OCR
Oxford Cambridge and RSA

Tuesday 11 January 2022 – Afternoon

Level 1/2 Cambridge National in Engineering Manufacture

R109/01 Engineering materials, processes and production

Time allowed: 1 hour

No extra materials are needed.

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. You can use an HB pencil, but only for graphs and diagrams.
- 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 **60**.
- The marks for each question are shown in brackets **[ ]**.
- Dimensions are in millimetres unless the question says something different.
- Quality of written communication will be assessed in questions marked with an asterisk (*****).
- This document has **12** pages.

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

Answer **all** the questions.

1 **(a)** **Fig. 1** shows a knife and fork.

Fig. 1

(i) Circle the material from the list below, which is commonly used to make the knife and fork.

carbon fibre **stainless steel** **epoxy resin** **lead** **[1]**

(ii) Give **two** reasons why the material chosen is suitable for the knife and fork.

1 .....

.....

2 .....

.....

[2]

(b) **Fig. 2** shows several transparent chess pieces.

Fig. 2

(i) Circle the material from the list below, which is used to make the chess pieces.

tin **brass** **polyester resin** **Glass Reinforced Plastic (GRP)** **[1]**

(ii) (Circle) the term from the list below which describes the type of material used to produce the chess pieces shown in **Fig. 2**.

pure metal **ceramic** **thermosetting plastic** **composite** **[1]**

(iii) Name **one** process that could be used to produce the chess pieces.

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

(iv) State why injection moulding is **not** a suitable process to make the chess pieces.

.....

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

(c) **Fig. 3** shows a child's plastic ball, with a diameter of 150 mm, made from thermoplastic material.

Ball

Fig. 3

(i) Name a suitable process that could be used to produce the plastic ball.

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

(ii) Give **two** reasons why plastic is a suitable material for the ball.

1 .....

.....

2 .....

.....

[2]

2 **(a)** A list of engineering materials is given below.

bronze
carbon steel
concrete
glass
high speed steel
Quantum Tunnelling Composite (QTC)
shape-memory alloy
tungsten carbide

(i) Select **two** materials from the list that are ferrous metals.

1 .....

2 .....
[2]

(ii) Select **two** materials from the list that are ceramics.

1 .....

2 .....
[2]

(iii) Select **two** smart materials from the list.

1 .....

2 .....
[2]

(b) Describe **one** use for a smart material from the list.

.....

.....

.....

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

(c) Explain why a non-ferrous metal might be used instead of a ferrous metal to make an engineered product.

.....

.....

.....

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

3 **(a)** Complete the table below by placing a tick (✓) to show the correct example for each of the processes listed.

One has been completed for you.

	Examples of Engineering Processes				
	linishing	**filing**	**brazing**	**nitriding**	**bending**
material removal		✓			
joining					
heat treatment					
surface finishing					
hand forming					

[4]

(b) State **three** properties that should be considered when selecting materials for an engineered product.

One example is machinability.

1 .....

2 .....

3 .....

[3]

(c) Copper sheet becomes work hardened when being hit with a mallet. It needs to be regularly softened (annealed).

Describe the process of annealing a copper disc, with a diameter of 125 mm.

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

4 **Fig. 4** shows a key fob made in the workshop from 75 × 20 × 3 mild steel.

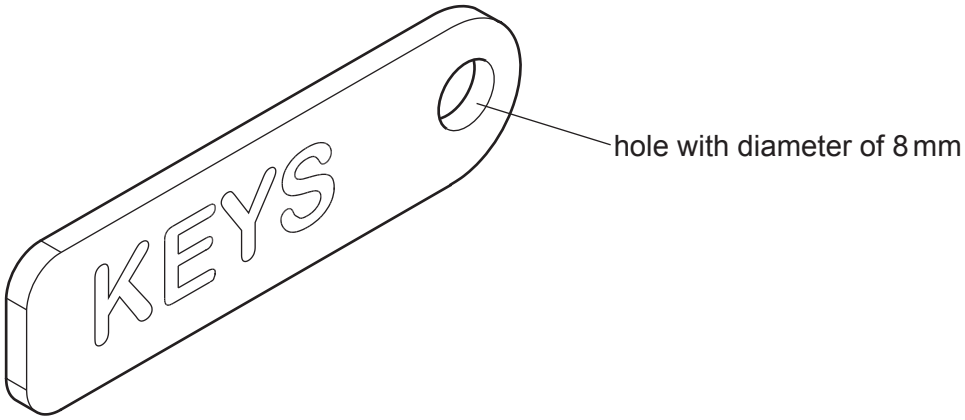

Fig. 4

(a) The table below shows the stages involved in making the key fob.

Stage	Process
A	Centre punch and drill 5 mm pilot hole
B	Cut the mild steel and file to size
C	Cut and file the curves of the key fob
D	Mark the shape and position of holes
E	Stamp letters KEYS and remove all sharp edges
F	Drill a hole, 8 mm in diameter

Put the stages in the correct order. Two have been completed for you.

B				C	

[3]

(b) State **two** safety precautions, other than PPE, that should be observed when using a drilling machine.

1 .....

.....

2 .....

.....

[2]

(c) Name **two** surface finishes that could be applied to the mild steel key fob.

1 .....

2 .....

[2]

(d) **(i)** Name a CNC machine that could be used to produce the key fob.

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

(ii) Explain why CNC manufacture would be more appropriate than hand manufacture.

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.....

.....

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

5 **(a)** **Fig. 5** shows a workpiece that is being manufactured on a multi-axis machining centre.

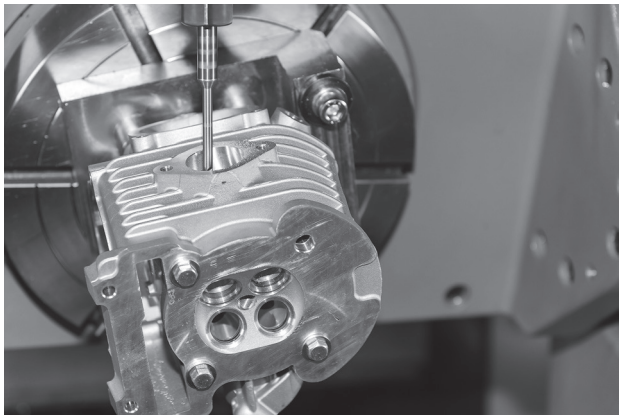

Fig. 5

(i) Describe the features of a multi-axis machining centre.

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.....

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

(ii) State **two** ways that a multi-axis machine is safer to use than a manual machine.

1 .....

2 .....

[2]

(b) Explain **two** cost factors that should be considered before introducing modern technology into an engineering company.

1 .....

.....

.....

2 .....

.....

.....

[4]

6 **(a)** **(i)** Explain why the use of modern technology during production gets products to market faster.

.....

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.....

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

(ii) Explain why it is important to have a trained workforce to carry out modern engineering processes.

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

(b)* Discuss the importance of quality control when manufacturing products using mass production processes.

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

END OF QUESTION PAPER

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