

HSC Trial Examination 2006

Biology

This paper must be kept under strict security and may only be used on or after the morning of Friday 11 August, 2006 as specified in the Neap Examination Timetable.

General Instructions

Reading time 5 minutes.

Working time 3 hours.

Board-approved calculators may be used.

Write using blue or black pen.

Draw diagrams using pencil.

Total examination marks 100

Section I Pages 2–18 Total marks 75

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 19–25 Total marks 25

Attempt ONE question from Questions 28–32.

Allow about 45 minutes for this section.

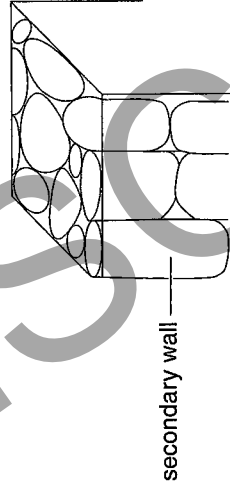
Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2006 HSC Biology Examination.

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

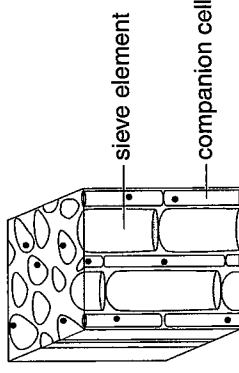
- (A) A rise in the pH, making it more acidic.
- (B) A lowering of the pH, making it more acidic.
- (C) A rise in the pH, making it more alkaline.
- (D) A lowering of the pH, making it more alkaline.

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

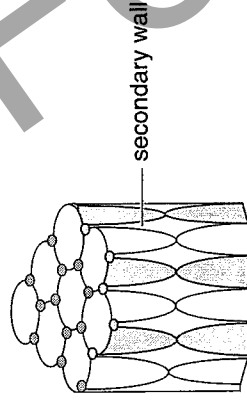
(A)



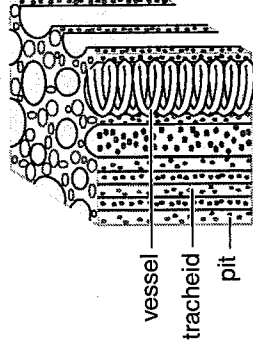
(B)



(C)



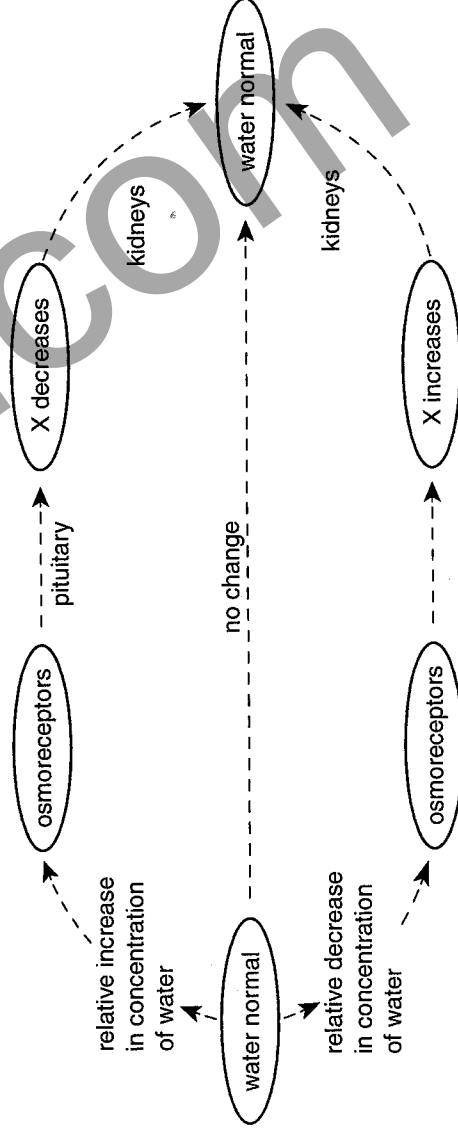
(D)



Which diagram is xylem?

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

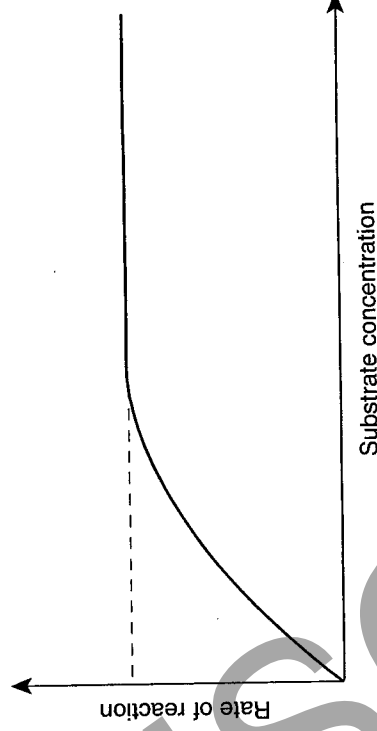
3. The diagram below shows one way in which a hormone can regulate salt levels in the blood of humans. X is the hormone responsible for this process.



What is the name of hormone X?

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

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.

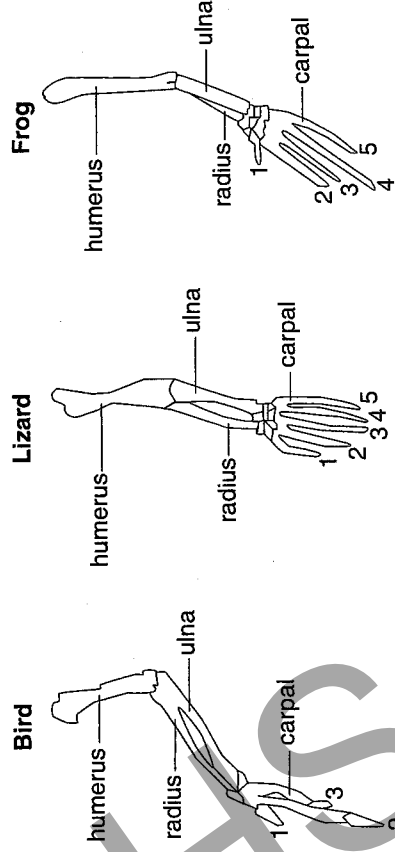
6. The diploid number for human cells is 46. How many chromosomes would a human egg cell have?

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

7. What was the 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.

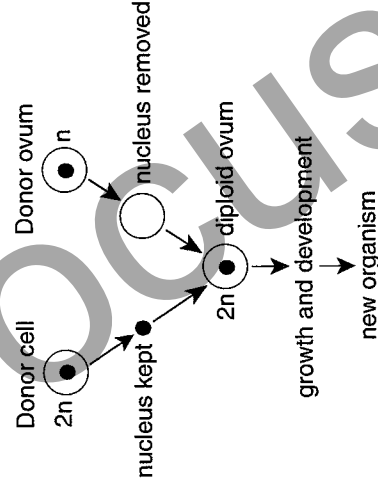
8. The diagram below shows different forms of the pentadactyl limb.



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 the 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.

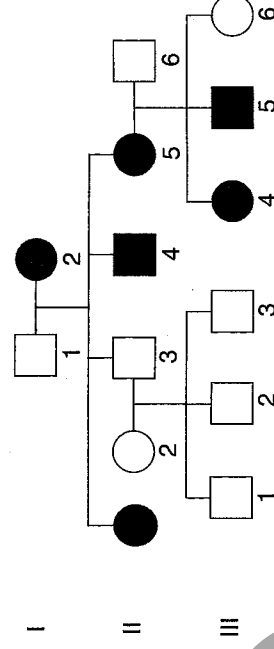
9. The diagram below shows a process that can be used to clone an animal.



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.

- 10.** 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

- 11.** Which of the following correctly identifies the cause of malaria?

- (A) a mosquito
(B) a fungus
(C) a protozoan
(D) an imbalance of microflora

- 12.** 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.

- 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.** Examples of a variety of human diseases/conditions are listed below:

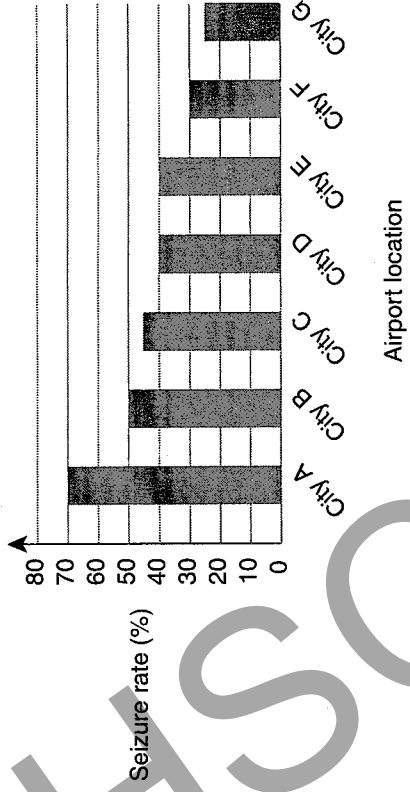
- influenza
- heavy metal poisoning
- red/green colour blindness
- scurvy (lack of Vitamin C)

Which line in the table below correctly categorises these conditions?

	<i>Environmental</i>	<i>Inherited</i>	<i>Nutritional deficiency</i>
(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

15. The graph shows the variation between airports in the estimated rate of detection and interception of seizable material.

Estimated rate of detection and interception of seizable material.



Which conclusion can be drawn from the graph?

- (A) It is easy to bring seizable material into City E.
- (B) City A has less plant and animal diseases than City G.
- (C) Seizure rates are greater in City F than in City B.
- (D) More information is needed to reach a valid conclusion.

Part B

Total marks 60

Attempt Questions 16–27.

Allow about 1 hour and 45 minutes for this part.

Answer Part B questions in the spaces provided.

Show all relevant working in questions that require calculations.

Marks

Question 16 (6 marks)

- (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. **2**

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- (c) If the offspring of this genetic cross were bred together, predict the proportion of the following generation that would be blue. **1**

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Question 17 (3 marks)

Marks

Outline the need for oxygen in living cells and explain why the removal of carbon dioxide from cells is essential. **3**

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Question 18 (4 marks)

Discuss how the theory of evolution by natural selection and isolation accounts for divergent evolution and convergent evolution. **4**

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Question 19 (4 marks)**Marks**

During your study of 'The Search for Better Health', you performed an investigation to model Pasteur's famous experiment in which he used swan-necked flasks. This experiment contributed to our understanding of decay and, ultimately, infectious disease.

- (a) State how Pasteur's experiment contributed to our understanding of decay.

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- (b) Justify the procedure you followed in modelling Pasteur's experiment, including the variables you controlled.

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Question 21 (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.

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

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

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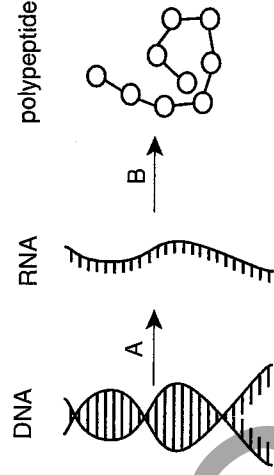
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Question 22 (4 marks)

Marks

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



- (a) Identify **one** of the bases (by NAME) that make up the DNA code.

1

- (b) Name the process that occurs at A.

1

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

2

Question 23 (2 marks)

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

2

<i>Number of chromosomes (2n)</i>	<i>Chance of receiving identical chromosome combinations</i>
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.

Question 24 (4 marks)

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

- (a) Outline the processes 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 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 into 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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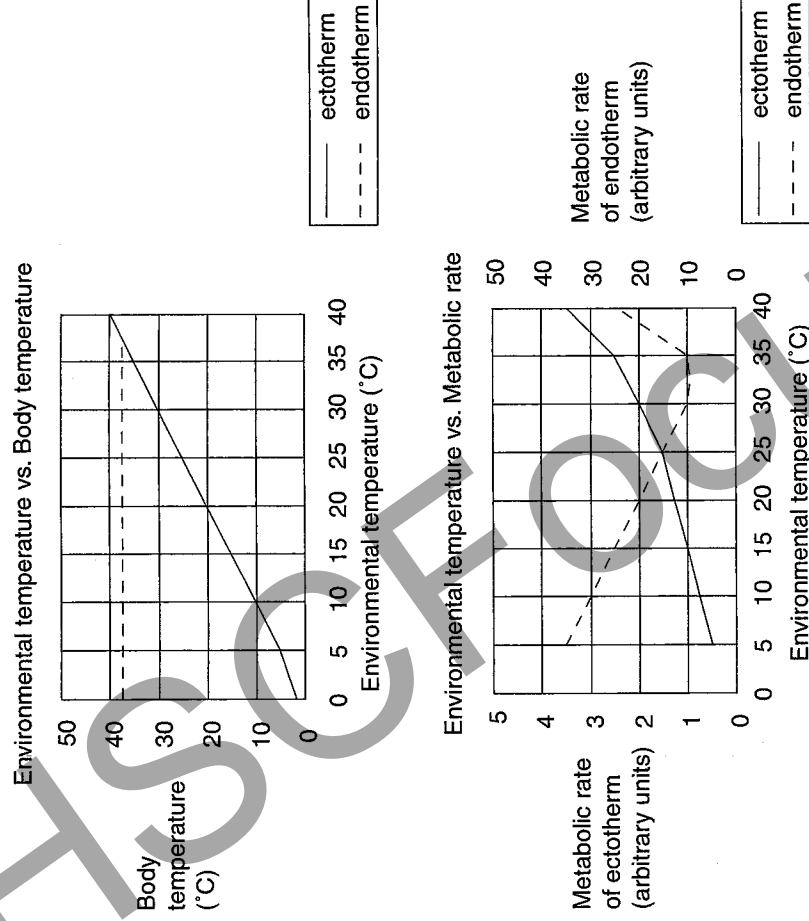
Organs from pigs are thought to be the most compatible with humans. Scientists are concerned, however, that viruses may pass from pigs to humans in transplanted organs.

- (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 26 (4 marks)

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

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

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Question 27 (8 marks)

Marks

8

Professor Ian Frazer was awarded Australian of the Year in 2006 after spending many years researching the link between the human papilloma viruses and cancer. A vaccine based on his research has been shown in worldwide trials to prevent papilloma virus infection.

Cervical cancer is a one of the commonest causes of cancer death amongst women. A vaccine to prevent the 250,000 deaths that occur globally from cervical cancer would obviously be a good public health measure.

Using this and other examples you have studied, evaluate the effectiveness of vaccination programs in preventing the spread of human disease and the controversy surrounding their use.

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Question 28 — Communication (25 marks)

- (a) Humans and other animals are able to detect a range of stimuli from the external environment, some of which are useful for communication.

(i) Identify the specific location in the human ear of the receptors used to detect sound. **1**

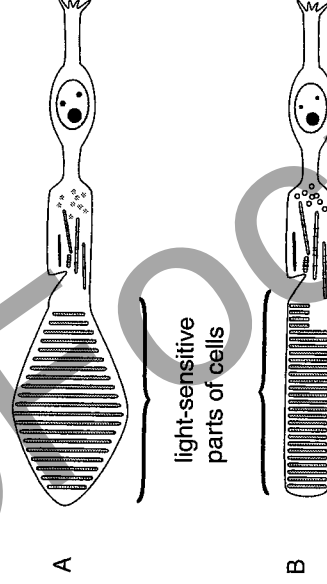
(ii) Explain why sound is a useful and versatile form of communication. **3**

(b) (i) Assess the usefulness of a model of a mammalian brain when gathering information about the **major** regions of the brain. **2**

(ii) Draw a labelled diagram that shows the **three** major parts of the human brain and the region(s) involved in the perception and interpretation of sound. **4**

(c) Evaluate the **impact** on society of **recent** technological advances used to prevent blindness caused by cataracts and to correct hearing loss in humans. **7**

(d) 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) Outline the differences in distribution and function of cells A and B. **2**

(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. **5**