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Centre Number

Student Number

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2008
TRIAL HIGHER SCHOOL CERTIFICATE
EXAMINATION

Biology

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
- Use the Data Sheet and Periodic Table provided
- Use Multiple Choice Answer Sheet provided
- Write your Centre Number and Student Number at the top of this page and page 2 and 7.

Total marks – 100

Section I

Pages 3-18

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 16-29
- Allow about 1 hour and 45 minutes for this part

Section II

Pages 19-24

25 marks

- Attempt ONE question from Questions 30-34
- Allow about 45 minutes for this section

Disclaimer

Every effort has been made to prepare this Examination in accordance with the Board of Studies documents. No guarantee or warranty is made or implied that the Examination paper mirrors in every respect the actual HSC Examination question paper in this course. This paper does not constitute 'advice' nor can it be construed as an authoritative interpretation of Board of Studies intentions. No liability for any reliance use or purpose related to this paper is taken. Advice on HSC examination issues is only to be obtained from the NSW Board of Studies. The publisher does not accept any responsibility for accuracy of papers which have been modified.

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Student Number

BIOLOGY – MULTIPLE CHOICE ANSWER SHEET

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 provided

1 Homeostasis is best described as

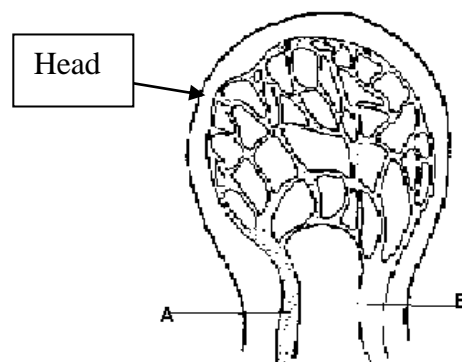
- (A) the maintenance of a relatively stable environment
- (B) control of substances in the blood
- (C) reabsorption of glucose by the kidney tubules
- (D) varying the rate of breathing according to activity

2 Compared to arteries, veins

- (A) carry less blood
- (B) have thicker walls
- (C) carry blood containing the same proportion of red blood cells
- (D) carry blood under greater pressure

3 If A is blood entering the head and B is blood leaving the head you would expect B to contain more

- (A) oxygen
- (B) carbon dioxide
- (C) urea
- (D) glucose



4 Animals produce various nitrogenous wastes such as ammonia, urea or uric acid to dispose of excess amino acids. The difference in the type of nitrogenous waste produced is an adaptation to

- (A) different protein needs
- (B) availability of energy
- (C) availability of water
- (D) a terrestrial existence

5 Desert plants carry on photosynthesis very slowly and consequently grow very slowly. The most likely reason for this is

- (A) the stomates are closed much of the time reducing gas exchange
- (B) their reduced surface area for transpiration (and photosynthesis)
- (C) the high availability of light in the desert
- (D) high temperatures in the desert

6 RNA differs from DNA in that

- (A) RNA contains thymine instead of uracil
- (B) RNA is not found in the nucleus
- (C) RNA is usually double stranded rather than single stranded
- (D) RNA contains uracil instead of thymine

7 What proportion of parent DNA is contained in each daughter cell after replication?

- (A) 100%
- (B) 75%
- (C) 50%
- (D) 25%

8 Human cells that ingest bacteria are known as

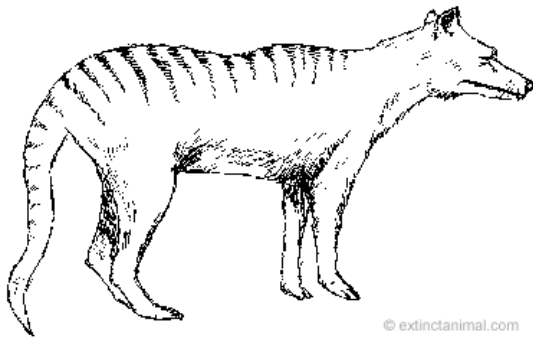
- (A) pathogens
- (B) phagocytes
- (C) antigens
- (D) antibodies

9 The body's defence mechanisms can be classified as specific and non-specific. Which of the following would be classified as a specific mechanism?

- (A) The action of tears
- (B) The production of antibodies
- (C) The clotting of blood
- (D) The action of lymph nodes

- 10** What do inherited, nutritional and environmental diseases have in common?
- (A) They are mostly diseases of developed nations
 - (B) They are all non-infectious diseases
 - (C) They can all be prevented using vaccinations
 - (D) They are all preventable diseases
- 11** Successful vaccination results in
- (A) passive immunity
 - (B) immune deficiency
 - (C) the formation of antigens by cells
 - (D) the production of memory cells
- 12** A liver transplant patient is kept under sterile conditions for some time after the operation because a transplant patient is very susceptible to disease. The most likely reason for this is that
- (A) the immune system is suppressed by drugs
 - (B) the liver is not functioning properly
 - (C) incompatibility between the blood of the donor and the recipient immobilizes the recipient's immune system for a short period
 - (D) antibodies formed to combat any infection would also attack the donated organ
- 13** A number of crosses between two plant parents produced a phenotypic ratio of 1:1 in the offspring. This indicates that
- (A) the genotype of both parents was heterozygous
 - (B) the genotype of one parent was heterozygous
 - (C) the genotype of both parents was homozygous
 - (D) the result was due to co-dominance in both parents
- 14** The term punctuated equilibrium is used to describe
- (A) Darwin's theory of evolution by natural selection
 - (B) a stable ecosystem disturbed by introduced plants or animals
 - (C) evolution with short periods of rapid change interrupted by long periods with little change
 - (D) evolution by gradual change as shown in the fossil record of the horse

15 There are many examples of animals that, despite not being closely related to each other, show some similarities, eg: Thylacine and wolf. This convergence in unrelated organisms is most likely the result of



- (A) similar biochemistry
- (B) mutation
- (C) the environment acting as a selecting agent
- (D) genetic variation

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Student Number

Biology

Section I (continued)

Part B – 60 marks

Attempt Questions 16-29

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

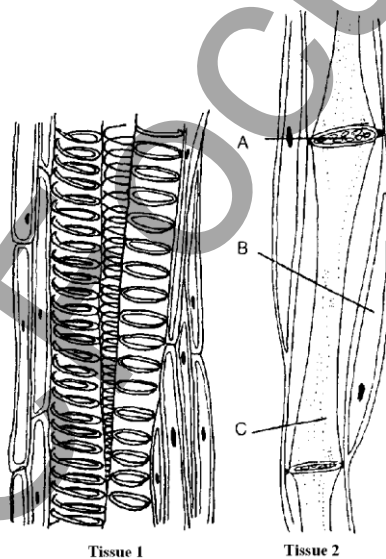
Show all relevant working in questions involving calculations.

Marks

Question 16 (4 marks)

- (a) Identify tissue 1 and 2 shown in the longitudinal sections below.

1



Tissue 1.....

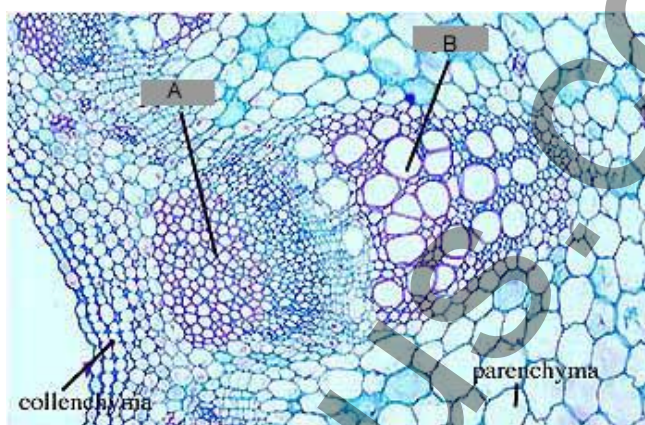
Tissue 2.....

Question 16 continues over page

Question 16 (continued)

Marks

- (b) Identify the tissue labelled B shown in the cross-section of a vascular bundle and the substance which is transported by this tissue. **1**



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- (c) Describe a current theory about a process responsible for the movement of the substance in tissue B. **2**

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Question 17 (4 marks)**Marks**

Bromelain (an enzyme found in fresh pineapple) breaks down gelatin protein. Gelatin proteins, when dissolved in hot water and allowed to cool, form a semi-solid jelly. Hence the name gelatin. The manufacturers of gelatin containing desserts warn the consumer against adding fresh pineapple to jelly desserts to prevent the breakdown of gelatine protein resulting in the jelly not setting.

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Using the above information, design an investigation to test the effect of increased temperature on the activity of bromelain.
Ensure your method allows for the collection of valid and reliable data.

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Question 18 (3 marks)

Identify a current technology that allows hospitals to measure the levels of oxygen in the blood and using an example, explain why this technology would be used.

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Question 19 (2 marks)**Marks**

Using the letter that corresponds to each statement, place the following events that occur during DNA replication in the correct order. **2**

- (a) bonds between complementary bases break
- (b) bonds between complementary bases form
- (c) DNA molecule uncoils from one end
- (d) Complementary strands of DNA separate
- (e) daughter DNA molecules coil into double helixes
- (f) sugar-phosphate bonds form

Question 20 (7 marks)

The data shown in the table below was obtained during an investigation into the functions of the human kidney. **7**

	Concentration of substance present in glomerular filtrate (g/100 mL)	Concentration of substance present in urine (g/100 mL)
Sodium ions	0.3	0.6
Glucose	0.1	0.0
Urea	0.03	2.1

Explain how the processes of filtration and reabsorption in the mammalian nephron can account for the changes in concentration of the sodium ions, glucose and urea as shown in the above table.

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Question 21 (5 marks)

Marks

- (a) 'A whale's flipper is homologous to a human hand'. Explain the evolution of these structures.

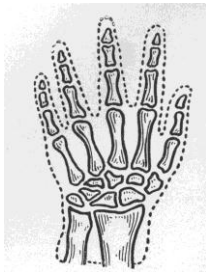
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- (b) Describe, using an example, how the theory of evolution is supported by evidence from a different area of study.

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Question 22 (2 marks)**Marks**

Using the descriptions provided below, complete the following table.

Monohybrid cross, sex-linkage, chromosomal theory of inheritance, one gene –one protein hypothesis

Scientist(s)	Contribution
Sutton and Boveri	
Morgan	
Beadle and Tatum	
Mendel	

2**Question 23** (3 marks)

The following table presents the results of an experiment to demonstrate the effects of radiation on the germination of seedlings.

Dose of radiation applied (Roentgens units)	Description of plants after 7 days
0	100% of seedlings germinated, normal germination and growth
15	50% of seedlings germinated, stunted growth
30	25% seedlings germinated, stunted growth

(a) In the experiment, radiation was used as a mutagenic agent. Define the term mutation.

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(b) What is the term given to the group of plants that did not receive any radiation in this experiment.

1

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Question 23 continued over page

Question 23 (continued)**Marks**

(c) State a conclusion that can be drawn from the results described above.

1

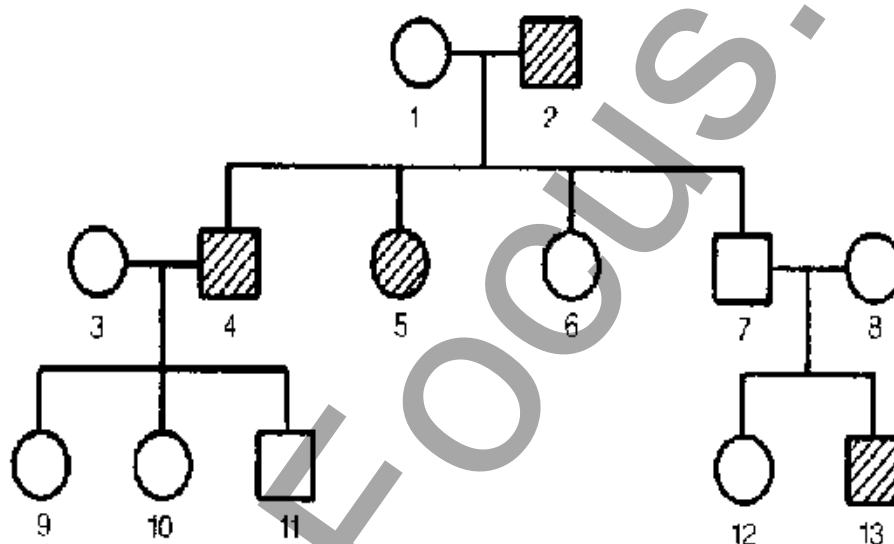
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Question 24 (6 marks)

The pedigree shown is for a family in which some members suffer from familial emphysema, an inherited lung disease. The shaded individuals are those that suffer from the condition.



(a) Explain whether the trait shown above is dominant or recessive.

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Question 24 continued over page

Question 24 (continued)

Marks

- (b) Using appropriate symbols identify the genotypes of individuals 1 and 4.

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- (c) If individual 13 marries a woman who does not suffer from familial emphysema, but whose father was a sufferer, what percentage of their children might suffer from familial emphysema? Show your working.

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Question 25 (5 marks)

The weaver ants of tropical Australia construct their homes from leaves and silk. Scientists have identified the silk producing genes in weaver ants and by placing these genes into bacteria or plants, it should be possible to create large amounts of insect silk, which is light, but tough enough to make a bullet-proof vest.

- (a) State the name given to a species that has had genes of a different organism added to their genetic makeup?

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- (b) Discuss the ethical issues associated with the use of species that have had genes of a different organism added to their genetic makeup. Specific examples must be given.

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Question 26 (7 marks)

Marks

- (a) Define the term 'pathogen'. 1

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- (b) Name the type of pathogen that causes the disease, malaria. 1

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- (c) Identify distinguishing features of this type of pathogen. 2

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- (d) Draw a simple time line showing the historical development of our understanding of the cause and prevention of malaria. Include at least 4 significant developments. 3

Question 27 (3 marks)

Thrush is a common disease caused by a yeast, *Candida albicans*, which lives harmlessly on the skin, in the mouth, gut or vagina. This disease occurs due to an imbalance of microflora. 3

Describe how this disease could develop.

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Question 28 (5 marks)

Marks

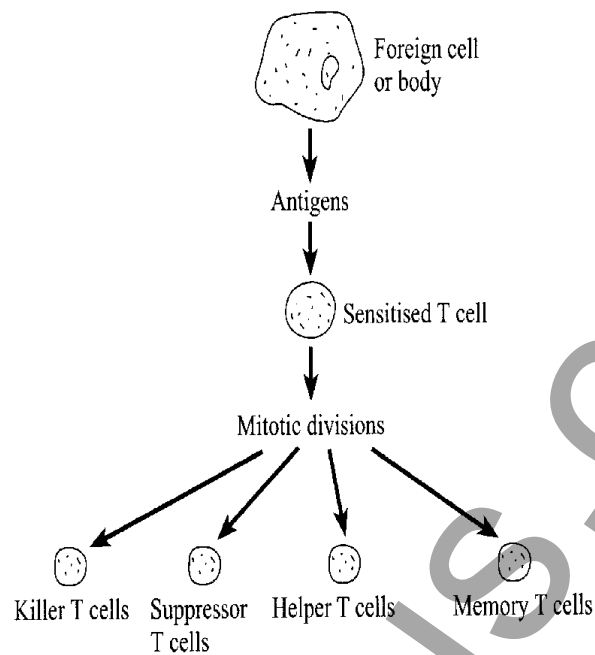
Throughout history there have been many developments in Biology. Discuss, using appropriate examples, why some biological investigations have been best undertaken individually while others are best undertaken by a team.

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Question 29 (4 marks)

Marks

The following diagram show one component of the immune response.



- (a) Describe the role of the following cells in terms of the immune response.
- (i) Suppressor T cells
 - (ii) Killer T cells

2

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Question 29 continues over page

Question 29 (continued)

Marks

- (b) Describe the interaction between B and T lymphocytes.

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End of Section I – Part B

Biology**Section II****25 marks****Attempt ONE question from Questions 30-34****Allow about 45 minutes for this section**

Answer the question in a SEPARATE writing booklet.

Show all relevant working in questions involving calculations.

		Page
Question 30	Communication	20
Question 31	Biotechnology	21
Question 32	Genetics: The Code Broken?	22
Question 33	The Human Story	23
Question 34	Biochemistry	24

Question 30 – Communication (25 marks)**Marks**

- (a) (i) Identify the role of receptors. **1**
- (ii) Draw a flow chart to show the steps involved in the production of a response to a stimulus. **2**
- (b) Copy and complete the following table relating structures of the eye to their function. **4**

Structure	Function
Conjunctiva	
Choroid	
Lens	
Optic nerve	

- (c) (i) Identify the relationship between nerves, neuronal fibres and nerve cells.
- (ii) Using a simple drawing, identify those areas of the cerebrum involved in the perception of light and sound.
- (d) The data presented in the table below shows the refractive indices of fluids/structures associated with the eye.

Fluid/structure	Refractive index (N)
Air	1.00
Water	1.33
Cornea	1.38
Aqueous humour	1.34
Lens	1.42

- (i) Present the data in a graph. **4**
- (ii) Define refraction. **1**
- (iii) Explain the change to the path of a ray of light as it passes from air into the cornea. **2**
- (e) Assess the impact of our increased knowledge and understanding about the anatomy and function of the human ear. **8**

End of Question 30

Question 31 – Biotechnology (25 marks)**Marks**

- (a) (i) Outline an ancient Australian Aboriginal use of biotechnology. **1**
- (ii) Justify the use of the term ‘biotechnology’ when discussing agricultural practices used 10,000 years ago. **3**
- (b) During the study of this option you conducted a first-hand investigation to demonstrate the use of fermentation processes in bread **or** alcohol production. **2**
- (i) Using a named type of micro-organism:
Outline the role of a named micro-organism in the fermentation process.
- (ii) Describe how changes in technology and scientific knowledge have modified the traditional uses of biotechnology. **4**
- (c) The data presented in the table below shows the rate of respiration in presence of different concentrations of sugar.

Sugar concentration (%w/v)	Fermentation rate (mL) (CO₂/min)
0	0
1	0.01
2.5	0.10
3	0.12
3.5	0.13

- (i) Present the data in a graph. **4**
- (ii) Predict the fermentation rate at a sugar concentration of 4%. **1**
- (d) Describe the role of biotechnology in the production of monoclonal antibodies. **2**
- (e) ‘Modern biotechnology includes recombinant DNA technology.’ **8**

Assess the impact of our increased knowledge of the structure and functions of DNA on the development of recombinant DNA techniques.

End of Question 31

Question 32 – Genetics: The Code Broken? (25 marks)**Marks**

- (a) Identify 2 examples of characteristics determined by multiple alleles in an organism other than a human. **1**
- (b) Blood type analysis is often used in resolving paternity issues. A woman who is blood type O has a child with blood group A. There is a dispute over who is the father. One male has type B, and the other type AB blood.
- (i) Which of the 2 men could be the father of the child? **1**
- (ii) Explain if it is possible to eliminate one of the men completely based on blood type analysis. **1**
- (iii) Explain how DNA fingerprinting could be used to resolve the paternity of the child. **2**
- (c) The data presented in the table below shows the effect of X-ray exposure on the rate of sex-linked mutations.

X-ray exposure (Roentgen units)	Sex-linked mutations (%)
1000	3.5
2500	8
4000	11.8
6000	15.5

- (i) Present the data in a graph on the graph paper provided. **4**
- (ii) Predict the percentage of sex-linked mutations for a dose of 7000 Roentgen. **1**
- (iii) Outline the ability of DNA to repair itself. **3**
- (d) Describe the evidence which indicates the presence of ancestral vertebrate gene homologues in lower animal classes. **4**
- (e) ‘Gene therapy is possible once the genes responsible for harmful conditions are indentified.’ **8**

Assess the impact of our increased knowledge of DNA on the development and use of gene therapy to manage a genetic disease, a named form of cancer or AIDS.

End of Question 32

Question 33 – The Human Story (25 marks)**Marks**

- (a) (i) Explain what is meant by the term species. **2**
- (ii) Outline features that classify humans as: **2**
- mammals and
 - primates
- (iii) Discuss the use of the terms hominin and hominid. **2**

- (b) The table below shows the evolution of hominid cranial capacity:

Species	Cranial capacity (cm ³)
Australopithecus afarensis	490
Paranthropus robustus	550
Homo habilis	800
Homo erectus	1200
Homo sapien	1500

- (i) Present the data in a graph. **4**
- (ii) Outline the relationship between the change in cranial capacity and culture of the hominid. **1**
- (iii) Discuss difficulties in interpreting the past from the fossil record alone. **2**
- (c) ‘Fossil and other biological evidence assist in the clarification of the relationships between humans and other primates.’ **7**

Assess the impact of our increased knowledge of DNA on the development of technologies which could be used to determine relationships between groups of primates.

- (d) (i) Describe the major events in the cultural evolution of humans. **3**
- (ii) Describe examples of existing physical evidence that infer cultural evolution. **2**

End of Question 33

Question 34 – Biochemistry (25 marks)**Marks**

- (a) (i) Draw and label the structure of a chloroplast as seen using an electron microscope. **3**
- (ii) In which part of a chloroplast would chlorophyll be found? **1**
- (iii) Explain Sachs' contribution to our understanding of photosynthesis. **2**

- (b) The table below shows the relative rate of photosynthesis under different light intensities.

Light intensity (candelas)	Relative rate of photosynthesis
0	0
500	38
900	49
1500	54
1750	54

- (i) Present the data in a graph. **4**
- (ii) Predict the relative rate of photosynthesis under a light intensity of 2,000 candelas. **1**
- (iii) Outline Blackman and Mathgel's hypothesis. **2**
- (c) Evaluate how a major advance in our scientific understanding or in technology has changed our knowledge of the process of photosynthesis. **8**
- (d) (i) Identify the role of ATP in a living cell. **1**
- (ii) Discuss the nature and organisation of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule. **3**

End of Paper