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 16 October 2024

Morning (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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QUESTION 1 BEGINS ON THE NEXT PAGE.

Answer ALL questions.

Write your answers in the spaces provided.

1 Maize is grown as a source of starch.

The photograph shows a ripe maize cob.

(Source: © IGOR STEVANOVIC / SCIENCE PHOTO LIBRARY)

(a) Describe the structure of starch.

(3)

(b) In maize, starch is synthesised at an optimum temperature of between 20°C and 30°C.

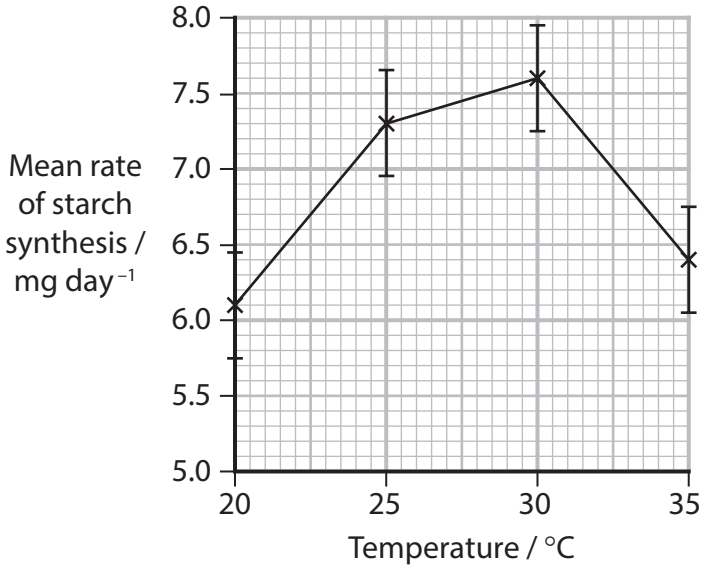
(i) Explain the effect this will have on the mass of starch produced in maize plants.

(2)

(ii) Studies have shown the effect of temperature on starch synthesis.

In an investigation, the rate of starch synthesis was measured at four different temperatures.

The results are shown in the graph.



Draw a table to show the results from the graph, excluding the standard deviations.

(3)

(iii) Explain what the value for the standard deviation at 30°C means in this investigation.

(2)

Value of standard deviation

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Explanation

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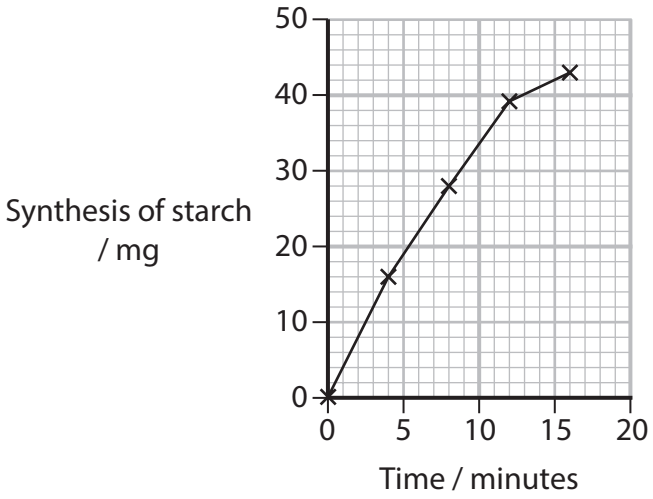
(iv) Justify conclusions about the changes in mean rate of starch synthesis between 20°C and 25°C and between 25°C and 30°C.

(2)

20°C and 25°C

25°C and 30°C

(c) The graph shows the synthesis of starch at 30°C over a period of 16 minutes.



The table shows the initial rates of reaction calculated for four other temperatures.

Temperature / °C	Initial rate / mg min^{-1}
20	2.0
25	2.6
30	
35	2.5
40	1.5

(i) Calculate the initial rate of reaction for 30°C shown in the graph.

(1)

Answer ..... mg min^{-1}

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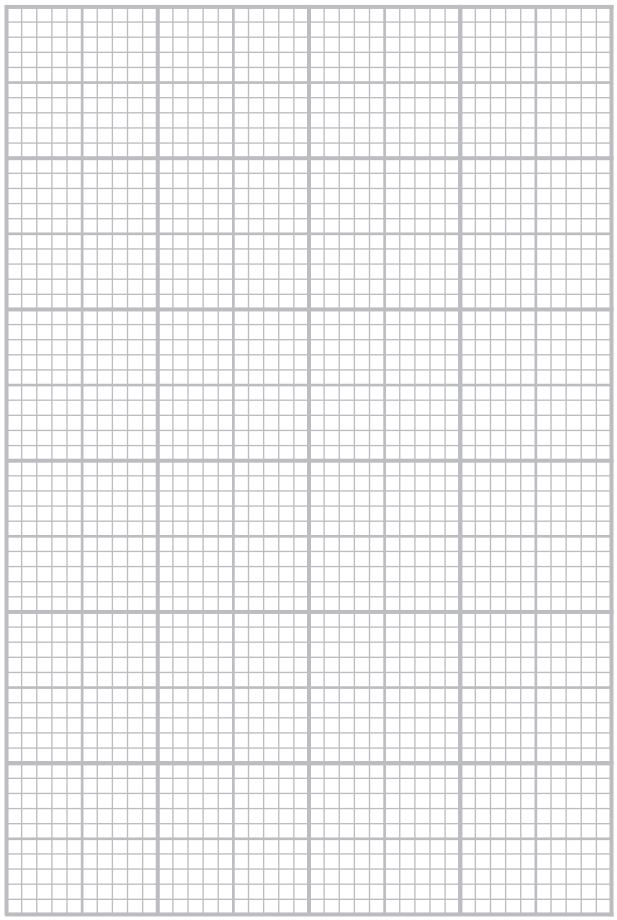
(ii) Plot a graph of the data in the table and join the points with straight lines.

(4)



(iii) Give **two** reasons why the initial rate of reaction was measured.

(2)

1 .....

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2 .....

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(Total for Question 1 = 19 marks)

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2 More farmers are using environmentally friendly fertilisers.

One example is vermicompost leachate (VCL), a liquid formed when worms decompose organic matter.

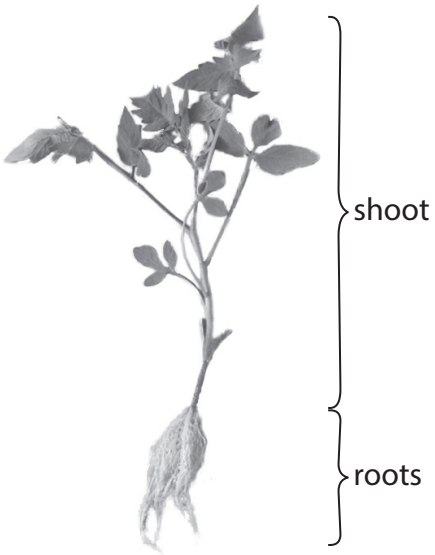
Hoagland's solution contains the mineral ions required for plant growth.

Three mineral-deficient solutions were made from Hoagland's solution:

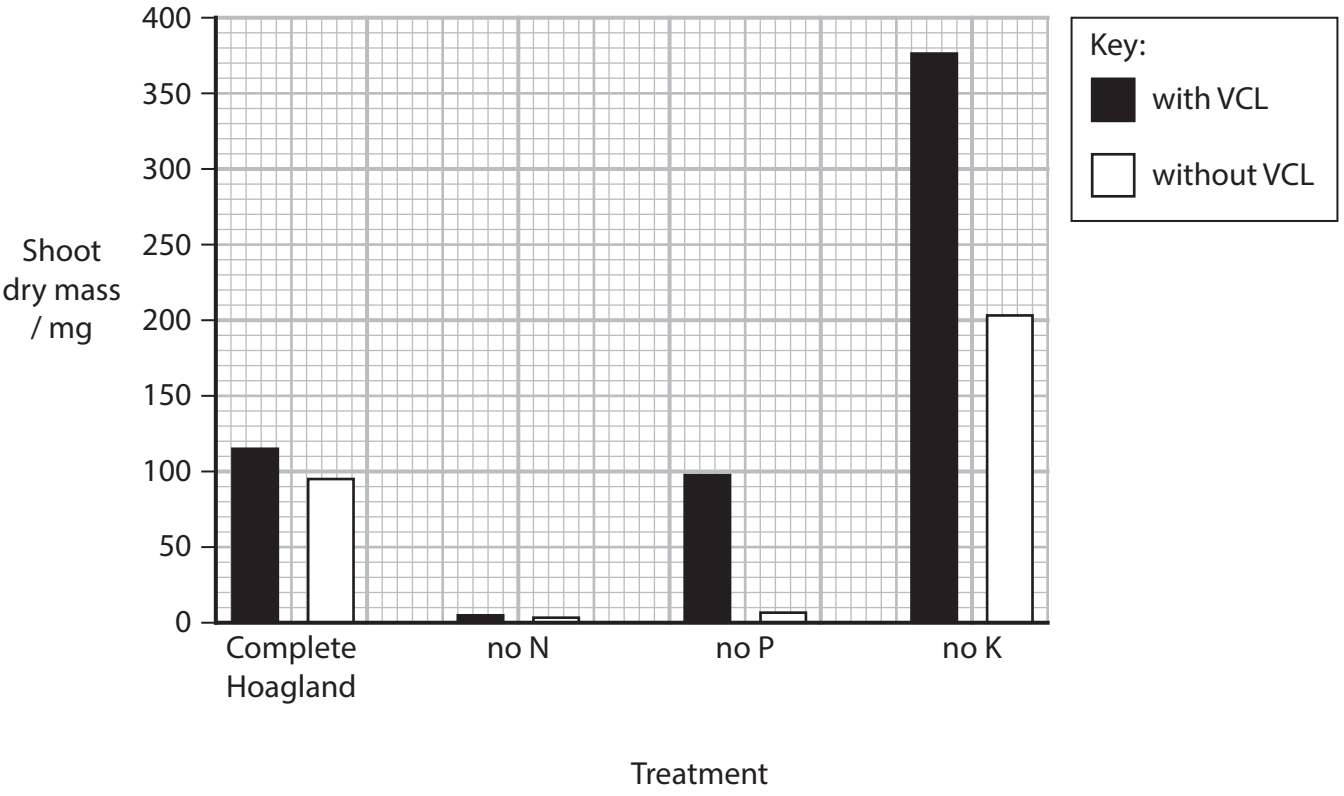
- solution A had no nitrate ions (no N)
- solution B had no phosphate ions (no P)
- solution C had no potassium ions (no K).

The effect on the dry mass and length of shoots of tomato plants treated with these mineral-deficient solutions, supplemented with VCL, was investigated.

The photograph shows a tomato plant.



The graph shows details of the treatments and the results for shoot dry mass.



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(a) (i) Describe a method that could be used to obtain the results for the complete Hoagland treatment, so that it can be compared with the other treatments.

(4)

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(ii) Calculate the percentage increase in shoot dry mass when VCL is added to Hoagland's solution.

(2)

Answer .....%

(b) (i) Suggest why shoot dry mass is a more accurate measure than the length of a fresh shoot.

(2)

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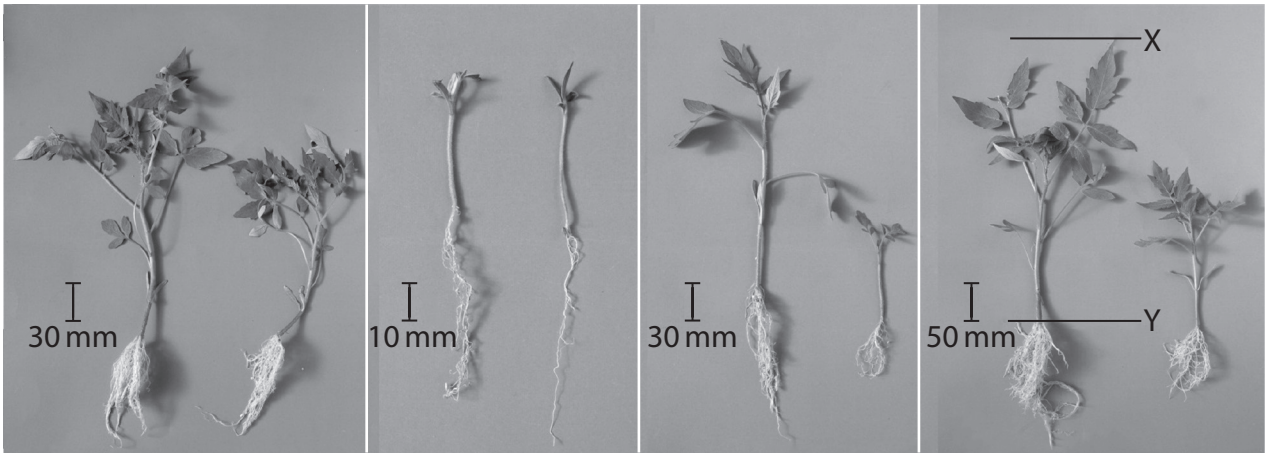
(ii) The photographs show the appearance of plants following each treatment.

The photograph for each pair of plants has its own scale bar.



Complete Hoagland with VCL | Complete Hoagland | no N with VCL | no N | no P with VCL | no P | no K with VCL | no K

Complete the table to show the actual shoot length, between X and Y, for the tomato plant labelled no K, with VCL.

(2)

Actual shoot length / mm							
Complete Hoagland with VCL	**Complete Hoagland**	**no N with VCL**	**no N**	**no P with VCL**	**no P**	**no K with VCL**	**no K**
240	180	40	40	210	96	.....	230

(iii) Discuss the use of VCL as a fertiliser.

Use all the information from this investigation.

(5)

(Total for Question 2 = 15 marks)

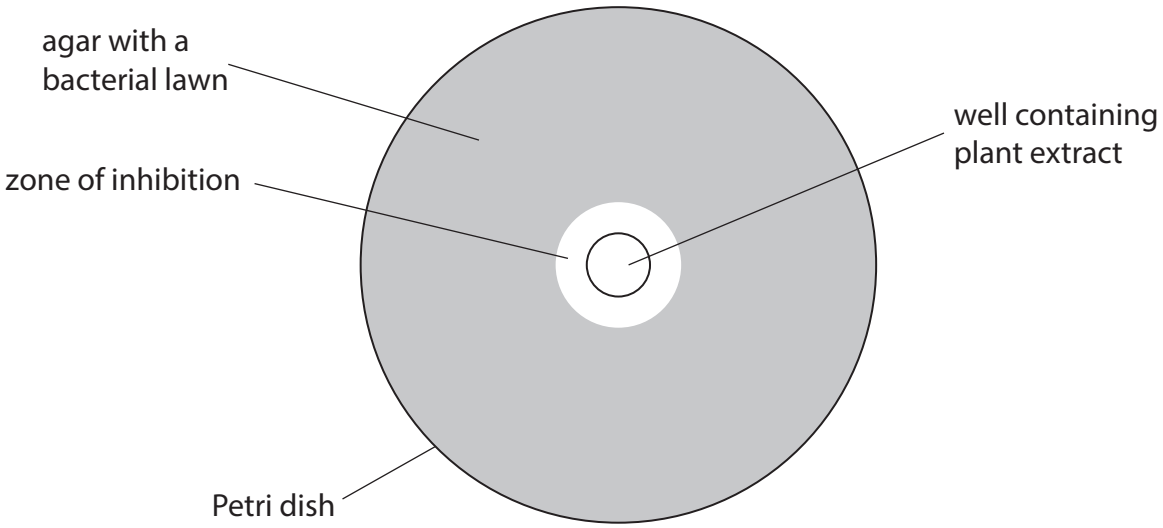
3 Petri dishes with nutrient agar were used in an investigation of the antimicrobial properties of plant extracts.

Bacteria were spread on the surface of the agar to form a lawn.

Plant extracts were placed in wells cut in the agar.

After incubation, the size of the zone of inhibition is a measure of the antimicrobial effect of the plant extract.

The diagram shows a Petri dish after the incubation period.



(a) (i) Explain why the dishes were incubated for 48 hours at 30°C.

(2)

48 hours

30°C

(ii) Explain **three** aseptic techniques that should be used when transferring bacteria from one culture to another.

(3)

1 .....

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2 .....

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3 .....

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(b) The technique described was used to investigate the antimicrobial effects of oil A and oil B, extracted from two species of plant.

Different bacterial lawns were made using *E. coli* and *B. subtilis*.

(i) Explain how the area of the zone of inhibition could be measured accurately.

(2)

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(ii) State **one** independent variable in this investigation.

(1)

(iii) The table shows the results from this investigation.

Type of bacteria	Diameter of zone of inhibition / mm	
	oil A	oil B
B. subtilis	20.66	11.33
E. coli	8.66	0.00

Determine the effect of these two oils on the growth of these bacteria.

(4)

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(c) The size of the zones of inhibition may also be affected by the rate of diffusion of the antimicrobial molecules through the agar.

(i) Suggest **two** factors that may affect the rate of diffusion of the antimicrobial molecules.

(2)

1 .....

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2 .....

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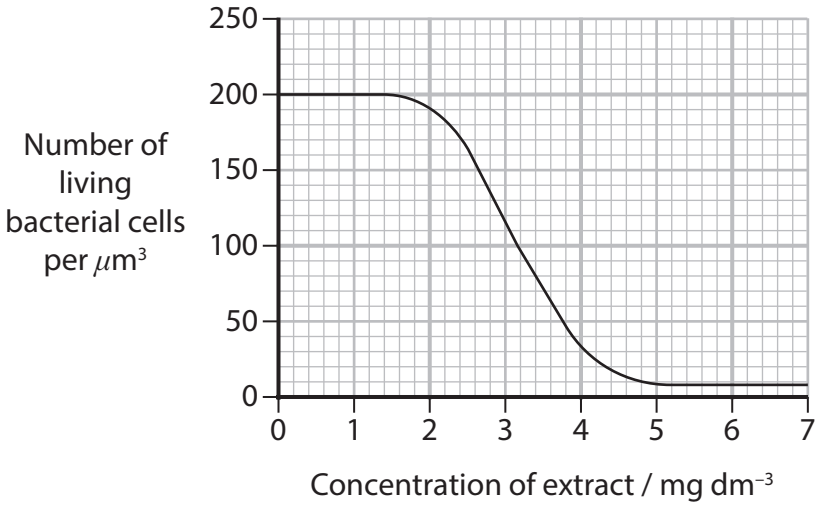
(ii) A method that avoids this problem is to find the minimum inhibitory concentration (MIC) of the extract.

The MIC can be defined as the minimum concentration of the antimicrobial molecule that will reduce the number of living bacterial cells by 90%.

In an investigation the following data were obtained.



Determine the MIC for this extract.

(2)

Answer ..... mg dm^{-3}

(Total for Question 3 = 16 marks)

TOTAL FOR PAPER = 50 MARKS

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Source acknowledgment:

Question 2: https://journals.ashs.org/hortsci/view/journals/hortsci/47/9/article-p1304.xml
Georgina D. Arthur, Adeyemi O. Aremu, Manoj G. Kulkarni, Johannes Van Staden