OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2805/05

Mammalian Physiology and Behaviour

Thursday **29 JANUARY 2004** Afternoon 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number

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.
- 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	12	
2	17	
3	14	
4	19	
5	13	
6	15	
TOTAL	90	

This question paper consists of 21 printed pages, 3 blank pages and an insert.

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For Examiner's Use

Answer **all** the questions.

1 **(a)** Fig. 1.1 shows the major components of the mammalian nervous system. Complete Fig. 1.1 using the terms from the list below.

autonomic nervous system
cerebellum
spinal cord
cerebrum
peripheral nervous system

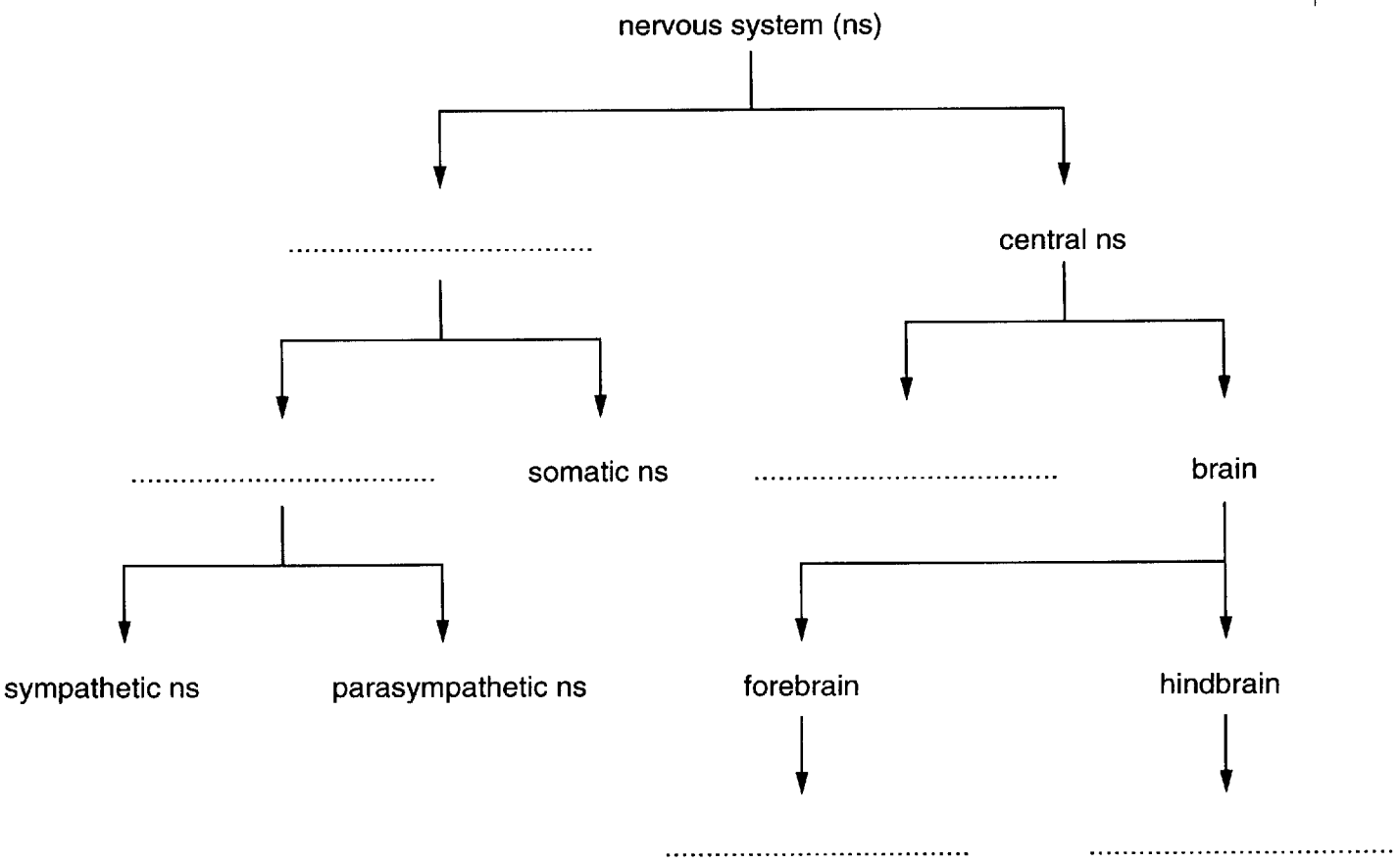

Fig. 1.1

[5]

(b) The brain consists of white matter, containing myelinated neurones, and grey matter, containing unmyelinated neurones.

Explain the advantage of a neurone being myelinated.

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.....[2]

(c) Cerebrospinal fluid (CSF) is formed by filtration of the blood. It bathes brain tissues, removing metabolites and excess heat, before returning into the bloodstream. CSF is similar to blood but contains no blood cells or plasma proteins. The main component of CSF is water.

(i) Explain how CSF is able to remove excess heat from the brain.

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(ii) Explain, using the term **water potential**, how CSF is returned into the bloodstream.

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.....[3]

[Total: 12]

2 Read the following passage about liver transplants.

The most common reason for a liver transplant in young children is a blockage of the bile duct. This leads to a build up of bile in the liver that cannot enter the duodenum. Liver cells become damaged by bile. Children with this condition suffer from jaundice and weight loss. Liver transplants in adults are usually required because of cirrhosis of the liver.

During transplant surgery, the diseased liver is removed leaving portions of its major blood vessels in place. The new liver is then inserted and attached to these blood vessels. The liver is also connected to the patient's bile duct by means of a 'T-tube'. One section of this T-tube passes to the outside of the patient's body where it is temporarily closed off.

The first successful liver transplant was performed in 1967, but until the discovery of new anti-rejection drugs in the 1980s only a small number of these transplants were performed and many were unsuccessful. These drugs prevent destruction of the transplanted liver by the patient's immune system. Use of these drugs has increased the number of successful transplants.

(a) Name **two** of the major blood vessels which are attached to the transplanted liver.

1 .....

2 .....[1]

(b) Suggest **one** use of the T-tube following a liver transplant.

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.....[1]

(c) Outline how the patient's immune system might destroy the transplanted liver if anti-rejection drugs were not given to the patient.

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.....[3]

(d) Explain why children with a blocked bile duct lose weight.

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.....[3]

Question 2 continues on page 6

[Turn over

(e) In this question, one mark is available for the quality of written communication.

Explain the likely effects of liver damage on the metabolism of carbohydrate and protein.

carbohydrate metabolism .....

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protein metabolism .....

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.....[8]

Quality of Written Communication [1]

[Total: 17]

3 **(a)** Explain why the eye is described as an organ.

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.....[2]

Fig. 3.1 is an electron micrograph of the retina showing the parts of several rod cells.

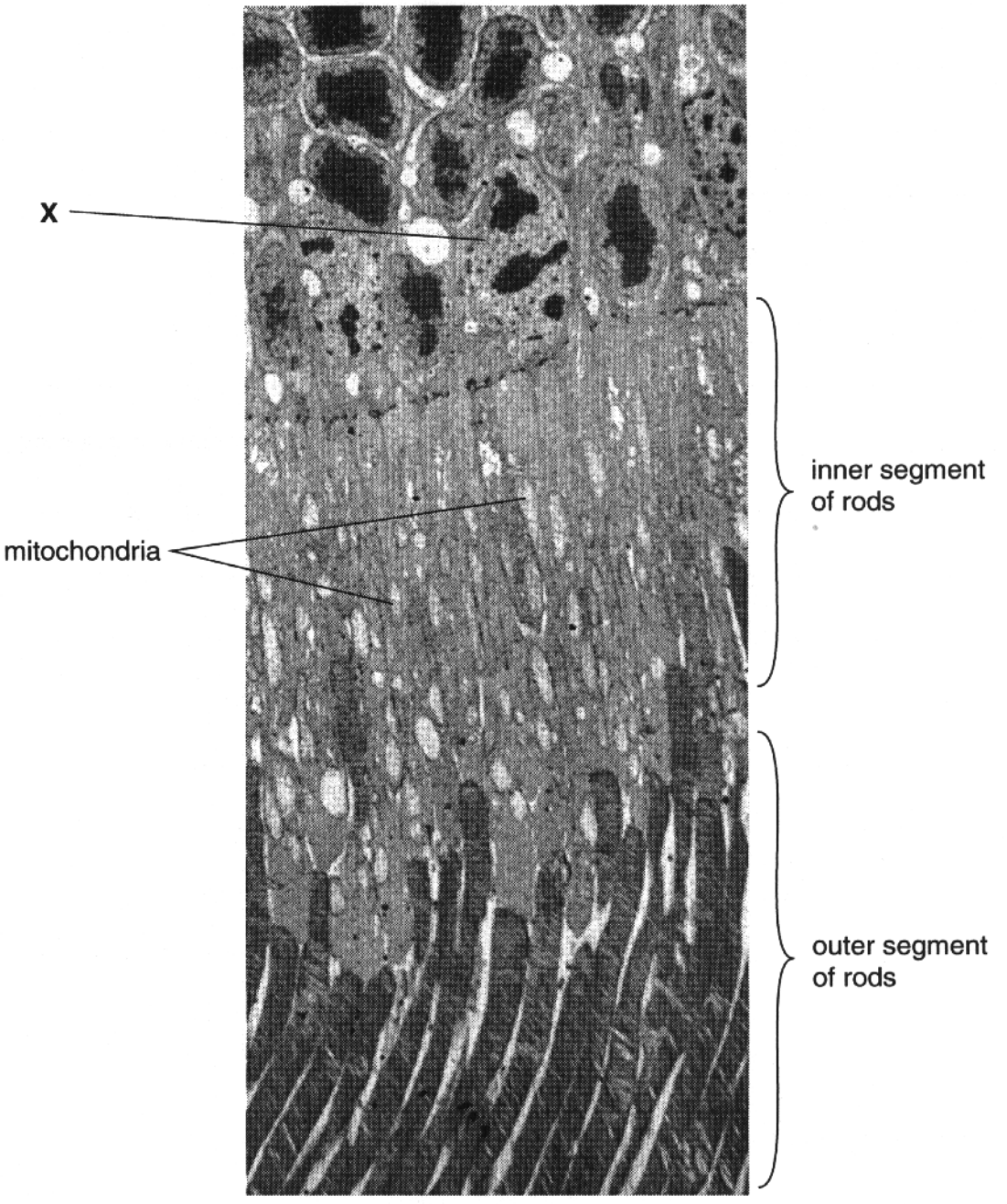

Fig. 3.1

(b) (i) Name structure **X**.

.....[1]

(ii) Use a line and the letter **P** to label a region of a rod cell on Fig. 3.1 that contains a high concentration of visual pigment. [1]

(c) Describe the role of mitochondria in rod cells.

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Question 3 continues on page 10

[Turn over

The sensitivity of the human eye can be measured in the following way.

- A person stares at a white light for five minutes, then the room is immediately made completely dark.
- Every minute, a large spot of red light is repeatedly flashed at increasing intensities until the person says they can see the light spot.

Fig. 3.2 shows the results of such an investigation.

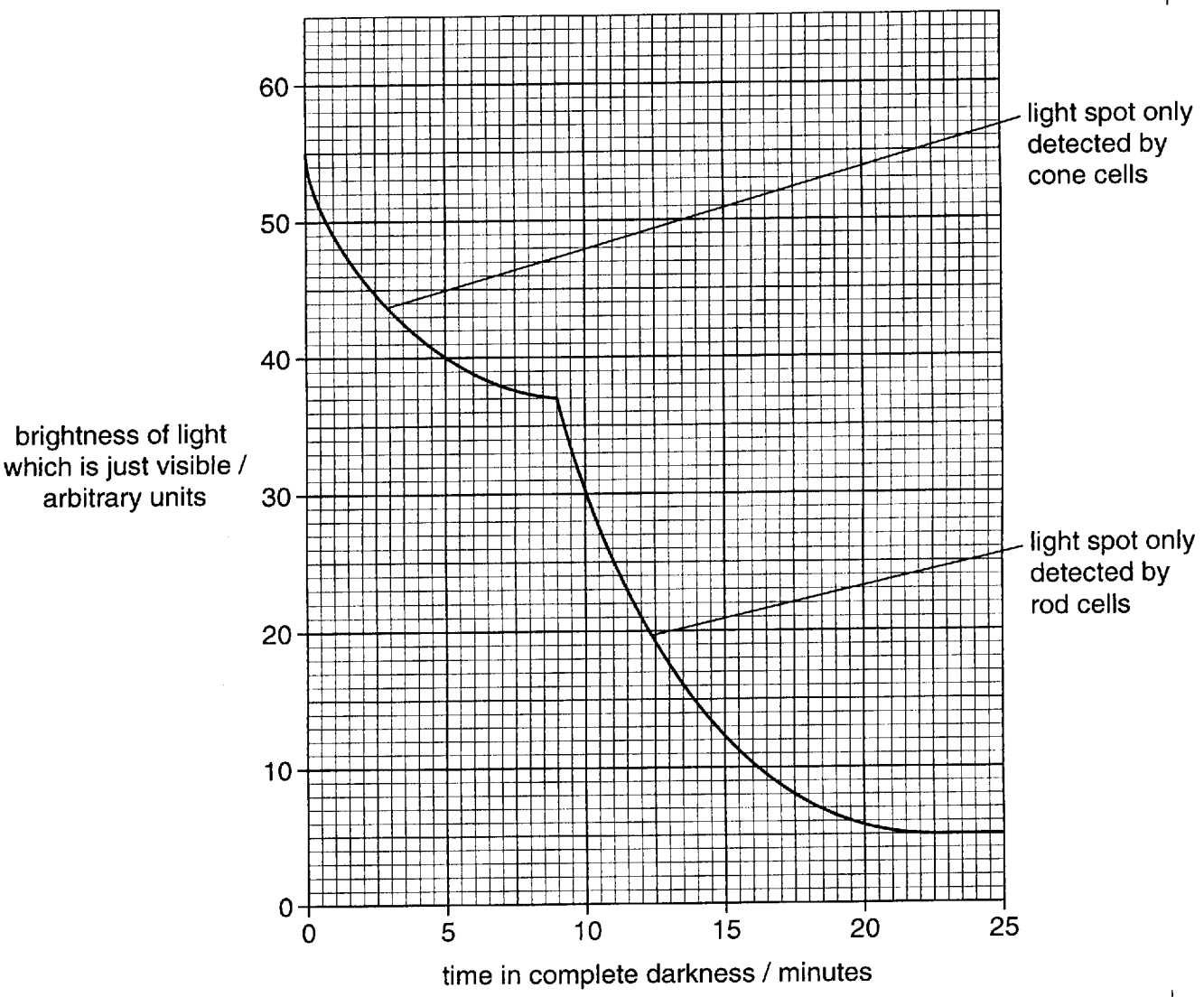

Fig. 3.2

(d) Name the process in which the sensitivity of the eye changes as shown in Fig. 3.2.

.....[1]

(e) Explain the results shown in Fig. 3.2 in terms of the sensitivity of rods and cones.

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.....[4]

(f) The results shown in Fig. 3.2 were obtained when a large spot of red light was directed at the whole of the surface of the retina.

Complete the curve on Fig. 3.3 to show the likely result obtained when a smaller spot of red light was directed **only** at the fovea. [2]

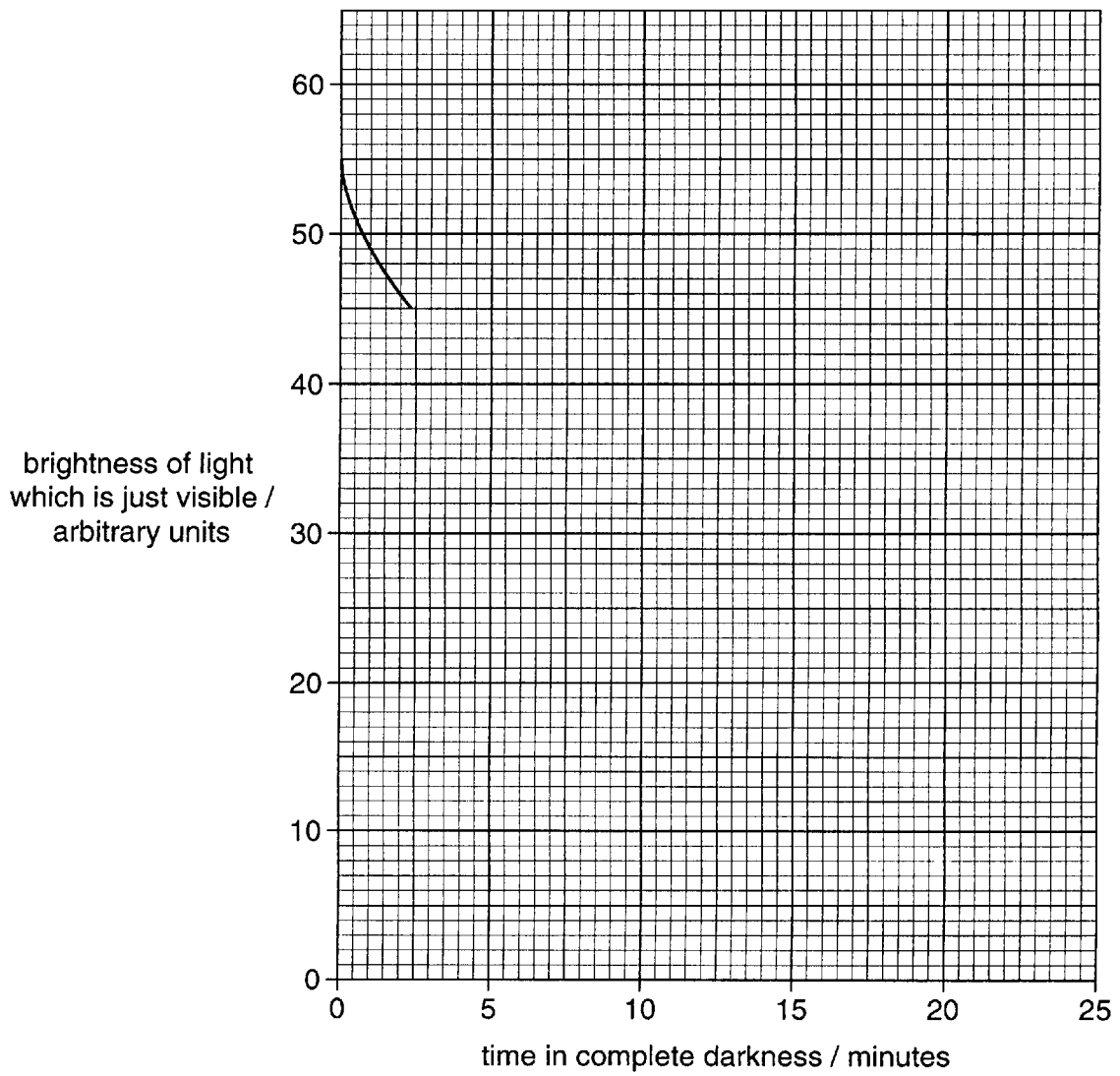

Fig. 3.3

[Total: 14]

4 The number of teeth in the lower and upper jaw in a mammal is represented by a dental formula. A mammal which has three incisors in each half of its upper jaw and in each half of its lower jaw has a dental formula for incisors of $\frac{3}{3}$.

Table 4.1 shows the dental formulae and diet of three mammals.

Table 4.1

name of mammal	incisors	canines	pre-molars	molars	diet of mammal
deer	$\frac{0}{3}$	$\frac{0}{0}$	$\frac{3}{3}$	$\frac{3}{3}$	herbivorous ruminant
leopard	$\frac{3}{3}$	$\frac{1}{1}$	$\frac{3}{2}$	$\frac{1}{1}$	carnivorous
pig	$\frac{3}{3}$	$\frac{1}{1}$	$\frac{4}{4}$	$\frac{3}{3}$	omnivorous

(a) (i) State **two** ways in which the arrangement of teeth in leopards differs from that in pigs.

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.....[1]

(ii) Explain the significance of the absence of canines and upper incisors in deer.

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.....[3]

(b) Explain how the structure of the pre-molars and molars in a carnivore such as a leopard are specialised for its diet.

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Fig. 4.1 shows a section of part of the wall of the ileum as seen with the light microscope.

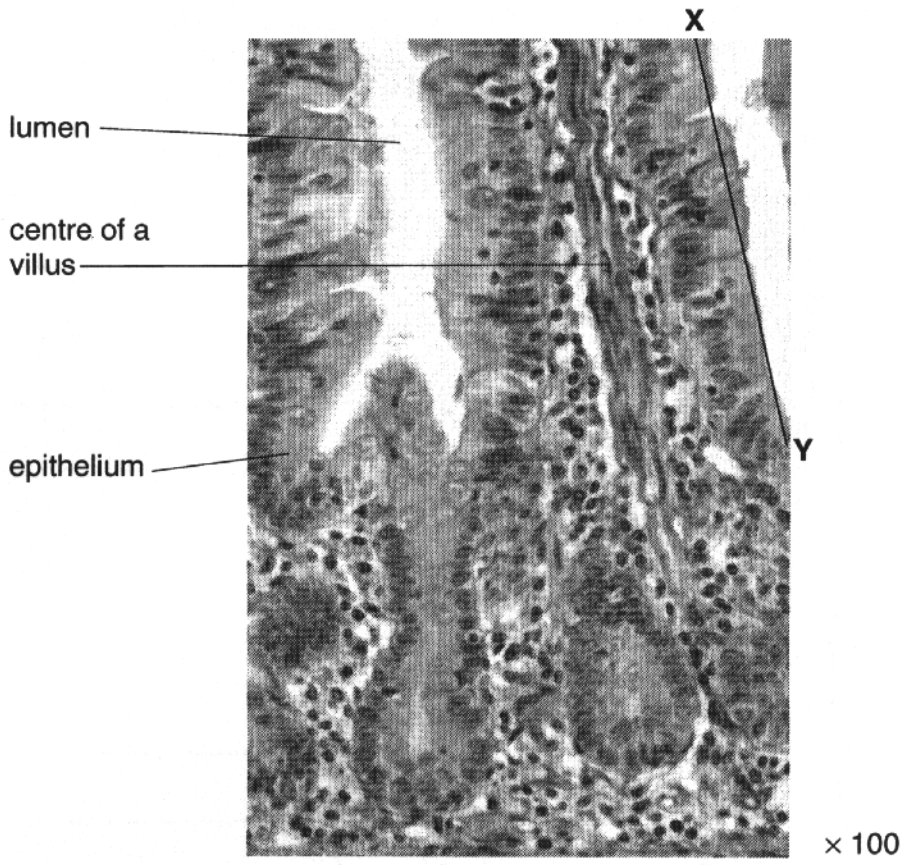

Fig. 4.1

(c) State **two** ways in which the epithelium lining the ileum differs from the epithelium lining the stomach.

1 .....

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2 .....

.....[2]

(d) New epithelial cells are produced by cell division at the base of each villus.
These cells migrate towards the top of the villus to replace cells worn away by contact with the contents of the lumen of the ileum.

Epithelial cells migrate at the rate of 0.022 mm per hour.
With reference to Fig. 4.1, calculate how many hours it will take for a cell to travel from point **Y** to point **X** on the villus. Show your working.

Answer = ... hours [2]

Fig. 4.2 is a drawing made from an electron micrograph of an epithelial cell from the ileum.

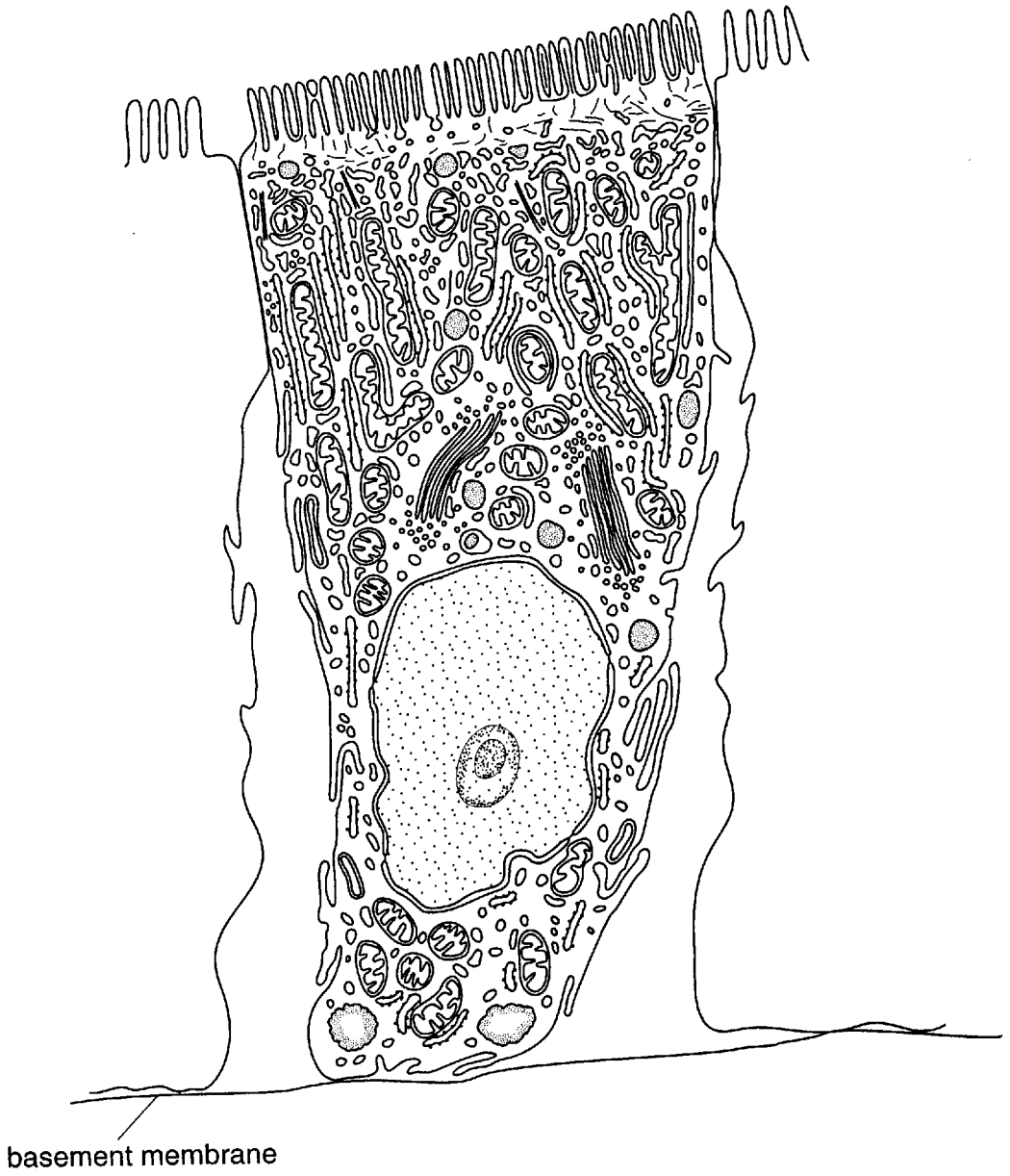

Fig. 4.2

(e) In this question, one mark is available for quality of written communication.

Explain how the structure of an epithelial cell, such as that shown in Fig. 4.2, is related to the different ways it absorbs the products of digestion.

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Quality of Written Communication [1]

[Total: 19]

For Examiner's Use

5 **(a)** Explain what is meant by *innate* behaviour.

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.....[2]

Fig. 5.1 shows an apparatus called a T-maze.

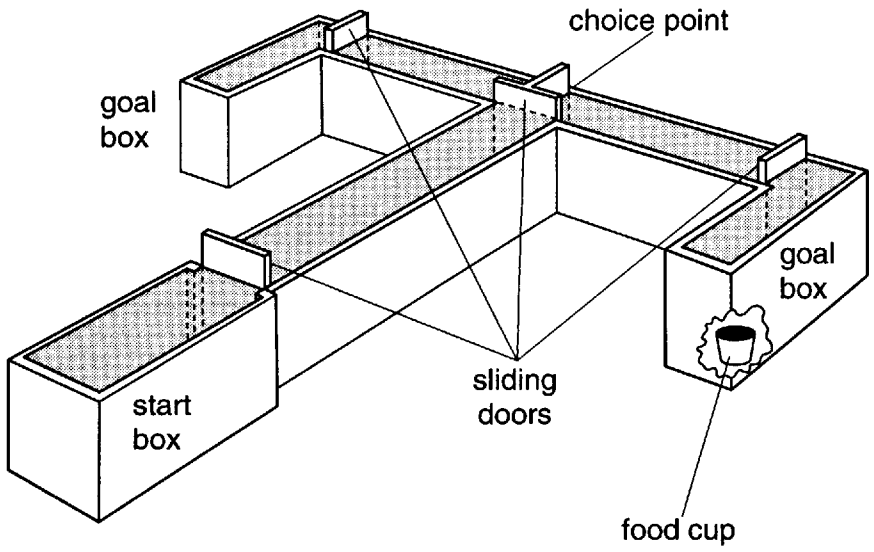

Fig. 5.1

A small mammal can be placed in the start box and then allowed to run to the choice point. At this point the animal has to decide between making a left or a right turn to enter one of the goal boxes. Food has been placed in one of the goal boxes. If the animal enters the goal box containing the food, this is recorded as a correct response. The sliding doors, which are operated by the experimenter, prevent the animal from retracing its path.

Two different series of experiments were performed using rats in a T-maze.

In the first experiment, thirty rats were divided into three groups of ten.
The groups differed in the number of food pellets each rat received for the correct response.

Within each group, food for five of the rats was always placed in the right goal box and for the other five rats food was always placed in the left goal box.
Each rat ran the maze several times a day for several days.

Fig. 5.2 on the insert shows the results of this experiment.

The second experiment was similar to the first except that when a rat produced a correct response it received one food pellet.
Rats in the first group received the pellet immediately.
Rats in the second group received it after five seconds and in the third group after 30 seconds.

Fig. 5.3 on the insert shows the results of this experiment.

(b) Explain how these experiments demonstrate operant conditioning.

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.....[2]

(c) Describe the effects of the number of pellets and the delay in receiving pellets on the learning ability of the rats. Use figures from the graphs to support your answer.

number of pellets.....

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delay in receiving pellets .....

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.....[5]

(d) Several factors should be controlled in order to produce reliable results when these tests are carried out. Suggest **two** of these factors.

1 .....

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2 .....

.....[2]

For Examiner's Use

(e) Explain why a statistical test must be applied to these data before any firm conclusions can be drawn.

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[Total: 13]

6 Fig. 6.1 represents part of a muscle fibril (myofibril).

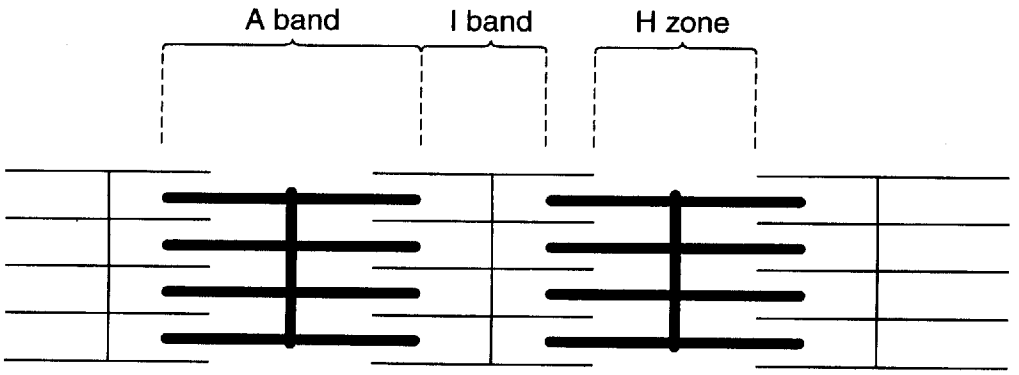

Fig. 6.1

(a) (i) Name **two** proteins found in the **I band**.

.....[1]

(ii) Using a bracket, label one sarcomere on Fig. 6.1. [1]

(iii) State **two** pieces of evidence shown on Fig. 6.1 which indicate that the myofibril is shown in the relaxed state.

1.....

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2.....

.....[2]

Question 6 continues on page 20

(b) During strenuous exercise the concentration of hydrogen ions in muscle tissue increases. A high concentration of hydrogen ions reduces the ability of calcium ions to bind to proteins in the myofibrils.

Using this information, explain how the increased concentration of hydrogen ions results in a reduction in the force of contraction of a muscle.

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.....[5]

(c) Fig. 6.2 shows a longitudinal section through a femur of a mammal.

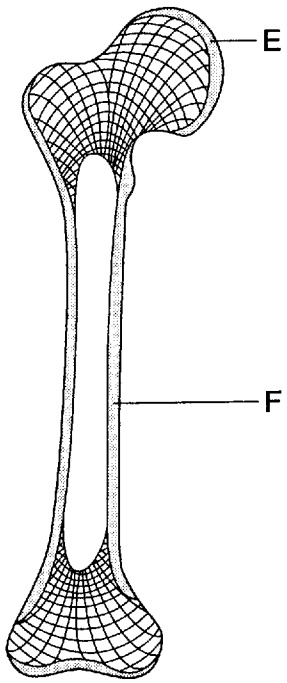

Fig. 6.2

(i) Name the type of cartilage labelled **E**.

.....[1]

(ii) Name the type of bone tissue labelled **F**.

.....[1]

The bones of the skeleton are constantly being restructured to allow their growth and repair. This means that calcium ions are constantly being both deposited in bone matrix and being removed from bone matrix by the action of cells.

(d) Name the most common calcium compound in bone.

.....[1]

(e) Name the type of cell responsible for **removing** calcium from the bone matrix.

.....[1]

(f) Osteoporosis is a degenerative disease.

Suggest **two** consequences of osteoporosis on the lives of people with this condition.

1 .....

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2 .....

.....[2]

[Total: 15]

END OF QUESTION PAPER

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY 2805/05

Mammalian Physiology and Behaviour

INSERT

Thursday **29 JANUARY 2004** Afternoon 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- This insert contains Fig. 5.2 and Fig. 5.3 for use with Question 5.

This insert consists of 2 printed pages.

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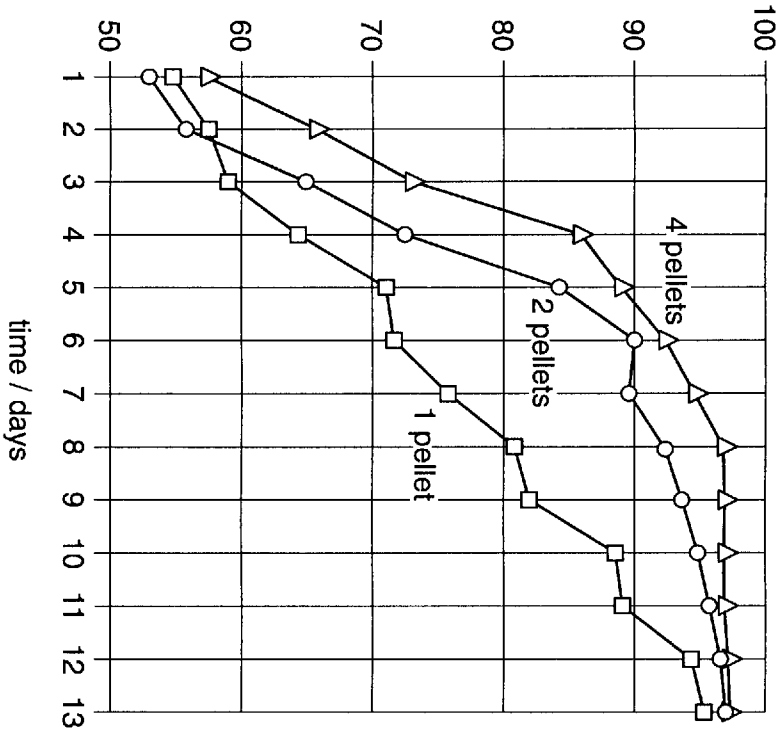
mean percentage of correct responses
100
90
80
70
60
50
1 2 3 4 5 6 7 8 9 10 11 12 13
time / days
4 pellets
2 pellets
1 pellet

Fig. 5.2

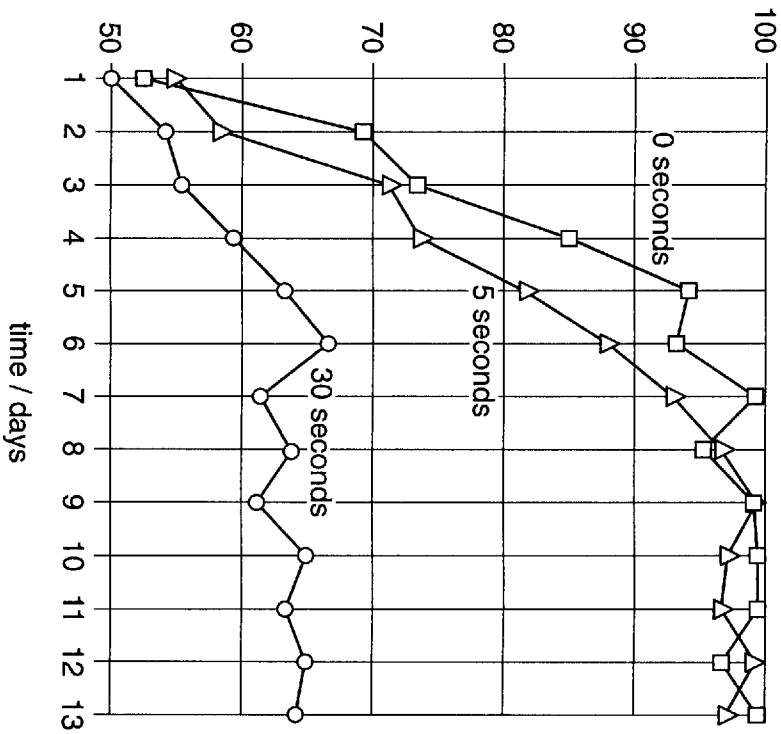
mean percentage of correct responses
100
90
80
70
60
50
1 2 3 4 5 6 7 8 9 10 11 12 13
time / days
0 seconds
5 seconds
30 seconds

Fig. 5.3