

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

HUMAN BIOLOGY

2866

Energy, Control and Reproduction

Monday **24 JANUARY 2005** Morning 1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:

Electronic calculator

Ruler (cm/mm)

Candidate Name	Centre Number	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 black or blue 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	15	
2	14	
3	15	
4	16	
5	17	
6	13	
TOTAL	90	

This question paper consists of 18 printed pages and 2 blank pages.

Answer all the questions.

- 1 (a) The divisions of the nervous system are shown in Fig. 1.1.

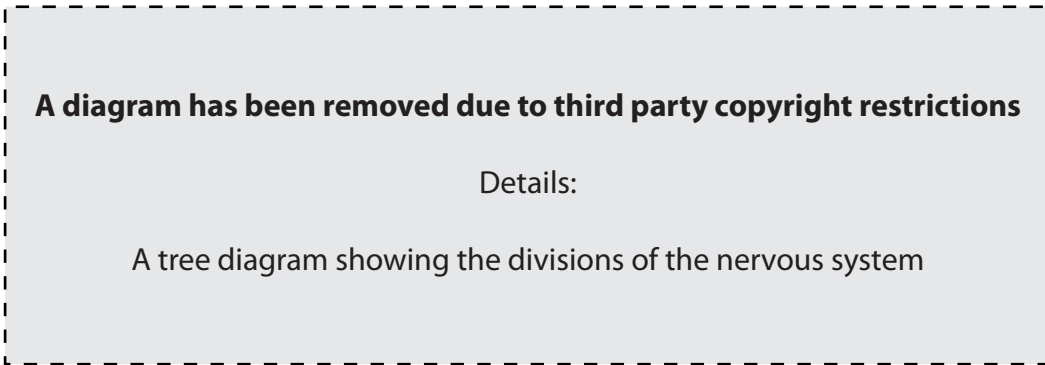


Fig. 1.1

State how the autonomic nervous system can be divided.

.....
[1]

- (b) Fig. 1.2 shows a motor neurone.

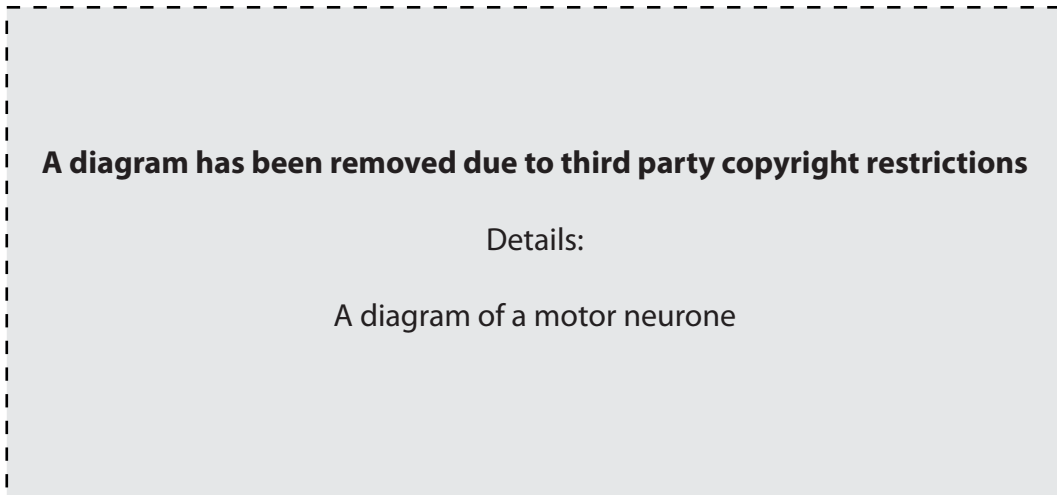


Fig. 1.2

- (i) Identify the structures labelled A to C.

A

B

C[3]

(ii) How would you recognise the neurone shown in Fig. 1.2 as a motor neurone?

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

(iii) Explain how the synaptic knob, labelled on Fig. 1.2, ensures that the nerve impulse only travels in one direction.

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.....[3]

- (c) A regular heart beat is controlled by the autonomic nervous system. When the heart stops beating suddenly, it is called a sudden cardiac arrest (SCA). SCA is caused by an abnormality in the nervous tissue which controls the heart beat. The nervous tissue controlling the heart beat is shown in Fig. 1.3.

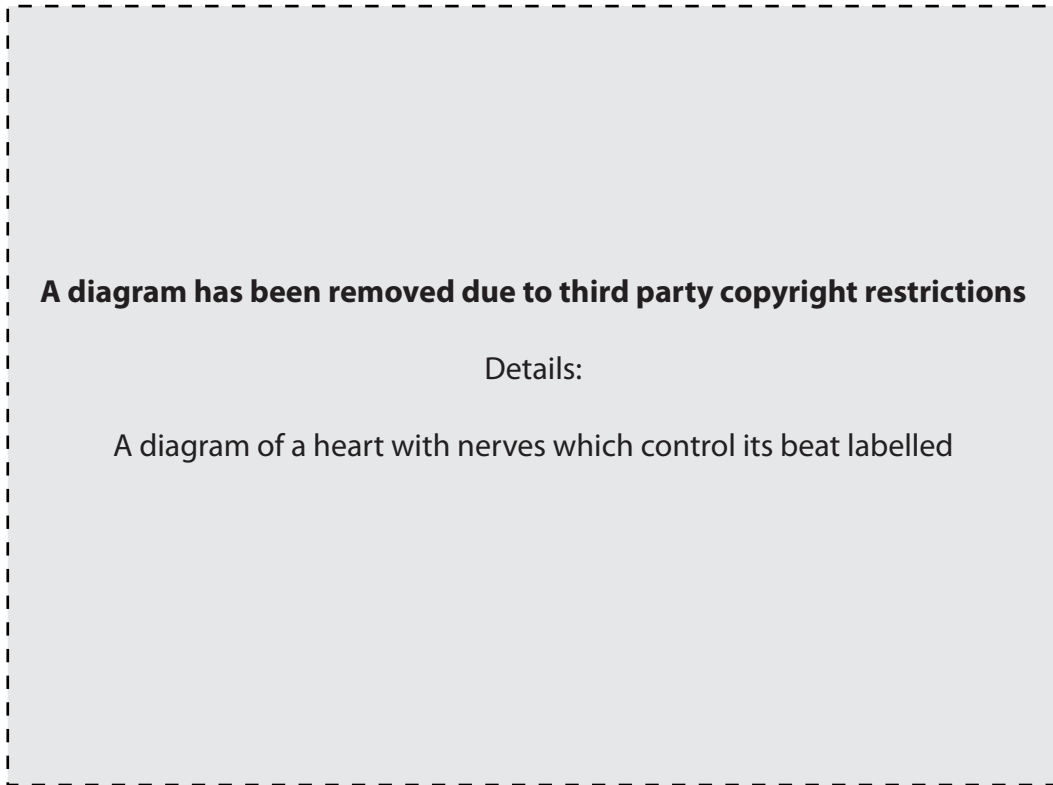


Fig. 1.3

- (i) Explain what the effects on the heart muscle will be if SCA occurs.

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.....[4]

- (ii) Describe how a record of the electrical activity of the heart may be obtained.

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.....
.....[3]

[Total: 15]

2 Human activity has a considerable impact on the environment.

(a) (i) Explain the term *deflected succession*.

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.....
.....[2]

(ii) State **two** ways in which agriculture can result in deflected succession.

1.
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2.
.....[2]

Question 2 is continued on page 6

(b) Fig. 2.1 shows the relationship between food production **per head** of world population and **total world** food production.

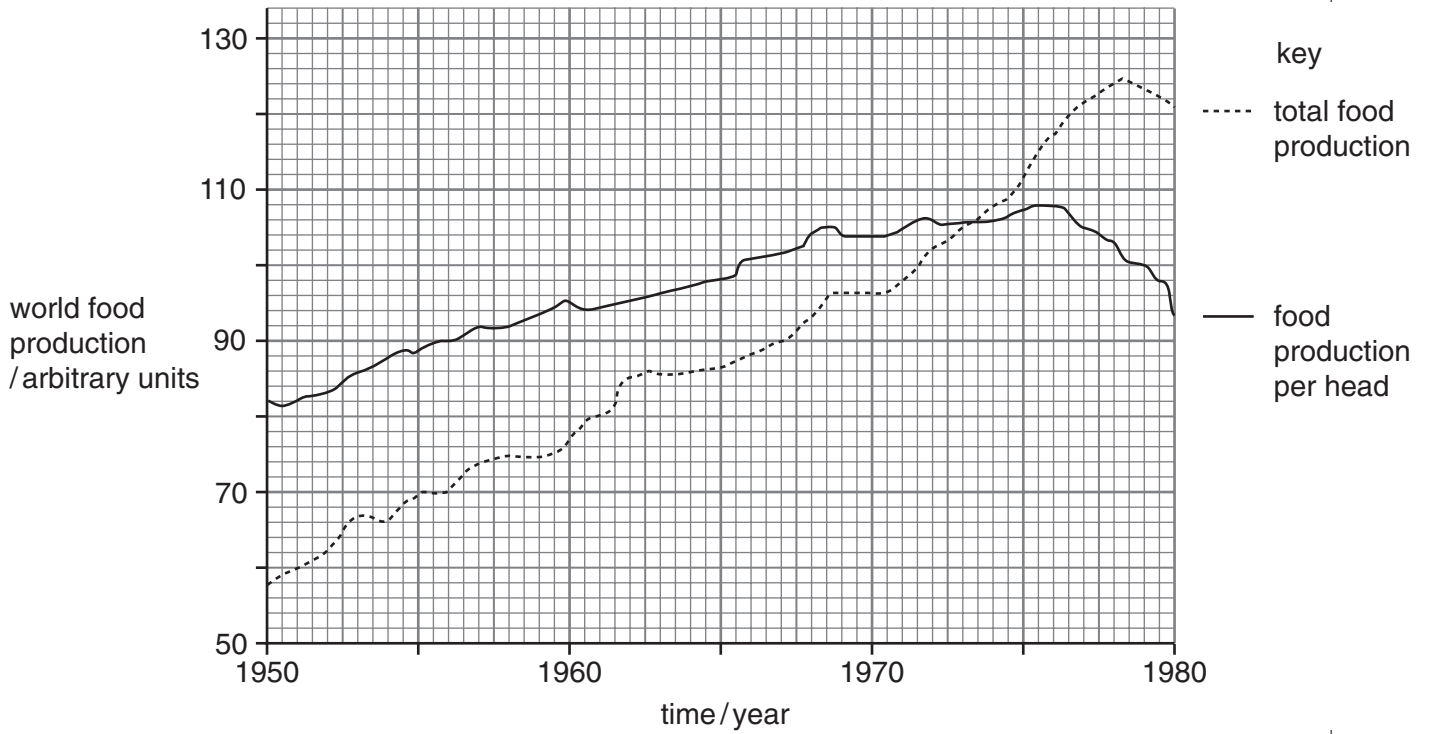


Fig. 2.1

Comment on these data and their significance for the human population.

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.....[3]

- 3 Understanding the biochemistry of oxygen transport has enabled athletes to improve their performance.

Fig. 3.1 shows the oxygen dissociation curve for adult haemoglobin at different partial pressures of carbon dioxide ($p\text{CO}_2$ /kPa).

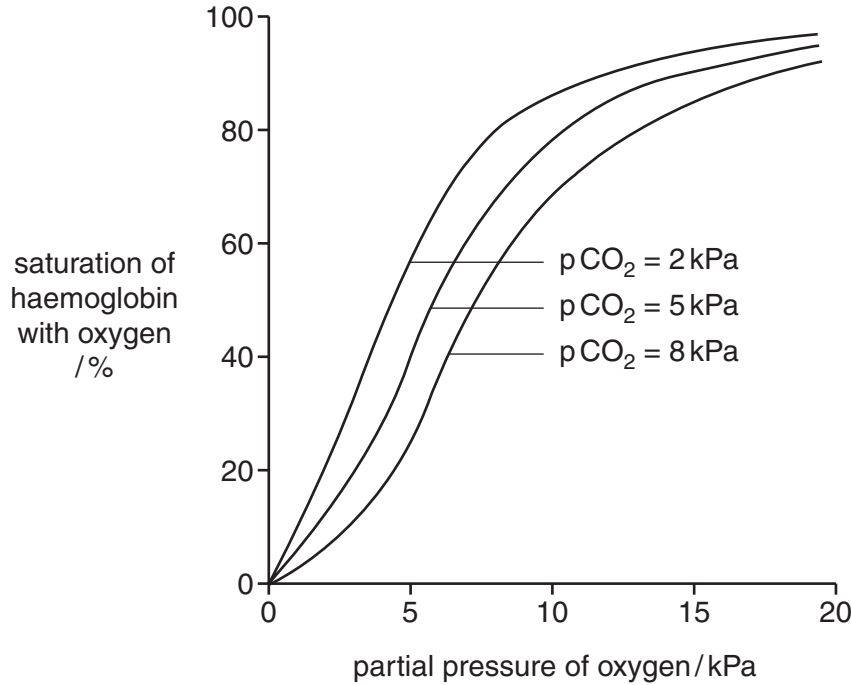


Fig. 3.1

- (a) (i) Explain how the properties of the haemoglobin molecule cause the oxygen dissociation curves shown in Fig. 3.1 to be sigmoid (S-shaped).

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.....[3]

- (ii) Using the information shown in Fig. 3.1, describe the effect of the **increase** in the partial pressure of **carbon dioxide** on the percentage saturation of haemoglobin.

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.....[2]

(iii) Explain how the increase in the partial pressure of carbon dioxide will **cause** the effect shown in Fig. 3.1.

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.....[4]

(iv) During exercise, the partial pressure of carbon dioxide increases. Explain the **importance** of the effect of this increase.

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.....[2]

(b) Muscles contain both red and white fibres. Explain why the **red** muscle fibres are of particular importance to an athlete during prolonged periods of **aerobic** exercise.

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.....[4]

[Total: 15]

- 4 (a) Many athletes prepare themselves for sustained exercise by eating a high carbohydrate diet during the period before the exercise. This form of preparation is known as carbo-loading.

An experiment was conducted to determine the effectiveness of carbo-loading as a preparation for sustained exercise.

- Volunteer cyclists were fed a mixed diet for three days and then they cycled to exhaustion.
- The length of time for exhaustion to occur was noted.
- After recovery, this procedure was repeated using a low carbohydrate diet.
- The procedure was then repeated again, using a high carbohydrate diet.
- During each of the three dietary periods, a small sample of skeletal muscle tissue (a muscle biopsy) was taken from each cyclist, before and after cycling to exhaustion.
- The muscle tissue was analysed to find the concentration of glycogen in each tissue sample.

The results of this experiment are shown in Fig. 4.1. The time taken to cycle to exhaustion during the three dietary periods is shown in minutes between the brackets.

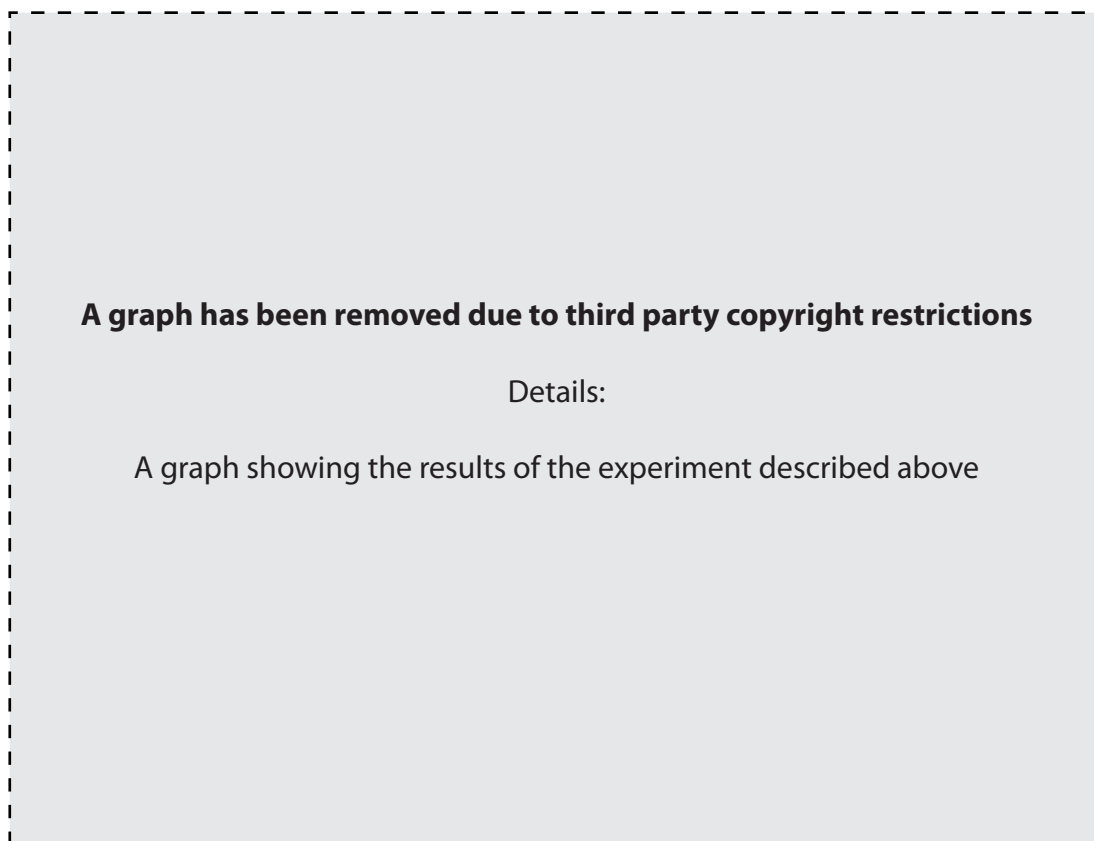


Fig. 4.1

(b) Dehydration may also be a factor in limiting the duration of sustained exercise. Athletes who have followed a high carbohydrate diet may have a temporarily high concentration of glucose in the gut.

(i) Explain why a high concentration of glucose in the gut may cause dehydration.

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.....
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.....[3]

(ii) State how an athlete may avoid dehydration during sustained exercise.

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

(c) Many athletes believe that an increase in lipid in the diet is the best preparation for sustained exercise. However, experimental evidence has shown that it is an increase in high carbohydrate food which is needed.

Suggest the long-term harmful effects on the body of a high intake of lipid.

.....
.....
.....
.....[2]

[Total: 16]

5 The early detection of pregnancy is important so that routine antenatal tests may be conducted to monitor the health of the mother and the foetus.

(a) Explain **two** precautionary steps regarding her health that a woman should take **before** she becomes pregnant.

- 1.
.....
.....
- 2.
.....
.....[4]

(b) As the zygote implants, human chorionic gonadotrophin (HCG) is secreted by the developing placenta.

(i) Describe how the secretion of HCG may be detected, **using monoclonal antibodies**, in a pregnancy test.

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.....[5]

(ii) Suggest why monoclonal antibodies are particularly suited to detect the presence of HCG.

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.....[2]

(iii) Explain why it is important to maintain the corpus luteum during the early stages of pregnancy.

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.....[2]

(c) Describe the role of prolactin,

(i) during pregnancy;

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.....[2]

(ii) following the birth of a baby.

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.....[2]

[Total: 17]

- 6 Fig. 6.1 shows the structure of a rod cell from the retina.

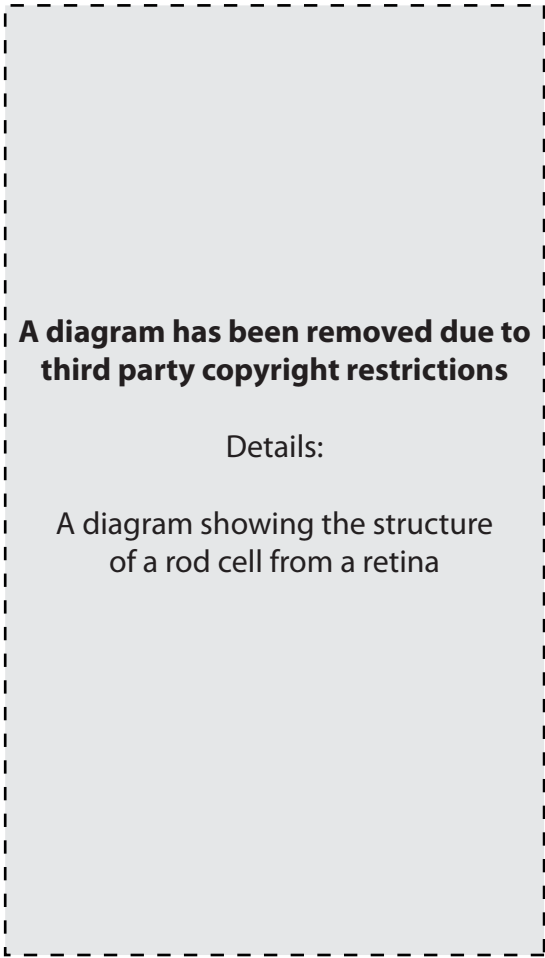


Fig. 6.1

- (a) (i) Draw an arrow on Fig. 6.1 to show the direction of light striking the retina. [1]
 (ii) Describe the effect of light on rhodopsin.

.....

 [3]

(iii) Explain why a poison which stops respiration will prevent the rod cell from functioning.

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.....
.....
.....[2]

(b) State **three** differences between rods and cones.

	rods	cones
1		
2		
3		

[3]

(c) Suggest why it is necessary for the retina to contain bipolar neurones.

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

(d) The sensitivity of the eye is its ability to detect low levels of light.

The degree of visual acuity (resolution) of the eye is its ability to distinguish between two separate points.

In the human eye, the rods are responsible for the high degree of sensitivity and the cones for the high degree of visual acuity.

Fig. 6.2 represents the arrangement of the rods and cones in the retina.

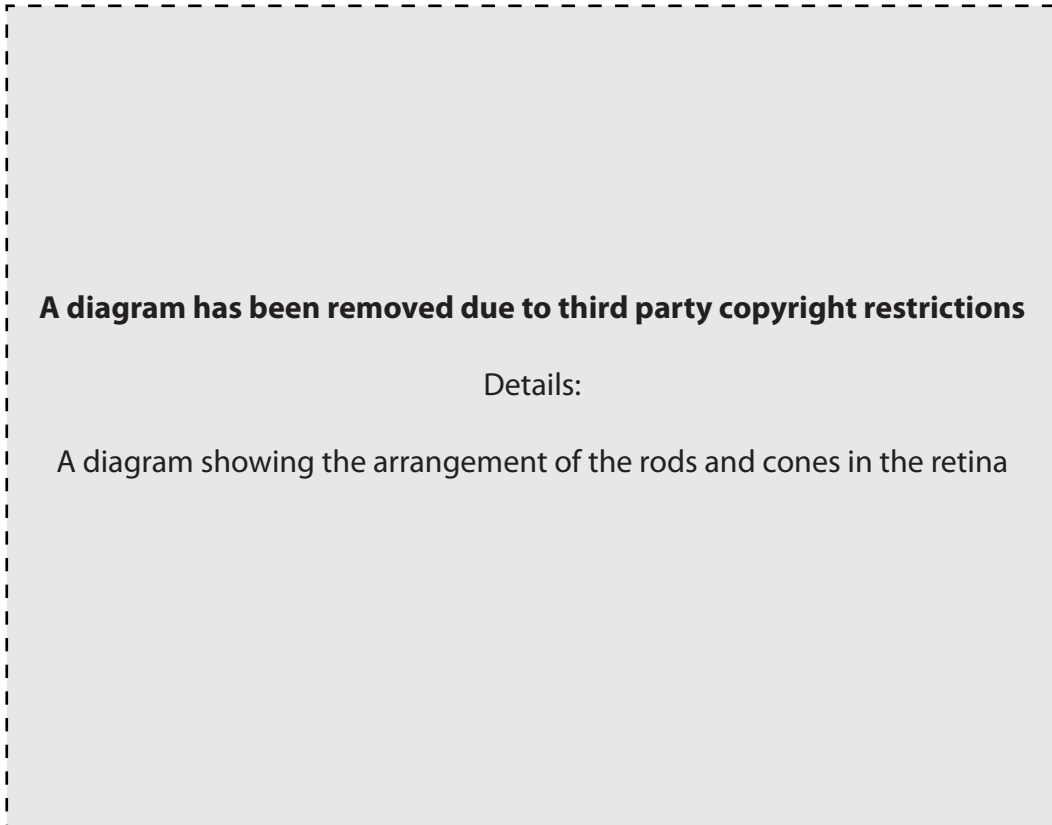


Fig. 6.2

Using the information on Fig. 6.2, explain how the rods have the greatest sensitivity and the cones the greatest visual acuity (resolution).

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.....[3]

[Total: 13]

END OF QUESTION PAPER

Copyright Acknowledgments:

- Fig. 1.1 Biology Jones and Jones Page 174 Fig. 12.3 CUP 1985 ISBN 0521 285321
Fig. 4.1 Adapted from Biological Science Review Volume 12 Number 2 November 1999 Page 22 Prof Clyde Williams
© Philip Allan Updates ISSN 0953-5365
Fig. 6.1 Advanced Human and Social Biology Students' Art Notebook Glenn and Susan Toole Page 112 Fig. 19.21
Stanley Thornes 1997 ISBN 07487 29119
Fig. 6. 2 Biology A Functional Approach MBV Roberts Page 304 Fig. 19.8 Nelson 4th Edition 1986 ISBN 0174480199

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