

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

For Examiner's Use

General Certificate of Education
June 2008
Advanced Level Examination



BIOLOGY (SPECIFICATION B)
Unit 4 Energy, Control and Continuity

BYB4

Friday 13 June 2008 1.30 pm to 3.00 pm

For this paper you must have:

- a ruler with millimetre measurements.
- You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked.**
- If you need extra space use pages 22 and 23 for your answers.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 81.
- The marks for questions are shown in brackets.
- Answers for **Section A** are expected to be short and precise.
- Answer questions in **Section B** in continuous prose where appropriate. Quality of Written Communication will be assessed in these answers.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in your answers.

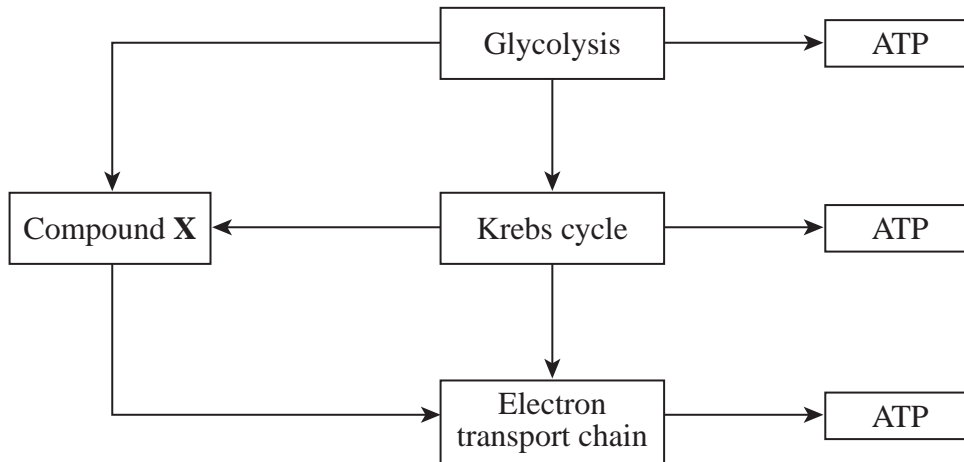
For Examiner's Use			
Question	Mark	Question	Mark
1		9	
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3			
4			
5			
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Total (Column 1) →			
Total (Column 2) →			
Quality of Written Communication			
TOTAL			
Examiner's Initials			



SECTION A

Answer **all** questions in the spaces provided.

- 1** The diagram shows the relationship between glycolysis, the Krebs cycle and the electron transport chain.



- 1** (a) Where in the cell does each of the following occur?

1 (a) (i) Glycolysis

1 (a) (ii) Krebs cycle

(2 marks)

- 1** (b) Compound **X** is produced by both glycolysis and the Krebs cycle.

Name compound **X**.

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(1 mark)



- 1 (c) Describe the reactions that link glycolysis to the Krebs cycle.

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(3 marks)

(Extra space)

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- 1 (d) There are differences in the ways in which ATP is made in glycolysis and in the electron transport chain.

Give **one** of these differences.

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(1 mark)

7

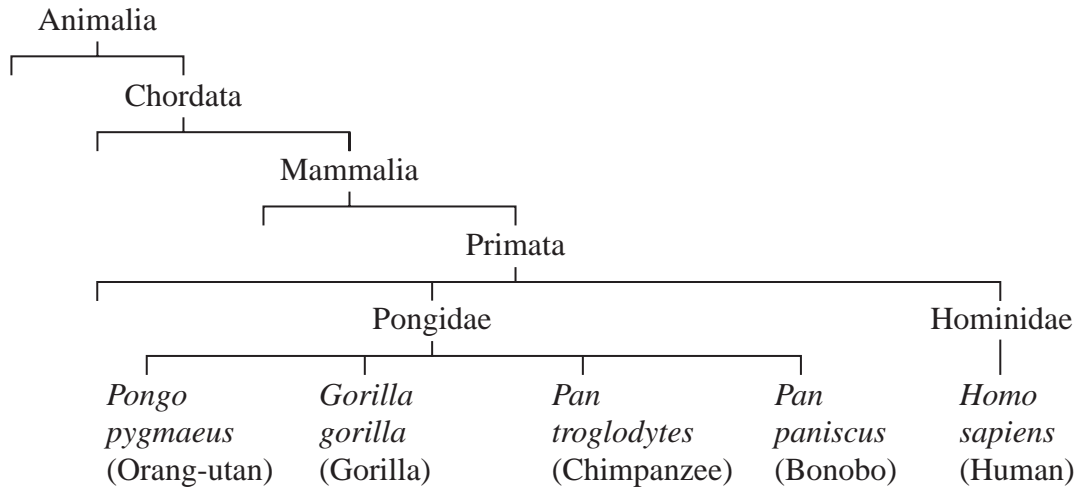
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2 **Figure 1** shows the classification of some primates.

Figure 1



2 (a) This classification is hierarchical and phylogenetic.

Explain what is meant by

2 (a) (i) hierarchical

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 (1 mark)

2 (a) (ii) phylogenetic.

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 (1 mark)

2 (b) (i) To which genus does the orang-utan belong?

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 (1 mark)

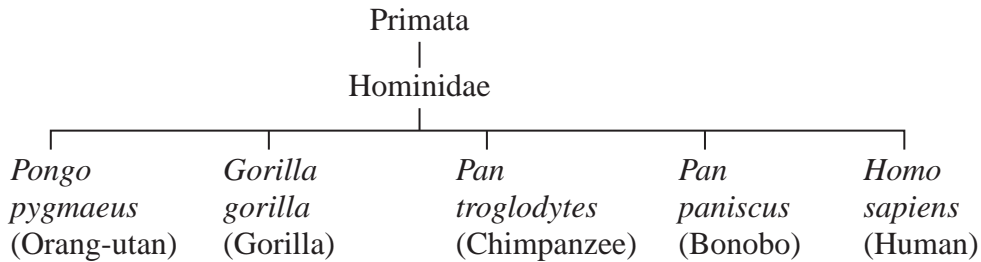
2 (b) (ii) To which order does the chimpanzee belong?

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 (1 mark)



- 2 (c) Many years ago, scientists used a different system of classification of the same primates. This is shown in **Figure 2**.

Figure 2



- 2 (c) (i) Using information from **Figure 1** and **Figure 2**, give **one** way in which the classification of these primates has changed.

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 (1 mark)

(Extra space)

- 2 (c) (ii) Suggest **one** new source of evidence that has contributed to the changes in classification.

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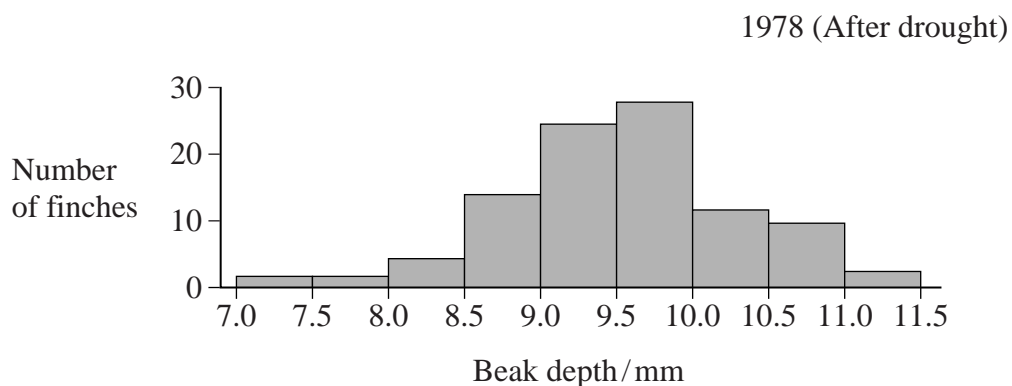
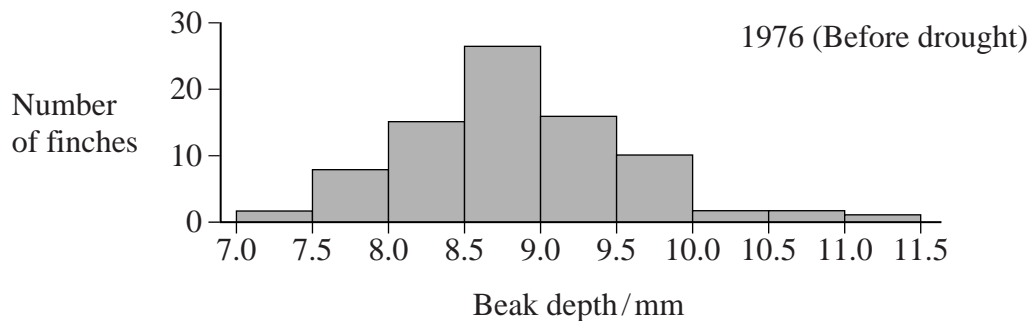
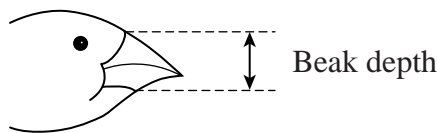
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- 3 The ground finch, *Geospiza fortis*, is a species of bird which lives on a small isolated island. These finches feed on seeds of different sizes from different species of plants. The finches show variation in the size of their beaks. Birds with larger beaks can eat large and small seeds. Birds with smaller beaks are only able to eat small seeds.

In 1977 there was a severe drought on the island. This killed many species of plants that the finches fed on. One species of food plant did survive and this produced large seeds.

The graphs show the distribution of beak sizes of the finch population before and after the drought. Beak size was measured by the depth of the beak, as shown in the diagram.



3 (a) (i) What type of variation is shown in the graphs?

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(1 mark)

3 (a) (ii) How is this type of variation genetically controlled?

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(1 mark)

3 (b) The evidence that beak size is determined by genetic factors was obtained by comparing beak sizes of parents and their offspring. Explain how this comparison provided evidence for the role of genetic factors.

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(1 mark)
(Extra space)

3 (c) Explain the changes in beak size from 1976 to 1978.

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(4 marks)
(Extra space)

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- 4 (a) Mutation may produce multiple alleles of a gene. Explain how.

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(2 marks)

(Extra space)

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- 4 (b) An allele may be present in the genotype but its effects are not seen in the phenotype. In terms of protein production, explain why.

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(2 marks)

(Extra space)

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- 4 (c) Independent assortment of homologous chromosomes might result in several different phenotypes among the offspring of two parents.

- 4 (c) (i) Explain what is meant by *homologous* chromosomes.

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(2 marks)



- 4 (c) (ii) Explain how independent assortment might result in several different phenotypes in the offspring of two parents.

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(2 marks)

(Extra space)

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8

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5 (a) Mammals control their blood water potential.

5 (a) (i) Describe how a decrease in the blood water potential is detected.

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(1 mark)

5 (a) (ii) Explain how the body responds to a decrease in blood water potential.

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(2 marks)

(Extra space)

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The whale is a large mammal that lives in the sea.

Whales take in sea water with their food. They have adaptations that prevent them from dehydrating when they take in sea water. Humans do not have such adaptations. If humans drink sea water they become dehydrated.

Scientists measured the volume of urine produced by whales and by humans when they take in sea water. They also measured the chloride ion content of the urine produced by humans and by whales. Sea water has a chloride concentration of 535 mmol dm^{-3} .

The table shows the results.

Species	Volume of urine produced per dm^3 of sea water taken in / cm^3	Chloride concentration of urine / mmol dm^{-3}
Human	1350	400
Whale	650	820

5 (b) Use the data in the table to explain

5 (b) (i) why a human who drinks sea water becomes dehydrated

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 (1 mark)
 (Extra space)

5 (b) (ii) how a whale is adapted to be able to drink sea water.

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 (1 mark)
 (Extra space)

5 (c) Long loops of Henle enable the whale to produce very concentrated urine.
 Explain how.

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 (3 marks)
 (Extra space)

- 6** (a) (i) Describe how a resting potential is maintained in a neurone.

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(2 marks)

- 6** (a) (ii) The potential across the membrane is reversed when an action potential is produced. Describe how.

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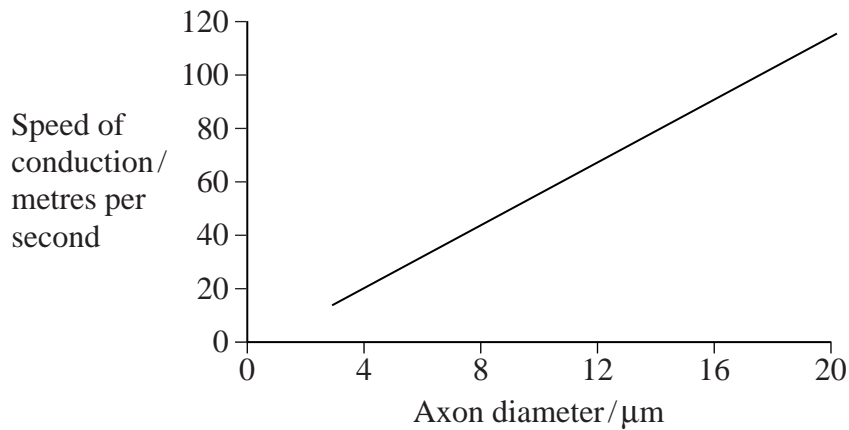
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- 6 (b) The graph shows the relationship between the diameter of the axon and the speed of conduction of nerve impulses in myelinated axons of a cat.



As the diameter of the axon increases, the length of myelination between the nodes increases. This could explain the increase in speed of conduction shown in the graph. Suggest how.

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(2 marks)

- 6 (c) A myelinated axon uses less ATP to transmit a nerve impulse than an unmyelinated axon of the same diameter. Explain why.

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(2 marks)

(Extra space)

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- 7 (a) Name **two** products of the light-dependent reaction of photosynthesis which are used in the light-independent reaction.

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2

(2 marks)

In early experiments on the biochemistry of photosynthesis, scientists discovered that the photosynthetic reactions occurred very rapidly. They measured photosynthesis by green protocists when exposed to flashes of light.

- 7 (b) Suggest how photosynthesis could have been measured.

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(1 mark)

- 7 (c) The experiments were carried out at both a high light intensity and a high carbon dioxide concentration. Suggest why.

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(1 mark)

Duration of light flash / ms	Duration of dark period between flashes / ms	Amount of photosynthesis per flash of light / arbitrary units
3	3	1
3	17	2
3	400	2

- photosynthesis consists of two stages – a light-dependent reaction and a light-independent reaction
- products of the light-dependent reaction are used in the light-independent reaction
- the light-independent reaction is much slower than the light-dependent reaction.

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- (Extra space) (2 marks)

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 (Extra space) (1 mark)

SECTION B

Answer **all** questions in the spaces provided.

Answer questions in continuous prose, where appropriate.
Quality of Written Communication will be assessed in these answers.

- 8** Chickens have a structure called a comb on their heads. The drawings show two types of comb.



Pea comb



Single comb

The shape of the comb is controlled by two alleles of one gene. The allele for pea comb, **A**, is dominant to the allele for single comb, **a**.

The colour of chicken eggs is controlled by two alleles of a different gene. The allele for blue eggs, **B**, is dominant to the allele for white eggs, **b**.

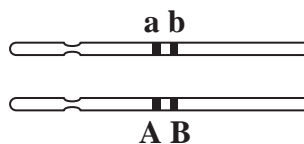
The genes for comb shape and egg colour are situated on the same chromosome.

A farmer crossed a male chicken with the genotype **AaBb** with a female chicken that had a single comb and produced white eggs.

- 8** (a) What was the genotype of the female parent?

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(1 mark)

The diagram shows how the alleles of the genes were arranged on the chromosomes of the male parent.



- 8** (b) Which **two** genotypes will be most frequent in the offspring?

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(1 mark)



- 8** (c) The farmer could identify which of the female offspring from this cross would eventually produce blue eggs. Explain how.

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(2 marks)

(Extra space)

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- 8** (d) Genes **A** and **B** are close together on the chromosome. This is important when trying to identify which of the female offspring would produce blue eggs. Explain why.

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(2 marks)

(Extra space)

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- 8** (e) Suggest **two** environmental factors which are likely to affect egg production.

1

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(2 marks)

Question 8 continues on the next page



In chickens it is the males which are XX and the females which are XY.

- 8 (f) A gene on the X chromosome controls the rate of feather production. The allele for slow feather production, **F**, is dominant to the allele for rapid feather production, **f**.

A farmer made a cross between two chickens with known genotypes. He chose these chickens so that he could tell the sex of the offspring soon after they hatched by looking at their feathers.

Which of the crosses shown in the table did he make? Explain your answer.

Cross	Genotype of male parent	Genotype of female parent
A	$X^F X^F$	$X^f Y$
B	$X^F X^f$	$X^f Y$
C	$X^f X^f$	$X^F Y$
D	$X^F X^f$	$X^F Y$

Answer (1 mark)

Explanation

 (2 marks)

(Extra space)

- 8 (g) Female chickens are more likely than male chickens to show recessive sex-linked characteristics. Explain why.

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 (3 marks)

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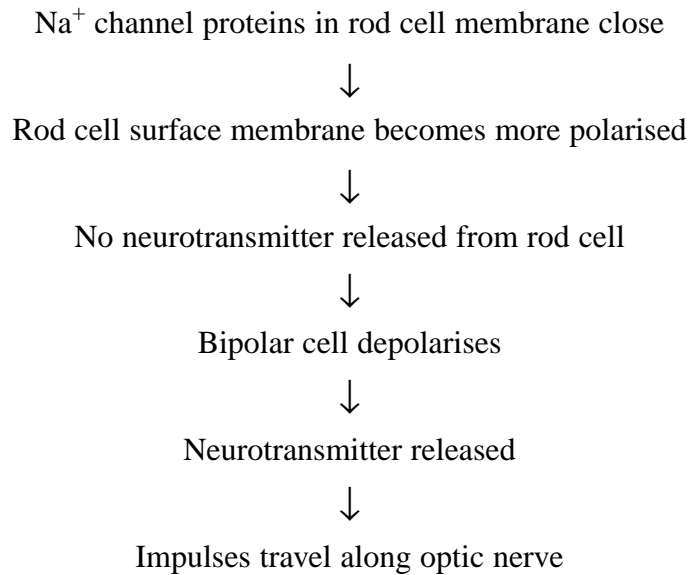
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The flow chart shows the sequence of some of the events which occur as a result of light falling on a rod cell.



- 9 (b) This sequence starts as a result of chemical changes which occur when light strikes a rod cell.

Describe these chemical changes.

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(2 marks)

- 9 (c) Neurotransmitters can have either a stimulatory or inhibitory effect. Use evidence from the flow chart to support this statement.

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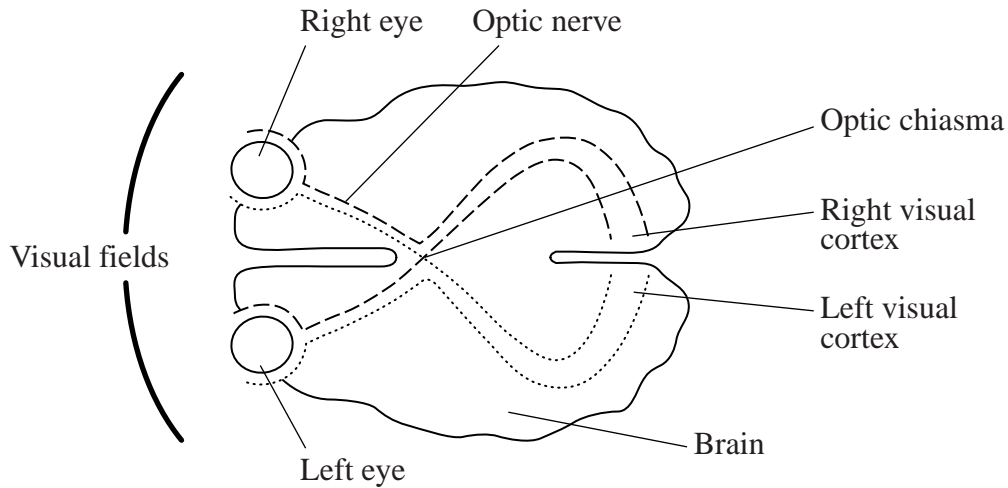
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- 9 (d) The diagram shows the nervous pathways from the retinas in the eyes to the visual cortex of the brain.



- 9 (d) (i) Humans have eyes that look forward. This allows humans to judge distance. Using the diagram, explain how.

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(4 marks)

(Extra space)

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- 9 (d) (ii) In which part of the brain does judgment of distance take place?

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(1 mark)

END OF QUESTIONS

QWC

15

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ANSWER IN THE SPACES PROVIDED**

