

Student Number _____

Student Name _____



Sydney Technical High School

Biology Trial 2006

General Instructions

- Reading Time - 5 minutes
- Working Time - 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- Write your Student Number at the top of each page
- Part A Multiple Choice Answer Sheet is on the last page and can be removed to record answers (put your Student Number on it)
- Hand all parts of the paper in together

Total marks - 100

Section I

75 marks

This section has two parts, Part A and Part B

Part A - 15 marks

- Attempt Questions 1-15
- Allow about 30 minutes for this part

Part B - 60 marks

- Attempt Questions 16-32
- Allow about 1 hour and 45 minutes for this part

Section II

25 marks

- Attempt all parts of Question 33
- Allow about 45 minutes for this section
-

Section I
Total marks 75

Part A
Total Marks (15)
Attempt Questions 1-15
Allow about 30 minutes for this part

Use the multiple-choice answer sheet.
Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample:

$$2 + 4 =$$

- (A) 2
- (B) 6
- (C) 8
- (D) 9

A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

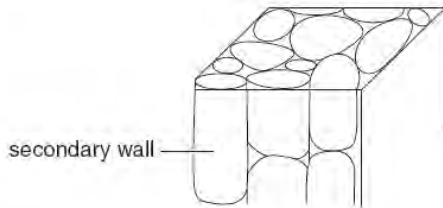
If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and draw an arrow as follows:

correct
↓
A B C D

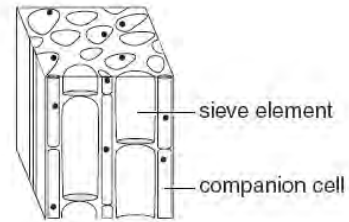
1. What is the effect of increasing the concentration of carbon dioxide on the pH of water?
- (A) A rise in the pH, making it more acidic.
 - (B) A lowering of the pH, making it more acidic.
 - (C) A rise in the pH, making it more alkaline.
 - (D) A lowering of the pH, making it more alkaline.

2. The diagrams below are longitudinal sections of plant tissue.

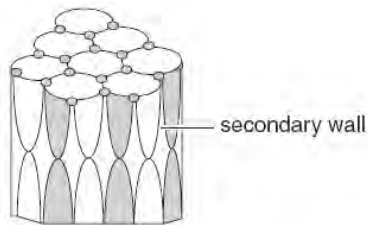
(A)



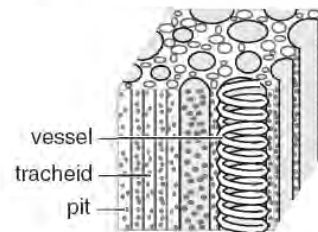
(B)



(C)



(D)

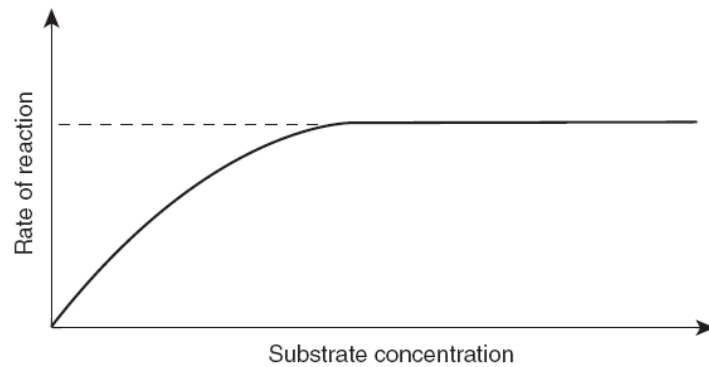


Which diagram is xylem?

- (A) A
 - (B) B
 - (C) C
 - (D) D
3. Amylase enzyme in saliva digests starch into sucrose. Saliva has a pH of 8. Which of these statements is **NOT** correct?

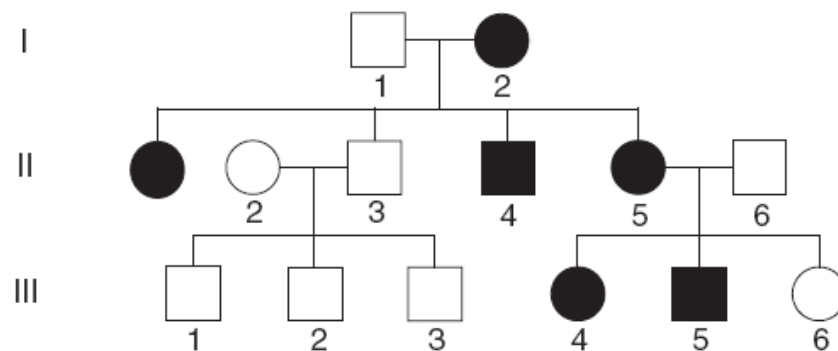
- (A) The amylase will be inactive in an acidic environment in the stomach..
- (B) The amount of sucrose finally produced will depend on the amount of amylase present.
- (C) The amylase will act more rapidly at 35°C than at 15°C.
- (D) The rate of sucrose production is proportional to the amount of amylase present.

4. The following graph shows the effect that the concentration of substrate has on the rate of an enzyme-mediated reaction.



What does the graph indicate?

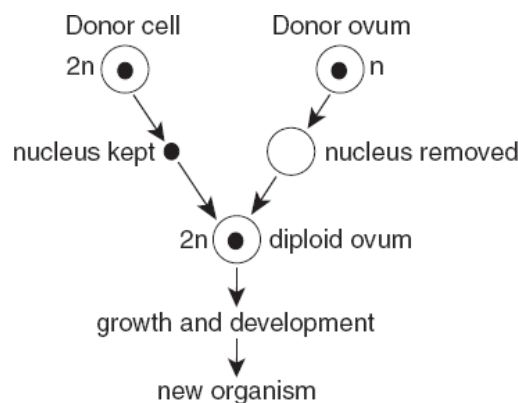
- (A) The higher the concentration of the substrate the greater the rate of reaction.
 (B) The rate of reaction is unaffected by the substrate concentration.
 (C) Above a certain concentration, increased levels of substrate have no effect on the rate of reaction.
 (D) Above a certain concentration, the rate of reaction is decreased by increased levels of substrate.
5. A species of Australian fish lays its eggs in freshwater streams. Soon after hatching, the young fish swim downstream and out into the sea where they spend most of their adult life. Each fish must undergo various changes as it moves from a freshwater to a marine environment. Which of the following is **not** true for the fish as it moves into the marine environment?
- (A) The fish would have to excrete large quantities of dilute urine from the kidneys.
 (B) The fish must contend with a greater concentration of salt in the sea compared with fresh water.
 (C) The fish would have to excrete more salt in its urine and from the gills.
 (D) The fish would have to change to a new diet in the sea because the organisms would be different from those in fresh water.
6. The pedigree shown below traces the inheritance of a dominant-recessive genetic trait in a family over three generations.



How can you describe individual 5 in generation II?

- (A) Male, homozygous-recessive
 (B) Female, homozygous-dominant
 (C) Male, heterozygous
 (D) Female, heterozygous

7. What was the contribution of George Beadle and Edward Tatum to our understanding of modern genetics?
- (A) Discovering the structure of the DNA molecule.
 - (B) Discovering that one gene codes for the production of one enzyme.
 - (C) Identifying the role of sex-linked genetic traits.
 - (D) Describing the principle of the segregation of alleles.
8. Chemical analysis of the DNA of a particular organism showed that 30% of the bases on type molecule were adenine. What is the percentage of cytosine present?
- (A) 20%
 - (B) 30%
 - (C) 40%
 - (D) 70%
9. Which of the following statements about DNA is correct?
- (A) Single stranded DNA becomes a double stranded helix on replication.
 - (B) The four bases are called adenine, tyrosine, cytosine and guanine.
 - (C) The sequence of bases in the DNA molecule provides the genetic code.
 - (D) The strands of the DNA double helix are a complementary pair of homologous chromosomes.
10. The diagram below shows a process than can be used to clone an animal.



How could you describe the new organism at the end of this process?

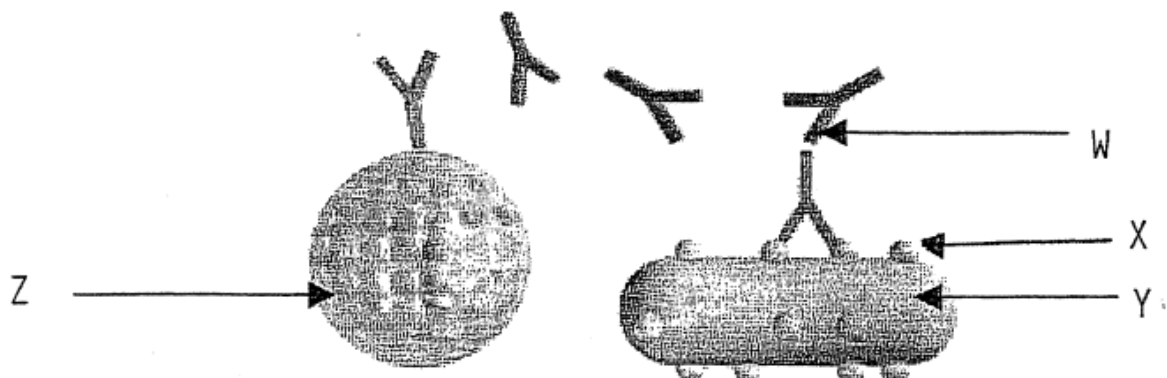
- (A) It will not be viable.
- (B) It will be genetically identical to the donor cell organism.
- (C) It will be genetically identical to the donor ovum organism.
- (D) It will be genetically different from both donors due to variability introduced through sexual reproduction.

11. Infectious diseases -
- (A) can all be cured by antibiotics
 - (B) are caused by pathogenic organisms
 - (C) are always contagious - transmitted from one host to another
 - (D) are always prevented by proper hygiene
12. Non-specific defence barriers and adaptations include -
- (A) macrophages, histamine, stomach acid
 - (B) skin, antibodies, phagocytosis
 - (C) tears, mucous membranes, memory cells
 - (D) inflammatory response, antigens, lymph system
13. Examples of a variety of human diseases/conditions are listed below:
- influenza
 - heavy metal poisoning
 - red/green colour blindness
 - scurvy (lack of Vitamin C)

Which line in the table below correctly categorises these conditions?

	Environmental	Inherited	Nutritional deficiency
(A)	red/green colour blindness	influenza	scurvy
(B)	influenza	red/green colour blindness	heavy metal poisoning
(C)	heavy metal poisoning	scurvy	influenza
(D)	heavy metal poisoning	red/green colour blindness	scurvy

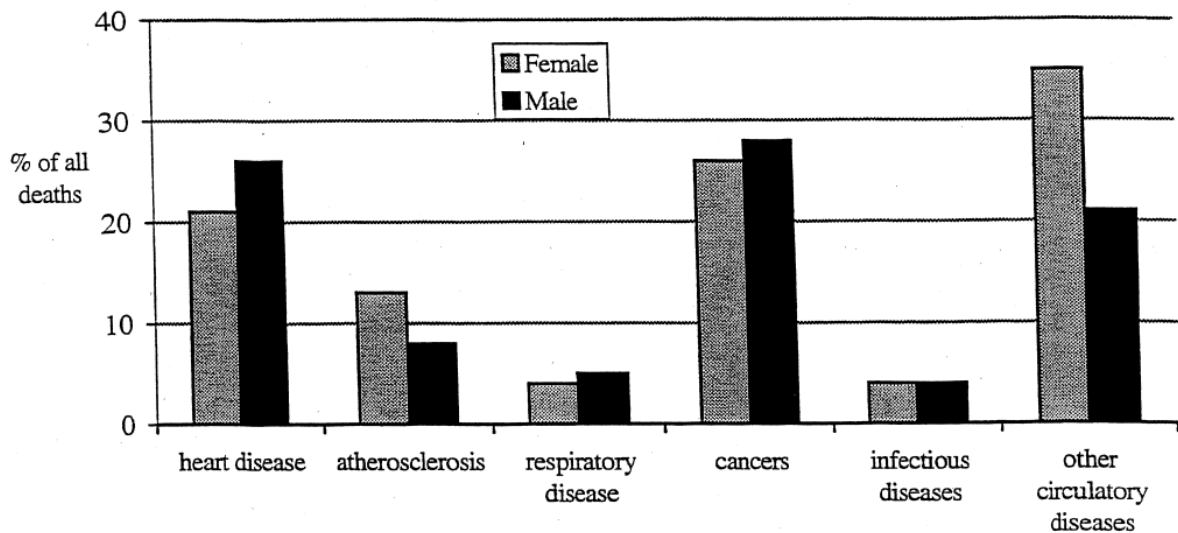
14. In the diagram below related to the immune response, identify each of the labelled components.



Q.14 continued

	W	X	Y	Z
(A)	Antibodies	Antigens	Bacteria	T-lymphocyte helper cells
(B)	Antibodies	Antigens	Pathogen	B-lymphocyte plasma cells
(C)	Antigen	Antibody	Prion	T-lymphocyte helper cells
(D)	Antibiotics	Antigen	Virus	B-lymphocyte plasma cells

15. Use the information in the graph to answer the question below -



Which statement below is most correct?

- (A) The percentage incidence of female deaths from infectious diseases is the same as that of males.
- (B) Males die from cancers because they spend too much time in the sun.
- (C) Females are more likely to die of heart disease than males.
- (D) Diet can influence the prevalence of respiratory diseases in both males and females.

Section I

Part B

Total Marks (60)

Attempt Questions 16-32

Allow about 1 hour and 45 minutes for this part

Answer this part in the spaces provided.

Marks

Question 16 (5 marks)

Homeostasis is essential for the survival of all organisms.

- (a) Describe homeostasis and explain why it is important for optimal metabolic efficiency.

2

- (b) Describe the adaptations or responses of **one** named Australian **plant** and **animal** which assist in temperature regulation.

3

Question 17 (3 marks)

Marks

Identify the major role of haemoglobin in the mammalian body and explain its adaptive advantage.

3

Question 18 (2 marks)

Complete the following table describing the changes in chemical composition of the blood as it circulates around the body and identifying the tissues in which these changes occur. 2

CHEMICAL IN BLOOD	CHANGE IN BLOOD CIRCULATION	TISSUES WHERE CHANGE OCCURS
CARBON DIOXIDE	RISE	SKELETAL MUSCLES
	FALL	LUNGS
OXYGEN	RISE	LUNGS
	FALL	SKELETAL MUSCLES
UREA	RISE	
	FALL	
GLUCOSE	RISE	
	FALL	

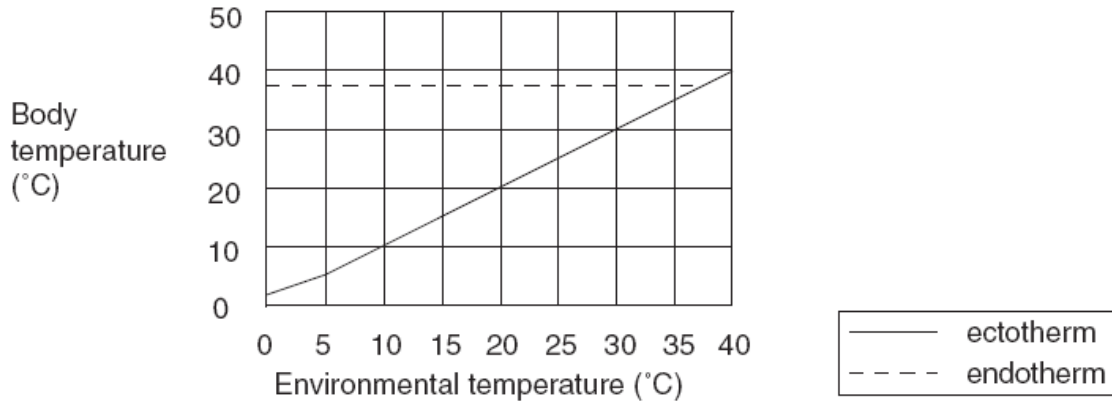
Question 19 (3 marks)

Marks

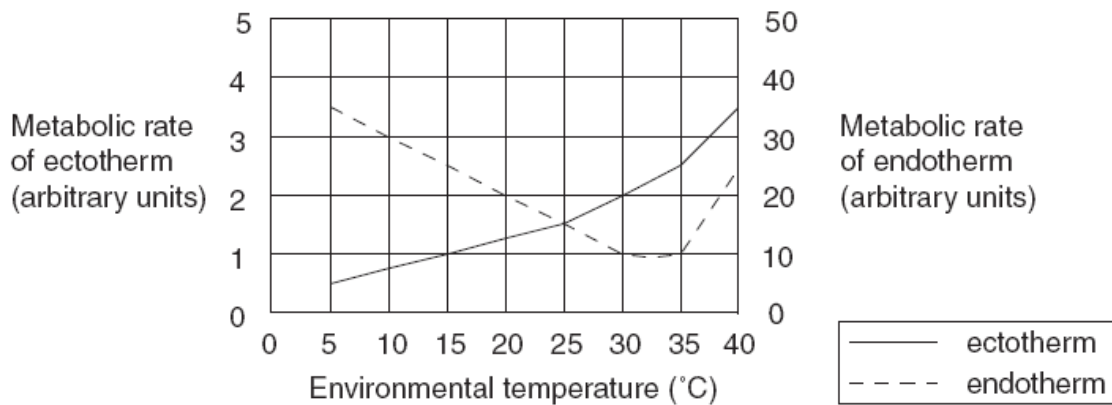
The graphs below show the differing effects of environmental temperature on endotherms and ectotherms.

3

Environmental temperature vs. Body temperature



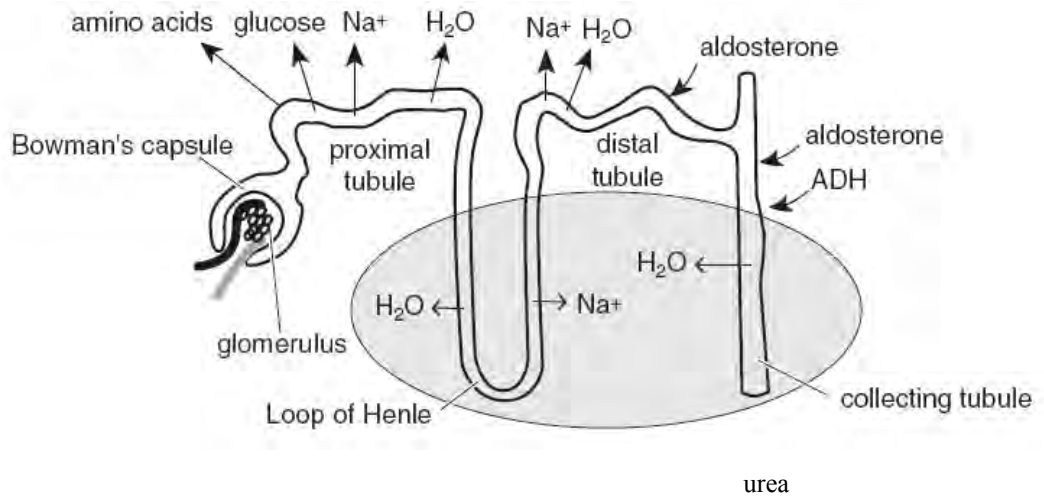
Environmental temperature vs. Metabolic rate



Use both graphs, explain why there are variations in the body temperatures of endotherms and ectotherms at different environmental temperatures.

Question 20 (7 marks)

Marks



(a) State the name of the structure pictured above. 1

(b) Using information from the diagram, explain how the processes of filtration and reabsorption in the above structure regulate body fluid composition. 3

(c) (i) What types of substances are aldosterone and ADH? 1

(ii) Differentiate between the two in their actions of regulating blood composition. 2

Question 21 (2 marks)

Marks

Using a specific transitional form as an example, describe how transitional fossils provide evidence to support the theory of evolution.

2

Question 22 (3 marks)

Gregor Mendel and Charles Darwin made their respective contributions to genetics and evolutionary theory at about the same time. Darwin's *The Origin of the Species* was published in 1859, while Mendel's paper outlining his work with pea plants was published in 1866.

Compare the responses of the scientific community to the publishing of Darwin's and of Mendel's work and propose reasons for significant differences in the responses.

3

Question 23 (4 marks)

Outline one process used to produce transgenic species. Include an example and reasons for creating this transgenic species.

4

Question 24 (3 marks)

Marks

Briefly describe the method and results of a first-hand investigation which demonstrated the effect of an environmental factor on phenotype.

3

Question 25 (3 marks)

Construct a flow chart that shows that changes in DNA sequences can result in changes in cell activity.

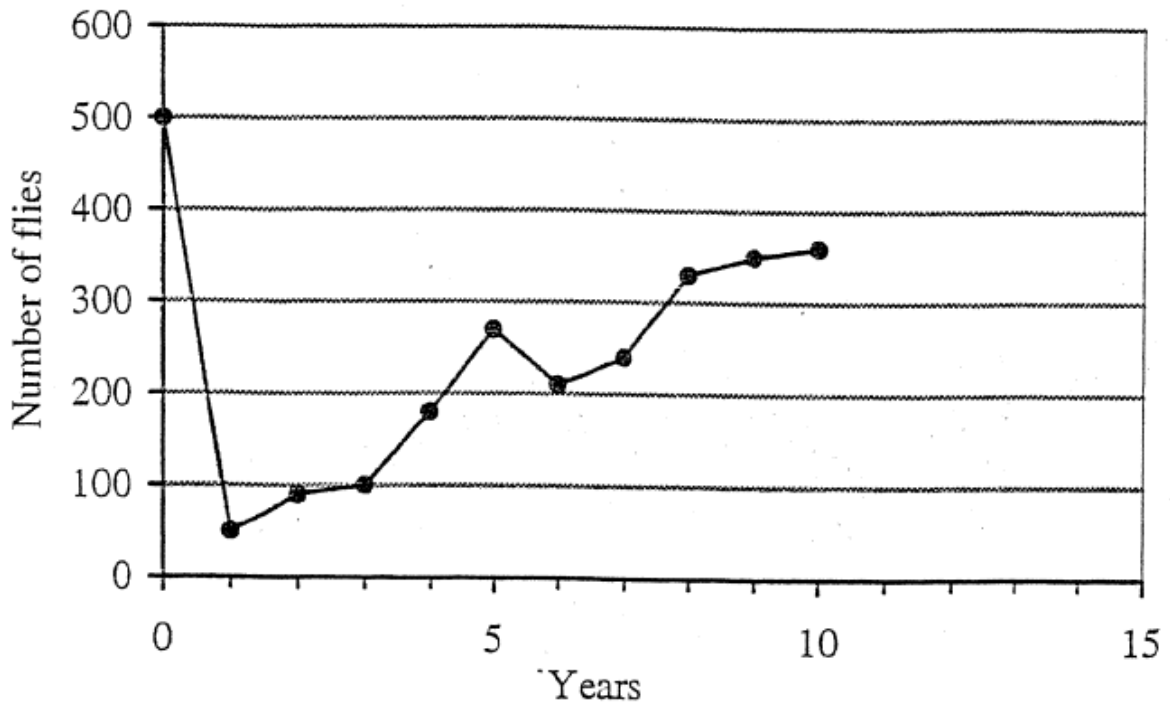
3

Question 26 (3 marks)

Marks

The information in the graph below shows the change in numbers of a fruit fly population that was sprayed with a particular insecticide in the first year of investigation and again five years later.

Change in number of flies over time



Explain how these results are a modern example of the process of 'natural' selection. 3

Question 27 (2 marks)

Distinguish between prions and viruses and **name one example** of a disease caused by each type of pathogen. 2

Question 28 (2 marks)

Marks

Fruit flies are insects whose bodies are covered by hair-like bristles. A female fruit fly, whose body is covered by forked bristles, is mated with a male fly with normal bristles.

Of their offspring, 62 are females with normal bristles and 65 are males with forked bristles. Assign symbols to the alleles and draw a Punnett square to explain the inheritance pattern for bristle shape in fruit flies.

2

Question 29 (3 marks)

Describe an experiment by Louis Pasteur to identify the role of microbes in decay. Use a diagram to show the apparatus used.

3

Question 30 (4 marks)

Marks

Lupin is a pulse crop primarily produced for stockfeed. *Colletotrichum lupini* is a fungi that causes a serious disease in lupin.

A series of controlled experiments was carried out to assess the effect of exposure to dry heat on *Colletotrichum lupini* infection in lupin seed. Four replicate seed lots of 250 seeds were used for each time period and temperature.

The results of one of these experiments, concerning the effect of up to eight days exposure to different temperatures on infection in lupin seed, appear in the table below.

<i>Temperature (°C)</i>	<i>Duration of exposure (days)</i>	<i>Seeds infected (%)</i>
Untreated (control)	1	3.8
50	1	3.8
60	1	3.8
60	7	1.0
65	1	1.7
65	7	0.0
70	1	1.3
70	7	0.0

(a) Name the pathogen referred to in the experiment described above. 1

(b) Outline the most efficient way to treat lupin seeds to prevent infection by this fungus. 1

(c) Assess the reliability of the data gathered. 1

(d) Assess the validity of the procedure used. 1

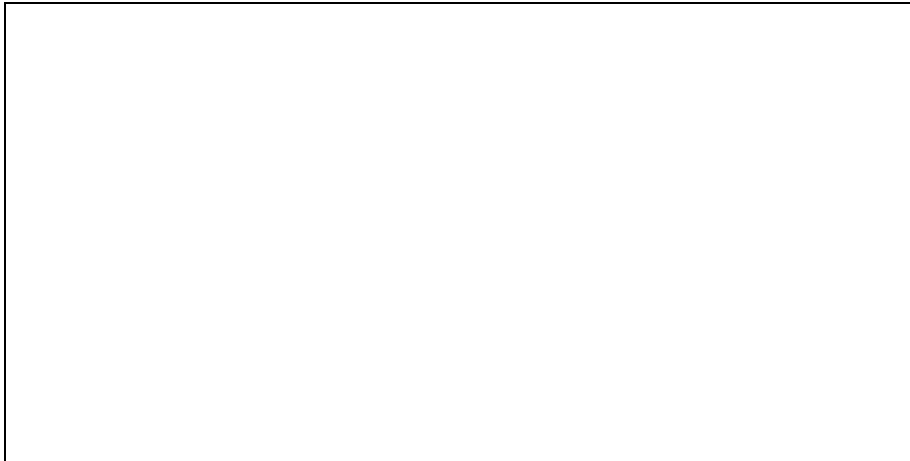
Question 31 (5 marks)

Marks

- (a) Explain why organ transplants trigger an immune response in the recipient. 1

- (b) Identify 2 signs of the inflammatory response that can be stimulated by an organ transplant. 1

- (c) Draw a labelled diagram to describe the process of phagocytosis that can occur. 2



- (d) Describe the major consequence of the immune response being triggered after an organ transplant. 1

Question 32 (6 marks)

Marks

The HIV virus specifically targets T-4 lymphocytes and eventually causes a dramatic decline in these T helper cells.

Explain why destruction of this one type of T-lymphocyte leads to a disabling of the entire immune response.

6

Section II

25 marks

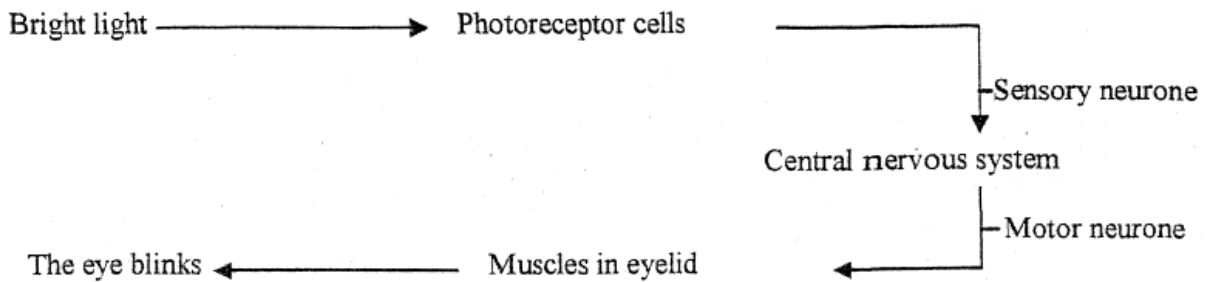
Attempt all parts of Question 33

Allow about 45 minutes for this section.

Question 33 - Communication (25 marks)

Marks

(a) The flow diagram shows how the eye reacts to a bright light.



Explain this reaction of the eye using the following terms:

- effector
- receptor
- stimulus
- response
- messenger

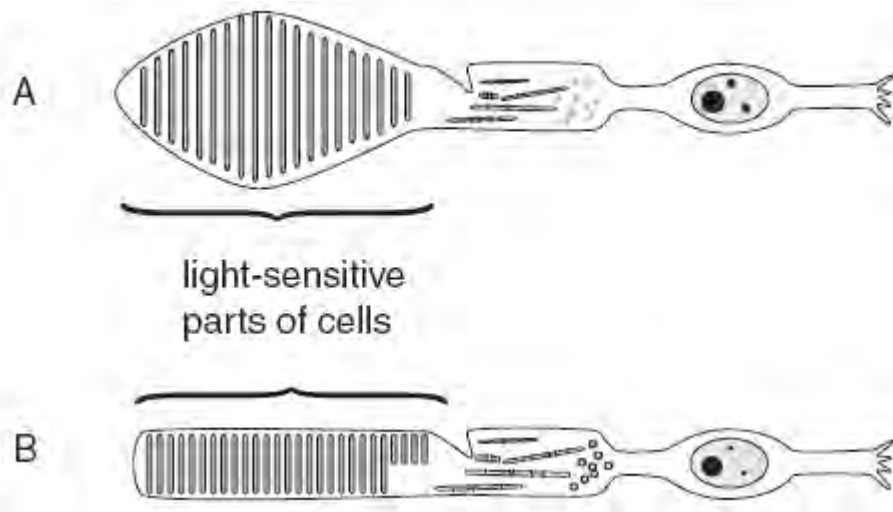
3

(b) You have studied the anatomy and function of the human eye. Construct a table which shows the relationship between the anatomical structure and function of each of the following parts:

- cornea
- vitreous humor
- choroid

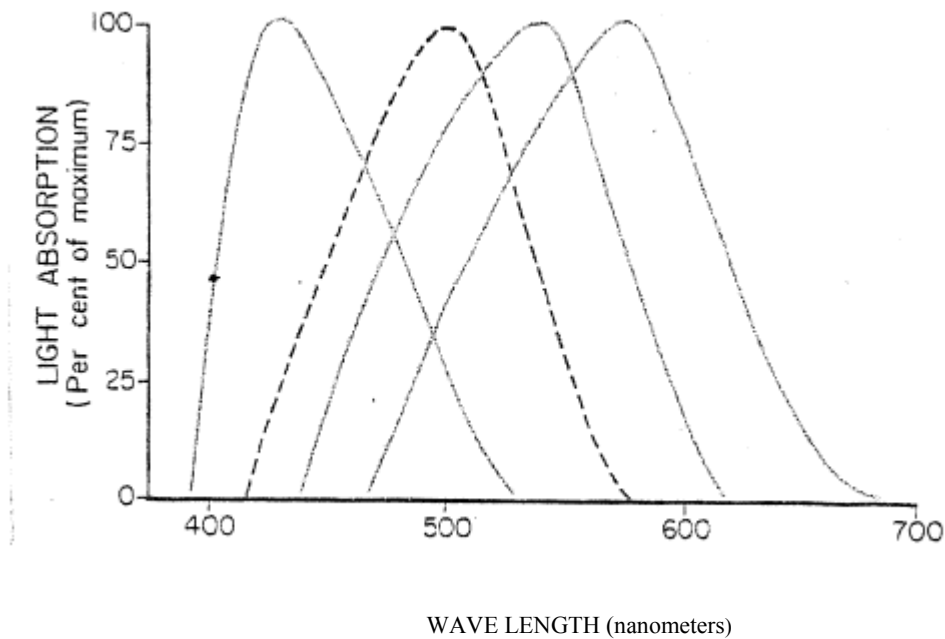
6

- (c) The diagram below provides a pictorial representation of the structure of two different types of photoreceptor cells found in the human eye.



- (i) Identify cells A and B. 1
- (ii) Explain the role of photoreceptors in the process of vision. 2
- (iii) Describe the differences in the **distribution** and **function** of cells A and B. 2

- (d) The following graph shows light absorption by the different photoreceptors of the human retina.



Question 33 continued-

Marks

- | | | |
|-------|---|---|
| (i) | Identify the range of wave lengths of the electromagnetic spectrum detected by humans. | 1 |
| (ii) | Compare this range with that of deep sea fish (450-500 nm) and honey bees (300-650 nm). | 1 |
| (iii) | Suggest reasons for the differences in ranges of electromagnetic radiation detected by the 3 species. | 3 |

Question 33 continued

Marks

- (e) In this option you have performed a first-hand investigation to model the process of accommodation.

Describe the model you used with the aid of a labelled diagram and evaluate its usefulness and limitations. 6

End of Exam

PART A
MULTIPLE-CHOICE ANSWER SHEET

- | | | | | |
|-----|-------------------------|-------------------------|-------------------------|-------------------------|
| 1. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 2. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 3. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 4. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 5. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 6. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
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| 8. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 9. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 10. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 11. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 12. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 13. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 14. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 15. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |

**STUDENTS SHOULD NOW CONTINUE
WITH PART B**

