OCR
Oxford Cambridge and RSA

Friday 12 January 2024 – Afternoon

Level 1/Level 2 Cambridge National in Engineering Manufacture

R014/01 Principles of engineering manufacture

Time allowed: 1 hour 15 minutes

You can use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question number.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

Put a tick (✓) in the box next to the **one** correct answer for each question.

1 Which type of process is sand casting?

(a) Forming ☐

(b) Joining ☐

(c) Shaping ☐

(d) Wasting ☐

[1]

2 Which of these means the ability to withstand abrasion without surface damage?

(a) Ductility ☐

(b) Elasticity ☐

(c) Hardness ☐

(d) Sustainability ☐

[1]

3 Which of these is a shaping process?

(a) Brazing ☐

(b) Forging ☐

(c) Powder metallurgy of ceramic products ☐

(d) Strip heating of polymers ☐

[1]

4 Which of these polymers is thermosetting?

(a) Acrylonitrile-Butadiene-Styrene (ABS) ☐

(b) Epoxy resin ☐

(c) Polycarbonate ☐

(d) Polylactic acid (PLA) ☐

[1]

5 What kind of material is silicon carbide?

(a) Ceramic ☐

(b) Composite ☐

(c) Metal ☐

(d) Polymer ☐

[1]

6 What does the abbreviation CL mean on an orthographic drawing?

(a) Centre lathe ☐

(b) Centre line ☐

(c) Contour line ☐

(d) Controlled link ☐

[1]

7 Which of these is a property of polylactic acid (PLA)?

(a) High brittleness ☐

(b) High conductivity ☐

(c) High ductility ☐

(d) High toughness ☐

[1]

8 Which of these is a mechanical fastening?

(a) Brazing ☐

(b) MAG welding ☐

(c) Nuts and bolts ☐

(d) Press forming ☐

[1]

9 Which of these uses molten material to form complex shapes?

(a) Fixture ☐

(b) Jig ☐

(c) Mould ☐

(d) Template ☐

[1]

10 A dimension is given on an engineering drawing as 20.00 mm ±0.05.

Which is the maximum allowed dimension?

(a) 19.95 mm ☐

(b) 20.05 mm ☐

(c) 20.10 mm ☐

(d) 20.50 mm ☐

[1]

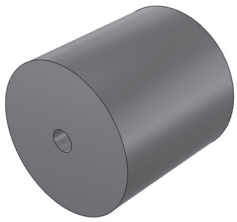
Section B

11 You have been asked to manufacture the component shown in **Fig. 1**.

It will be manufactured from a 20 mm diameter low carbon steel rod.

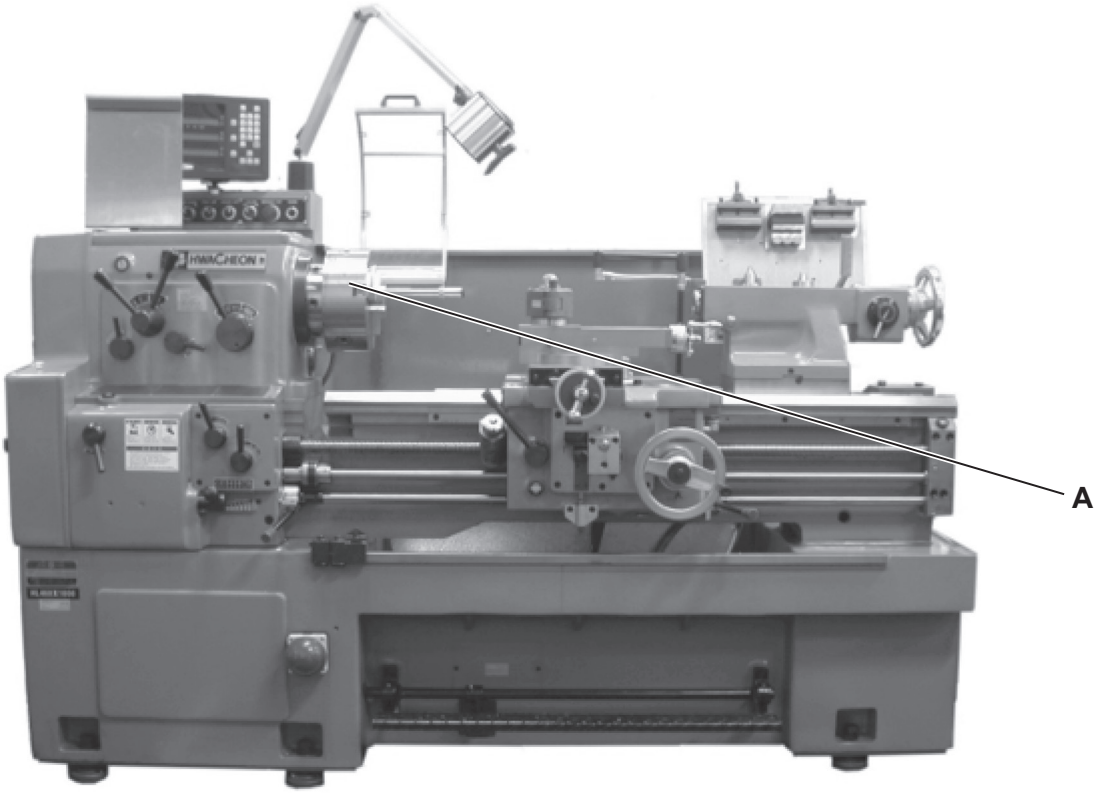
The final component will be 20 mm long and have a 3 mm hole drilled through the centre as shown.

Fig. 1



You will be using the machine in **Fig. 2** for the manufacture.

Fig. 2



(a)

(i) Identify the machine in **Fig. 2**.

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

(ii) Explain why the machine is suitable for producing the component shown in **Fig. 1**.

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.....

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

(b) Part of the machine has been labelled.

(i) Identify **part A** and describe its function.

Part A .....

Function .....

.....

[2]

(ii) Other than making sure the safety screen is down, identify **one** other safety measure that **must** be used for **part A**.

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

(iii) Explain why the safety measure you have identified in **part (b)(ii)** is important.

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

(c) Safety gloves should be worn for **some tasks** when using the machine in **Fig. 2**.

(i) Identify **one** task where safety gloves should be worn when using the machine.

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

(ii) State why it would **not** always be appropriate to wear safety gloves when using the machine.

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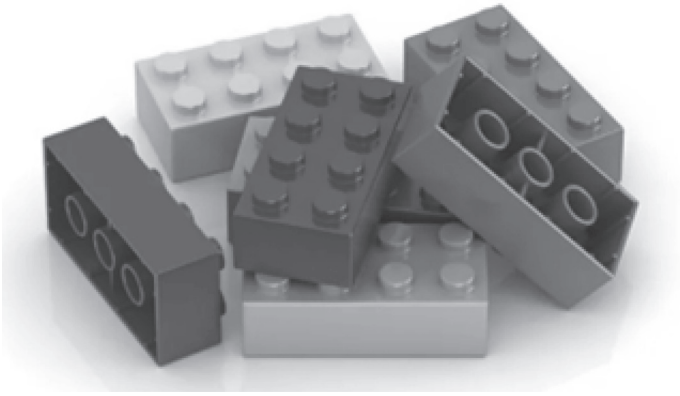
..... **[1]**

12 An engineering company is using injection moulding to manufacture childrens' toy bricks from Acrylonitrile-Butadiene-Styrene (ABS).

An example of the toy bricks is shown in **Fig. 3**.

Fig. 3



(a) Identify, in the correct sequence, any **three** of the steps required in the injection moulding process.

Step 1 .....

Step 2 .....

Step 3 .....

[3]

(b)

(i) Identify **two** properties of ABS that make it suitable for childrens' toy bricks.

1 .....

2 .....

[2]

(ii) Explain why the properties of ABS make it suitable for childrens' toy bricks.

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

(c) ABS is available in different forms of supply.

State **one** form of supply that is suitable to manufacture the toy bricks and explain why your chosen form of supply is suitable.

Form of supply .....

Why suitable .....

.....

.....

.....

[3]

13 **Fig. 4** shows a bike frame that is manufactured from a carbon reinforced polymer (carbon fibre).

Carbon fibre is a composite material.

Fig. 4

(a) Identify **two** properties of carbon fibre that make it suitable for the bike frame.

1 .....

2 .....

[2]

(b) Describe how the carbon fibre is formed into the shape of the bike frame.

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..... **[4]**

(c) Describe, giving an example, the differences between a composite material and an alloy.

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

(d) Identify **one** composite material **other** than carbon fibre.

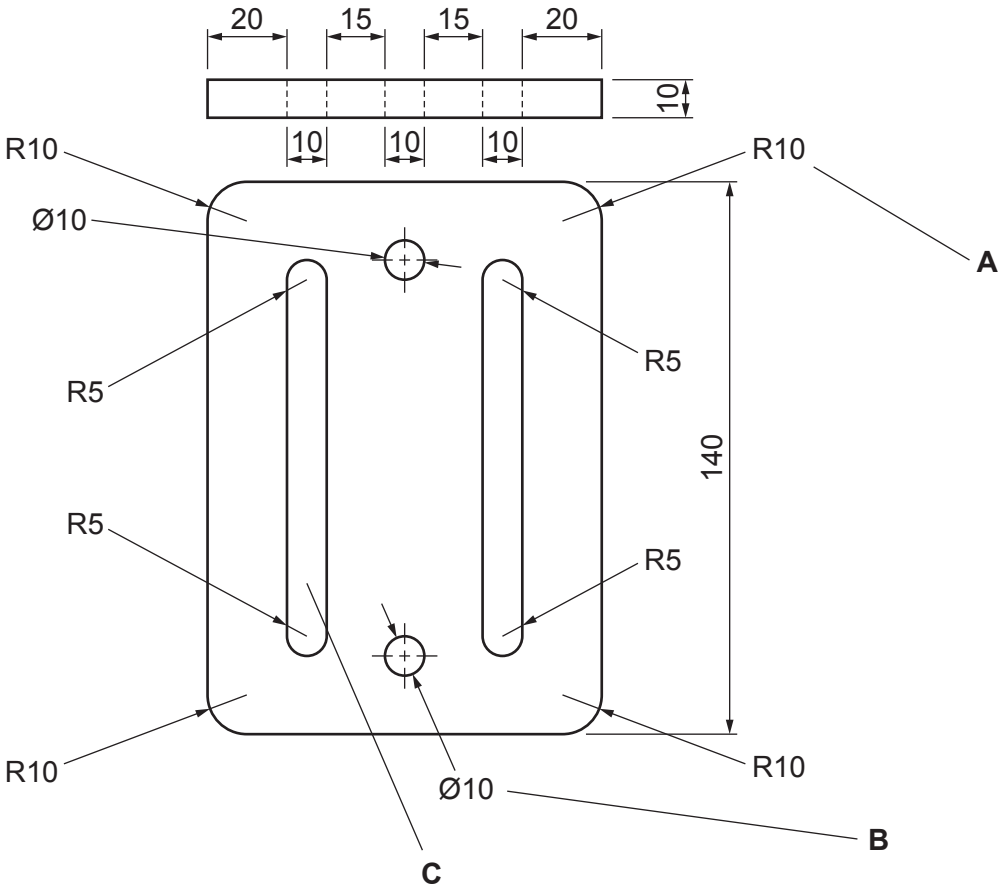
..... **[1]**

14 **Fig. 5** shows part of an orthographic drawing that will be used to manufacture a slotted bracket.

The slotted bracket will be manufactured from a 10 mm thick low carbon steel sheet.

All dimensions are shown in mm.

Fig. 5



(a) Identify the standard drawing convention labelled **A**, giving the dimension shown.

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

(b) Identify the standard drawing convention labelled **B**, giving the dimension shown.

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

(c) Consider the following statement:

A pillar drill and centre lathe are the machines that could be used to manufacture the slotted bracket shown in **Fig. 5** with **C** being made before **B**.

How far do you agree with this statement? Give reasons for your answer.

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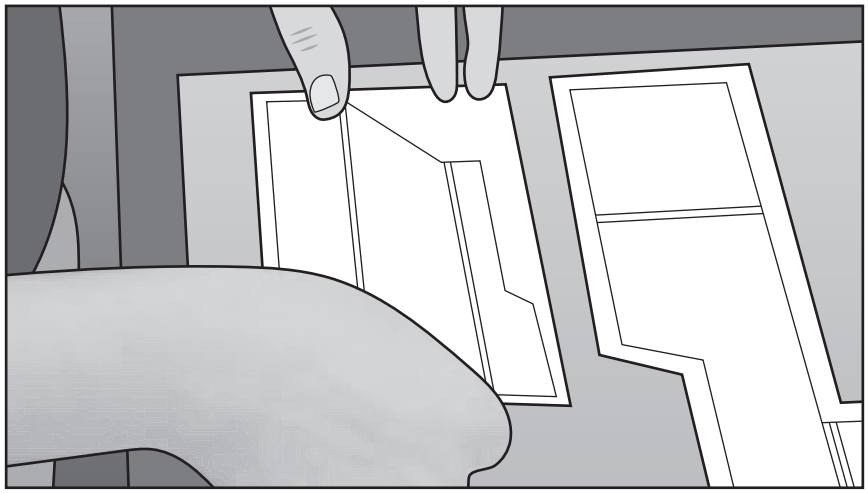
..... **[6]**

15 An engineering company is manufacturing a product from sheet metal.

Fig. 6 shows an engineer using a template to mark out and cut sheet metal.

Fig. 6



(a) Describe how using templates to provide consistency can reduce waste when producing identical products.

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

(b) One method of ensuring consistency in the manufacturing process is by using CNC machines.

Identify **two other** methods of quality assurance.

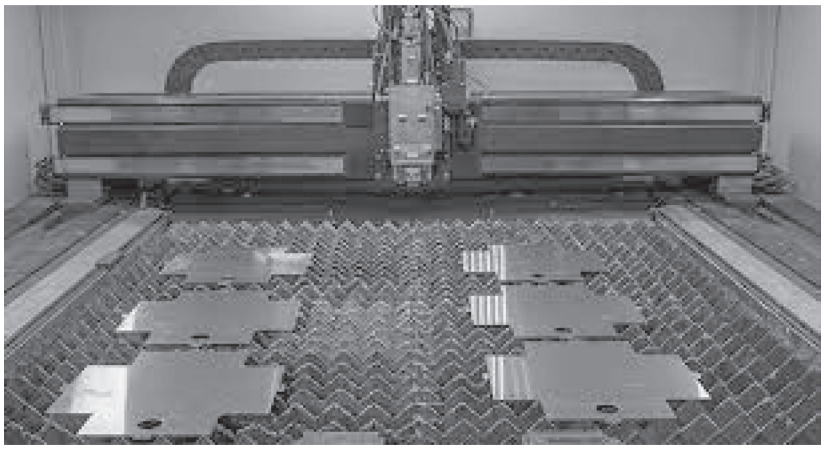
1 .....

2 .....

[2]

Fig. 7 shows sheet metal components cut using a laser cutter.

Fig. 7



(c) A company is considering using CNC machines to ensure consistency in the quality of its manufactured products.

Discuss the following statement:

The **approach** to achieving consistent quality will depend on the scale of manufacture and the value of the product.

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

16 A company receives an order for 3000 drill bits.

The company manufactures the drill bits.

A – 4000 drill bits were manufactured.

B – 500 drill bits failed quality control.

(a) Identify the category of waste in **A** and describe how the category of waste identified impacts lean manufacturing performance.

Category of waste .....

How impacts lean manufacturing performance .....

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.....

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

(b) Identify the category of waste in **B** and describe how the category of waste identified can be reduced.

Category of waste .....

How can be reduced .....

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

(c) Describe how just in time (JIT) manufacturing can be used by the company to manage inventory.

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..... **[4]**

END OF QUESTION PAPER

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