i) State the name of the process that uses the machine shown in **Fig. 2**.

_____ [1]

(ii) State **one** reason, other than cost, why this is a suitable method to manufacture the acrylic lighting system cover.

_____ [1]

Examiner Only	
Marks	Remark

(ii) Name **two** tools that can be used to check that the outside diameter of the tubing is within tolerance.

1. _____ [1]

2. _____ [1]

(iii) State **one** reason why tolerances are used in manufacturing.

_____ [1]

Examiner Only	
Marks	Remark

- 3 (a) The manufacturer of the bicycle trailer employs 12 employees at a cost of £80 each per day. Calculate the total weekly labour costs for five days.

Show your working out in the space below.

Answer _____ [2]

Examiner Only	
Marks	Remark

(c) It costs £18400 to manufacture 46 trailers.

What is the selling price of each trailer to achieve a 20% profit?

Show your working out in the space below.

Answer £ _____ [3]

(d) The company uses a 1.2 m length of tubular low carbon steel instead of a 1.2 m length of solid low carbon steel. **Fig. 4** shows a tubular cross-section and **Fig. 5** shows a solid cross-section.

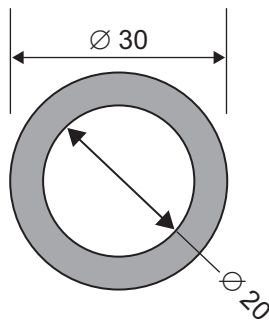


Fig. 4

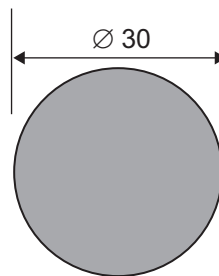


Fig. 5

(Not to scale)

Note: All units are in mm

Calculate the reduction in material volume between the tubular and solid low carbon steel for a 1.2 m length.

Show your working out in the space below.

Answer _____ mm³ [2]

Examiner Only	
Marks	Remark

- (e) The 1.2 metre lengths of tubular low carbon steel need to be cut into 115 mm pieces before shaping.

What is the length of the tubing left over at the end of the cutting process when using a saw with a blade thickness of 2.4 mm?

Show your working out in the space below.

Answer _____ mm [3]

Examiner Only	
Marks	Remark

- 4 **Fig. 6** shows the handle of the bicycle trailer which is used to push the trailer when it is detached from the bicycle.



Adjustable
foam
covered
handle

© Getty Images

Fig. 6

In the space provided, use 2D, assembly and exploded annotated sketches, with appropriate terminology, show how the handle could be adjusted and secured in place to suit different heights of users.

Marks will be awarded for:

Detail contained in the sketches

Quality of sketches

Annotation

[4]

[4]

[4]

Examiner Only	
Marks	Remark

Show your response to Question 4 in the space below.

Examiner Only

Marks Remark

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(Questions continue overleaf)

Section B

Examiner Only	
Marks	Remark

- 6 (a) State the name of the activation methods used for Valve A and Valve B shown in Fig. 7.

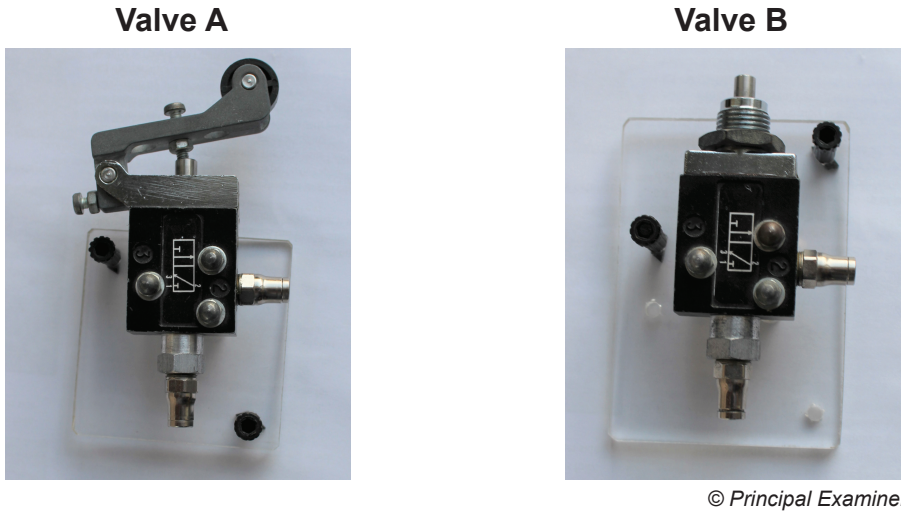
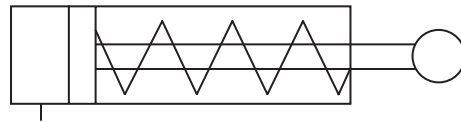


Fig. 7

Valve A _____ [1] Valve B _____ [1]

- (b) State the name of the pneumatic component represented by the symbol shown in Fig. 8.



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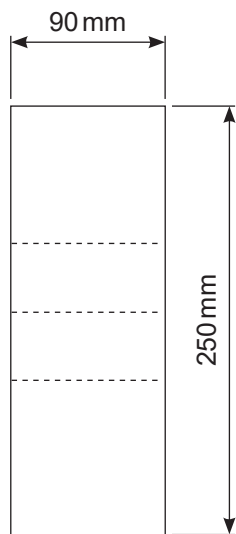
Fig. 8

_____ [1]

- (c) Explain the function of a shuttle valve in a pneumatic circuit.

_____ [2]

(c) Fig. 9 shows a piece of acrylic which is to be made into a mobile phone holder.



Model of mobile phone holder



© Principal Examiner

Fig. 9

- (i) Calculate the maximum number of pieces of acrylic that could be cut from a 600 mm by 1200 mm sheet of acrylic.

Show your working out in the space below.

Answer _____ [4]

Examiner Only	
Marks	Remark




- (ii) The piece of acrylic shown in **Fig. 9** is cut from an acrylic sheet which measures 600 mm by 1200 mm. Calculate the area of the acrylic sheet.

Answer _____ mm² [1]

Examiner Only	
Marks	Remark

- 9 (a) Complete **Table 2** by stating a suitable material or process for each of the three items shown.

Table 2

Item	Material	Process
 Biscuit packaging <small>© Getty Images</small>	(i)	Vacuum forming
 Flat washers <small>© Getty Images</small>	Mild steel	(ii)
 Sheet metal part <small>© Getty Images</small>	Low carbon steel	(iii)

[3]

- (b) Explain the need for taper/draft angles in the manufacture of the mould for the vacuum formed tray shown in **Table 2**.

[2]

Examiner Only	
Marks	Remark

(c) Explain the difference between quality control and quality assurance.

[2]


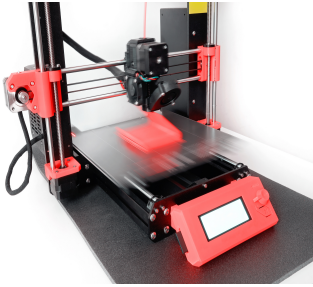

Examiner Only	
Marks	Remark

10 (a) What do the letters CIM stand for?

_____ [1]

(b) Complete **Table 3** by naming each of the machines shown.

Table 3

		
<p>Answer:</p> <p>_____</p>	<p>Answer:</p> <p>_____</p>	<p>Answer:</p> <p>_____</p>

Sources: Images © Getty Images

[3]

(c) Manufacturing companies need to consider costs.

(i) Explain the difference between direct and indirect costs.

_____ [2]

(ii) Give **one** example of a direct cost.

_____ [1]

(d) Outline **two** benefits of the use of 3D printing to a manufacturer.

1. _____

_____ [1]

2. _____

_____ [1]

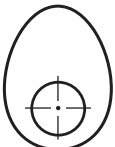
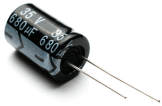
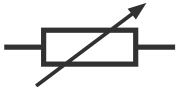

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

11 (a) Complete **Table 4** by inserting the correct name for each component or symbol.

Table 4

Component/Symbol	Name
 <p>© CCEA</p>	
 <p>© Getty Images</p>	
 <p>© Getty Images</p>	
 <p>© Shutterstock</p>	

[4]

(b) Define the term mechatronics.

[2]

Examiner Only	
Marks	Remark

(c) Outline **three** advantages that robotics offer in the manufacturing of electronic devices.

[3]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education

Engineering and Manufacturing

Unit 3

assessing

Materials, Processes and Systems

[GEM31]

Assessment

**PRE-RELEASE
MATERIAL**

Fig. 1 and Fig. 2 show a bicycle trailer.



Fig. 1



Fig. 2

Product features include:

- Dual function as a trailer or push buggy;
- Extruded tubular low carbon steel frame;
- Zipped open and closed nylon cover;
- User safety harness;
- Adjustable foam covered handle;
- Bicycle trailer connection bar;
- Universal coupler / fits any bicycle;
- Rear facing LED lighting system with acrylic covers;
- Folds for compact storage; and
- Dimensions (assembled) Height (960 mm) – Length (980 mm) – Width (530 mm).

Pre-release investigation:

You should investigate the possible impact and use of the following, where appropriate, in the design and production of the bicycle trailer:

- Materials and components: including application, properties, form, supply and types of finish;
- Manufacturing processes: including joining, assembly and the use of standard parts;
- Quality control and quality assurance;
- Costing: including direct and indirect costs incurred in the manufacture of the bicycle trailer; and
- Safety: including factor of safety and safety related features.

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