OCR
Oxford Cambridge and RSA

# Friday 10 January 2025 – 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 numbers.
- 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 fastener creates its own thread as it is driven into a material?

**(a)** Hammered rivet ☐

**(b)** Pop rivet ☐

**(c)** Nut and bolt ☐

**(d)** Self-tapping screw ☐

**[1]**

**2** Which wasting process uses a thin beam to melt the material?

**(a)** Filing ☐

**(b)** Laser-cutting ☐

**(c)** Milling ☐

**(d)** Turning ☐

**[1]**

**3** Which of these is a specific consideration of globalisation?

**(a)** Automation ☐

**(b)** Defects ☐

**(c)** International standards ☐

**(d)** Quality control ☐

**[1]**

**4** Which of these describes hardness as a material property?
The ability of a material to:

**(a)** be drawn into thin wire ☐

**(b)** resist scratches and abrasion ☐

**(c)** withstand pulling forces ☐

**(d)** withstand stretching forces ☐

**[1]**

**5** Which is an engineering ceramic material?

**(a)** Epoxy resin ☐

**(b)** Photochromic pigment ☐

**(c)** Shape memory alloy ☐

**(d)** Tungsten carbide ☐

**[1]**

**6** What is BS 8888 the standard for?

**(a)** Engineering drawing conventions ☐

**(b)** Environmental practices ☐

**(c)** Finishing processes ☐

**(d)** Waste management procedures ☐

**[1]**

**7** Which of these describes quality assurance?

**(a)** A preventative approach to quality, measuring parts ☐

**(b)** A preventative approach to quality, putting in place systems to reduce defects ☐

**(c)** A reactive approach to quality, measuring parts ☐

**(d)** A reactive approach to quality, putting in place systems to reduce defects ☐

**[1]**

**8** Which of these describes batch production?

**(a)** Continuous production 24 hours a day 7 days a week ☐

**(b)** High volume production of products ☐

**(c)** Individual one-off prototype production ☐

**(d)** Production of products in small groups over a set time ☐

**[1]**

**9** Which material is a thermosetting polymer?

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

**(b)** High impact polystyrene ☐

**(c)** Polycarbonate ☐

**(d)** Urea formaldehyde ☐

**[1]**

**10** What is material requirements planning (MRP) a type of?

**(a)** Drawing standard ☐

**(b)** Inventory management system ☐

**(c)** Material supply ☐

**(d)** Quality control system ☐

**[1]**

## Section B

**11** A manufacturing company produces wings for commercial passenger aeroplanes, like the one shown below.

**(a)** Identify **one** material that would be suitable for the aeroplane wings.

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

**(b)** State **two** typical forms of supply of your material in Part **(a)**.

1 .....

2 .....

**[2]**

**(c)** Evaluate how the **properties** of your material make it suitable for the aeroplane wings.

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

**(d)** State **three other** typical applications of your material.

1 .....

.....

2 .....

.....

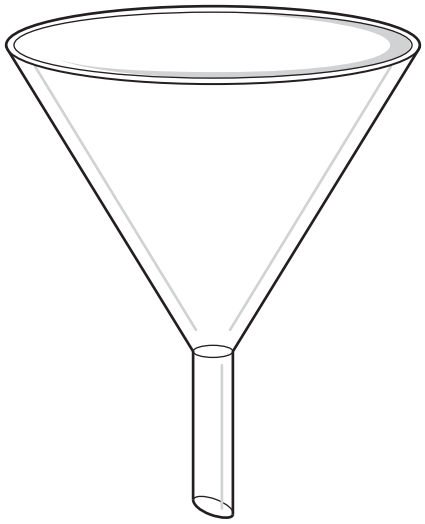
3 .....

.....

**[3]**

**Turn over for the next question**

**12** You are manufacturing a funnel, like the one below.



**(a)** Describe **four** steps required to manufacture this product using **3D printing** (fused deposition modelling).

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

**[4]**

**(b)** Explain **one** safety measure that should be taken when using a 3D printer to manufacture this product.

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.....

.....

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

**(c)** Explain **two** reasons why additive processes are suitable for manufacturing this product.

1 .....

.....

.....

.....

2 .....

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.....

.....

**[4]**

**Turn over for the next question**

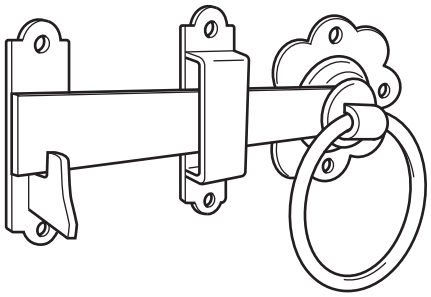
**13**

**(a)** Complete the table below to describe each category of waste in **Lean manufacturing**. State how reducing each waste improves the performance of manufacturing.

An example is provided.

| **Category of waste** | **Description of category of waste** | **How reducing it improves the performance of manufacturing** |
|---|---|---|
| Over-processing | *Performing processes that are not needed by the customer.* | *Reducing this saves production time.* |
| Transportation | **[1]** | **[1]** |
| Over-production | **[1]** | **[1]** |
| Defects | **[1]** | **[1]** |

**(b)** A garden gate latch similar to the one shown below will be manufactured from low carbon steel.



The manufacturer offers a range of finishings for the garden gate latch.

The table below shows a comparison of the finishing processes, where a score of 1 is the lowest and 5 is the highest.

| Finishing process | Time | Processing | Cost |
|---|---|---|---|
| Painting | 1 | 1 | 2 |
| Powder coating | 3 | 5 | 3 |
| Galvanising | 5 | 3 | 5 |

**(i)** State why the manufacturer might produce more garden gate latches using painting, than the other finishing processes.

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

**(ii)** Explain what **powder coating** is.

.....

.....

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

**(iii)** State **one** advantage of powder coated finishing compared to painting.

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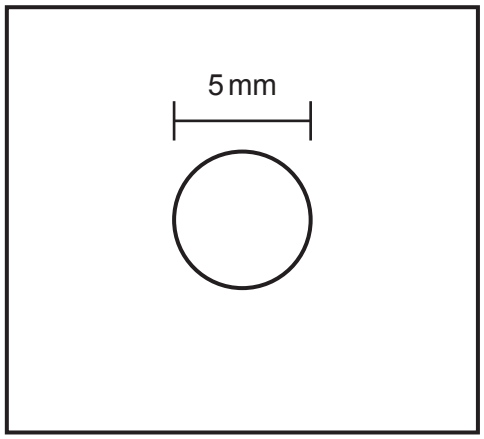
..... **[1]**

**14** A hole of 5 mm diameter will be drilled through a thin piece of plastic, as shown below.

There is a tolerance of **± 0.2 mm** for this diameter.




**(a)** Calculate the maximum and minimum acceptable diameters for the hole.

Maximum .....

.....

Minimum .....

.....

**[2]**

**(b)** Describe **four** steps required to accurately drill the hole.

1 .....

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2 .....

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3 .....

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4 .....

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**[4]**

**(c)** Explain **two** safety measures that should be taken when drilling the hole.

1 .....

.....

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2 .....

.....

.....

**[4]**

**15**

**(a)** Mass manufacturing often involves the use of automated systems.

Describe how **fully automated robotic control** is used to manufacture **two** products.

1. Product .....

How it is manufactured .....

.....

.....

2. Product .....

How it is manufactured .....

.....

.....

**[4]**

**(b)** Jigs are often used when mass manufacturing products.

Discuss the advantages and limitations of using jigs when mass manufacturing products.

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

**16**

**(a)** State what **each** of the following abbreviations used on orthographic drawings stand for.

**(i)** AF ..... **[1]**

**(ii)** DIA ..... **[1]**

**(iii)** MAT ..... **[1]**

**(iv)** SQ ..... **[1]**

**(b)** Explain what each of the following lines mean in an orthographic drawing.

**(i)**



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

**(ii)**



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

**(c)** A drawing shows that a product must be manufactured from sustainable materials.

Explain what **sustainable** means.

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

**END OF QUESTION PAPER**

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