



Sydney Girls High School

2007

TRIAL HIGHER SCHOOL CERTIFICATE
EXAMINATION

Biology

Student Number

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

Total marks – 100

Section I Pages 2 – 15

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 – 28
- Allow about 1 hour and 45 minutes for this part.

Section II Pages 16 – 18

25 marks

- Attempt all parts of this question 29
- Allow about 45 minutes for this section

Section I
75 marks

Part A – 15 marks

Attempt Questions 1 - 15

Allow about 1 hour and 45 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 drawing an arrow as follows:

A B C D
correct

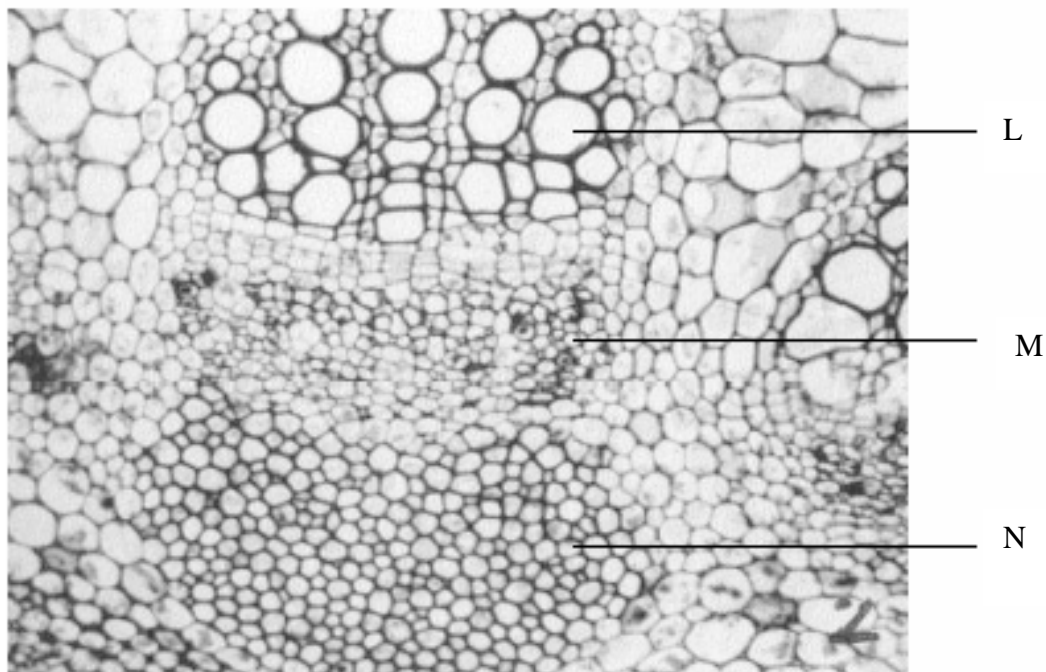
- 1) The table below shows the substrate and optimum pH of several enzymes involved in the digestion of foods in the digestive system.

Digestive Enzyme	Substrate	Optimum pH
Salivary amylase	Starch	7
Gastric protease	Protein	3
Pancreatic protease	Protein	5
Lipase	Fats	5
Maltase	Maltose	7

In an experiment lipase was mixed with a solution containing maltose at a temperature of 37°C with a pH of 8.

How effectively would lipase digest maltose?

- (A) It would not digest any of the maltose.
 - (B) It would digest the maltose only very slowly because pH 8 is basic whereas the optimum pH is acidic.
 - (C) It would digest the maltose slowly because pH 8 is close to the optimum.
 - (D) It would digest the maltose quickly because the temperature is the same as body temperature.
- 2) This diagram is a micrograph showing a transverse section of the vascular tissues from a plant.



Close up of vascular bundle.

In which of the labelled tissues does transport occur primarily through the processes of cohesion, adhesion and transpiration pressure?

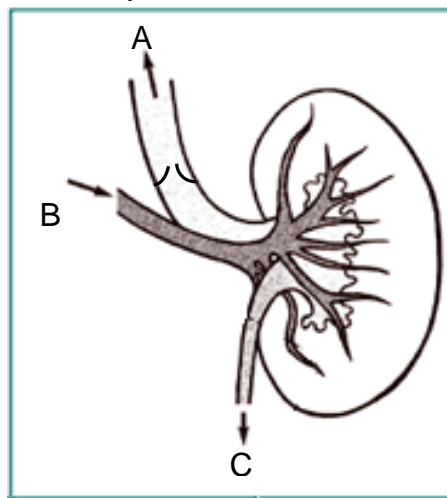
- (A) L.
- (B) M.
- (C) N.
- (D) L and M.

3) Water dragons are a type of insectivorous lizard which lives near ponds and streams. In the mornings they spend their time lying on rocks beside the water. By the middle of the day they are normally actively searching for the insects in the water or the nearby bush. Late in the afternoon they return to the rocks.

Which statement best explains the behaviour of the water dragons in the morning?

- (A) The behaviour is in response to an increased body temperature due to heat absorbed from the rocks.
- (B) The behaviour is a stimulus for the water dragon to search for food.
- (C) The behaviour is a response to a decreased body temperature due to heat lost over night to the cool air.
- (D) The behaviour is stimulus which leads to increased heat and oxygen absorption.

4) This diagram represents a human kidney.



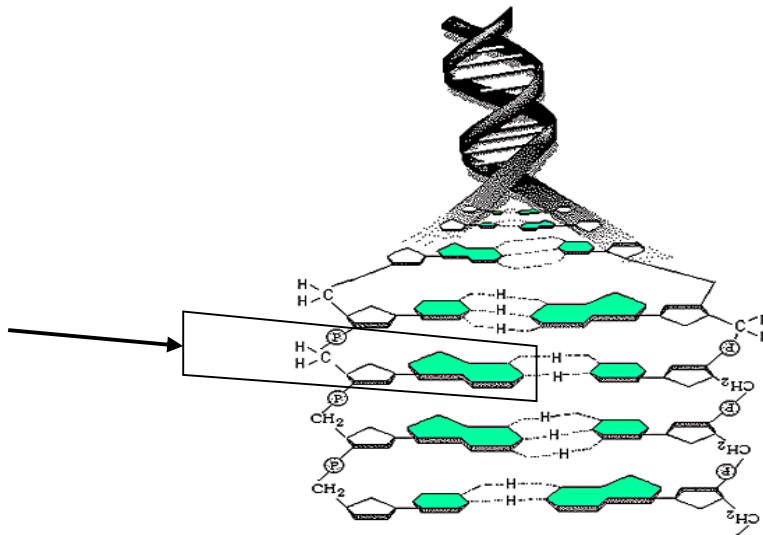
Which solutions are carried by the vessels labelled on the diagram?

	Solution A	Solution B	Solution C
(A)	Urine	Filtered Blood	Unfiltered Blood
(B)	Unfiltered Blood	Urine	Filtered Blood
(C)	Filtered Blood	Unfiltered Blood	Urine
(D)	Urine	Unfiltered Blood	Filtered Blood

5) Which of these adaptations would be of assistance to the survival of a plant living in a hot and dry environment such as the Australian desert?

- (A) An increase in the number of stomata.
- (B) An increase in the surface area of leaves.
- (C) An increase in thickness of the leaf cuticle.
- (D) A decrease in the depth and size of the root system.

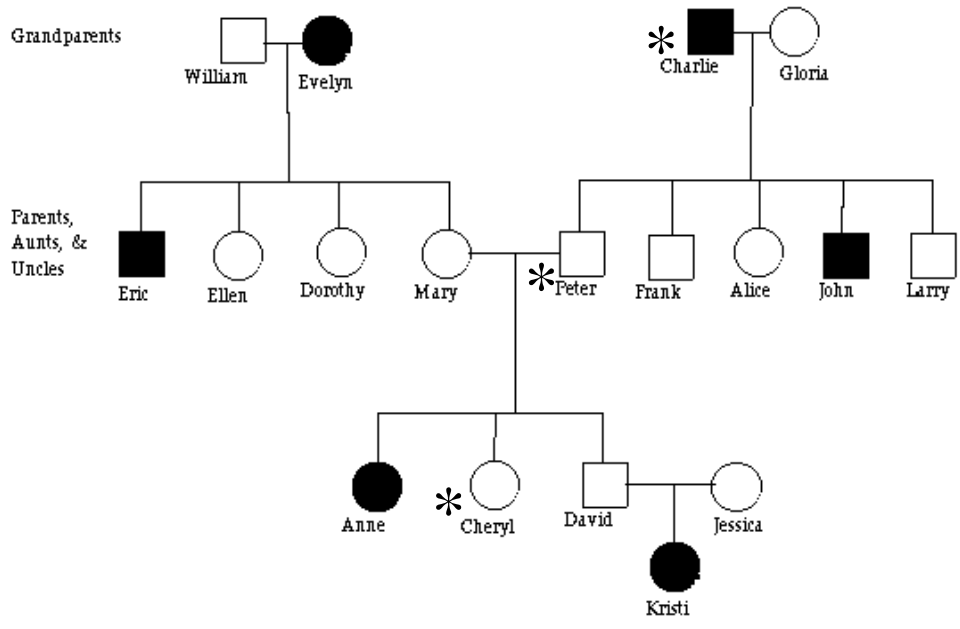
- 6) Friedreich's ataxia is a rare recessive genetic disorder, caused by a mutation of a single gene on chromosome 9. A couple unaffected by the disorder, discover that their only child, a son, has inherited the disorder. They attend counselling to determine the likelihood that they will give birth to another child with Friedreich's ataxia. What advice would the counsellor give them?
- (A) All of the couple's children will have the disorder.
 (B) Each of the couple's children has a 1 in 4 chance of having the disorder.
 (C) Male children of the couple will have a 50% chance of having the disorder.
 (D) As this is a rare disorder (1 in 150,000 of the population) there is little chance of the couple having another affected child.
- 7) This diagram is a model of a biological molecule.



What is the term used to name the section of this molecule outlined by the box and indicated by the arrow?

- (A) Gene
 (B) Base pair
 (C) Nucleotide
 (D) Chromosome
- 8) Which scientist(s) identified the existence of factors which were passed from parents to offspring and determined the characteristics that offspring will exhibit?
- (A) Mendel
 (B) Watson and Crick
 (C) Boveri and Sutton
 (D) Darwin and Wallace
- 9) What is the name of the biological molecule which carries out the role of transferring the genetic code from the nucleus of the cell to the cytoplasm?
- (A) Deoxyribose nucleic acid.
 (B) Transfer ribose nucleic acid.
 (C) Messenger ribose nucleic acid.
 (D) Ribosomal ribose nucleic acid.

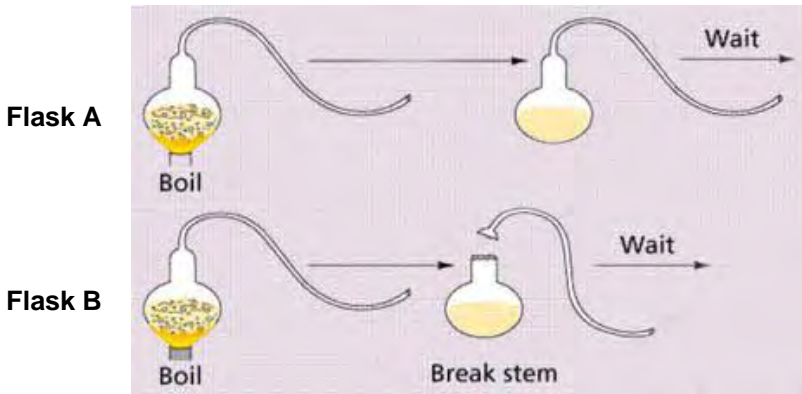
- 10) This diagram shows the inheritance of a characteristic in a family. Individuals who show the characteristic are shaded. The symbols used to represent the alleles of the gene responsible for this characteristic are M and m, where M is dominant and m is recessive.



What are the genotypes of the individuals indicated with * in the diagram?

	Charlie	Peter	Cheryl
(A)	MM	Mm	mm
(B)	mm	Mm	Mm or MM
(C)	Mm	mm	mm
(D)	mm	Mm	mm

- 11) The diagram below is a representation of the experiment carried out by Pasteur. Both flask A and B contain protein broth and were sterilized by the boiling process.



What are the most likely results of this experiment?

- (A) Flask A becomes infected with bacteria but flask B remains sterile.
- (B) Both Flask A and B become infected, but flask A is infected first.
- (C) Both Flask A and B become infected, but flask B is infected first.
- (D) Flask B becomes infected with bacteria but flask A remains sterile.

- 12) Health authorities encourage patients not to request and use antibiotics for viral infections which cause colds and flus. Why are antibiotics not recommended for viruses?
- (A) Viruses are able to metabolise antibiotics, inactivating them.
 - (B) Viruses constantly change and become resistant to the antibiotics.
 - (C) Viruses are able to enter body cells in order to “hide” from the antibiotics.
 - (D) Viruses do not independently carry out the metabolic processes affected by antibiotics.
- 13) What response would occur when a B lymphocyte encounters a virus particle that it recognises?
- (A) The B cell would secrete phagocytes.
 - (B) The B cell would secrete antibodies.
 - (C) The B cell would secrete cytokines.
 - (D) The B cell would secrete antigens.
- 14) Patients who have had to undergo a heart transplant operation must take prescription drugs for the rest of their lives.
What type of drugs are they and what is their role?
- (A) Drugs for high blood pressure: prevent the new heart working too hard.
 - (B) Anticancer drugs: prevent tumours growing around the new heart tissue.
 - (C) Immunosuppressants: prevent the patient’s immune system attacking the new heart.
 - (D) Antibiotics: protect the patient from infectious diseases to which they become susceptible.
- 15) Women who take a course of strong antibiotics can suffer thrush, which causes a rash around their vaginal area.
What is the cause of thrush?
- (A) Antibiotics kill all bacteria in the women including beneficial bacteria which usually suppress fungi, thereby allowing fungi to flourish, causing thrush.
 - (B) Some women are allergic to antibiotics and their immune systems initiate an inflammation response to the antibiotics.
 - (C) The antibiotics can cause some bacteria to mutate which allows these bacteria to colonise the vaginal area.
 - (D) The women’s immune response can cause inflammation to the original bacterial infection.

Biology

Section I (continued)

Part B – 60 marks

Attempt Questions 16 - 28

Allow about 1 hour and 45 minutes for this part

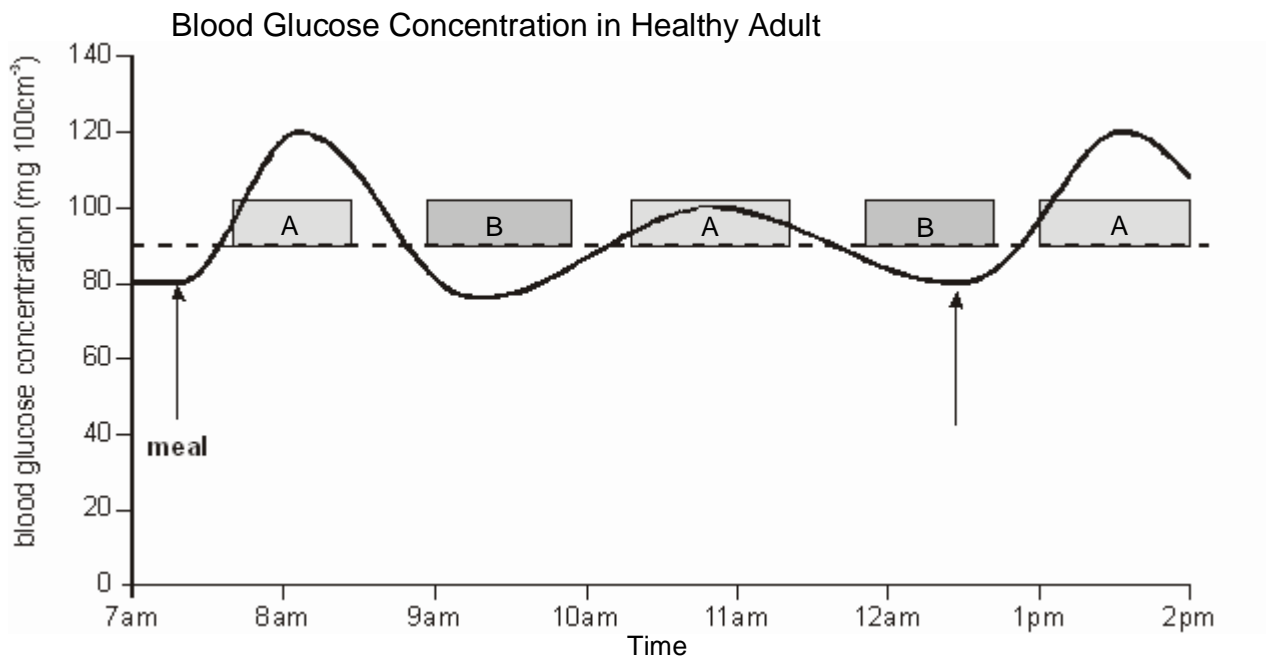
Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Question 16 (4 marks)

Marks

The figure below illustrates the changes in blood glucose concentration of a person from the morning to the afternoon.



- (a) The grey boxes on the graph represent the times during which hormones are released into the blood from the pancreas. The boxes labelled B represent secretion of the hormone glucagon. What hormone is represented by the boxes labelled A?

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- (b) Suggest what event occurred at approximately 12.30, as indicated by the arrow?

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Question 16 is continued over the page

Marks

- (c) Explain the significance of the dotted line on the graph at a blood glucose concentration of $90/100 \text{ cm}^3$ and identify the name of the process which maintains this concentration.

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Question 17 (6 marks)

- (a) Compare the water availability in the environments and the concentration of urine excreted by terrestrial mammals, marine fish and freshwater fish.

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Question 18 (5 marks)

- (a) Many people donate their blood to the Red Cross Blood Bank in Australia. Identify three products which are obtained from this donated blood, and describe the uses of these products

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Question 18 is continued over the page

- (b) Despite the use of donated blood in Australia, there is continuing research to develop a source of artificial blood. Justify continued research into artificial blood development by identifying two properties that a source of artificial blood would have to have to make it an improved replacement for donated blood.

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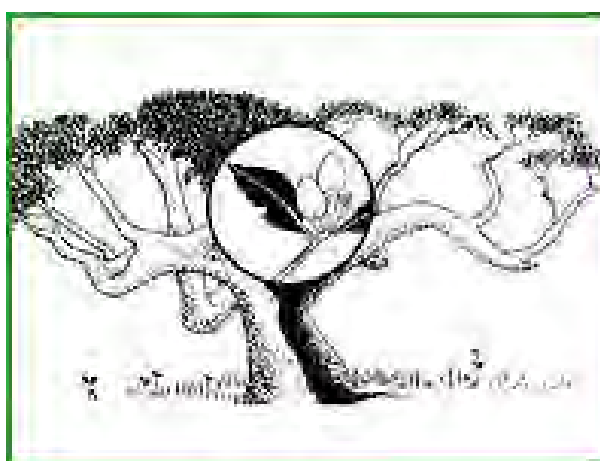
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Question 19 (5 marks)

This diagram shows a grey mangrove tree, *Avicennia marina*, a type of mangrove found in estuarine waters of Australia's coast.



- (a) Identify what feature of the mangrove tree's environment causes difficulties for organisms which cannot carry out processes of enantiostasis.

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- (b) Describe two adaptations of mangrove trees which enable them to live in this environment and explain why they make the mangrove trees successful.

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Question 20 (5 marks)

Marks

Scientists within the agricultural industry are interested in producing transgenic species of important agricultural species of plants and animals. One example is a species of cotton plant which has resistance to the pest *Heliothis* grub because it carries a gene from the microorganism *Bacillus thuringiensis*.

- (a) Outline the processes which would have been used to produce the *Heliothis*-resistant cotton.

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- (b) Discuss the potential impact of the production and use of *Heliothis* resistant cotton on the genetic diversity of cotton species in Australia.

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Question 21 (4 marks)

Describe two methods of treating water so that it is safe for drinking and explain how and why each method is effective

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Question 22 (5 marks)

Marks

The concept of evolution of species over time was first published in 1859, when it was met with much criticism. Since then however much evidence which supports the theory has been gathered using advances in technology. Evolution is now universally accepted within the scientific community.

Identify one piece of new evidence and explain how it supports evolution. Describe the technology that needed to be developed for the evidence to be collected or analysed.

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Question 23 (6 marks)

- (a) Chromosome 11 of the human genome contains a gene for the polypeptide haemoglobin beta. This polypeptide is a subunit of the oxygen-carrying protein haemoglobin found in red blood cells. Construct a flow chart which illustrates how a mutation to the haemoglobin beta gene could lead to a change in red blood cell activity. In your flow chart include all processes leading from mutation to changed cell activity.

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- (b) Explain how this changed cell activity of red blood cells could be either beneficial or harmful to a person.

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Question 24 (5 marks)

A long term study was carried out by the staff and students of the University of Western Australia in Perth characterising the features of the population of seagulls at the popular seaside tourist town of Fremantle.

Each summer over 40 years the sea gulls and tourists were observed and data about the gulls and tourists were recorded, as below.

- There were three types of gulls identified by the researchers,
 - gulls with two legs that always used both legs (*two legged gulls*).
 - gulls which had lost a leg through an accident (*one legged gulls*).
 - gulls which have two legs but appear to have only one leg through a habit of standing on one leg (*pretending gulls*).
- It was not possible to tell one legged gulls from pretending gulls during counts.
- Tourists are more likely to feed gulls which appear to have only one leg.
 - *One legged gulls* cannot copulate and therefore cannot breed.
 - In 1967 the percentage of *two legged gulls* was 93% .
 - By 2006 the percentage of *two legged gulls* had fallen gradually to 89%.

A tendency to stand on one leg is a genetic trait in sea gulls.

- (a) The percentage of gulls which appeared to have only one leg rose from 7% to 11% over the time of the study. Predict whether there has been a change in the relative proportions of *one legged gulls* and *pretending gulls* within this group over this time and state what the change in proportions may have been.

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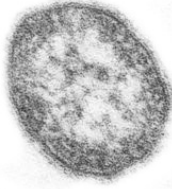

- (b) Use Darwin’s theory of natural selection to explain the changes in the seagull population observed during the study and predicted by you in part (a).

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Question 25 (3 marks)

Marks

The images below show several organisms responsible for some indicated diseases.

				
Size	85 µm long	1000 µm long	0.1 µm across	5 µm long
Name	<i>Plasmodium malariae</i>	<i>Ascaris lumbricoides</i>	<i>Morbillivirus measles</i>	<i>Salmonella pullorum</i>
Disease caused	Malaria	Ascariasis	Measles	Food poisoning
Type of organism				

(a) Complete the table above to identify the type of each of the organisms

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(b) State what property of these organisms makes them pathogens.

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Question 26 (4 marks)

(a) A recent outbreak of chicken pox in Adelaide prompted health authorities there to recommend that all children under the age of 15 be vaccinated for chicken pox. As her class mates lined up for their injections, Sarah gratefully declared “I’m glad I’ve already had chicken pox and don’t have to have a needle”.

Describe the method of action of vaccinations in preventing disease and explain why having a vaccination is similar to having been infected with the actual disease.

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Question 27 (4 marks)

Marks

A large scale, long term, Australian wide research study was recently started by the University of Sydney to determine the usefulness of pregnant women taking multivitamin tablets during pregnancy to prevent diseases in children during the first five years after birth.

Australian general practice doctors have been asked to recruit pregnant women who are asked to fill in a survey while they are pregnant to document how many and how often they take multivitamins. The researchers hope to recruit 5000 women, whose children they will follow to record their health until they turn five.

This type of study is known as an epidemiological study.

- (a) Discuss the purpose of this type of study, explaining why it is necessary to include such a large number of participants.

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- (b) Suggest one problem with the design of this particular study, explaining why it may be a problem.

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Question 28 (4 marks)

Describe the features of a public health programme you have studied. What was the purpose of the programme? How was the programme delivered to the public? Discuss the benefits of the programme.

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Biology

Section II

25 marks

Allow about 45 minutes for this section

Answer the questions in a writing booklet. Extra writing books are available.
Show all relevant working in questions involving calculations.

	Pages
Question 29	
Genetics: The Code Broken?	16 – 18

Question 29 – Genetics – The Code Broken? (25 marks)**Marks**

(a) An unmarried woman Joan, gave birth to a child she called James.
Joan was unsure of which man was the father of James, but she knew that it could only be one of three men, Alan, Bruce or Charles.

i) Joan's blood type is A negative. 4
James' blood type is A positive.
Joan asked the three possible fathers to have their bloods typed so that she could establish paternity.

The results of the testing was: Alan, A positive
 Bruce, B positive
 Charles, O negative

Determine whether these results confirm or eliminate any of the men as the father of James, by identifying the possible genotypes of the five people involved

ii) The diagram below shows the results of DNA profiles which were prepared from each of the five individuals involved in the paternity case. Identify the father of James and discuss why the paternity of James can be established conclusively using this DNA fingerprinting by explaining what the bands in the profiles represent. 5

Joan James Alan Bruce Charles

- (b) You performed a first hand investigation to model linkage in the inheritance of genes.
- i) Define what is meant by linkage of genes. **1**
 - ii) Describe the model you used and explain what was shown by your model about the way that linked genes are inherited. **5**
- (c) Pregnant women are advised not to have x-rays because the radiation used can cause mutations in the DNA of their foetus. This DNA damage could lead to major deformities in the child because one cell damaged by radiation could be the stem cell for an entire limb or organ system, and all these cells would then carry the DNA mutation.
- i) Contrast this type of DNA mutation in a child with the DNA mutation in a child who inherits a genetic disease from their mother. **1**
 - ii) Discuss when or if either of these children could pass the DNA mutation to any of their gametes. **3**
- (d) Outline the procedure to produce recombinant DNA and explain how the use of probes which have been produced with recombinant DNA technology can identify the position of a gene on a chromosome. **6**

End of Examination.

Student Number

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