GradeMax

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Wednesday 20 May 2026

Afternoon (Time: 1 hour 20 minutes)

Paper reference **WBI13/01**

Biology

International Advanced Subsidiary/Advanced Level
UNIT 3: Practical Skills in Biology I

You must have:
Scientific calculator, ruler, HB pencil

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions.

Write your answers in the spaces provided.

1 The photograph shows lettuces growing in a hydroponic system.



(Source: © Aula Tani/Shutterstock)

The plants are grown in water without soil.

In hydroponic systems, the water contains all the necessary nutrients.

Hydroponic systems are useful where space is limited and can give yields greater than crops grown in fields. They also use less water than growing in irrigated soil.

In an investigation, the effects of using an organic fertiliser on the growth of lettuces in a hydroponic system and lettuces planted in sacks containing soil were compared.

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Four groups of plants, each containing 38 lettuces, were grown in a nutrient solution.

The table shows whether they were grown in a hydroponic system or in sacks containing soil.

The table shows whether an organic fertiliser was also added.

Conditions	Group A	Group B	Group C	Group D
Medium for growth	hydroponics	hydroponics	soil	soil
Organic fertiliser added	no	yes	no	yes

After 60 days, the growth of the lettuce plants was recorded.

(a) (i) Name **two** abiotic variables that should be controlled in this investigation.

(2)

1 .....

2 .....

(ii) Name **two** mineral ions supplied by the organic fertiliser needed for the growth of the lettuce plants.

(2)

1 .....

2 .....

(iii) State the **two** independent variables in this investigation.

(1)

1 .....

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2 .....

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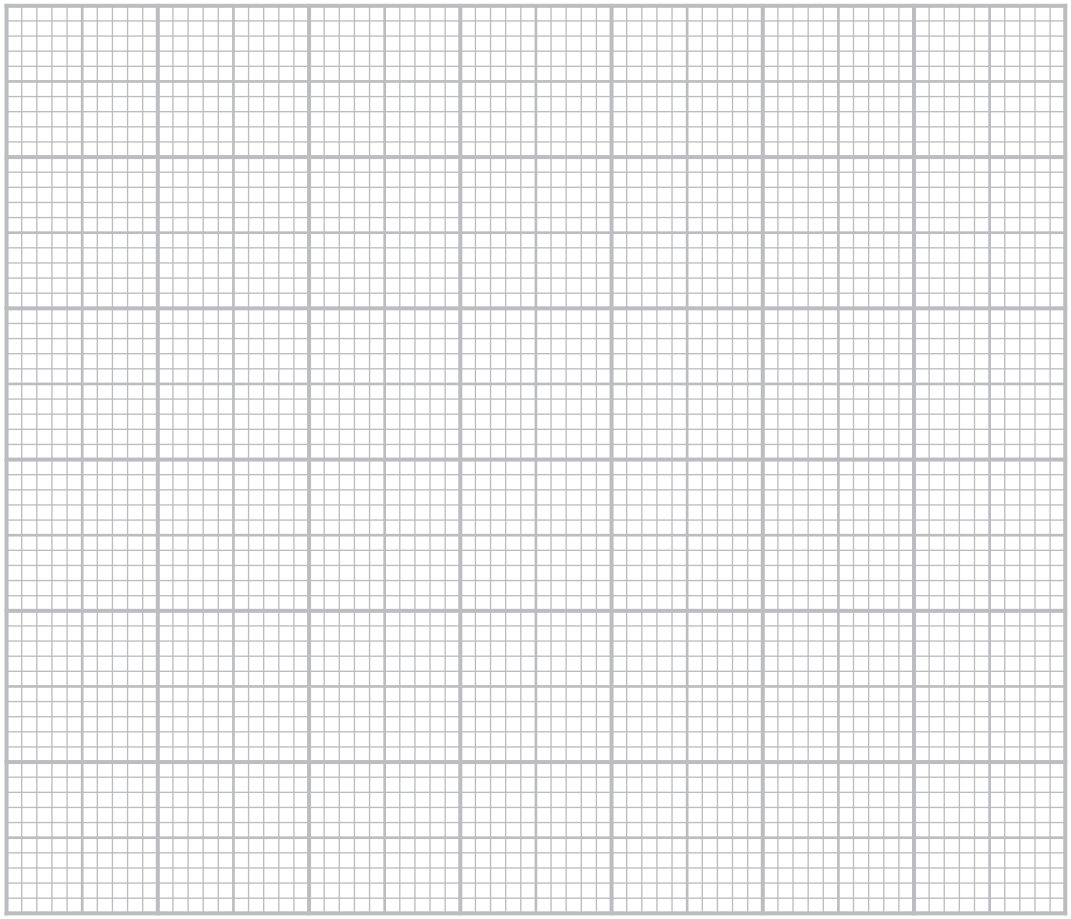
(b) The results are shown in the table.

Group	Mean number of leaves	Mean root length / cm	Mean carbohydrate content / grams per 10 g of lettuce
A	23 ± 2.1	21 ± 2.0	1.5 ± 0.2
B	29 ± 3.0	24 ± 2.3	2.9 ± 0.3
C	20 ± 1.8	18 ± 1.6	1.2 ± 0.1
D	21 ± 2.0	20 ± 1.9	1.3 ± 0.1

(i) Plot a bar chart to compare the results for the mean number of leaves and the mean root length for **group B** and **group D**.

Do not plot error bars.

(4)



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(ii) Scientists concluded that the organic fertiliser increases the mean number of leaves and the mean root length.

Discuss these conclusions.

(3)

(iii) Calculate the percentage decrease in carbohydrate content between lettuces in Group A and lettuces in Group D.

Give your answer to **one** decimal place.

(2)

Answer ..... %

(Total for Question 1 = 14 marks)

2 Human gum disease is thought to be the main reason for tooth loss in adults. Gum disease can be caused by mouth bacteria, one of which is *Porphyromonas gingivalis*.

The effect of pH on the growth and enzyme activity of *P. gingivalis* was investigated.

Breakdown of collagen was used to measure enzyme activity.

(a) Describe the structure of collagen.

(3)

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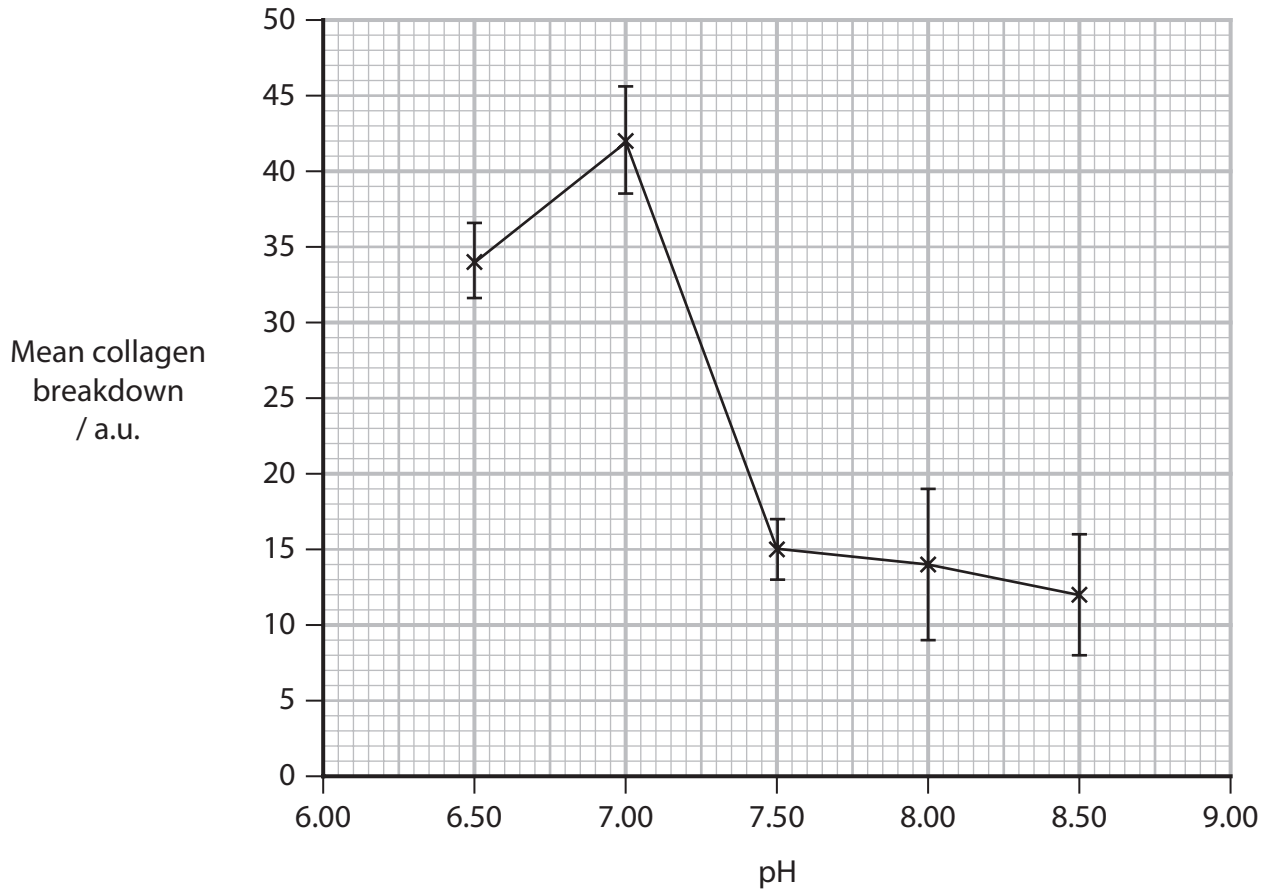
(b) Collagen breakdown was measured at a range of pH values.

Describe how the concentration of this protein could be estimated using a semi-quantitative method.

(3)

(c) The collagen breakdown at each pH was determined.

The graph shows the results of this investigation.



(i) Draw a table to show all the data in this graph.

(4)

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(ii) Evaluate the statements that:

- the optimum pH of the enzyme that breaks down collagen is 7.0
- pH values of 7.5 to 8.5 have the same effect as each other on collagen breakdown.

(4)

(Total for Question 2 = 14 marks)

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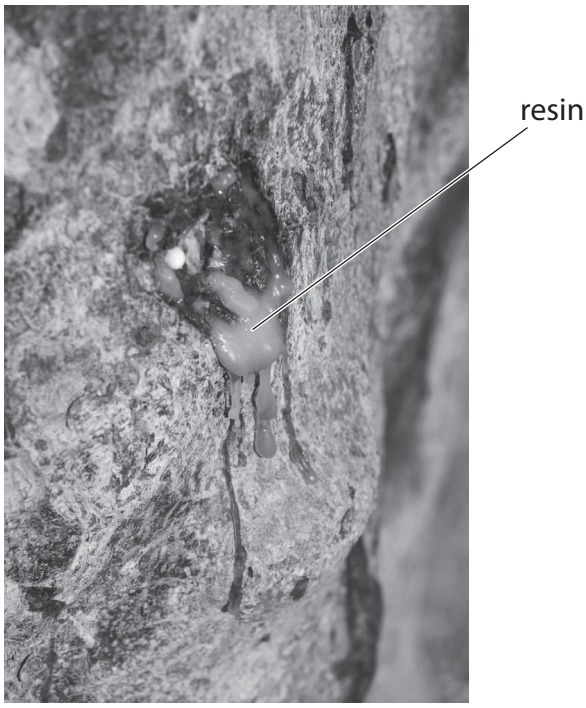
3 The photographs show resin leaking from the wood of a frankincense tree and the wood of a myrrh tree. These trees grow in north Africa.

These resins have long been thought to have medicinal properties.



(Source: © Tekijä ChWeiss/Shutterstock)

Wood of a frankincense tree



(Source: © Tekijä Vladimir Melnik /Shutterstock)

Wood of a myrrh tree

The antimicrobial properties of these two resins have been investigated in a medical laboratory.

Methicillin-resistant *Staphylococcus aureus* (MRSA) bacteria were spread on the surface of agar in a Petri dish, to form a lawn of bacteria.

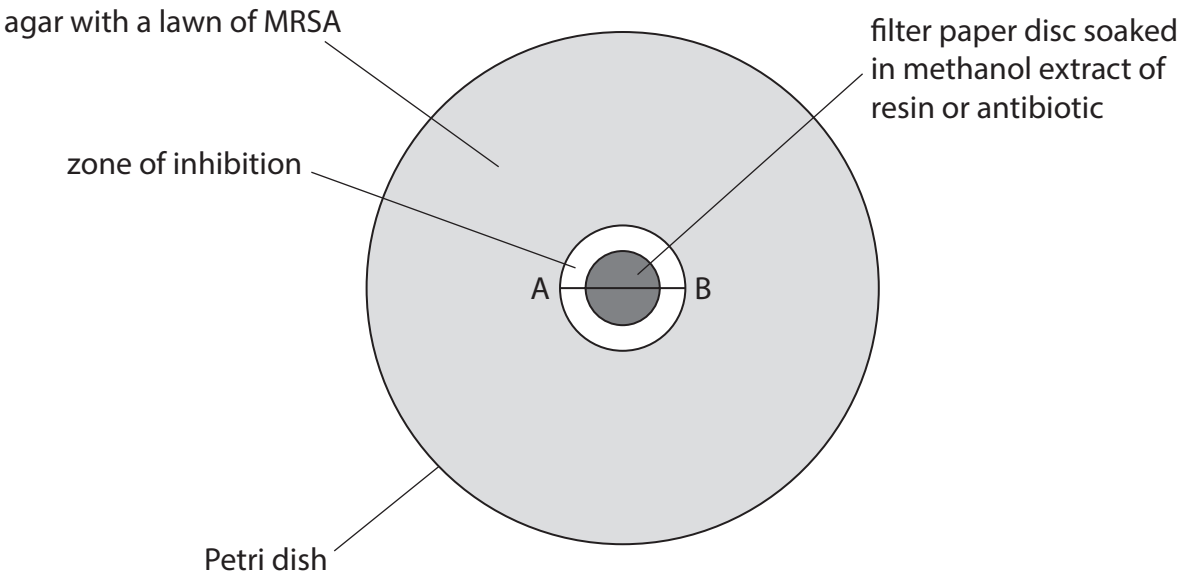
Filter paper discs were used to transfer methanol extracts of the resins to the lawns of bacteria.

After incubation at 37 °C for 24 hours, the size of the zone of inhibition was measured.

The larger the zone of inhibition, the greater the antimicrobial effect.

The antibacterial effects of the resins were compared with two antibiotics, penicillin and tetracycline.

The diagram shows a Petri dish after the incubation period.



(a) (i) Describe **three** aseptic techniques that should be used when transferring bacteria safely.

(3)

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(ii) The methanol used as a solvent to make the extract may have antimicrobial properties.

Explain how this could be taken into account in the investigation.

(2)

(iii) Justify the following steps that were used in this medical laboratory.

(3)

Filter paper discs all the same size

Incubation at 37 °C

Incubation for 24 hours

(b) The table shows results for myrrh, frankincense and the two antibiotics.

Antimicrobial chemical	Diameter of zone of inhibition (A to B) / mm	Area of zone of inhibition / mm²
myrrh	9.0	63.6
frankincense	9.6	72.4
penicillin	7.7	46.6
tetracycline	14.3	

(i) Calculate the area of the zone of inhibition for tetracycline.

Give your answer to **three** significant figures.

(2)

Answer ..... mm²

(ii) In the investigation, a ruler was used to measure a single diameter for each zone of inhibition.

Describe how the diameter of the zone of inhibition can be determined more accurately.

(2)

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(iii) Describe the conclusions that can be drawn from these results.

Use the data in the table to support your answer.

(4)

(iv) Explain how factors influencing the rate of diffusion of the antimicrobial chemicals can affect these results.

(3)

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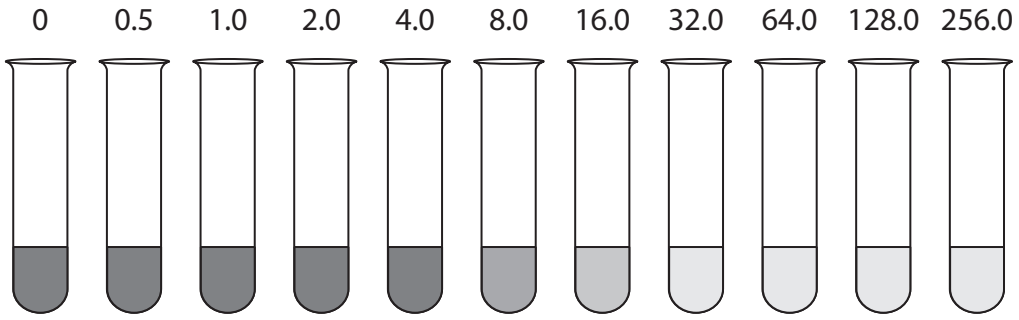
(c) The minimum inhibitory concentration (MIC) is another method of determining the antimicrobial properties of an extract.

The MIC can be defined as the **lowest concentration** of extract that prevents the visible growth of the bacteria.

Different concentrations of the extract are added to test tubes containing the same concentration of bacteria.

Each tube is incubated for 24 hours.

The diagram shows the tubes, the concentration of extract in $\mu g\ dm^{-3}$ and their appearance after incubation.



(i) State the MIC of this extract.

(1)

Answer ..... $\mu g\ dm^{-3}$

(ii) Suggest how the procedure shown in the diagram could be improved to get a more accurate measurement of the MIC.

(2)

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(Total for Question 3 = 22 marks)

TOTAL FOR PAPER = 50 MARKS

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