OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2806/01

Unifying Concepts in Biology

Monday **17 JUNE 2002** Morning 1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 15 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 on the question paper.
- 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	17	
2	12	
3	12	
4	10	
5	9	
TOTAL	60	

This question paper consists of 13 printed pages, 3 blank pages and an insert.

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[Turn over

For Examiner's Use

Answer **all** questions.

1 In California there are mountain ranges, one of which is the Sierra Nevada. Climatic factors, such as temperature and rainfall, vary greatly over short distances across these mountains.

Sampling points were selected to form a transect running across central California from west to east. At these points, populations of a plant, *Achillea lanulosa*, were sampled. Seeds were collected from random plants of *Achillea lanulosa* at each sampling point. Each batch of seeds was germinated and grown to maturity under the same experimental conditions.

Fig. 1.1 (Insert) shows

- a profile diagram indicating location and altitude from which each population of seeds was originally harvested
- scale drawings of typical plants grown from each group of seeds
- the range of heights of the plants from each group
- the mean height of plants from each group.

(a) With reference to Fig. 1.1,

(i) state the mean height of the plants grown from the seeds collected at Timberline;

.....[1]

(ii) describe how the range of plant heights varies with altitude;

.....

.....

.....[2]

(iii) describe how the mean of plant heights varies with altitude;

.....

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.....[2]

(iv) name a statistical test that could be used to assess the significance of the difference between the mean heights of any two of the populations.

.....[1]

There is no overlap in height between the populations taken from Mather and from Big Horn Lake.

(b) **(i)** Explain why it is likely that this is because of genetic differences between these populations.

.....

.....

.....[1]

(ii) Suggest **one** way in which the small mean size of Big Horn Lake plants may adapt them for survival in their habitat.

.....

.....[1]

The Great Basin Plateau has a very low annual rainfall, yet several types of plant grow there.

(c) Outline the structural and physiological adaptations that plant species growing on the Great Basin Plateau may show.
(In this question, 1 mark is available for the quality of written communication.)

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For Examiner's Use

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.....[8]

QWC [1]

[Total : 17]

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QUESTION 2 STARTS ON PAGE 6

2 A laboratory culture of the bacterium *Escherichia coli* was sampled using a sterile pipette. These samples were transferred to large volumes of fresh sterile culture medium in flasks **A** and **B**. Each flask contained the same volume of medium; the concentration of nutrient ions in the media was the same.

The carbohydrate content of each flask was as follows
flask **A** 50 g dm^{-3} glucose
flask **B** 50 g dm^{-3} lactose.

The population of bacteria in each flask was estimated at 20 minute intervals and the results of the investigation are shown in Fig. 2.1 (opposite).

(a) With reference to Fig. 2.1 (opposite),

(i) describe the changes in the population of bacteria in flask **A**;

.....

.....

.....

.....[3]

(ii) suggest why the population increase is delayed in flask **B**.

.....

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.....[2]

Natural populations of organisms fluctuate. In some species the fluctuations are very large, while in other species populations are relatively stable over many years.

(b) Describe some of the factors which may help to stabilise populations.

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.....[7]

[Total : 12]

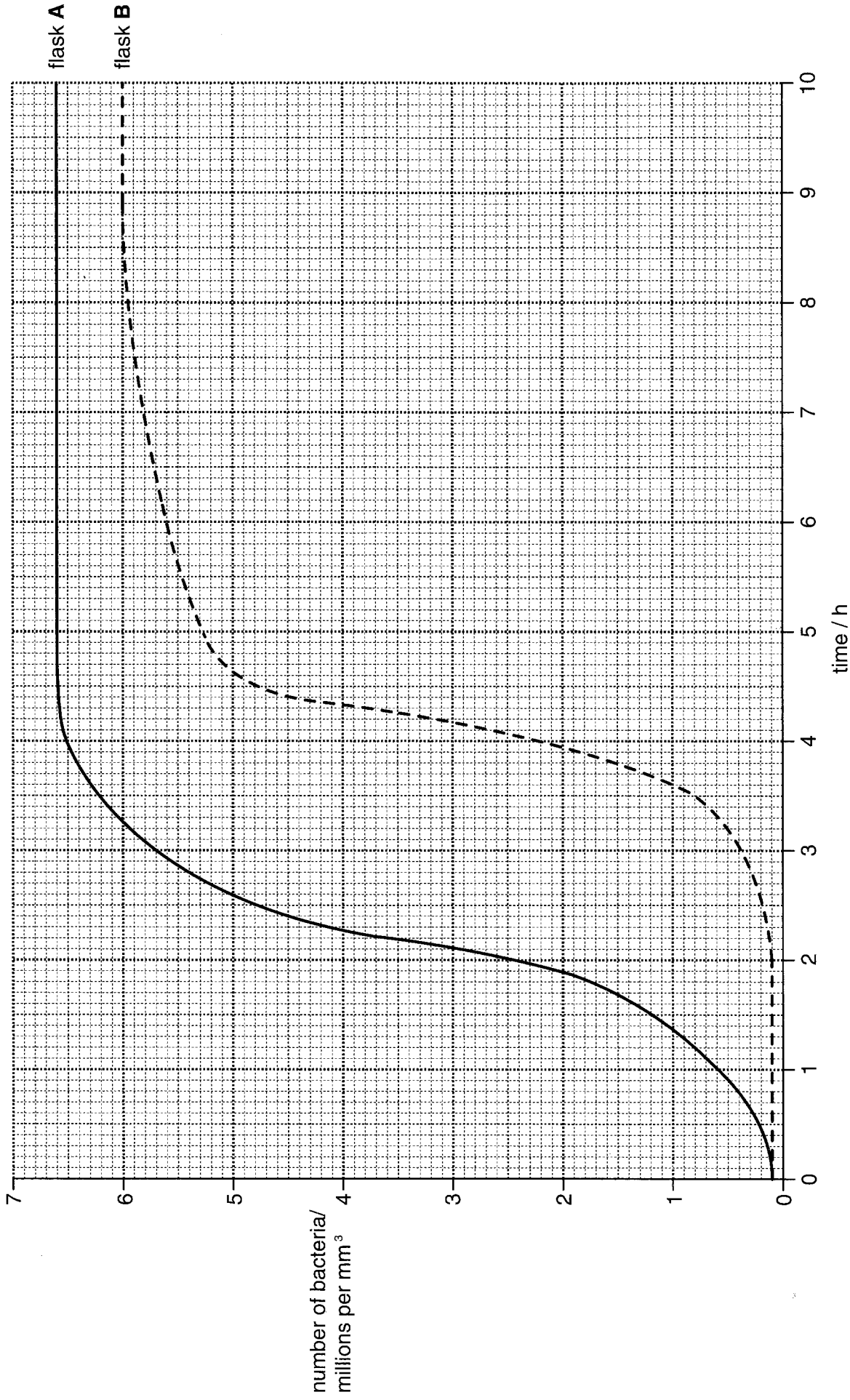

Fig. 2.1

[Turn over

3 Plant roots have projections from their outer surface known as root hairs. The unaided human eye can just resolve root hairs in some species. Some types of mammalian cell also have projections from their surfaces called microvilli.

(a) Name **one** mammalian organ that has cells with numerous microvilli.

.....[1]

(b) Describe **two** ways in which root hairs and microvilli are similar.

1. .....

.....

2. .....

.....[2]

(c) Describe **two** differences between root hairs and microvilli.

1. .....

.....

2. .....

.....[2]

Cuttings taken from the stems of *Tradescantia* plants were placed in water in individual specimen tubes and allowed to develop roots. After healthy root systems had developed, the tubes were divided into four groups and the plants treated as indicated in Fig. 3.1.

A thin layer of oil was pipetted onto the surface of the water in each tube, taking care not to get oil on the leaves of the plant. Control tubes containing only water and oil were prepared.

Each tube, including the water and plant, was weighed and its mass recorded. The tubes were weighed again 24 hours later. The mean loss in mass over this 24 hour period is shown in Fig. 3.1.

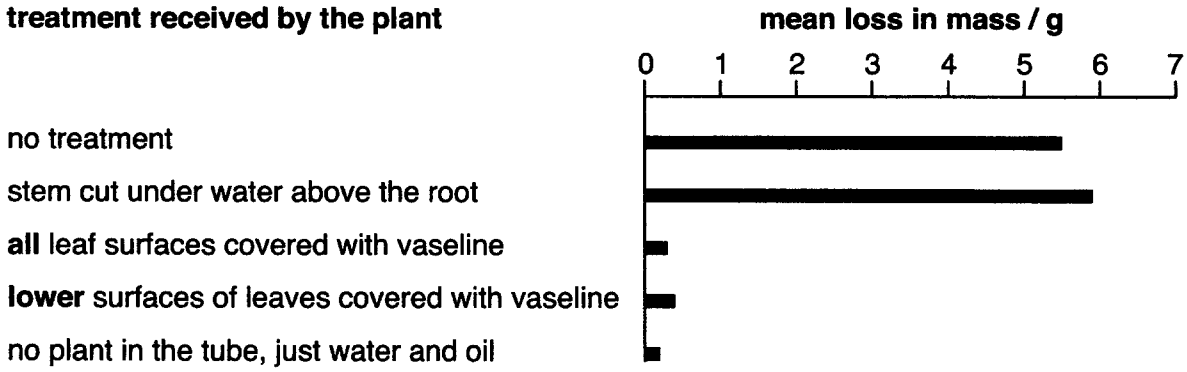

Fig. 3.1

For Examiner's Use

(d) With reference to Fig. 3.1,

(i) explain why oil was pipetted onto the water surface of each tube;

.....

.....[1]

(ii) suggest **two** environmental factors that should be controlled in this investigation.

1. .....

2. .....[1]

(e) Explain the results shown in Fig. 3.1.

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.....[5]

[Total : 12]

[Turn over

For Examiner's Use

4 Table 4.1 gives data on a number of common edible fats and oils that are used in cooking and which are important constituents of food.

Table 4.1

plant source of lipid	amount of different fatty acids present / % of total fat or oil			
	saturated	mono-unsaturated	poly-unsaturated (including linolenic acid)	linolenic acid
cocoa	60	33	3	< 1
rape	7	59	30	9
coconut	87	6	2	0
olive	14	74	8	< 1
sunflower	10	20	66	< 1
mean for the plants	36	38	22	–
animal source of lipid				
beef	50	41	4	< 1
butter	67	27	4	1
pig	39	45	11	1
chicken	30	44	22	1
mean for the animals		39	10	–

(a) With reference to Table 4.1,

(i) complete the column for saturated fatty acids by filling in the mean value for animals in the box shaded grey; [1]

(ii) comment on the statement that 'animals store mainly saturated fatty acids while plants store mainly unsaturated fatty acids';

.....

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.....[3]

For Examiner's Use

(iii) explain why rape seed oil is likely to be superior to olive oil as a constituent of a healthy diet.

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.....[3]

None of the rows in Table 4.1 add up to 100% because all the fats and oils have another constituent which is not a fatty acid.

(b) Name this constituent.

.....[1]

Linolenic acid is an essential fatty acid. Some amino acids are also described as essential.

(c) Explain what is meant by an essential nutrient.

.....

.....

.....[2]

[Total : 10]

5 Fig. 5.1 is an electron micrograph of a leaf mesophyll cell. Several cell structures have been indicated by letters. Some of these produce ATP.

(a) With reference to Fig. 5.1 (opposite),

(i) identify **two** organelles in which ATP is produced and name these organelles;

1. identifying letter ..... name .....

2. identifying letter ..... name .....[2]

(ii) explain why the cell is eukaryotic rather than prokaryotic.

.....

.....

.....[2]

Photophosphorylation and oxidative phosphorylation are two processes that occur in cells, such as that shown in Fig. 5.1.

(b) Describe similarities and differences between oxidative phosphorylation and photophosphorylation.

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.....[5]

[Total : 9]

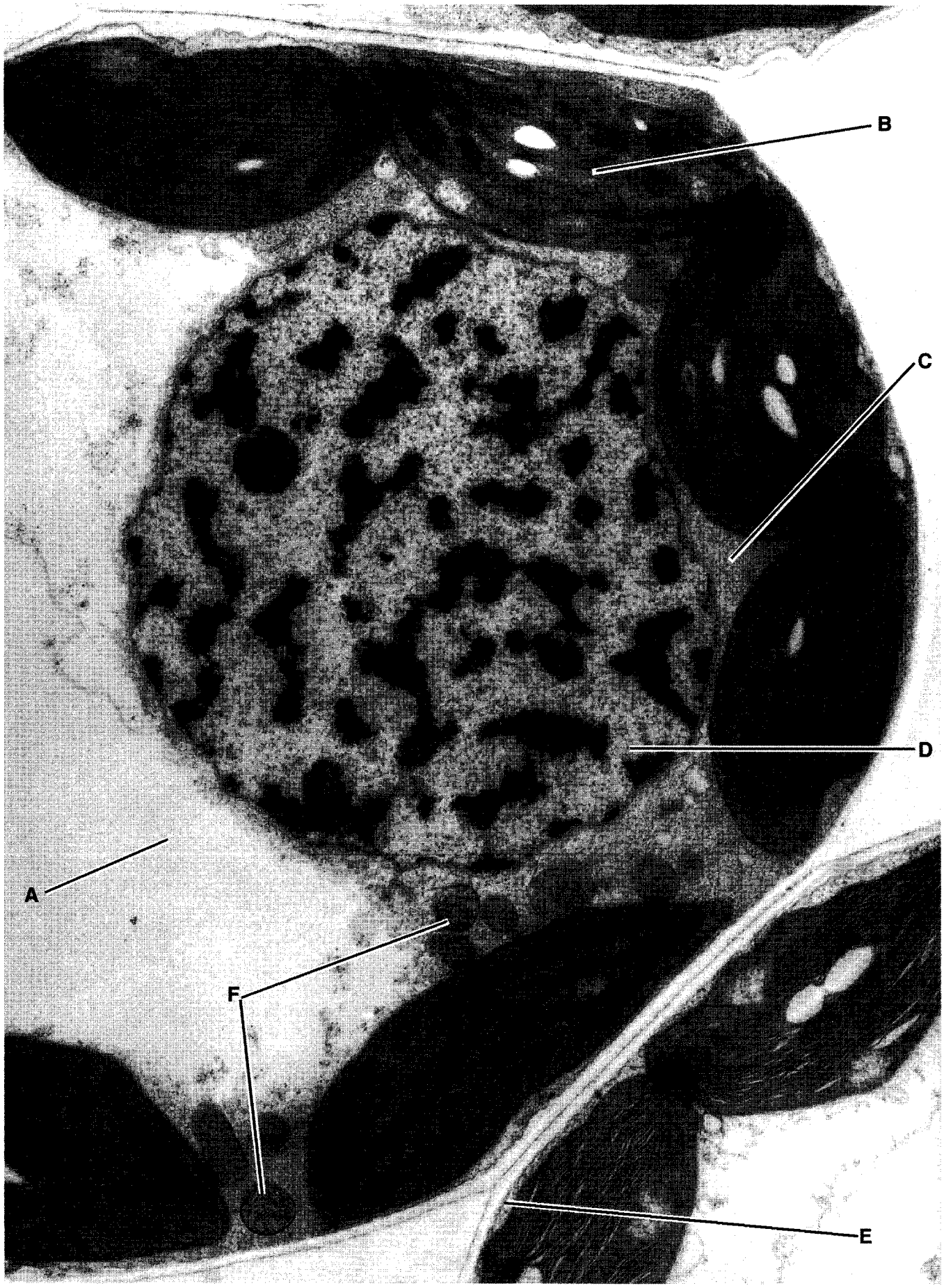

Fig. 5.1

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INSERT

Monday **17 JUNE 2002** Morning 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- This insert contains Fig. 1.1 for Question **1**.

This insert consists of 2 printed pages.

Registered Charity Number: 1066969
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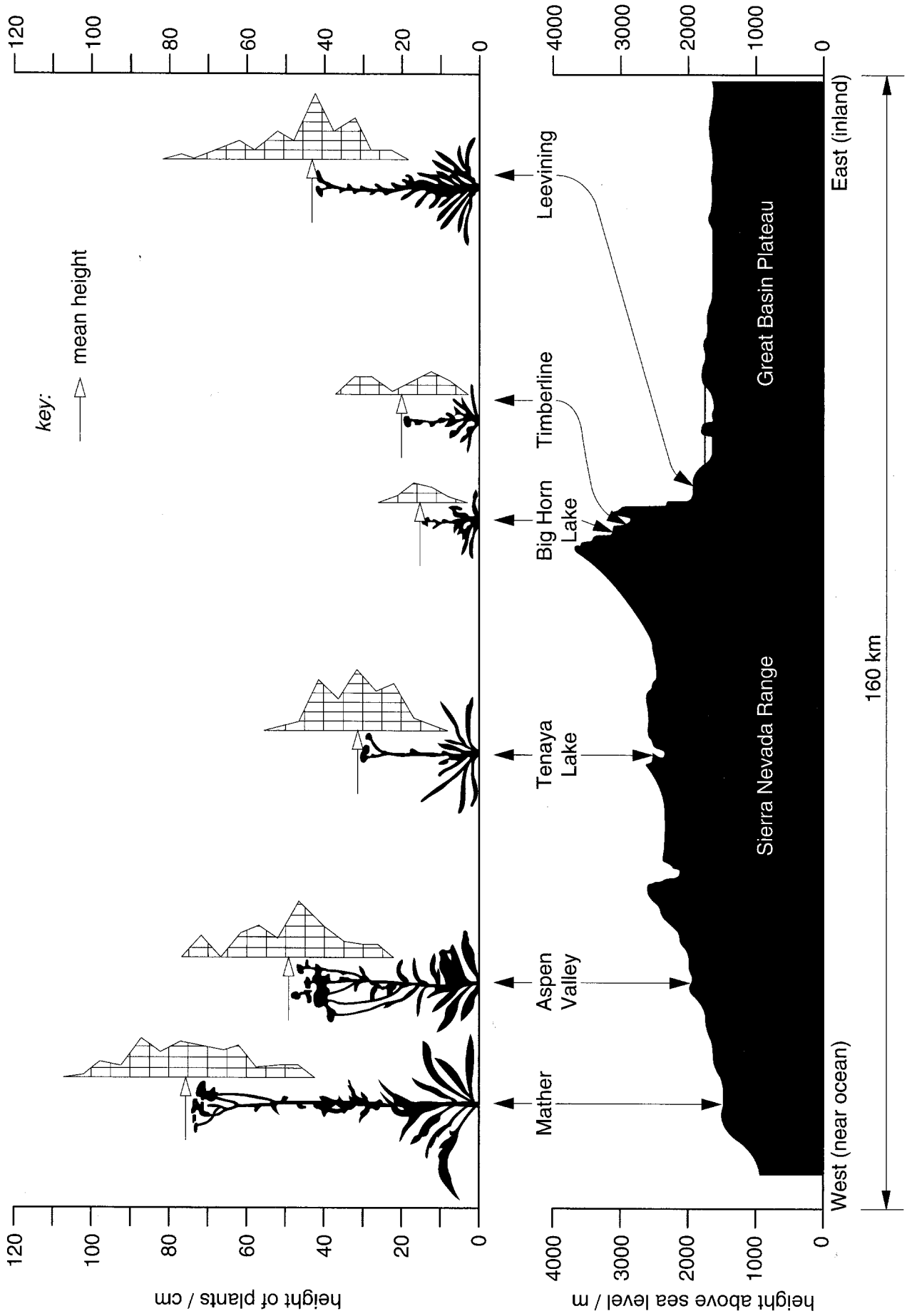

Fig. 1.1