



OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY
Central Concepts



2804

Tuesday **22 JUNE 2004** Morning 1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:
Electronic calculator
Ruler (cm/mm)

Candidate Name

Centre Number

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Candidate Number

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TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.

DO NOT ANSWER IN PENCIL. DO NOT WRITE IN THE BARCODE.
DO NOT WRITE IN THE GREY AREAS BETWEEN THE PAGES.

- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	15	
2	12	
3	12	
4	18	
5	15	
6	10	
7	8	
TOTAL	90	

This question paper consists of 17 printed pages and 3 blank pages.



Answer **all** the questions.

For
Examiner's
Use

1 In the majority of plants, the leaf is the main photosynthetic organ.

(a) List **four** ways in which the structure of a dicotyledonous leaf is adapted for **gas exchange**.

- 1
- 2
- 3
- 4[4]

In an experiment to investigate the effect of light intensity on the rate of photosynthesis, the following procedure was carried out by some students.

- Discs were cut from the photosynthetic tissue of the brown alga *Fucus serratus*, a common rocky shore seaweed, using a cork borer.
- Ten discs were placed in each of four beakers filled with 50 cm³ of sea water. The discs are denser than sea water and therefore sink to the bottom of the beaker.
- Each beaker was illuminated with a bench lamp placed at different distances (d) from the beaker.
- The time, in minutes, at which the third disc from each batch reached the surface (t) was recorded.
- The rate of photosynthesis was determined by calculating 1000/t .

A student's set of results is shown in Table 1.1.

Table 1.1

distance of beaker from lamp (d) / cm	light intensity 1 / d ²	time for third disc to reach the surface (t) / min	rate of photosynthesis 1000 / t
5	0.04	23	43.5
10	0.01	36	27.8
15	0.004	52	19.2
20		88	



For
Examiner's
Use

(b) Calculate the values for light intensity and rate of photosynthesis when the distance between beaker and lamp was 20 cm. Record the values in the shaded boxes in Table 1.1. [2]

(c) Explain why the discs float after being illuminated for a length of time.

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.....[3]

(d) Using the data in Table 1.1, describe the relationship between light intensity and the rate of photosynthesis.

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.....[2]

(e) State the environmental factor limiting the rate of photosynthesis in this experiment.

.....[1]

(f) State the evidence from Table 1.1 you used to support your answer to (e).

.....
.....[1]

(g) Suggest why the student is **not** likely to find an increase in the rate of photosynthesis when two lamps are placed 5 cm from the beaker.

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.....[2]

[Total: 15]





For
Examiner's
Use

.....[7]

Quality of Written Communication [1]

[Total: 12]

[Turn over



3 Glycolysis takes place in the cytoplasm of the cell. Fig. 3.1 is an outline of the process.

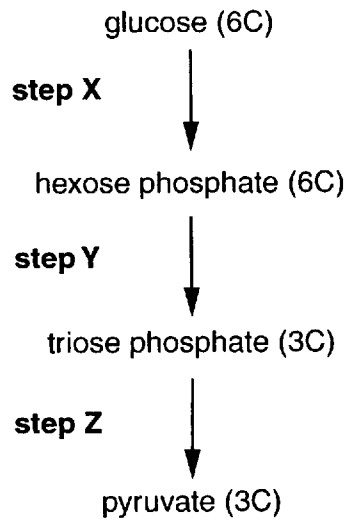


Fig. 3.1

(a) State at which **step** or **steps** the following occur:

- ATP is utilised
- ATP is formed
- reduced NAD (NADH₂) is formed[3]

(b) Describe what happens to the pyruvate so that the Krebs cycle can continue.

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.....[4]

For
Examiner's
Use



For
Examiner's
Use

(c) Under anaerobic conditions, the reduced NAD cannot be oxidised using oxygen. However, without it being oxidised glycolysis will stop and no ATP will be formed.

Explain how the reduced NAD is oxidised under anaerobic conditions in mammalian muscle tissue and in yeast.

mammalian muscle tissue

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yeast

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.....[5]

[Total: 12]





For
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- 4 Fig. 4.1 shows two unicellular organisms labelled **D** and **E**. These organisms are members of different kingdoms.

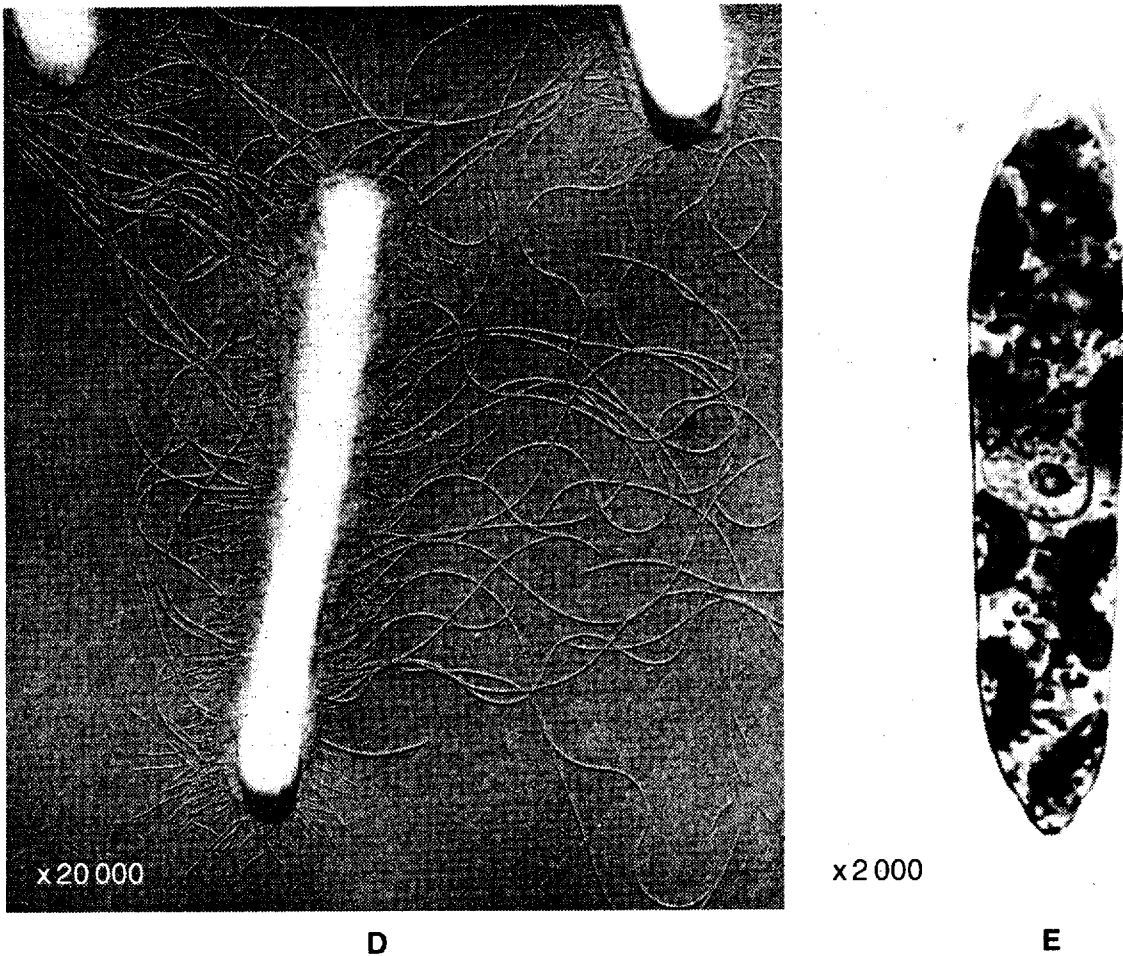


Fig. 4.1

- (a) (i) Study Fig. 4.1 and identify the kingdom to which each organism belongs. Write your answers in the table below.
- (ii) Complete the table by stating two features which are characteristic of the organism in the kingdom you have stated.

	unicell D	unicell E
kingdom		
features	1	1
	2	2

[6]



For
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The BBC also reported: 'The salt water is not ideal for the camels and they have had to adapt to drink it. Some young animals are unable to adapt and they die as a result'.

(d) Explain the effect on body tissues of drinking only salty water.

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.....[2]

(e) Suggest **two** physiological adaptations that would allow some camels to survive when their only source of water is salty.

1
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2
.....[2]

(f) Explain how genetic variation in the ancestral wild camel population enabled the development of this 'new species'.

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.....[2]

[Total: 18]



For
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5 Copper trim and sable trim are coat patterns found in Australian Shepherd dogs. This pattern is most noticeable on the muzzle, at the eyebrows, inside the ears, on the legs and under the tail.

Coat pattern is controlled by three alleles of a gene:

- A – no trim
- a^s – sable trim
- a^c – copper trim

The alleles form a series with:

- A dominant to both a^s and a^c
- allele a^s dominant to a^c.

There are six possible genotypes involving these alleles.

(a) Write out the six possible genotypes with their correct phenotypes in the space below.

genotype	phenotype
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[3]

(b) If two dogs showing no trim but carrying the recessive allele for copper trim are crossed, there is a 25% chance that they will produce a copper trim puppy. Complete the following genetic diagram to show this cross.

<i>parental phenotypes</i>	no trim	no trim
<i>parental genotypes</i>
<i>gametes</i>

<i>offspring genotypes</i>
<i>offspring phenotypes</i>

[4]



For
Examiner's
Use

(c) A dog breeder wishes to know whether a dog with sable trim is either homozygous or heterozygous for this particular trait.

(i) State the cross needed to determine the dog's genotype.

.....[1]

(ii) Explain why the offspring of this cross will reveal the genotype of the dog.

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.....[3]

(d) The inheritance of coat pattern in Australian Shepherd dogs illustrates the principle of multiple alleles at a single locus.

Explain the meaning of:

multiple alleles
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locus
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.....[4]

[Total: 15]



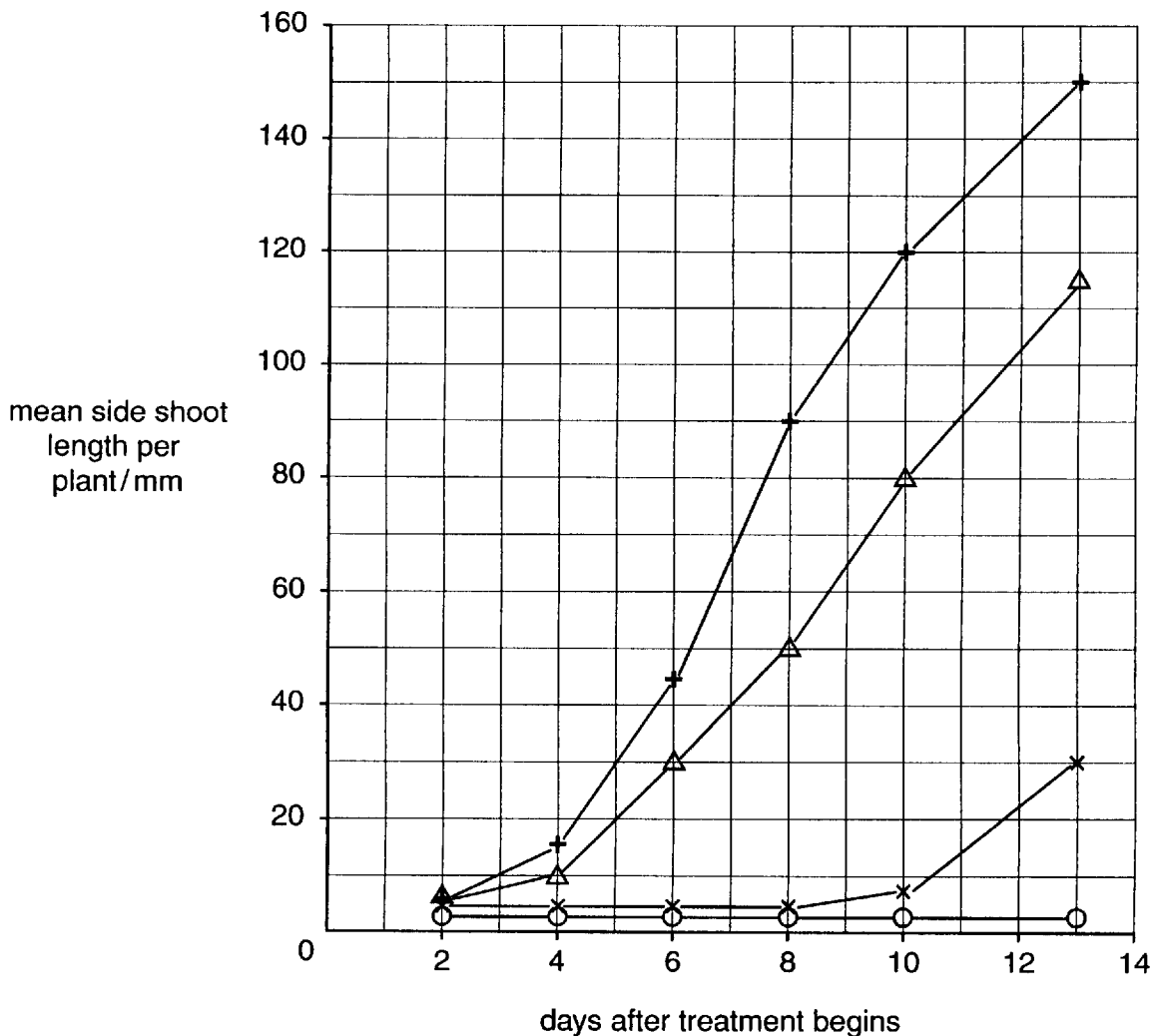


- 7 An investigation was carried out into the effects of two plant growth substances, gibberellins and auxins, on apical dominance. The terminal (apical) buds of a number of pea plants were removed and discarded. The tops of each of the remaining shoots were given one of the following treatments:

- coated with a paste containing gibberellin
- coated with a paste containing auxin (IAA)
- coated with a paste without any plant growth substance

In addition, a control group of plants did not have their terminal buds removed and were not coated with paste.

The growth of the side shoots was measured at regular time intervals and a mean value calculated. The results are shown in Fig. 7.1.



key

- + — + : paste and gibberellin
- Δ — Δ : paste only
- x — x : paste and auxin
- O — O : control

Fig. 7.1



For
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(a) Explain why the side shoots grow when the terminal buds are removed.

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.....[3]

(b) Side shoots show greater growth when paste containing gibberellin is applied than when paste without any plant growth substance is applied.

Calculate the percentage increase in growth due to gibberellin in 8 day old seedlings compared with seedlings with paste only. Show your working.

answer% [2]

(c) Using data from Fig. 7.1, describe **and** explain the effect of auxin (IAA) on the growth of side shoots.

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.....[3]

[Total: 8]

END OF QUESTION PAPER

