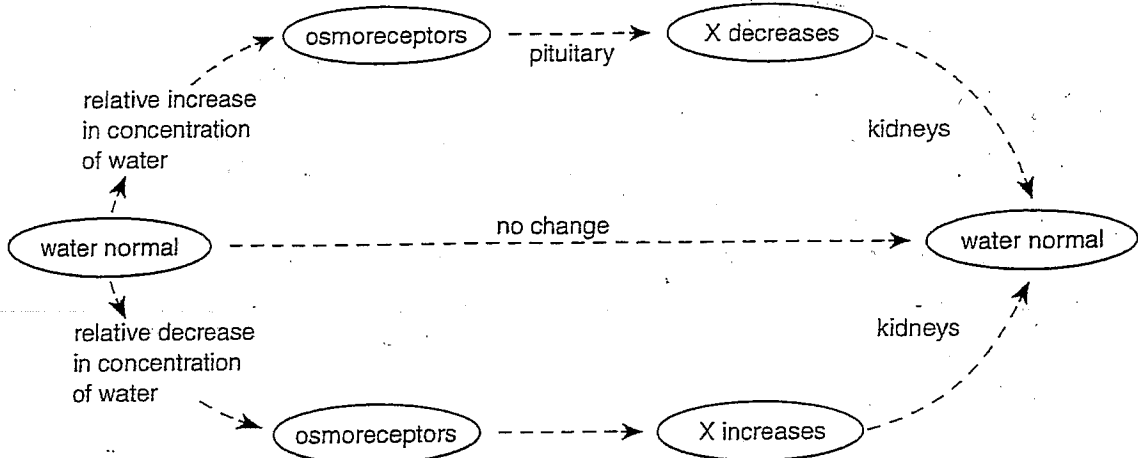


Student Number: \_\_\_\_\_

**Sydney Boys High School**  
**2006**  
**BIOLOGY**  
**TRIAL HIGHER SCHOOL CERTIFICATE**  
**EXAMINATION**

<p><b>General Instructions</b></p> <ul style="list-style-type: none"><li>• Reading time – 5 minutes</li><li>• Working time – 3 hours</li><li>• Write using blue or black pen</li><li>• Draw diagrams using pencil</li><li>• Board-approved calculators may be used</li></ul>	<p><b>Total marks – 100</b></p> <p><b>Section I</b> <b>75 marks</b> This section has two parts, Part A and Part B</p> <p><b>Part A</b> <b>15 marks</b></p> <ul style="list-style-type: none"><li>• Attempt Questions 1-15</li><li>• Allow about 30 minutes for this part</li></ul> <p><b>Part B</b> <b>60 marks</b></p> <ul style="list-style-type: none"><li>• Attempt Questions 16-27</li><li>• Allow about 1 hour and 45 minutes for this part</li></ul> <p><b>Section II</b> <b>25 marks</b></p> <ul style="list-style-type: none"><li>• Attempt question 29</li><li>• Allow 45 minutes for this section</li></ul>
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1. The diagram below shows one way in which a hormone can regulate salt levels in the blood of humans. X is the hormone responsible for this process.



What is the name of hormone X?

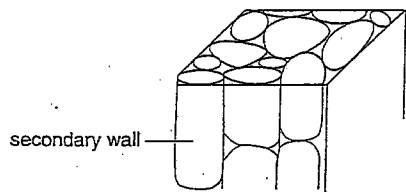
- (A) Sodium chloride
- (B) Antibody
- (C) Aldosterone
- (D) Anti-diuretic hormone (ADH)

2. What is the effect of increasing the concentration of carbon dioxide on the pH of water?

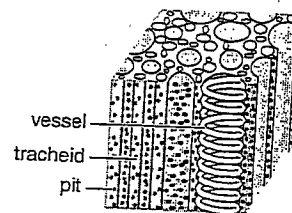
- (A) A rise in the pH, making it more acidic.
- (B) A lowering of the pH, making it more acidic.
- (C) A rise in the pH, making it more alkaline.
- (D) A lowering of the pH, making it more alkaline.

3. The diagrams below are longitudinal sections of plant issue.

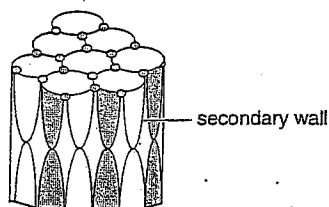
(A)



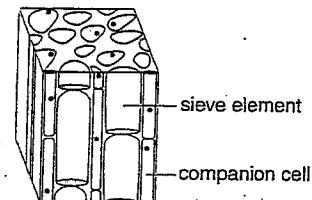
(B)



(C)



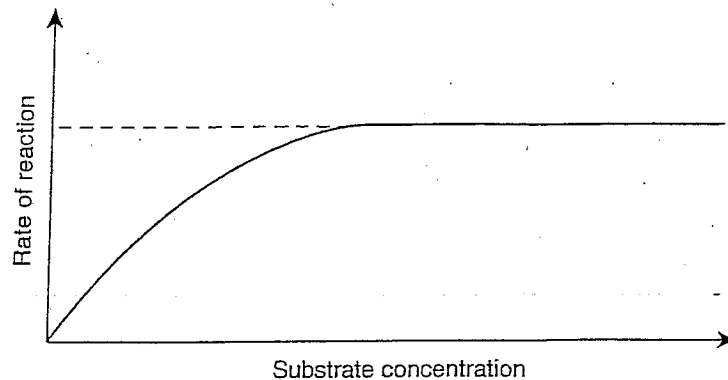
(D)



Which diagram transports dissolved minerals and water?

- (A) A
- (B) B
- (C) C
- (D) D

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 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 new diet in the sea because the organism would be different from those in fresh water.

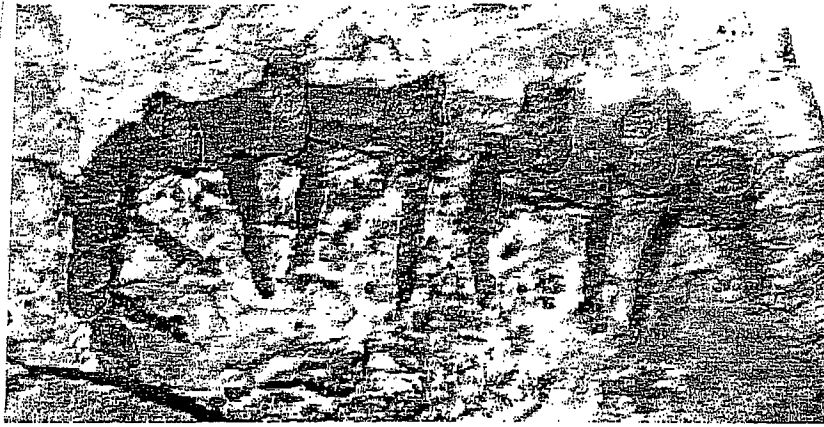
6. The diploid number for human cells is 46. How many chromosomes would a human egg cell have?

- (A) 2
- (B) 8
- (C) 23
- (D) 46

7. What was the concentration 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. The photo below shows a fossil of *Peripatus*. This group of invertebrates is represented in the fossil record and in some present day species.

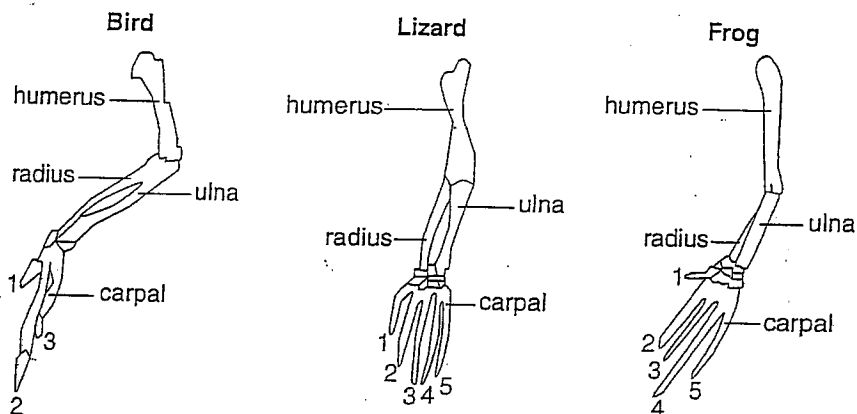


Members of the two families of *Peripatus* – like organisms shows mixture of characteristics typical of the Annelids (segmented worms) and the Arthropods (insects and similar organisms).

Organisms like *Peripatus* are of particular interest to biologists studying evolution because they provide evidence of:

- (A) transitional forms
- (B) common ancestry
- (C) natural selection
- (D) convergent evolution

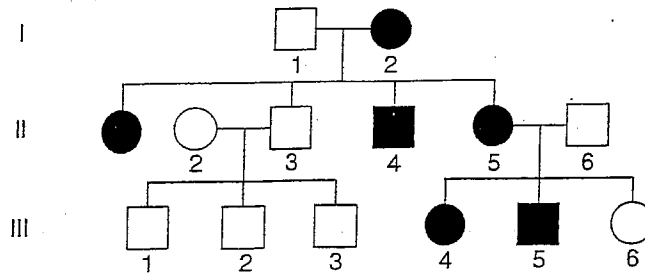
9. The diagram shows different forms of the pentadactyl limb.



How does the pentadactyl limb provide evidence for evolutionary theory?

- (A) By suggesting that all the limbs evolved from a common ancestor.
- (B) By the fact that all limbs are used in the same way.
- (C) By explaining that the limbs 'structure is due to genetics.
- (D) By suggesting that the limbs' ancestry is from different branches of the evolutionary tree.

10. The pedigree shown below traces the inheritance of a dominant-recessive genetic trait in a family over three generations.



How can you describe the individual 5 in the generation II?

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

11. Legionnaires' disease is caused by bacterial pathogen called *Legionella*. *Legionella* is widespread in the environment and tests show that many people are exposed to it and fail to develop the disease.

One group of people who are particularly at risk of dying from Legionnaires' disease are organ transplant patients.

Which one of the following is the best explanation for this?

- (A) Transplant tissue is always more susceptible to infection.
- (B) Transplant patients cannot take antibiotics as they will attack the transplant tissue.
- (C) Organ transplant patients take immunosuppressant drugs.
- (D) Pathogens such as *Legionella* are common in hospitals.

12. 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 categories 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

13. Which of the following applies to all infectious diseases?

- (A) They involve a host response.
- (B) They are transmitted by vectors.
- (C) They are caused by bacteria and viruses.
- (D) They are able to be treated with antibiotics.

14. Which of the following incorrectly associates the pathogen with the plant disease it causes?

- (A) Bacteria cause crown galls in peaches.
- (B) Viruses cause leaf roll disease in potatoes.
- (C) Protozoa cause tick fever in roses.
- (D) Fungi cause rust disease in wheat.

15. What is the main difficulty involved in defining the terms *health* and *disease*?

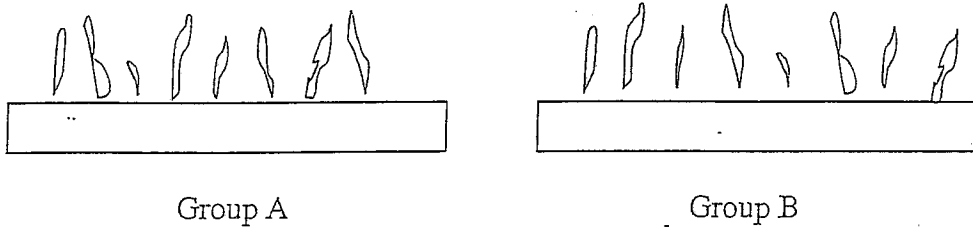
- (A) Both are influenced by genes and the environment.
- (B) Each is often defined in terms of the absence of the other.
- (C) Disease can be defined but it is impossible to define health.
- (D) Genes and mitosis assist in the maintenance of health, but have nothing to do with disease.

**Question 16 (5 marks)**

**Marks**

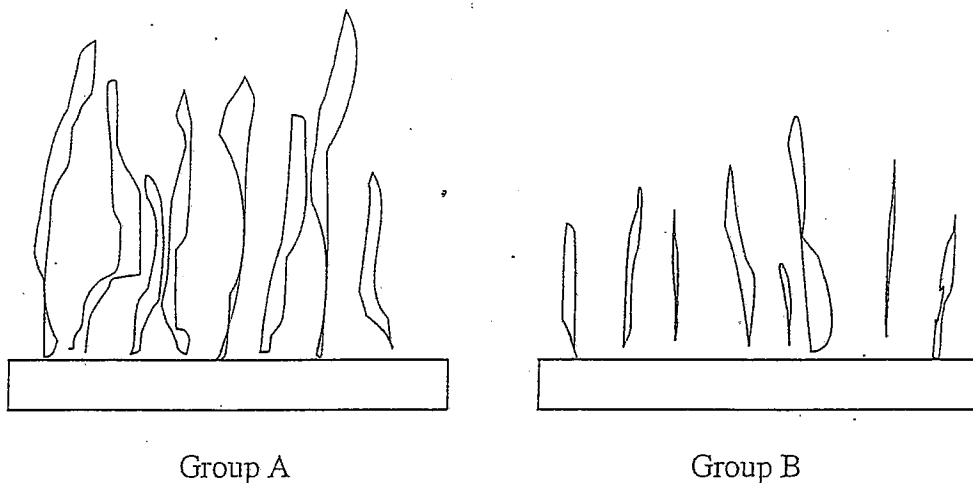
A biologist wished to demonstrate the effect of the environment on the phenotype of a species of plant and set up the following experiments.

She took a group of cutting from a planted half of them in one tray (Group A) and the others in another tray (Group B)



She recorded the average height of the cuttings in each tray and then watered Group A with water containing a high fertilizer and group B with normal water.

After a few weeks of this treatment she obtained the following results.



Group A showed a significantly greater increase in height than Group B.

(a) Which variable was she controlling by using cuttings from the same plant for both groups? 1

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**Question 16 (continued)**

**Marks**

(b) Name one other important variable that she would have needed to control. **1**

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(c) Explain why it is important to have a large number of cuttings in each group. **1**

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(d) The plants from group A were allowed to breed amongst themselves and the seeds were collected. The same was done with group B. **2**  
These seeds were then all grown together under similar conditions.

How would the plants grown from group A seeds differ from those grown from group B seeds? Justify your answer.

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**Question 17 (4 marks)**

**4**

Discuss how the theory of evolution by natural selection and isolation accounts for divergent evolution and convergent evolution.

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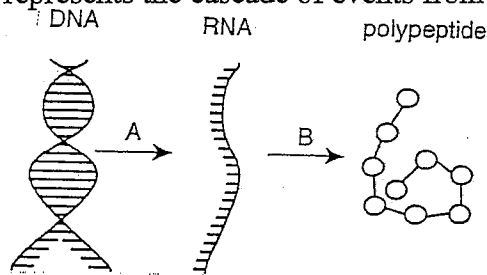
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**Question 18** (3 marks)

**Marks**

The diagram below represents the cascade of events from DNA to polypeptide.



(a) Name the process that occurs at A.

1

(b) Explain how a change in the DNA code can affect the formation of the polypeptide.

2

**Question 19** (6marks)

(a) Construct a Punnett square that shows a genetic cross between a pure-bred green budgerigar (dominant) and a pure-bred blue budgerigar (recessive).

3

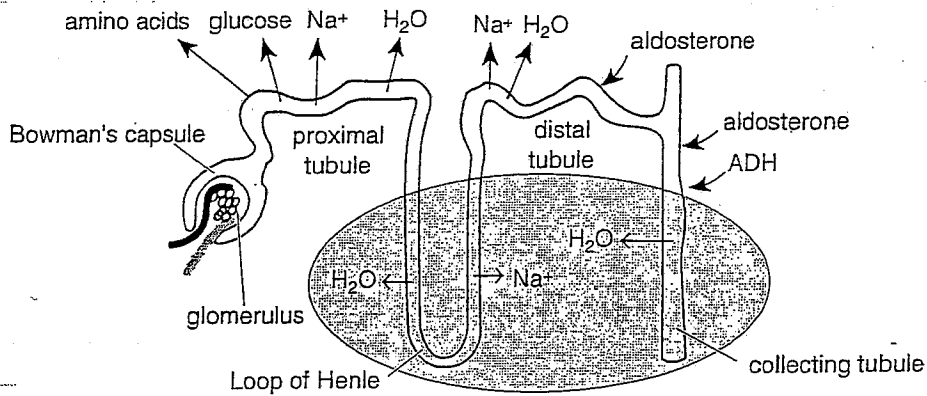
(b) State the proportions of each genotype and phenotype produced by this cross.

4

(c) If the off-spring of this genetic cross were bred together, predict the proportion of the following generation that would be blue.

1

**Question 20 (5 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.

4

**Question 21 (3 marks)**

**Marks**

Outline the need for oxygen in living cells and explain why the removal of carbon dioxide from cells is essential.

3

**Question 22 (8 marks)**

In your study of "Maintaining a Balance" you were required to perform a first-hand investigation using the light microscope and prepared slides. The aim was to gather information to estimate the size of red and white blood cells and to draw scaled diagrams of each.

(a) State the name of the instrument you used to view prepared slides of red and white blood cells. **1**

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(b) Outline the method you used to estimate the size of red and white blood cells. **5**

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(c) Explain why students are not able to observe fresh human blood when completing this first-hand investigation. **2**

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**Question 23.** (4 marks)

**Marks**

Genetically modified crops are an example of the use of transgenic species.

(a) Outline the process used to produce transgenic species such as genetically modified crops. **2**

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(b) Describe reasons for the development and use of transgenic species such as genetically modified crops. **2**

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**Question 24** (2 marks)

The table below provides the probabilities of two offspring receiving identical chromosome combinations from their parents. **2**

Number of chromosomes ( $2n$ )	Chance of receiving identical chromosome combinations
4	1 in 16
6	1 in 64
8	1 in 256
10	1 in 1024
20	1 in 16 777 216
46	1 in 225 112 120 885 248

By referring to the information in the table above, explain how sexual reproduction increases genetic variability in offspring.

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Question 25 (8 marks)

Marks

Read the following information about xenotransplantation in the boxes below and answer the questions that follow:

**Could xenotransplantation be a solution to the shortage of donor organs?**  
Organs from animals can sometimes be used to ease the shortage of human ones for transplantation. Scientists are continuing to study xenotransplantation, the process of taking an organ from one species and transplanting it to another. Over the last 50 years, experiments in transplantation between humans and animals have had mixed results...

(a) Outline the main biological reason why 'mixed results' have been obtained from experiments in xenotransplantation. 2

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(b) Describe **three** of the body's responses to the introduction of a transplanted organ. 3

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Organs from pigs are thought to be the most compatible with humans. Scientists are concerned, however, that viruses may pass from pigs to humans in transplanted organs.

(c) Name a type of pathogen, other than viruses, that could be transmitted via xenotransplantation. 1

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(d) Identify possible future directions for research into xenotransplantation. 2

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**Question 28 Communications (25 marks)**

**Marks**

a) The following table summarises the characteristics of some common vision problems and methods used to correct these problems.

Condition	Description	correction
(1)	Focal plane of eye lies in front of the retina	(A)
(2)	Focal plane of eye lies behind the retina	(B)
Normal	Focal plane of eye coincides with retina	None

(i) Name Condition (1) 1

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(ii) Draw a simple diagram of a lens (B) that would correct Condition (2). 1

(iii) Outline a technology, other than lenses, that could correct Condition (1). 2

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b) During your study of Communication you identified data sources to investigate the range of senses involved in communication.

(i) Describe a technology or strategy for data collection or information gathering that would analysis of the data. 2

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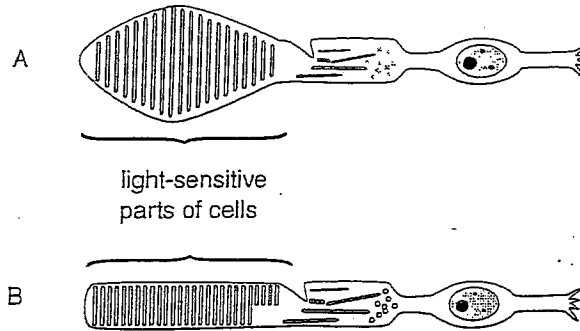
(ii) Explain how animals detect and respond to stimuli from the external environment. 2

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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

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(ii) Outline the differences in distribution and function of cells A and B. 1

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(iii) Contrast the nature of the image produced by the human eye with that produced by the eye of a typical insect, and analyse why these images differ. 3

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