BAULKHAM HILLS HIGH SCHOOL

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

2002

BIOLOGY

(Total Marks – 100)

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 name at the top of all papers.

SECTION I -

Total marks (85)
This section has two parts, PART A and PART B.

PART A (20 marks)
- Attempt Questions 1 - 20.

PART B (65 marks)
- Attempt all questions.

SECTION II - OPTION

Total marks (15)
- Attempt all parts of this question.

(20 Marks)

Use the multiple choice Answer Sheet provided.
Attempt Questions 1 – 20.

1 What is a possible consequence of overuse and misuse of antibiotics?

(A) Parasites may become stronger.
(B) New disease-causing bacteria may be produced.
(C) Resistant strains of pathogens may develop.
(D) People may become immune to the antibiotics.

2 Which of the following does NOT describe an adaptation that Australian plants use to regulate their leaf temperature?

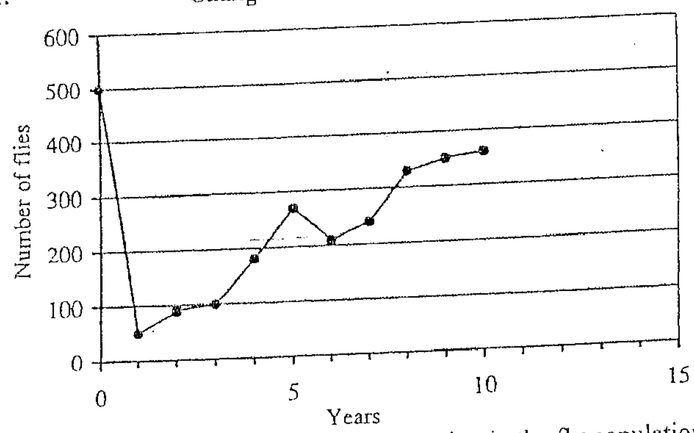
(A) Leaves with a large surface area.
(B) Leaf surfaces with a shiny cuticle.
(C) Silvery hairs on the leaves.
(D) Vertically hanging leaves.

3 A response to a cold environmental temperature in an endothermic species is most likely to include:

(A) sweating, vascoconstriction of surface capillaries and decreased metabolism.
(B) shivering, vascodilation of surface capillaries and increased metabolism.
(C) shivering, vascoconstriction of surface capillaries and erection of hairs (fur).
(D) sweating, reduced metabolism and erection of hairs (fur).

The information in the graph below shows the change in numbers of a fruit fly population that was sprayed with a particular insecticide in the first year of investigation and again five years later.

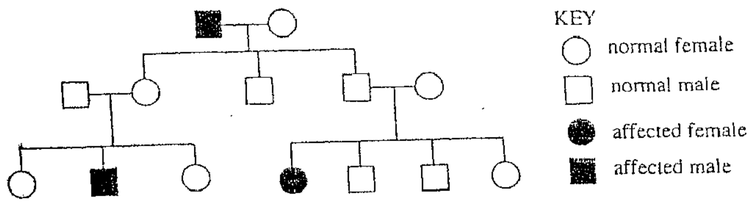
Change in number of flies over time



Which of the following best illustrates natural selection in the fly population?

(A) The rapid drop in numbers after the first spraying.
(B) The increase in numbers at the time of the first spraying.
(C) The relatively small drop in numbers after the second spraying.
(D) The gradual increase in numbers over the period of the study.

5 The family tree below shows the inheritance of a disease in a human family.



This inherited disease is:

(A) sex-linked and dominant.
(B) sex-linked and recessive.
(C) not sex-linked and dominant.
(D) not sex-lined and recessive.

6 A pathogen passed from a mother to an unborn baby across the placenta causes a disease which is:

(A) infectious.
(B) genetic.
(C) nutritional.
(D) environmental.

7 Antidiuretic hormone, ADH, is secreted by the pituitary gland. Its role is to regulate the functioning of the kidney. Which of the following does ADH primarily control?

(A) The concentration of sodium and potassium ions in the blood.
(B) The amount of water in the blood.
(C) The filtration process in the glomerulus.
(D) The concentration of urea and salt in the urine.

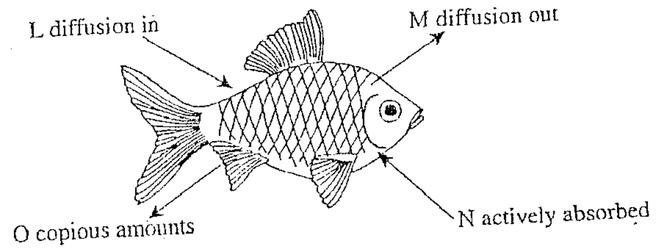
8 Which of the following conditions could be treated with antibiotics?

	Conditions	Cause
(A)	Down syndrome	Additional chromosome
(B)	Smallpox	Virus
(C)	Pneumonia	Bacteria
(D)	BSE	Prion

9 Immunisation usually involves the introduction into the body of:

(A) plasma cells.
(B) killer T cells.
(C) non-specific phagocytes.
(D) samples of a pathogen.

10 The diagram below shows osmoregulation in a freshwater fish.



The parts of the diagram labelled L, M, N and O correspond to which alternative below?

	L	M	N	O
(A)	salt	water	salt	urine
(B)	water	urine	salt	salt
(C)	water	salt	salt	urine
(D)	water	water	salt	urine

11 In Shorthorn cattle (*Bos Taurus*) a cross between a female with a red coat and a male with a white coat produced offspring of both sexes whose coats contained a mixture of red hairs and white hairs. When these offspring were crossed with each other, some of their offspring had coats with only red hairs. Which of the following would be most useful in explaining the results of these crosses?

(A) Co-dominance
(B) Sex Linkage.
(C) Simple Mendelian ratios.
(D) The effect of environment on genotype.

12 Complex multicellular animals such as mammals, require complex respiratory systems. Protists, such as amoeba, do not have respiratory organs. This is because:

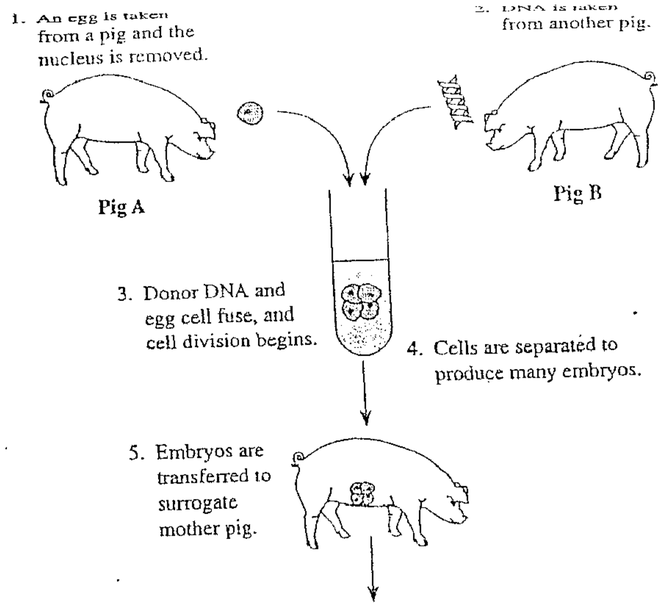
(A) they use the oxygen that is produced as a by-product of the digestion of food.
(B) they produce their own oxygen by photosynthesis.
(C) they can live anaerobically.
(D) sufficient oxygen can be transported across the cell membrane.

1. An egg is taken from a pig and the nucleus is removed.

2. DNA is taken from another pig.

15 For which of the following is T.H. Morgan remembered?

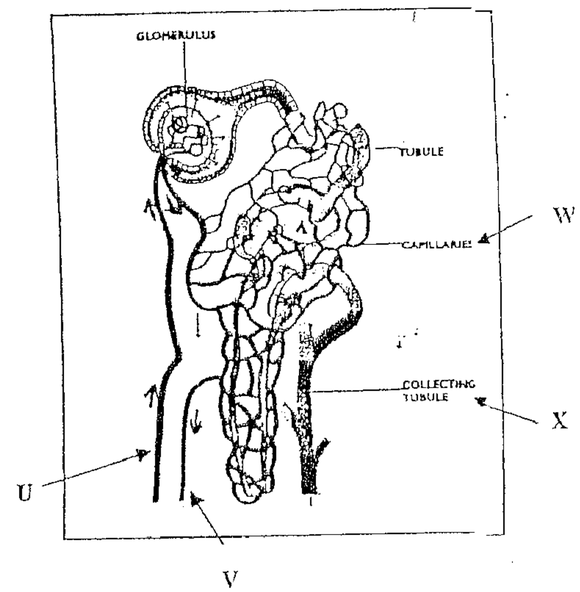
(A) The discovery of genes on the sex chromosomes.
(B) [illegible] theory of inheritance.



What will be most likely produced as a result of this process?

(A) Genetically altered pigs.
(B) Clones of Pig A.
(C) Clones of Pig B.
(D) Transgenic offspring.

14



The above diagram displays the parts of a nephron. Which area of the nephron would contain the greatest concentration of urea?

(A) U
(B) V
(C) W
(D) X

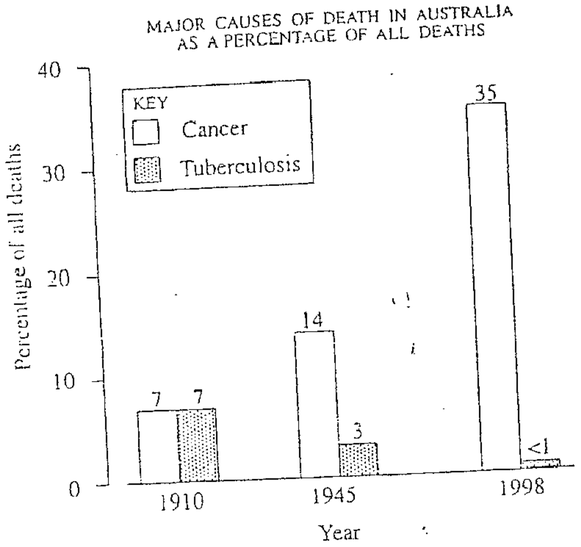
15 For which of the following [illegible]

(A) The discovery of genes on the sex chromosomes.
(B) The chromosomal theory of inheritance.
(C) The "rediscovery" of Mendel's work.
(D) The X-ray diffraction pattern of DNA.

16 Which of the following lists only contain what is considered to be "first lines of defence" in the human immune system?

(A) Cilia, skin, mucous membrane, lymph system.
(B) Stomach acid, oil on the skin, cilia, mucous.
(C) Phagocytes, macrophages, inflammation response.
(D) Inflammation response.

17



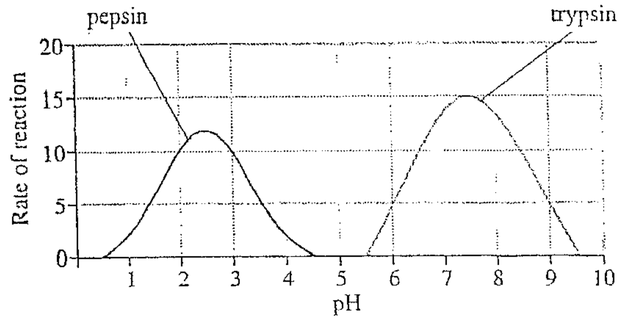
What does the graph show?

(A) The people who would once have died of tuberculosis now die of cancer.
(B) By 2010 fifty per cent of all deaths will be due to cancer.
(C) By 2010 tuberculosis will be eradicated.
(D) Most deaths in Australia are not due to cancer.

18 The example below that clearly illustrates the influence of environment on the phenotype is:

(A) black fur develops under a cold pad placed on the normally white fur of a Himalayan rabbit.
(B) identical twins reared separately show many physical similarities.
(C) pure bred snapdragon plants show red or white flowers but hybrids show pink flowers.
(D) many people with red hair also have blue eyes and fair freckled skin.

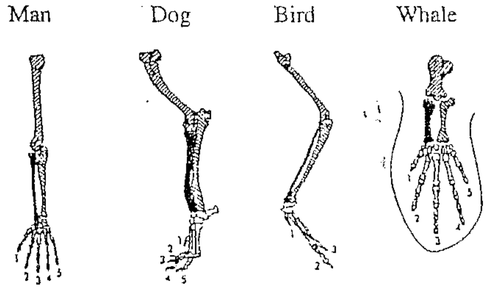
19 The graph below shows the effect of pH on the action of two different enzymes, pepsin and trypsin.



From the graph, which of the following conclusions can be made?

(A) The pH range for the activity of pepsin is the same as for trypsin.
(B) Pepsin works within the pH range 1 – 4.5 and trypsin 5.5 – 9.5.
(C) Pepsin's optimum rate of reaction is greater than trypsin's.
(D) The rate of reaction for both enzymes decreases significantly above pH of 5.

20 The bone structure of the forelimbs of four different vertebrates is shown below.



Each of these limbs shows the same basic pattern.

This has been caused by:

(A) adaptations to similar environments.
(B) all the vertebrates belonging to the same species.
(C) evolution from a common ancestor.
(D) adaptation to the same basic function.

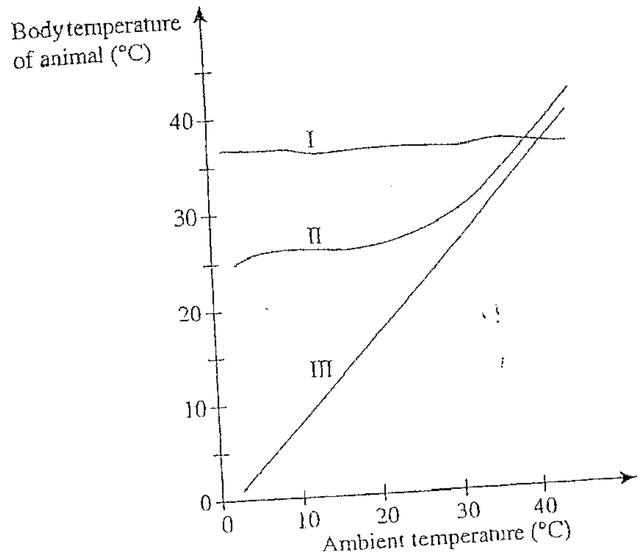
SECTION I

PART B
(65 Marks)

Answer the questions in the spaces provided.

Question 21 (6 marks) Marks

The graph below shows the results of an experiment in which the internal temperature of three different animals was monitored as the ambient (air) temperature changed.



(a) (i) Which of these animals (I, II or III) is most likely to be an endotherm? 1

(ii) Justify your conclusion using information from the graph. 1

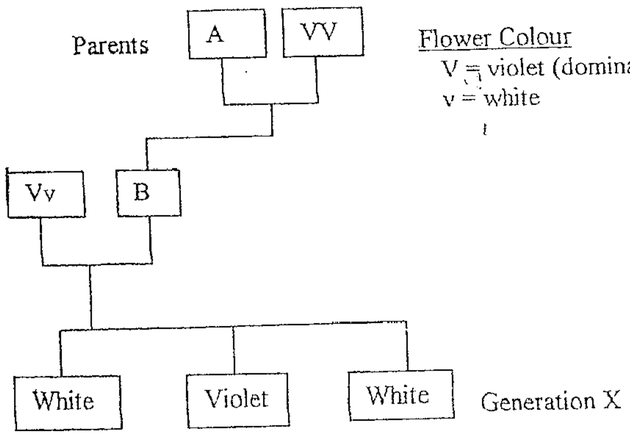
Question 21 (Continued): Marks

Marks

(b) The hypothalamus in the mammalian brain functions as a thermostat (a temperature control mechanism). Describe the way it fulfils this function and justify the statement that this is an example of a negative feedback mechanism. 4

Question 22 (6 marks)

Mendel experimented with white and violet pea flower colours.



Use the above information to answer the following questions.

(a) Name the flower colours for VV and Vv. 2

(b) What is the phenotype and allele notation for A? 1

Marks

(c) What is the phenotype and allele notation for B? 1

(d) State the ratio of violet to white flower colours that you would expect at generation X if a large number of plants were produced. 2

Give a reason for your answer.

Question 23 (2 marks)

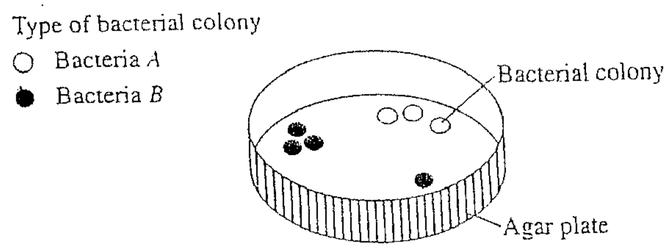
(a) Suggest a reason for the suppression of the immune response in organ transplant patients. 1

(b) Describe **ONE** implication immune suppression may have on a patient. 1

Question 24 (3 marks)

Marks

Blood from an organism with a bacterial disease was diluted and smeared onto a nutrient-rich agar plate. Two different species of bacteria grew on the plant as shown in the figure.



How could you use Koch's postulates to identify the bacterium responsible for the disease? 3

Question 25 (2 marks)

Name one public health program or strategy and explain how it is designed to reduce or eliminate a disease. 2

Question 28 (Continued)

Marks

Question 26 (4 marks)

Marks

Identify four T lymphocyte types in the immune system and describe the role each plays in the immune response. 4

Question 27 (5 marks)

(a) Assess the impact of ONE social or political influence on the development of Darwin's theory of evolution. 2

(b) Using a specific named transitional form as an example, describe how transitional fossils provide evidence to support Darwin's theory of evolution. 3

Question 28 (3 marks)

(a) Explain why mammals need such a large supply of oxygen. 1

Question 30 (6 marks)

Marks

Marks

(b) Compare the different modes of transport for oxygen and carbon dioxide through human blood. 2

Question 29 (4 marks)

Fruit flies are insects whose bodies are covered by hair-like bristles. A female fruit fly, whose body is covered by forked bristles, is mated with a male fly with normal bristles.

Of their offspring, 62 are female with normal bristles and 65 are males with forked bristles. Assign symbols to the alleles and draw a Punnett square to explain the inheritance pattern for bristle shape in fruit flies. 4

Marks

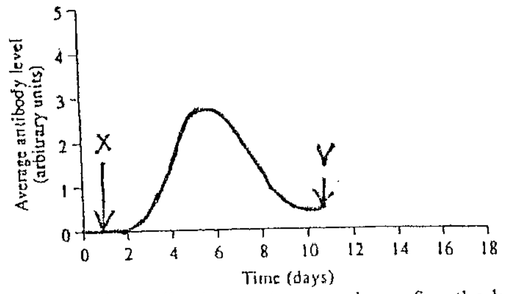
During your studies you have performed a first hand practical investigation on the structure of the major transport systems in plants.

(a) Outline the procedure you used. 2

(b) Draw a diagram of a longitudinal section of a xylem vessel or phloem tissue under a magnification of 400x. Label **TWO** features of its structure and relate its importance in the movement of materials throughout the plant. 4

Question 31 (7 marks)

The responses of animals to experimentally-induced infections are used as models to investigate human immunity. In an experiment to study the immune response of rabbits to a strain of bacteria, a small sample of the bacteria was injected into a group of rabbits at *X*. Blood samples were drawn from the rabbits at regular time intervals for the analysis of antibody levels. The results of these measurements are shown in the graph below.



a) Describe the changes in antibody levels over time after the bacteria were injected. 1

(b) Complete the graph above to show how the antibody levels would change if a second injection of bacteria were given at *Y*. 2

(c) Explain the shape of the curve you drew in Part (b). 2

(d) Can the antibodies produced in response to the injection at *X* be used to combat different bacteria that can infect these rabbits? Explain your answer. 1

(e) Apart from antibody production, describe ONE other way by which the immune system can fight bacterial infections. 1

Question 34 (5 marks)

Question 32 (6 marks)

James Watson, Francis Crick, Rosalind Franklin and Maurice Wilkins were important scientists in determining the structure of DNA. With reference to their work, discuss the role of collaboration and effective communication in scientific research. 5

Question 33 (6 marks)

(a) Distinguish between infectious and non-infectious disease. 1

(b) Name ONE infectious disease and state: 5

(i) how the disease is transmitted.
(ii) the typical symptoms of the disease.
(iii) the possible prevention and treatment of the disease.

Question 34 (5 marks)

Bromeliads are plants that are common throughout Central America. Some species thrive in arid soil, while other species are epiphytes, growing on tree limbs and trunks, high in the rainforest canopy. Like their arid soil-living cousins these epiphytic bromeliads have a problem obtaining water.

(a) Identify **THREE** adaptations that assist in minimising water loss, which you might reasonably expect to find in bromeliads. 3

(b) The epiphytic bromeliads are thought to have evolved from ancestral arid adapted forms, such as pineapples. 2

Describe a technological advance that could be used to demonstrate the evolutionary relationship between these plants.

Option : Genetics – the Code Broken? (15 marks) Marks

(a) In your study of genetics, you performed a first hand investigation to construct a model of D.N.A. 5

Evaluate the relevance and accuracy of your model.

(b) If a child with AB blood group has a father who is homozygous A group, determine the possible genotypes of the mother. Clearly explain your answer using diagrams or Punnett squares. 3