

**ADVANCED GCE****BIOLOGY**

Unifying Concepts in Biology

**2806/01**

Candidates answer on the Question Paper

**OCR Supplied Materials:**

- Insert (inserted)

**Other Materials Required:**

- Electronic calculator
- Ruler (cm/mm)

**Wednesday 16 June 2010  
Morning****Duration:** 1 hour 15 minutes

Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

**Examiner's Use Only:**

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5			
<b>Total</b>			

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Answer **all** the questions.

- 1 Several groups of discs cut from spinach leaves were placed in test tubes of water. The discs all sank to the bottoms of the tubes. Each tube was placed at a measured distance from a lamp, as shown in Fig. 1.1.



**Fig. 1.1**

- (a) The experiment was carried out at a constant temperature. Explain why.

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- (b) The lamp was switched on and the time taken for five of the ten discs in each tube to float was recorded. The results are shown in Table 1.1.

**Table 1.1**

tube number	distance from lamp / mm	time taken for 5 discs to float / s
1	50	125
2	100	210
3	150	360
4	200	600
5	250	none floated in the time available

- (i) Describe **and** explain the trend shown by the results in Table 1.1.

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- (ii) Suggest why the experimenter recorded the time taken for five discs to float rather than the time taken for all of them to float.

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- (c) The experiment was repeated by putting spinach leaf discs into water that had been boiled for several minutes and cooled in the absence of air. None of the discs floated.

Explain why.

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- (d) The experiment was repeated at a lower temperature. The results are shown in Table 1.2.

**Table 1.2**

tube number	distance from lamp / mm	time taken for 5 discs to float / s
1	50	275
2	100	390
3	150	410
4	200	620
5	250	none floated in the time available

Using the data in Tables 1.1 and 1.2, explain why the effect of temperature change is larger when the lamp is closer to the tube.

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**[Total : 12]**

- 2 Isle Royale is an island 544 km<sup>2</sup> in Lake Superior, between the USA and Canada. The island is about 25 km from the Canadian shore. During exceptionally cold winters, ice bridges connect the island to Canada.

The island is mostly covered by climax forest. It is a national park where hunting and logging are prohibited.

Shortly after 1900, moose colonised Isle Royale for the first time. Moose are a large species of deer which feed on shrubs and the lower branches of trees. Since 1915, the population of moose has been monitored.

In 1948, wolves arrived on the island. Wolves hunt and feed on moose as well as on other prey species.

Fig. 2.1, **on the insert**, shows estimated numbers of both species between 1915 and 1995.

- (a) Using Fig. 2.1, calculate the **population density** of moose in 1928.

Give your answer to the nearest whole number per km<sup>2</sup>. Show your working.

Answer = .....per km<sup>2</sup> [2]

- (b) Suggest **two** reasons to explain the rapid fall in the moose population between 1928 and 1936.

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- (c) In 1936, a fire destroyed about 20% of the forest on Isle Royale.

Suggest how the fire may have helped the recovery of the moose population.

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- (d) The decline in the wolf population between 1965 and 1967 was the result of an outbreak of a disease caused by a virus.

Explain why a disease may act on a population as a density-dependent limiting factor.

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- (e) Biologists have argued that the Isle Royale wolf and moose populations are an example of a predator-prey relationship in which the population of prey is controlled by the population of predators.

Explain how the data in Fig. 2.1 support this hypothesis.

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- (f) Explain how the data in Fig. 2.1 **do not** support the hypothesis that a shortage of moose limits the wolf population.

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[Total : 12]

- 3 Roots absorb ions selectively from the soil. When the concentration of an ion in the soil is high, it may be absorbed in unusually large amounts, interfering with biochemical functions and producing symptoms of toxicity. Different species of plant vary in the range of concentrations of specific ions which they will tolerate.

(a) State **two** mechanisms by which ions may be taken in by plant cells.

1 .....

2 ..... [2]

(b) Suggest **one** way in which increased concentrations of an ion to toxic levels within cells may interfere with biochemical functions.

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Saline soils, with high concentrations of sodium ions, are a major problem in many parts of the world. Most crop species are unable to tolerate high concentrations of sodium ions.

In an investigation into the effects of soil salinity on tomato plants, two species, the edible tomato, *Lycopersicon esculentum*, and a wild species of tomato that is salt-tolerant, *L. cheesmanii*, were compared. Fig. 3.1 shows some of the results of this investigation.

Soil salinity was simulated by adding sodium chloride to the standard nutrient solution in which the plants were grown. The accumulation of sodium ions in the leaves of the two species was measured.

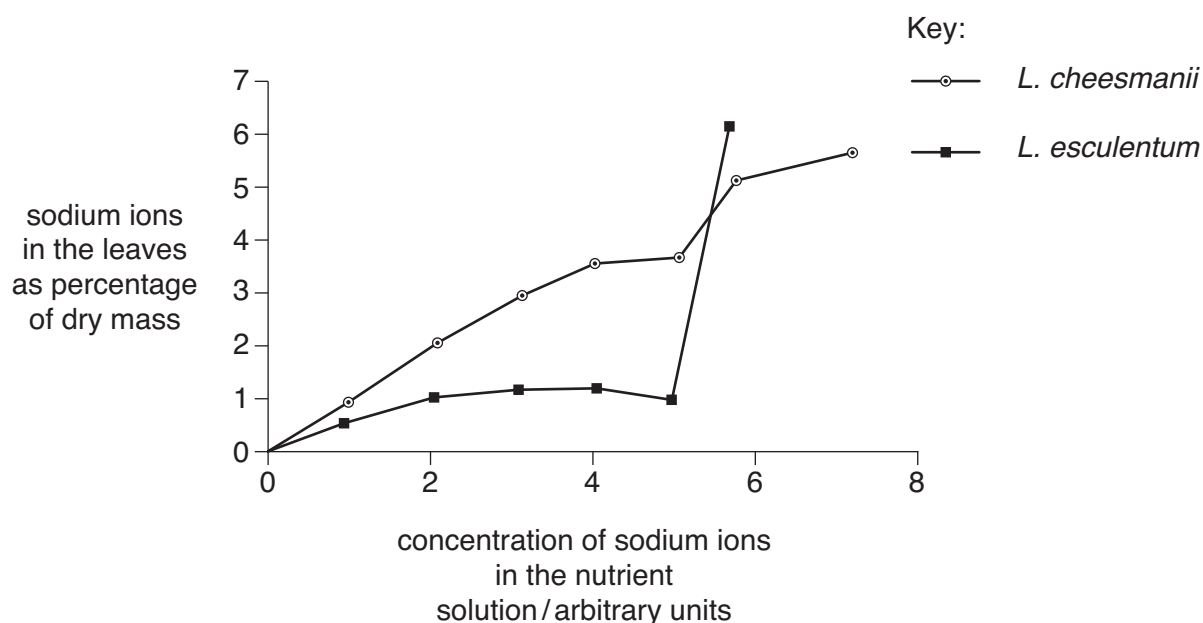


Fig. 3.1



- (c) Describe the relationship between the accumulation of sodium ions in the leaves of *L. cheesmanii* and the concentration of sodium ions in the nutrient solution, as shown in Fig. 3.1.

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- (d) When *L. cheesmanii* grows in saline soils, it stores excess sodium ions in the cell vacuoles. When *L. esculentum* grows in saline soils, it is unable to do this and actively pumps excess sodium ions from the root cells into the soil.

- (i) Suggest why plants which actively pump sodium ions into the soil do not grow well in saline soils.

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- (ii) Suggest why excess sodium ions are less toxic to the plant if they accumulate in the vacuole rather than in the cytoplasm.

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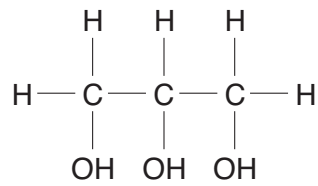
- (iii) State **one** function of the solution found in the vacuoles of root cells, other than to store excess ions.

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[Total : 10]

**4** Fig. 4.1 shows the structure of glycerol.



**Fig. 4.1**

Some molecules are produced by condensation reactions between glycerol and other compounds. The products of these reactions may have structural or storage roles in cells.

**(a)** Name a class of molecule, produced in this way, which has:

- (i) a storage role .....
- (ii) a structural role .....[2]

**(b)** In cells, more than one metabolic pathway may lead to the synthesis of glycerol.

State, using an example, what is meant by a metabolic pathway.

..... [3]

**(c)** Glycerol molecules diffuse into cells more rapidly than glucose molecules.

Suggest why this is so.

..... [2]



- 5 At the bottom of the oceans there is no light and the temperature is constant at about 4°C. In some parts of both the Pacific and the Atlantic oceans, there are holes or cracks in the ocean floor, called volcanic vents. Hot water escapes from the Earth's crust through these vents. This water is rich in sulphide ions. The sulphide ions are oxidised by several species of bacteria and this provides them with a source of energy.

Some of these species of bacteria remain active at temperatures above 110°C, fixing carbon and reproducing. Most organisms, especially eukaryotes, are unable to survive prolonged exposure to temperatures greater than 50°C.

(a) Using the information above,

- (i) explain why these bacteria have carboxylase enzymes;

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- (ii) explain why the structure of the enzymes of these bacteria are **stabilised** by disulphide bonds rather than by hydrogen bonds.

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The groups of volcanic vents are widely separated. The ocean floor surrounding each group of vents has a large and diverse community of animals. These include primary consumers, secondary consumers and decomposers. Areas of the deep ocean floor that are not close to vents have few organisms.

- (b) Suggest why there are fewer organisms in areas that are **not** close to a vent.

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- (c) State the food source of the primary consumers **near** a vent.

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- (d) Each group of volcanic vents has some species which are not found elsewhere.

Suggest why this is the case.

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[Total : 12]

END OF QUESTION PAPER

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