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Centre Number

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Student Number

SCEGGS Darlinghurst

2007

HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION

Biology

This is a TRIAL PAPER only and does not necessarily reflect the content or format of the Higher School Certificate Examination for this subject.

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- Write your Centre Number and Student Number at the top of pages 8, 10 and 16

Total marks – 100

Section I

Pages 2–21

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 16–27
- Allow about 1 hour and 45 minutes for this part

Section II

Pages 22–24

25 marks

- Attempt Question 28
- Allow about 45 minutes for this section

Section I

75 marks

Part A – 15 marks

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

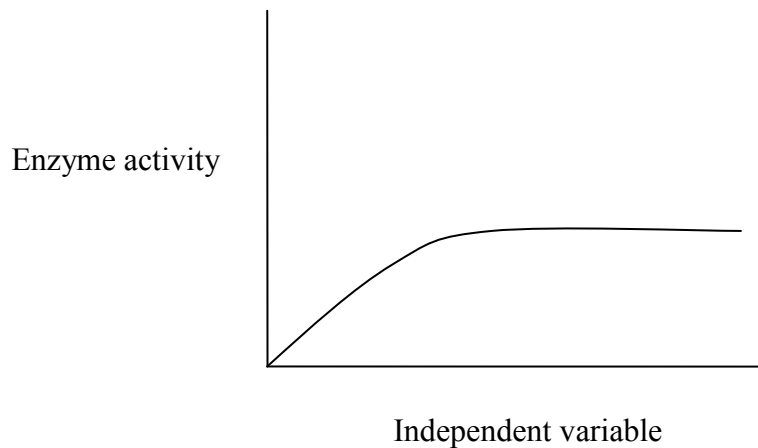
If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

 A B C D

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

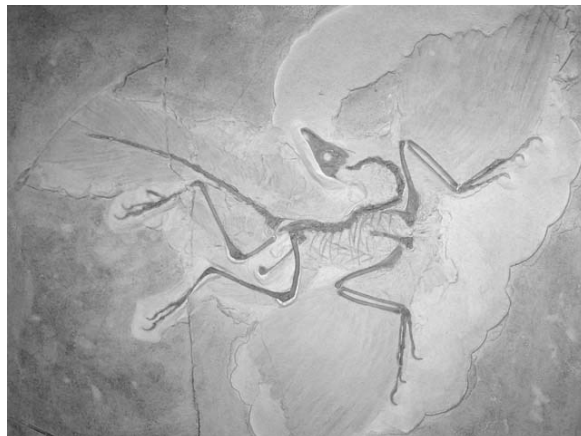
 A B C D ***correct***

- 1 The graph below shows the relationship between an independent variable and enzyme activity.



Which one of the following independent variables has this effect on enzyme activity?

- (A) substrate concentration
 - (B) light intensity
 - (C) pH
 - (D) temperature
- 2 Palaeontologists studying fossils of the bird-like reptile, *Archaeopteryx*, believe that it must have been at least partially endothermic.



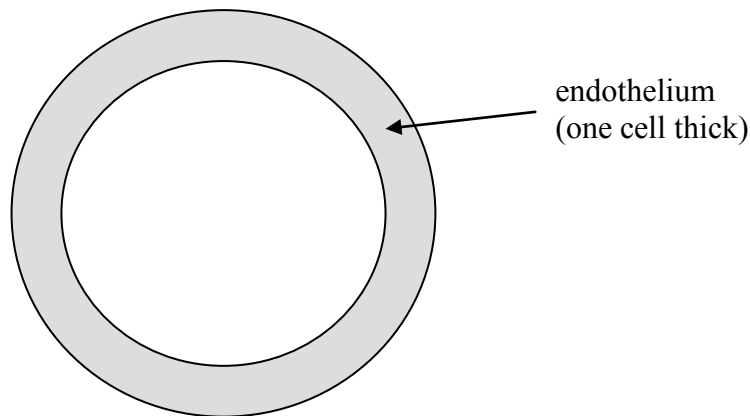
Which one of the following features suggests that it was an endotherm?

- (A) teeth
- (B) feathers
- (C) wishbone
- (D) it laid eggs

- 3 Sufferers from Addison's disease are commonly given the synthetic hormone fluorocortisone. This is to compensate for the fact that their adrenal glands are not producing enough aldosterone.

The main effect of fluorocortisone would be to:

- (A) increase permeability of collecting ducts to water.
 - (B) decrease permeability of collecting ducts to water.
 - (C) increase blood volume and blood pressure.
 - (D) decrease blood volume and blood pressure.
- 4 The drawing below shows a section through a structure found in the human body.



Which one of the following structures does this drawing show?

- (A) a vein
 - (B) an artery
 - (C) a capillary
 - (D) a bronchiole
- 5 Which one of the following organisms would you expect to produce uric acid as its principal nitrogenous waste?
- (A) a salt water fish
 - (B) a fresh water fish
 - (C) a terrestrial mammal
 - (D) a terrestrial insect

6 What is the most appropriate term which describes “any molecule that the body recognises as being foreign”?

- (A) Antibody
- (B) Antigen
- (C) Vaccine
- (D) Pathogen

7 Gregor Mendel, the ‘father of Genetics’, formulated his Laws of Inheritance in the 1860s. However, it wasn’t until the early 1900s, well after Mendel’s death, that they came to be widely known and accepted.

Which one of the following is the main reason for this?

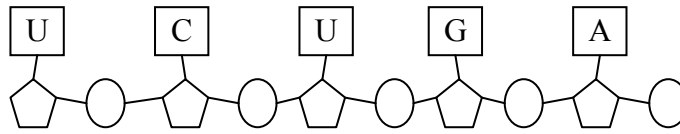
- (A) Mendel wasn’t well known to other scientists and he didn’t publish his findings in a well-known scientific journal.
- (B) Most people at the time of Mendel believed in the literal word of the Bible, and were reluctant to accept something that seemed to contradict it.
- (C) As a monk, Mendel suppressed his own findings as he feared they would lend support to the work of Darwin.
- (D) Mendel’s experiments were very complex and for a long time no-one understood what he had discovered.

8 Spherocytosis is a non sex-linked inherited condition that is determined by a dominant allele.

Which one of the following statements is true?

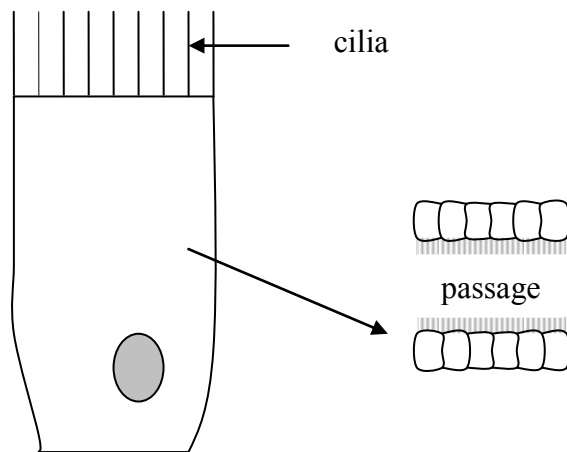
- (A) A child of two spherocytosis sufferers must also have the condition.
- (B) It is possible for two people without spherocytosis to have a child with the condition.
- (C) If one parent has spherocytosis the children will be carriers of the condition but not suffer from it themselves.
- (D) If a person has spherocytosis, at least one of their grandparents must have had it as well.

- 9 The diagram below shows a section of mRNA.



- Which one of the following shows the base sequence on the template strand of DNA from which this piece of mRNA was transcribed?
- (A) TGTCT
(B) AGACU
(C) TGTCU
(D) AGACT
- 10 Which one of the following contributes to variation by producing new combinations of alleles on a chromosome?
- (A) mitosis
(B) crossing-over
(C) fertilisation
(D) random segregation
- 11 During the second half of the nineteenth century our understanding of the causes of infectious disease advanced greatly. The two scientists mainly responsible for these advances were:
- (A) Pasteur and Koch
(B) Sutton and Boveri
(C) Laveran and Ross
(D) Jenner and MacFarlane Burnet.

- 12 What is the main difference between active and passive transport?
- (A) Active transport involves the use of energy to move substances, passive transport does not.
 - (B) Active transport involves conscious thought processes from the brain, passive transport does not.
 - (C) Active transport moves all substances, passive transport only moves liquids.
 - (D) Active transport is osmosis whereas passive transport is diffusion.
- 13 The diagram below shows a single ciliated epithelium cell and shows how a number of these cells surround a passage in the human body.



Cilia form part of the first line of defence against infection.

Where in the human body would you expect to find the greatest concentration of these cells?

- (A) the digestive system
- (B) the urinary system
- (C) the respiratory system
- (D) the immune system

- 14** Which type of pathogen consists simply of nucleic acid enclosed in a protein coat?
- (A) bacteria
 - (B) fungi
 - (C) prions
 - (D) viruses
- 15** Antibodies are produced by plasma cells. Which one of the following types of cell gives rise to plasma cells?
- (A) red blood cells
 - (B) phagocytes
 - (C) T lymphocytes
 - (D) B lymphocytes

2007 HIGHER SCHOOL CERTIFICATE TRIAL EXAMINATION
Biology

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Centre Number

Section I (continued)

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Student Number

Part B – 60 marks

Attempt Questions 16–27

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Marks

Question 16 (6 marks)

- (a) In the space below make a clear labelled drawing of a section of DNA, identifying one nucleotide.

3

- (b) Use a flow chart to explain how a change in the base sequence of DNA can bring about a change in cell activity.

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Question 17 (4 marks)

One of the probable consequences of rising sea levels is the occasional inundation of low lying coastal land. This will have an effect on the types of plants which are able to live in these areas.

- (a) Suggest an explanation for why conventional crops such as wheat cannot survive if the water they receive is too salty. 2

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- (b) Some plants are able to live with high levels of salinity. Describe one way in which a named species of plant is adapted to live in salty water. 2

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Question 18 (4 marks)

One of the major functions of blood is the transport of materials around the body.

4

Complete the table below to identify the forms in which particular substances are transported in the blood, their major source in the body and their major destination

Substance	Form in which transported	Transported	
		From	To
carbon dioxide			
nitrogenous waste			

Question 19 (8 marks)

The text boxes below contain information about the disease pertussis (whooping cough).

Causative organism	The bacterium <i>Bordetella pertussis</i> .
Transmission	<ul style="list-style-type: none">• Via respiratory droplets, from human to human. Highly contagious.
Effect on host	<ul style="list-style-type: none">• Toxin mediated disease. (Bacteria attach to respiratory epithelial cells and release a toxin which paralyses the cilia.)• Gives rise to major symptoms: catarrh, followed by 'paroxysmal' cough.• Disease less severe in adults and adolescents, but can lead to death in young children. Particularly < 6 months old.• Death usually results from complications such as pneumonia.
Treatment	<ul style="list-style-type: none">• Antibiotics such as erythromycin.

History

During the first half of the twentieth century pertussis was a major cause of death amongst young children in the developed world.

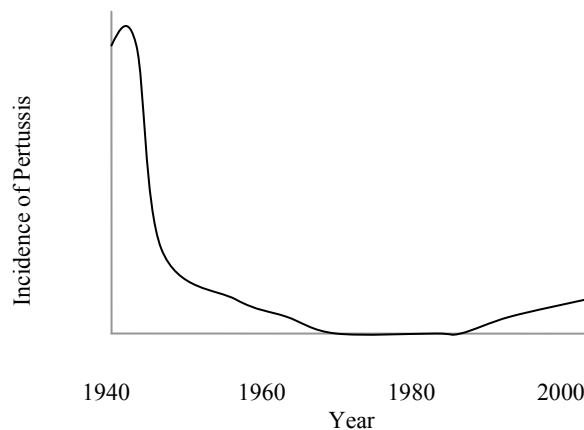
Mass vaccination began in the 1940s and the incidence declined dramatically.

Rare complications with the vaccine have led many parents to choose not to vaccinate their children since the 1980s.

The incidence of the disease is increasing in developed countries again.

In developing countries there has never been a co-ordinated program of mass vaccination against pertussis and it remains a major source of infant mortality. (The W.H.O. estimates 294,000 deaths from pertussis in 2002.)

Sketch graph to show trends in incidence of pertussis in the developed world from 1940 to 2005.



Question 19 continues on page 12

Question 19 (continued)

(a) Explain why infection by *B. pertussis* leads to intense coughing. 2

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(b) Pertussis is much less serious for adults and adolescents than it is for infants. Suggest why health authorities still see it as a priority to vaccinate previously unvaccinated adults against pertussis. 2

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(c) Assess the effectiveness of the vaccination programs against pertussis in the developed world. 4

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Question 20 (6 marks)

Some Mediterranean communities show a high incidence of the blood disease, Thalassaemia.

There are three phenotypes, normal and two recognised forms of the disease, a severe and a mild form called Thalassaemia major and Thalassaemia minor respectively.

The disease has a genetic basis. The table below shows some of the possible outcomes of crosses between people with the different forms of the disease.

Parent phenotypes	Possible offspring phenotypes
major x major	major
normal x normal	normal
major x normal	minor

(a) A couple who both have Thalassaemia minor have 4 children.

3

- Their oldest child, a boy, has Thalassaemia major.
- Their next 2 children, both girls, have Thalassaemia minor and normal blood respectively.
- Their youngest, a boy called Marc, has Thalassaemia minor.
- Marc is married to Anna who has normal blood.

Draw a pedigree diagram in the box below to display this information. Use a different colour to represent the two forms of the disease.

Question 20 continues on page 14

Question 20 (continued)

- (b) What advice would you give Marc and Anna on the chance of their first child having either Thalassemia major or minor? Justify your answer. 3

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Question 21 (4 marks)

With reference to a named example that you have studied, assess the benefits to society of hybridisation within a species. 4

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Question 22 (6 marks)

Pectinase is an enzyme which is used commercially in the production of fruit juice. It catalyses the breakdown of the cell walls of the fruit to both turn fruit pulp into juice and to make cloudy juice clear.

6

Outline a procedure you could follow to investigate the effect of pH on the activity of pectinase.

In your answer make sure you include:

- a hypothesis
- a list of equipment needed
- a step by step method
- one safety procedure
- the measures you should take to ensure that your results are valid and reliable

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Section I — Part B (continued)

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Student Number

Marks

Question 23 (2 marks)

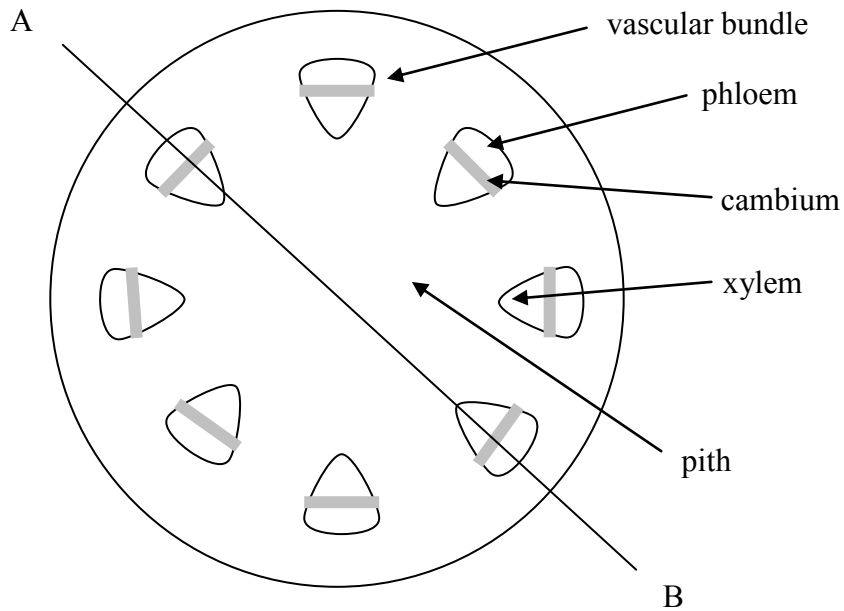
Complete the table below to explain how each of the measures mentioned reduces the risk of infectious disease.

2

Hygiene strategy	The reason why this practice reduces the risk of infectious disease.
Treating drinking water with chlorine	
Washing hands after using the toilet	

Question 24 (5 marks)

The drawing below is of a transverse section through a young stem. It is a map diagram, it shows no individual cells, just tissue types.



- (a) In the space below, draw a map diagram of a longitudinal section of the stem above along the axis A-B. Label all tissues.

2

Question 24 continues on page 18

Question 24 (continued)

(b) Explain how water is transported from the roots to the leaves in the xylem. **3**

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Question 25 (6 marks)

Many viruses, such as the one which causes the common cold, have high mutation rates. **6**

Describe fully how the human immune system defends the body from a viral pathogen such as the cold virus, and explain why this protection is not long lasting in the case of a virus with a high mutation rate such as the common cold.

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Question 26 (4 marks)

The text below was taken from a paper by Robyn Condor Broyles written in 1997 on the topic of punctuated equilibrium.

4

In it she refers to Richard Dawkins, currently one of the most highly regarded evolutionary biologists, and Niles Eldredge and Stephen Jay Gould, the two biologists who put forward the theory of punctuated equilibrium.

Dawkins argues that punctuated equilibrium is not a "new" theory. Evolution under punctuated equilibrium occurs gradually, as it was assumed to do under Darwinism before punctuated equilibrium was proposed. Dawkins notes that Eldredge and Gould are "truly as gradualist as anybody else". Their theory merely proposes that the rate of evolution varies. According to Dawkins, this conclusion arises out of common sense; no biologist ever claimed that the speed of evolution has never varied. Dawkins says that "It isn't true that Darwin believed evolution proceeded at a constant rate", and implies that neither has any serious evolutionist since his time.

Broyles R.C. 1997 Punctuated Equilibrium www.geocities.com/ginkgo100/pe.html -

Discuss Dawkins' suggestion that punctuated equilibrium and gradualism are essentially one and the same thing.

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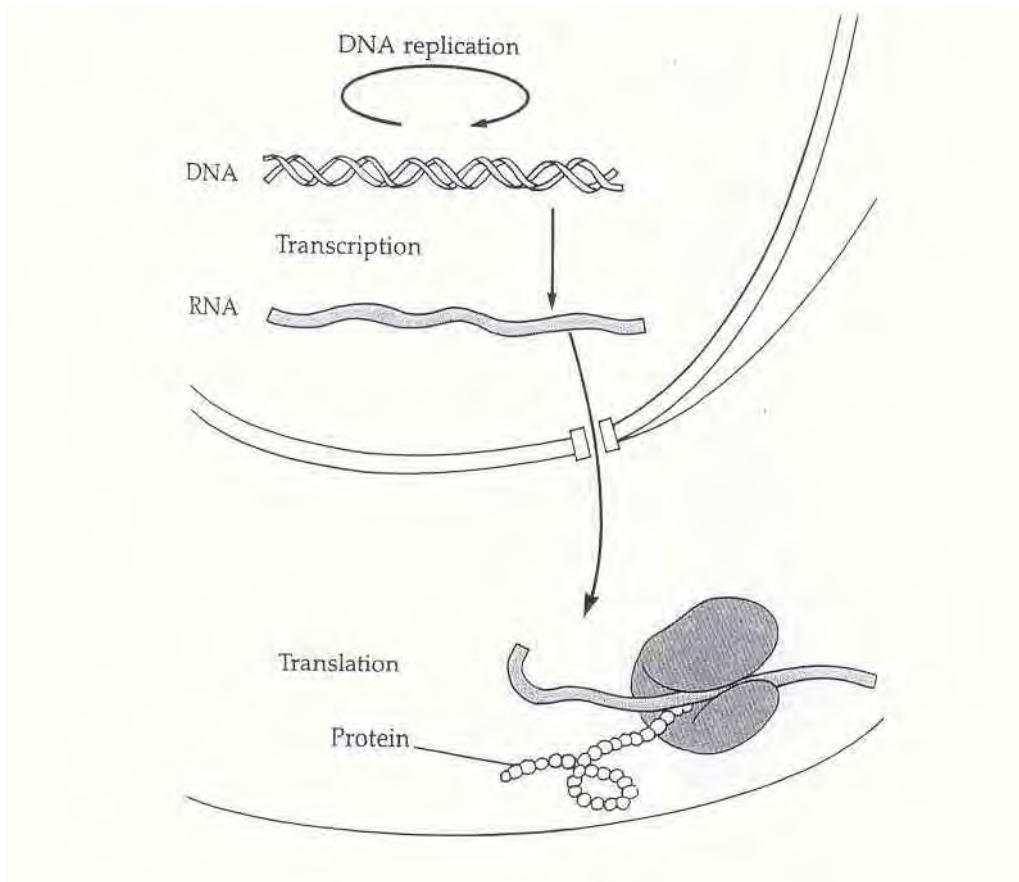
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Question 27 (5 marks)

The diagram below represents the main stages in an intracellular process.



(a) Identify this process. 1

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(b) Identify the site in the cell where transcription occurs. 1

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(c) Describe the process of translation. 3

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Biology

Section II

25 marks

Attempt Question 28

Allow about 45 minutes for this section

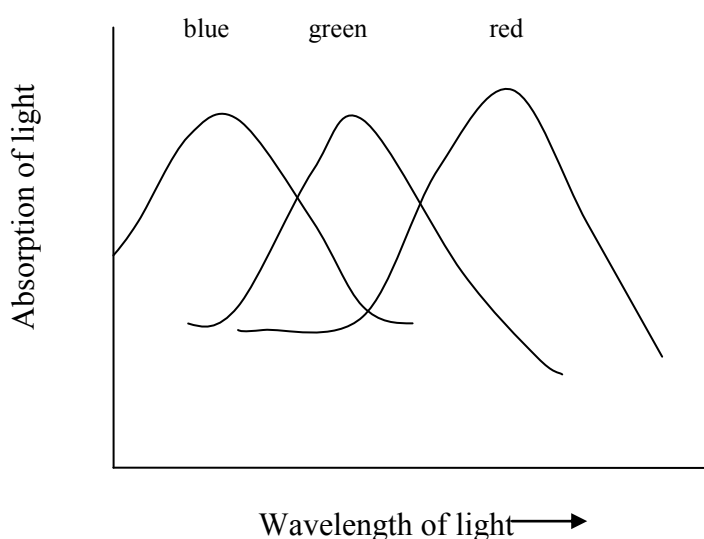
Answer the question in a writing booklet. Extra writing booklets are available.

	Pages
Question 28 Communication	23–24

Question 28 — Communication (25 marks)

- (a) (i) Identify the four refractive media in the human eye. 2
- (ii) Identify the condition under which refraction will occur. 1
- (iii) You performed a dissection in class to relate the structure of the parts of the eye to their function. Identify two structures you observed and relate their structure to their function. 2

- (b) The graph below shows the wavelengths of light absorbed by the three types of opsins in human cone cells.

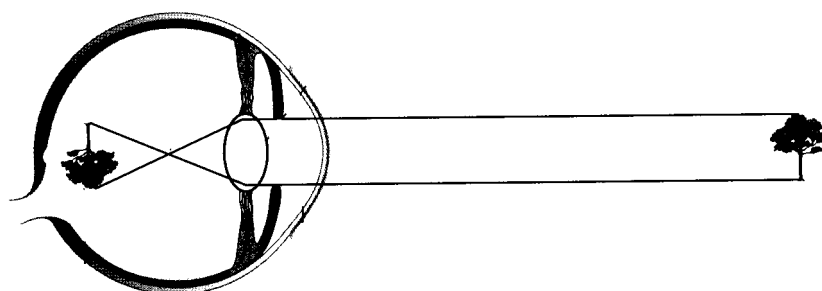


- (i) Explain how the three types of cone cells ensure colour vision across the whole spectrum. 2
- (ii) Outline the physiological cause of red-green colour blindness in humans. (Genetic details are not required.) 2
- (iii) Describe the differences in the range of electromagnetic radiation detected by humans and one other vertebrate and invertebrate. Suggest reasons for these differences. 5
- (c) Describe one technology that can be used to correct blindness from cataracts and discuss the implications of this technology for society 4

Question 28 continues on page 24

Question 28 (continued)

- (d) (i) Identify the name of the visual defect illustrated in the diagram below. **1**



- (ii) Outline a possible cause of this condition. **1**
- (iii) Identify a technology that can correct this condition and explain how it works. **2**
- (e) Describe the differences in distribution, structure and function of photoreceptor cells in the human eye. **3**

End of paper