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School code

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School name

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Given name/s

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Family name

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Attach your
barcode ID label here

Book

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of

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books used

External assessment

Question and response book

Engineering

Time allowed

- Perusal time — 10 minutes
- Working time — 120 minutes

General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- Protractor and ruler required.
- QCAA formula and data book provided.
- Planning paper will not be marked.

Section 1 (10 marks)

- 10 multiple choice questions

Section 2 (35 marks)

- 7 short response questions

Section 3 (40 marks)

- 6 short response questions



Section 1

Instructions

- Choose the best answer for Questions 1–10.
- This section has 10 questions and is worth 10 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	A	B	C	D
1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Section 2

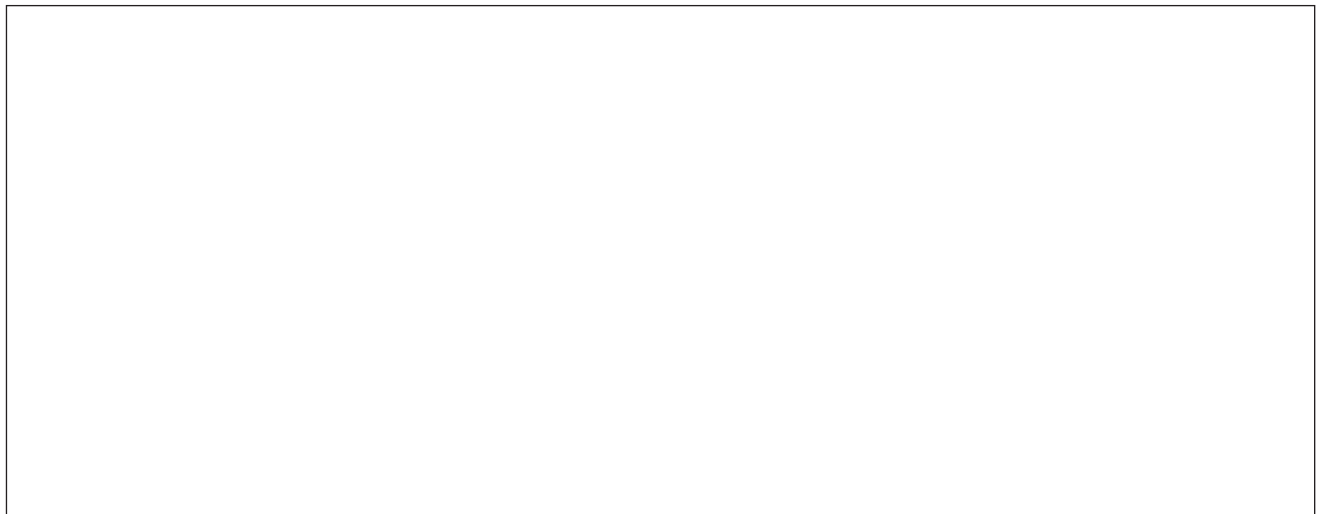
Instructions

- Write using black or blue pen.
 - If you need more space for a response, use the additional pages at the back of this book.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
 - This section has seven questions and is worth 35 marks.
-

QUESTION 11 (4 marks)

Explain what is meant by the proportional limit of a material as indicated on a stress–strain diagram. Provide an annotated sketch to support your explanation.

Note: If you make a mistake in the sketch, cancel it by ruling a single diagonal line through your work and use the additional response space on page 20 of this question and response book.



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QUESTION 12 (4 marks)

List four properties of polylactic acid (PLA) that make it a useful material for medical implants.

- 1. _____
- 2. _____
- 3. _____
- 4. _____

QUESTION 13 (5 marks)

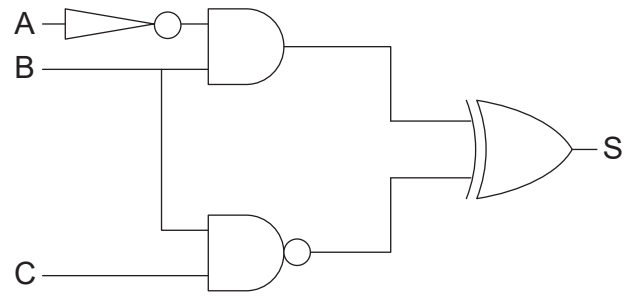
Explain how the microstructure of a 62% tin and 38% lead binary alloy changes during cooling from liquid to solid. Provide an annotated sketch of the microstructure to support your explanation.

Note: If you make a mistake in the sketch, cancel it by ruling a single diagonal line through your work and use the additional response space on page 20 of this question and response book.



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QUESTION 14 (6 marks)



Interpret the logic circuit to create the corresponding truth table.

Note: If you make a mistake in the table, cancel it by ruling a single diagonal line through your work and use the additional response space on page 21 of this question and response book.

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Section 3

Instructions

- Respond showing full working for calculations.
 - If you need more space for a response, use the additional pages at the back of this book.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
 - This section has six questions and is worth 40 marks.
-

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THIS PAGE WILL NOT BE MARKED

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QUESTION 18 (5 marks)

A 900 kg machine is designed to rest without slipping on a slope of up to 30° on the surface of Mars. The acceleration due to gravity on Mars is one-third of that on Earth.

- a) Determine the coefficient of static friction required to keep the machine from slipping on a 30° incline on Mars. Answer to two decimal places. *[1 mark]*

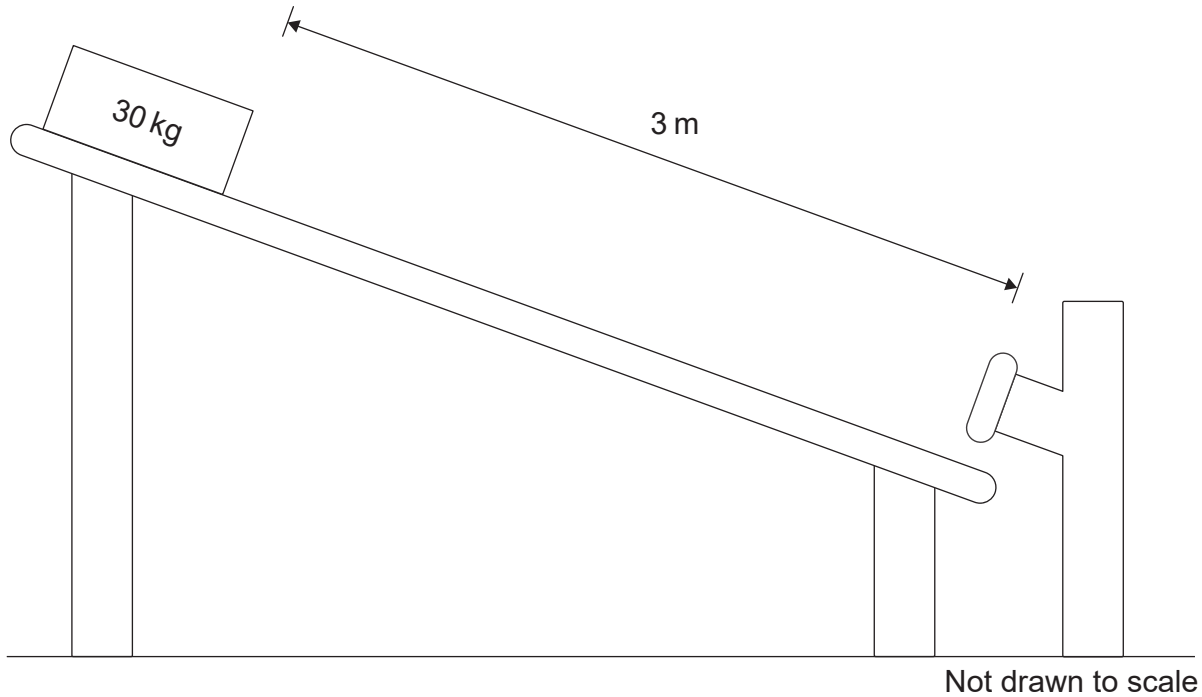
- b) Calculate the resulting force of static friction between the machine and Mars' surface. Answer to the nearest whole unit. *[2 marks]*

- c) Explain what would happen to the coefficient of static friction if the machine was tested on Earth. *[2 marks]*

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QUESTION 22 (9 marks)

A bag slides for 3 seconds at a constant velocity of 1 m/s down a 20° luggage chute until it impacts with a cushioning device as shown in the diagram. If the cushioning device is removed, the surface of the chute will need to be modified to slow the bag to a stop at the base of the chute.



Determine the difference between the coefficients of friction for the modified chute and the original with the cushioning device. Answer to two decimal places.

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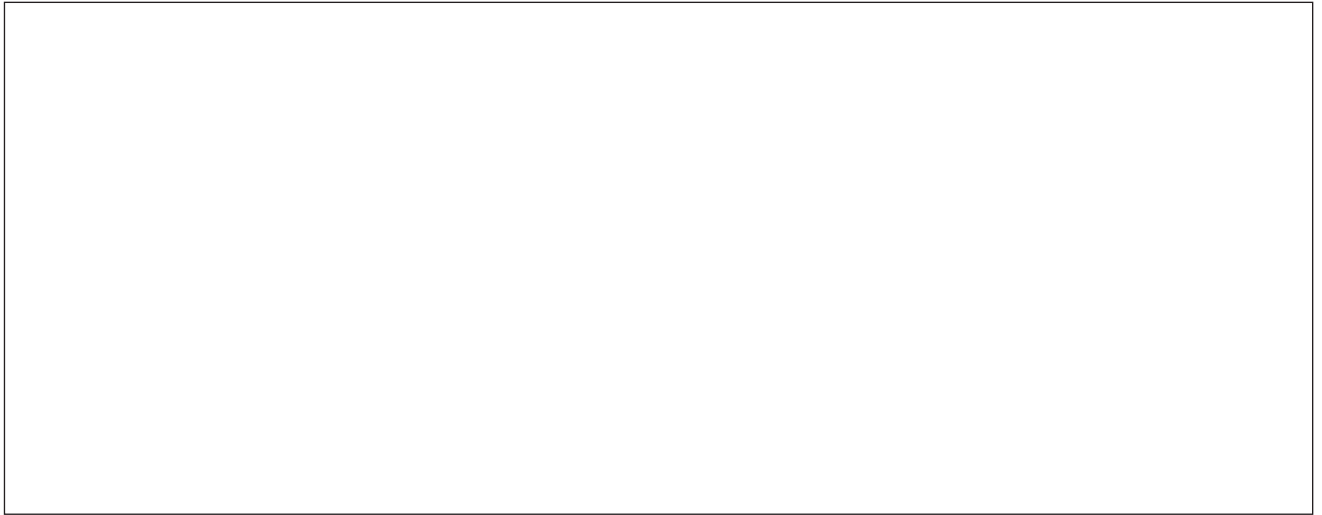
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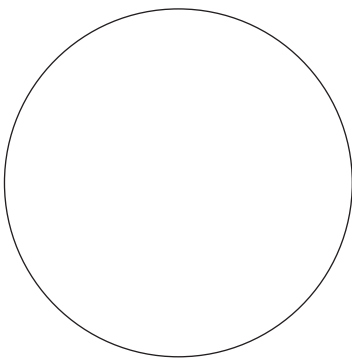
ADDITIONAL RESPONSE SPACE FOR QUESTION 11

If you want this sketch to be marked, rule a diagonal line through the sketch on page 2.



ADDITIONAL RESPONSE SPACE FOR QUESTION 13

If you want this sketch to be marked, rule a diagonal line through the sketch on page 3.



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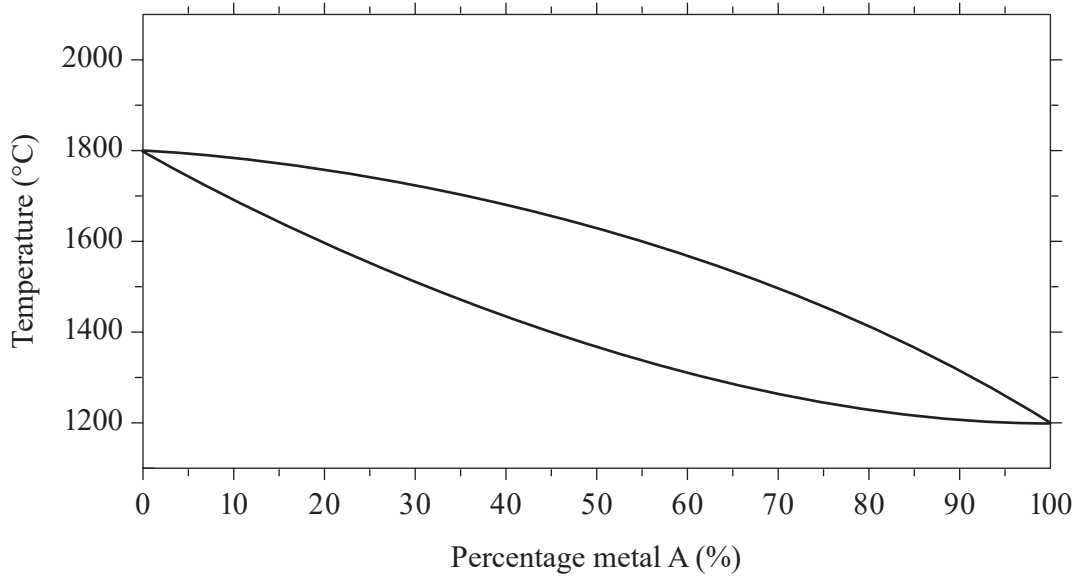
ADDITIONAL RESPONSE SPACE FOR QUESTION 14

If you want this table to be marked, rule a diagonal line through the table on page 4.

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ADDITIONAL RESPONSE SPACE FOR QUESTION 21

If you want this diagram to be marked, rule a diagonal line through the diagram on page 12.



ADDITIONAL RESPONSE SPACE FOR QUESTION 23

If you want this diagram to be marked, rule a diagonal line through the diagram on page 15.

Do not write outside this box.



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