OCR
Oxford Cambridge and RSA

Tuesday 12 January 2021 – 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 **[ ]**.
- 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.

Turn over

Answer **all** the questions.

1   **(a)**   Fig. 1 shows a lead fishing weight.

Fig. 1

  (i)   Give **two** reasons why lead is suitable for the fishing weight.

1 ....

....

2 ....

....
  [2]

  (ii)   Give **one** reason why lead weights are banned in some areas and alternative materials have to be used.

....

.... **[1]**

(b) Fig. 2 shows a boat propeller.
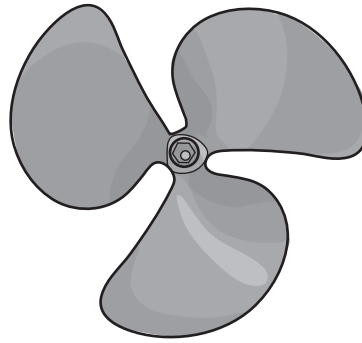
Fig. 2

   (i) (Circle) the material commonly used to make a boat propeller.

bronze　　　　**mild steel**　　　　**glass reinforced plastic (GRP)**　　　　**epoxy resin**

[1]

  (ii) (Circle) the term from the list below which describes the type of material used in the casting process used to manufacture the boat propeller.

ferrous metal　　　　**alloy**　　　　**ceramic**　　　　**composite**

[1]

  (iii) Give **two** reasons why the material is suitable for the propeller.

1 ....

....

2 ....

....

[2]

　　　　　　　　　　　　　　　　　　　　　　　　　　　　Turn over

(c) Fig. 3 shows a toy tipper truck.

Fig. 3

(i) (Circle) the material commonly used to make the body of the toy tipper truck.

zinc   **Acrylonitrile-Butadiene-Styrene (ABS)**   **iron**   **polyester resin**

[1]

(ii) Give **two** reasons why the material chosen is suitable for the body of the toy tipper truck.

1 ....

....

2 ....

....

[2]

2 A list of engineering materials is given below.

polyester resin copper concrete glass

nylon stainless steel polyvinyl chloride (PVC)

(a) Select a suitable material from the list to complete the following statements.

(i) .... is a non-ferrous metal.

(ii) .... is a ferrous metal.

(iii) .... is a ceramic.

(iv) .... is a thermosetting plastic.

(v) .... is a thermoplastic.

[5]

(b) (i) Explain what is meant by the term 'composite material'.

....

....

.... **[2]**

(ii) Name **one** composite material and state **one** use for the material.

Composite material ....

Use ....

.... **[2]**

(iii) Give **one** property of the material that makes it suitable for the use identified in **2(b)(ii)**.

....

.... **[1]**

Turn over

3 Material removal, joining and surface treatment are all engineering processes.

(a) Name **two** hand methods used for material removal.

1 ....

2 ....

[2]

(b) Name **two** CNC processes that could be used for material removal.

1 ....

2 ....

[2]

(c) Name **two** processes used when joining metals.

1 ....

2 ....

[2]

(d) A piece of mild steel plate 100 mm × 25 mm × 3 mm is to be surface treated by plastic coating. Describe how this would be carried out.

....

....

....

....

....

.... **[3]**

(e) Name **one** surface treatment, other than plastic coating, that could be applied to mild steel.

.... **[1]**

**4** Fig. 4 shows a vacuum forming machine.
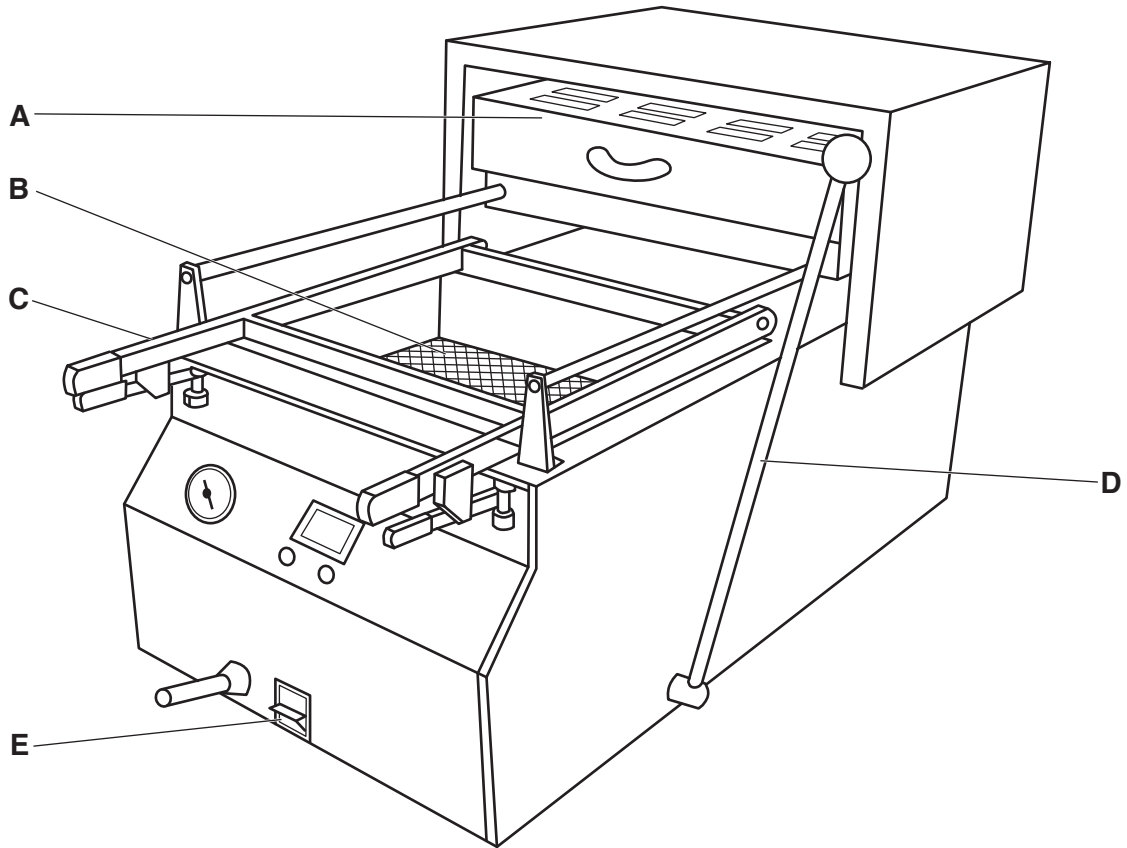
Fig. 4

(a) Select the parts from the list below that have been labelled in Fig. 4.

vacuum pressure gauge	clamping frame	mould shelf	heater
vacuum pump switch	shelf lever	toggle clamp	sliding bars

A ....

B ....

C ....

D ....

E ....

[5]

(b) The table below shows the stages involved in vacuum forming a shape.

Stage	Process
F	Place the mould in the vacuum former.
G	Raise the shelf and switch on the vacuum pump.
H	Heat the plastic sheet until it is flexible.
I	Lower the shelf supporting the mould.
J	Clamp a sheet of plastic into position.
K	Leave the plastic sheet to cool and then remove from the vacuum former.

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

F					K

[3]

(c) State **two** processes, other than vacuum forming, of moulding plastic sheet.

1 ....

2 ....

[2]

5 **(a)** Explain, giving an example, what is meant by the term 'manually controlled production'.

....

....

.... **[2]**

(b) Fig. 5 shows a wrench that has been produced using an additive manufacturing process.
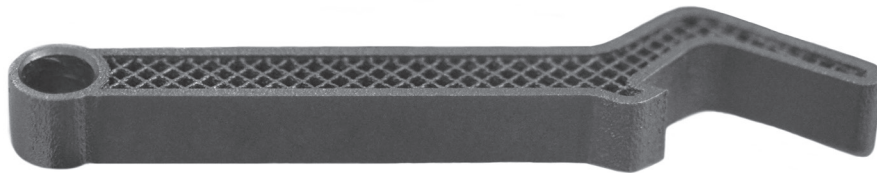
Fig. 5

(i) Name **one** appropriate additive manufacturing process to make the wrench shown in Fig. 5.

.... **[1]**

(ii) Explain how the process named in **5(b)(i)** would be used to produce the wrench.

....

....

....

....

....

.... **[3]**

(c) Describe the advantages of using CNC machines rather than manual production.

....

....

....

....

....

....

....

.... **[4]**

Turn over

6 **(a)** Using an example, describe the reasons for developing new and emerging engineering materials.

Example ....

Reasons ....

....

....

....

....

[4]

(b)* Discuss the advantages and disadvantages to a manufacturer of introducing modern technology.

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.... **[6]**

END OF QUESTION PAPER

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