



Biology

Standard level

Paper 1B — Mock Examination

Mock Exam 1

Calculator required

Time allowed: **40 minutes**

Maximum mark: **25 marks**

Candidate information

Candidate name:

Session number:

Date:

Topic emphasis: osmosis and the movement of water into and out of plant tissue, sampling techniques and the distribution of species within a habitat, factors affecting the rate of enzyme-catalysed reactions, and reproduction, mutation and natural selection in bacteria. Data processing, experimental design and the evaluation of method are assessed throughout.

Instructions to candidates

- Write your session number in the box on the cover.
- Do not open this examination paper until you are told to do so.
- Answer **all** questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[25 marks]**.

The mark allocation is shown in square brackets at the end of each question or part question. Where a numerical answer is required, show all of your working. Unless otherwise stated, all measurements were made at 293 K and 100 kPa.

Mark allocation

Question 1 (osmosis in plant tissue)	[6 marks]
Question 2 (distribution and sampling)	[6 marks]
Question 3 (enzyme activity)	[6 marks]
Question 4 (bacteria and antibiotic resistance)	[7 marks]
Total	[25 marks]

Answer **all** questions. Answers must be written within the answer boxes provided.

1. A student investigated osmosis in plant tissue. Six cylinders of potato (*Solanum tuberosum*) tissue of the same length and diameter were cut using a cork borer. Each cylinder was blotted dry, weighed, and then left in a different concentration of sucrose solution for 24 hours at 20 °C. Each cylinder was then blotted dry and reweighed. The results are shown in the table.

Concentration of sucrose / mol dm^{-3}	Initial mass / g	Final mass / g	Change in mass / %
0.00	4.02	4.52	+12.4
0.20	3.95	4.19	+6.1
0.40	4.10	4.04	−1.5
0.60	3.88	3.57	−8.0
0.80	4.05	3.52	−13.1
1.00	3.99	3.33	−16.5

- (a) State the independent variable in this investigation.

[1]

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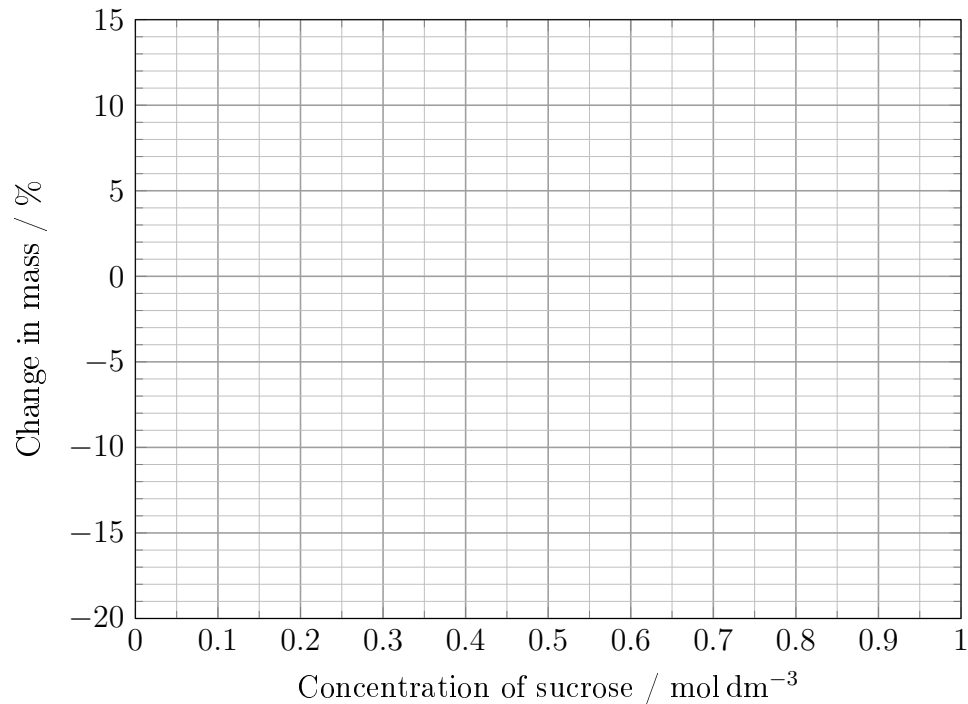
- (b) Explain why the change in mass of each cylinder was expressed as a percentage rather than in grams.

[1]

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(Question 1 continued)

- (c) Plot the percentage change in mass against the concentration of sucrose on the grid below, and draw a line of best fit. **[2]**



- (d) Determine, using your graph, the concentration of sucrose that is isotonic with the potato cell sap, and explain how the graph shows this. **[2]**

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2. A group of students investigated the distribution of the common limpet (*Patella vulgata*) on a rocky shore. A tape measure was laid out from the low-water mark to the top of the shore. Quadrats of area 0.25 m^2 were then placed at five randomly selected positions within each of three zones, and the number of limpets in each quadrat was counted.

Zone (height above chart datum)	Number of limpets per quadrat				
	1	2	3	4	5
Upper (3.5–4.5 m)	2	0	1	3	1
Middle (2.0–3.0 m)	12	9	15	11	13
Lower (0.5–1.5 m)	7	5	8	4	6

- (a) State the name of the sampling method used to measure the change in distribution of a species along a line across the shore. [1]

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- (b) Calculate the mean number of limpets per square metre in the middle zone. [2]

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- (c) Suggest **one** abiotic factor that could account for the small number of limpets found in the upper zone. [1]

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- (d) Explain why the positions of the quadrats within each zone were selected randomly. [2]

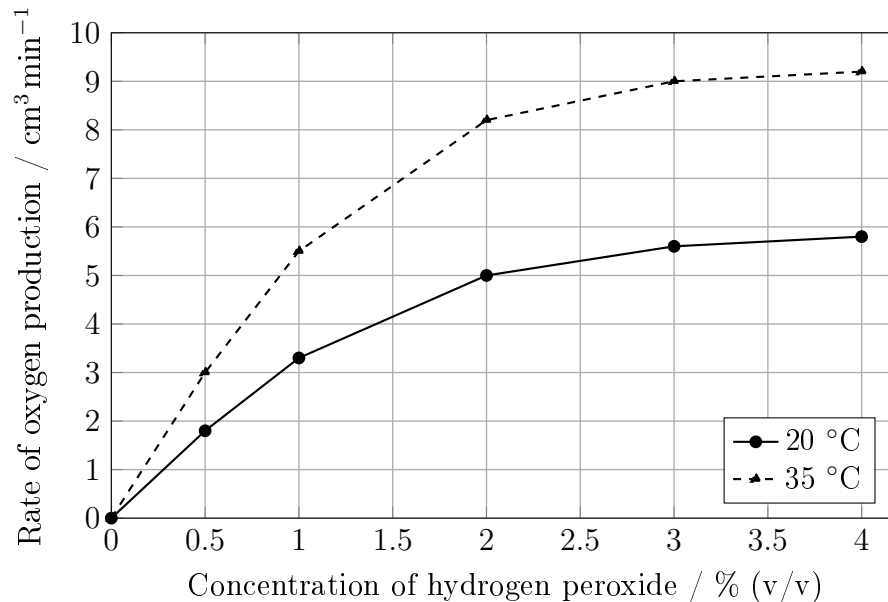
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3. Hydrogen peroxide is a toxic by-product of metabolism. The enzyme catalase catalyses its breakdown into water and oxygen. Discs of potato tissue of the same size were added to hydrogen peroxide solutions of different concentration, and the volume of oxygen produced during the first minute was measured using a gas syringe. The investigation was carried out at 20 °C and then repeated at 35 °C. The graph shows the mean results of three trials.



- (a) Outline the effect of increasing the concentration of hydrogen peroxide on the rate of oxygen production at 20 °C. [1]

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- (b) Explain the shape of the curve at 20 °C above a hydrogen peroxide concentration of 3.0 %. [2]

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(Question 3 continued)

(c) Compare **and** contrast the results obtained at 20 °C with those obtained at 35 °C. [2]

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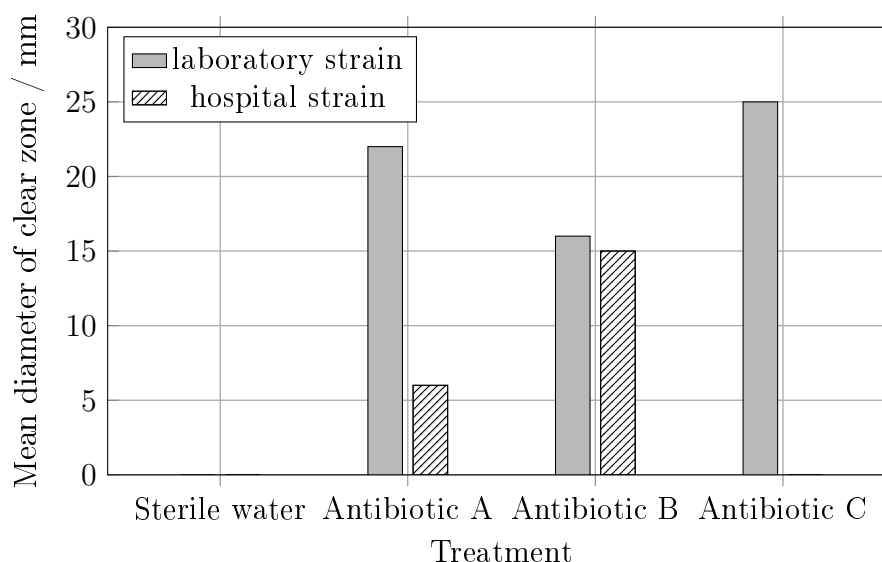
(d) Predict, with a reason, the effect on the rate of oxygen production of repeating the investigation at 65 °C. [1]

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4. Two strains of the bacterium *Escherichia coli* were investigated: a laboratory strain and a strain isolated from a hospital. Agar plates were inoculated with an even lawn of one of the strains. Four sterile paper discs were then placed on the surface of each plate: three had been soaked in different antibiotics (A, B and C) and one had been soaked in sterile water. The plates were incubated at 30 °C for 48 hours, after which the diameter of the clear zone around each disc was measured. The bar chart shows the mean diameter for three plates of each strain.



- (a) State the reason for including a disc soaked in sterile water.

[1]

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- (b) Describe how the bacteria on the agar plates reproduce.

[2]

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(Question 4 continued)

(c) Explain how the hospital strain could have become resistant to antibiotic C. **[3]**

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(d) Deduce which antibiotic should be used to treat a patient infected with the hospital strain, giving a reason for your answer. **[1]**

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End of examination.

Total: 25 marks