

SECTION A

Answer BOTH questions

- 1. Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Maggot cure for ‘unbeatable bug’

5 Maggots may be the answer to antibiotic-resistant infections that affect humans. Doctors say that maggots are able to clear up methicillin-resistant *Staphylococcus aureus* (known as MRSA) – the bacteria that have defeated most other drugs and have become a problem in many hospitals. Doctors even suggest that early use of maggots on infected wounds would, in many cases, reduce the need for treatment with antibiotics.

It is not fully understood how the maggots work. But there are three main theories – they may produce antibacterial agents, or they may suck up the bacteria, or perhaps change the acidity of an infection.

10 Maggots were widely used for medicinal purposes as early as 1900 but with the introduction of antibiotics in the 1940s their use died out. Now, with the rise of antibiotic-resistant infections, there is renewed interest. The maggots are used to treat ulcers, pressure sores and infections caused by diabetes. The maggots used are sterile greenbottle fly larvae. These are used because they digest only dead tissue and do not burrow down into live flesh. Other larvae, for example the screw worm, do eat living tissue.

20 The greenbottle maggots are used when they are only three days old and two millimetres long. They are applied to the wound, sealed in with a bandage and left to feed. They release enzymes that break up the dead tissue and liquify it. The maggots then suck up the liquid, clearing up the infection as they go.

(BBC online network news 18/3/99)

- (a) Methicillin is an antibiotic. Explain why bacteria that have become resistant to antibiotics have led to problems in many hospitals. (Line 4)

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 (2)

- (b) Suggest why ‘a change in the acidity’ might reduce the infection. (Line 9)

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 (1)



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(c) Name **two** multicellular organisms mentioned in the passage.

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(2)

(d) Greenbottle larvae are used in preference to other larvae, such as the screw worm. Suggest why greenbottle larvae are used. (Line 14)

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(2)

(e) (i) The maggots produce enzymes that break up and liquify the dead tissue. (Line 19) Name **one** enzyme that the maggots would release and name the product(s) of this reaction.

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(2)

(ii) In what way is this nutrition similar to the nutrition of a fungus such as *Mucor*?

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(1)

(f) The increase in the number of *Staphylococcus aureus* that are resistant to antibiotics is the result of mutations. Explain what is meant by a **mutation**.

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(2)

(Total 12 marks)

Q1

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2. A student carried out an investigation into the effects of different concentrations of sodium chloride solution on potato tissue.

Six cubes, each measuring 2 cm × 2 cm × 2 cm, were cut from a large potato. The cubes were placed on filter paper, gently blotted dry and weighed. Two cubes were then placed in Petri dishes in each of three solutions as follows: 10% sodium chloride solution, 2% sodium chloride solution and distilled water. The potato cubes were left in the solution for 2 hours, then removed, blotted as before and weighed again. The results are shown in the table below.

Solution	Initial mass of cubes in g	Final mass of cubes in g	Change in mass in g	Change in mass (%)
10% sodium chloride	10.7	9.8	-0.9	-8.41
2% sodium chloride	10.9	10.8		
Distilled water	11.3	13.0	+1.7	+15.04

- (a) Why were the cubes gently blotted dry before weighing?

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(1)

- (b) Calculate the change in mass and percentage change in mass for the potato cubes in 2% sodium chloride solution. Write your answers in the appropriate boxes in the table. Show your working.

(3)



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(c) Explain the difference between the changes in mass for potato cubes in distilled water and in the 10% sodium chloride solution.

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(5)

(d) Why is it more appropriate to compare percentage change in mass rather than the change in mass?

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(1)

(e) Suggest another method of investigating the effect of the different solutions on potato cubes that does not require weighing the cubes.

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(3)

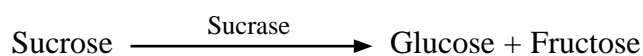
(Total 13 marks)

Q2

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3. Sucrose can be digested to give glucose and fructose. This reaction is speeded up by the enzyme sucrase.



- (a) A student carried out an investigation into the effects of increasing the concentration of the enzyme sucrase on the rate of this reaction.

He kept the concentration of sucrose constant. He used six different concentrations of the enzyme (sucrase) and for each of these he measured the time taken for the sucrose to be completely digested. He carried out all the reactions at 40°C. The student's results are shown in the table below.

Enzyme (sucrase) concentration (%)	Time taken to digest the sucrose in seconds
0.10	950
0.25	600
0.50	470
1.00	290
1.50	225
2.00	160

- (i) Plot a line of these results on the grid opposite. Join the points with straight lines. (5)
- (ii) Describe how increasing the concentration of the enzyme (sucrase) affected the time taken for the sucrose to be digested.

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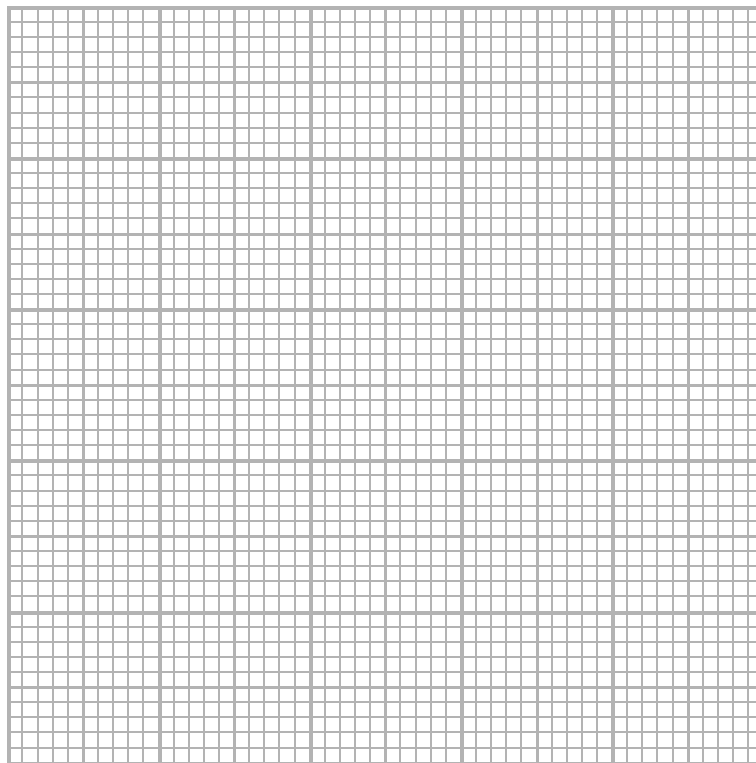
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(2)



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(b) (i) Suggest why he carried out all of the reactions at 40 °C.

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(1)

(ii) Describe **one** way that he could keep the temperature constant (at 40 °C).

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(1)

(c) The student then repeated this experiment, first at 20 °C and then at 80 °C.

Suggest what would happen to the time taken for the sucrose to be digested at 20 °C and 80 °C. In each case give a reason for your answer.

20 °C
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80 °C
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(4)

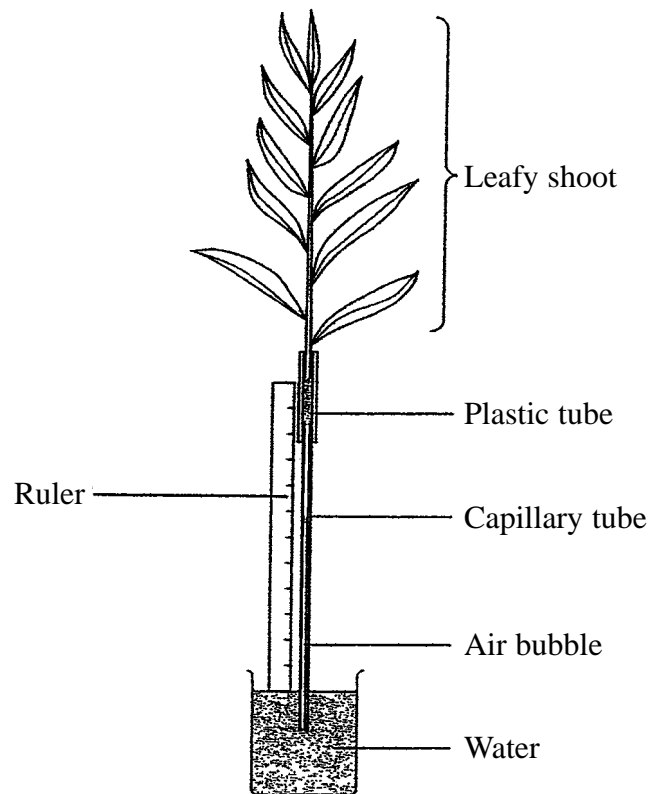
(Total 13 marks)

Q3



4. The diagram below shows the apparatus used by a student to measure water uptake by a leafy shoot.

The rate of water uptake by the leafy shoot in different conditions was compared by measuring the distance moved by the air bubble in one minute.



(a) (i) What name is given to this type of apparatus?

..... (1)

(ii) Name the process by which water is lost from the leaves of a plant.

..... (1)

(b) Give **two** precautions you should take when setting up this apparatus.

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2

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(2)



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(c) The student measured the distance moved by the bubble in one minute, with the shoot in different conditions. The results are given in the table below.

Conditions	Distance moved by bubble in mm
Normal conditions	20
Increased temperature	24
Increased humidity	15
Increased air speed	25

(i) Calculate how many centimetres you would expect the bubble to move in a five-minute period with increased air speed. Show your working.

Answer
(2)

(ii) Explain the change in the rate of water loss as the air speed increased.

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(3)

Q4

(Total 9 marks)



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5. Describe a simple controlled experiment to find out how changing the colour of light affects the rate of photosynthesis in a water plant.

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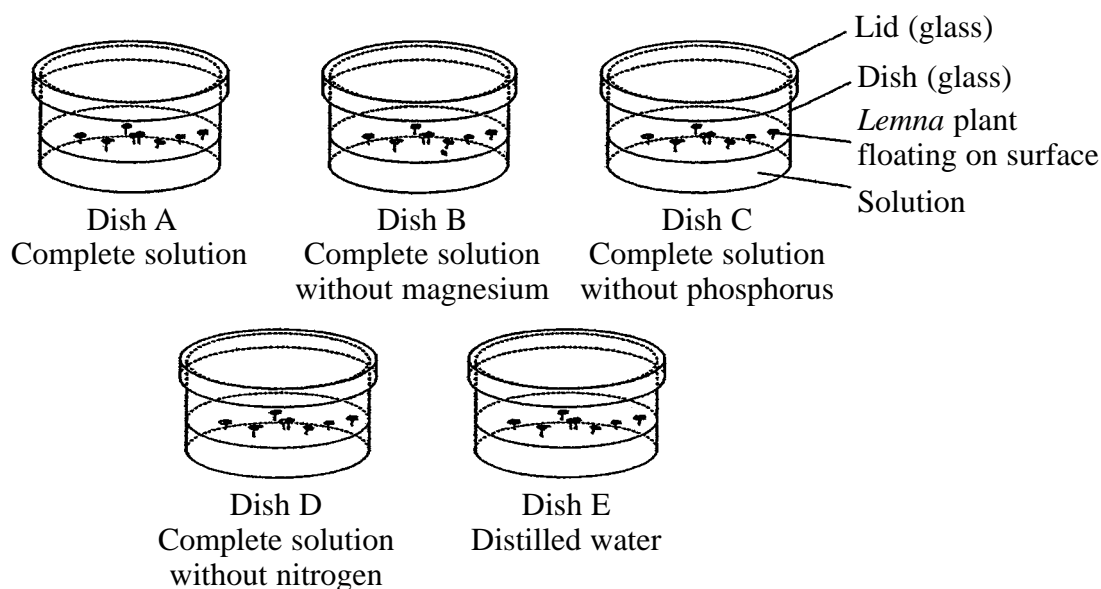
(Total 6 marks)

Q5



6. *Lemna* (also known as duckweed) is a small floating plant, which grows in fresh water.

An experiment was set up to investigate the role of mineral ions in the growth of *Lemna*. Five dishes (labelled A to E) were set up as shown in the diagram below. Each dish contained the same number of *Lemna* plants but in a different solution. Dish A contained 'complete solution', which included all the mineral ions required by *Lemna* for normal growth. Dishes B, C and D each lacked a different mineral ion. Dish E contained distilled water, which has no mineral ions.



The dishes were placed by a window in the classroom and observed over a period of three weeks. Growth of the *Lemna* plants was estimated from the changes in leaf size and number of leaves.

(a) Compared with dish A, *Lemna* plants in dish B showed less growth and their leaves turned yellow. Suggest an explanation for this result.

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 (2)

(b) In this experiment, why is a comparison made with dish A rather than dish E?

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 (1)



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(c) Explain why all the dishes were placed by a window in the classroom.

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(2)

(d) Suggest a method you could use to estimate the leaf area of all the *Lemna* plants in dish A.

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(2)

Q6

(Total 7 marks)

TOTAL FOR SECTION A: 60 MARKS



SECTION B

Answer TWO questions in this section. Where appropriate you may draw diagrams to help make your answers clearer. Write your answers in the separate answer book.

7. Gas exchange in a leaf can be affected by the environmental conditions surrounding the leaves. Explain how each of the following changes would affect the gases passing into and out of the leaf.

(a) An increase in light intensity from dim light to bright light. (4)

(b) An increase in temperature during the day. (4)

(Total 8 marks)

8. (a) Compare sexual and asexual reproduction. (4)

(b) Describe the differences between mitosis and meiosis. (4)

(Total 8 marks)

9. (a) Explain how the appearance of an organism can be influenced by both its genotype and its environment. Use examples to illustrate your answer. (5)

(b) Explain why the energy passed along food chains decreases as the number of trophic levels increase. (3)

(Total 8 marks)

TOTAL FOR SECTION B: 16 MARKS



SECTION C

Answer TWO questions in this section. Where appropriate you may draw diagrams to help make your answers clearer. Write your answers in the separate answer book.

10. Describe what would happen to a piece of meat from when it is first eaten to when its constituent molecules are absorbed into the bloodstream.

(Total 12 marks)

11. Describe the mechanism by which carbon dioxide in the blood capillaries around the alveoli passes into the alveoli and is exhaled from the lungs.

(Total 12 marks)

12. Describe how the structure of a leaf helps it carry out photosynthesis. For each feature you give, explain how it enables photosynthesis to occur efficiently.

(Total 12 marks)

TOTAL FOR SECTION C: 24 MARKS

TOTAL FOR PAPER: 100 MARKS

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