Student Number

Exam Choice

2005

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Approved calculators may be used
- Write your student number in the space provided

Total marks – 100

Section I Pages 2 - 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 16-28
- Allow about 1 hour and 45 minutes for this part

Section II Pages 20 - 27

25 marks
- Attempt **ONE** Question from Questions 29-33
- Allow about 45 minutes for this section

1. Blood samples were taken from the artery flowing into an organ and from the vein flowing from it.

The blood was analysed and the results are summarised in the table below.

	Artery	Vein
oxygen	**high**	**low**
glucose	**low**	**low**
carbon dioxide	**low**	**low**
urea	**low**	**high**

The organ is most likely the:

(A) liver

(B) small intestine

(C) kidney

(D) lungs

2. Dolphins (mammals) and sharks (cartilagenous fish) both have streamlined bodies and paddle shaped tails. This is a result of:

(A) divergent evolution

(B) convergent evolution

(C) descent from a common ancestor

(D) the effect of environment on the phenotype.

3. In cats there is a pair of alleles which affect development of the vertebrae in the back and tail. They are co-dominant.

Normal cats are homozygous for the S^N allele (S^NS^N) and have long tails.

Manx cats are heterozygous (S^NS^A) and are missing some vertebrae, leading to their tailless condition.

The homozygous S^AS^A condition is lethal and kittens with this genotype die before birth.

Which of the following offspring ratios would you expect to find amongst the live kittens resulting from a cross between two Manx cats?

(A) 3 normal : 1 manx

(B) 2 normal : 1 manx

(C) 1 normal : 1 manx

(D) 1 normal : 2 manx

4. Some Australian plants have sunken stomates. Instead of opening directly into the open air they open into semi-enclosed cavities called pits, on the underside of the leaf

Which of the following best describes the adaptive advantage of this arrangement.

(A) This increases the surface area of the leaf and thereby maximises heat loss by radiation.

(B) The pits provide a moist microclimate for evaporation to occur into, thereby reducing loss of water by evaporation.

(C) The stomates are concealed from direct sunlight, preventing them from opening during the day and thereby conserving water.

(D) The pits trap cool air during the night thereby helping to prevent the leaf from overheating during the day.

5. Cilia act as a barrier to pathogen entry

(A) on the skin

(B) in the digestive tract

(C) in the urinary tract

(D) in the respiratory tract

6. Health authorities recommend that adults have tetanus boosters at least every ten years.

The main reason for this is:

(A) to increase the number of memory cells sensitised to the antigen.

(B) because the tetanus pathogen is always changing.

(C) to replenish the antibodies given in the previous vaccination.

(D) because tetanus vaccine contains a modified toxin which is less effective than dead pathogen.

7. Which one of the following nitrogenous bases is found in DNA but not in RNA?

(A) uracil

(B) thymine

(C) adenine

(D) guanine

8. The evolution of new features by natural selection relies upon new alleles appearing in a population. The source of these new alleles is:

(A) crossing over

(B) mutation

(C) hybridisation

(D) random segregation

9. The mechanism by which substances move through the phloem is now well understood thanks to some innovative experimental techniques.

Which one of the statements below about the movement of substances in the phloem is correct?

(A) Sugars move into the phloem by diffusion.

(B) Sugars are moved from one sieve element to the next by active transport.

(C) Sugars leave the phloem by osmosis

(D) Sugars are moved from one sieve element to the next by fluid pressure.

10. ADH (vasopressin) is a hormone released by the pituitary gland which targets the walls of the collecting ducts of the kidney tubules.

Which one of the following stimuli will trigger ADH release?

(A) A drop in blood pressure.

(B) A rise in blood pressure.

(C) An increase in concentration of solutes in the blood.

(D) A decrease in concentration of solutes in the blood.

11. Read the description of a pathogenic organism below.

It is cellular, contains a single circular chromosome and reproduces rapidly.

This description best describes a:

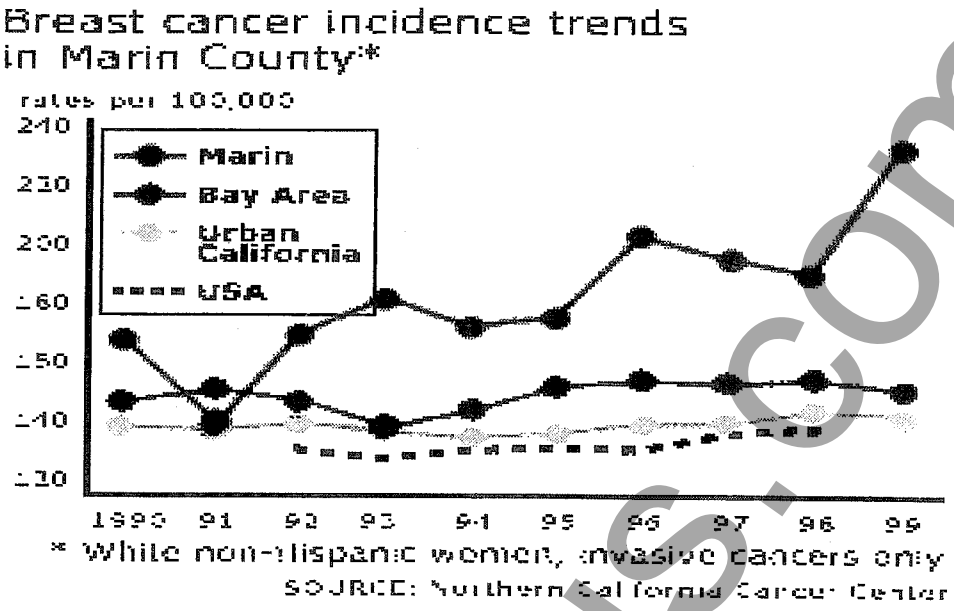
(A) prion

(B) virus

(C) bacterium

(D) protozoan

12. The graph below compares rates of breast cancer in different areas of California with the national rate for the USA as a whole.



The rise in cancer rates in Marin County greatly concerned epidemiologists.

Which one of the following factors, even if true, could NOT be responsible for this trend.

(A) An increase in population in Marin County.

(B) An increase in the average age of women in Marin County

(C) An increase in the availability of breast screening programs.

(D) Pollution of the water supply by radioactive waste.

13 The milk yields of identical twin cows were found to differ by about 10%. The difference between the yields of the twins

(A) must be due to differences in their chromosomes.

(B) must be due to differences in their environments

(C) is probably due to differences in both their chromosomes and their environments.

(D) cannot be accounted for by either their chromosomes or their environment.

14. Which one of the following is MacFarlane Burnet's main contribution to our understanding of disease.

(A) Disproving the theory of spontaneous generation.

(B) Proposing the criteria by which a causative pathogen can be identified.

(C) Identifying the role of pathogens in causing disease.

(D) Explaining the mechanism of the immune response.

15. During your study of enzymes you performed a first hand investigation of the effect of factors such as temperature and pH on enzyme activity.

You would have repeated each test several times and averaged your results.

Repeating an experiment improves:

(A) the reliability of the results

(B) the accuracy of the results

(C) the control of variables

(D) the validity of the experiment.

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.

Question 16 (3 marks) **Marks**

Read the following extract from a newspaper article.

> Health authorities around the world agree that the single most important threat to good health in much of the developing world is the lack of access to clean drinking water.

Discuss this statement.

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Question 17 (5 marks) **Marks**

Red – green colourblindness is caused by a recessive allele which is carried on the X chromosome. The condition is much more common in men than in women. **5**

Use a pedigree or family tree to explain how a woman could be born with colour blindness while none of her four grandparents shows the condition.

Marks

Question 18 (4 marks)

Medical Science makes use of a wide range of technologies in the diagnosis and treatment of disease.

(a) Describe a current technology that allows measurement of oxygen saturation in blood. 2

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(b) Using an example of a condition for which it could be used, assess its importance. 2

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Question 19. (3 marks)

An animal health officer investigating a mysterious outbreak of disease in cattle finds an unfamiliar species of bacteria present in the milk of the two sick animals he examines.
He suspects that it might be the pathogen causing the disease.

Outline the steps he should take to test whether his suspicion is correct. 3

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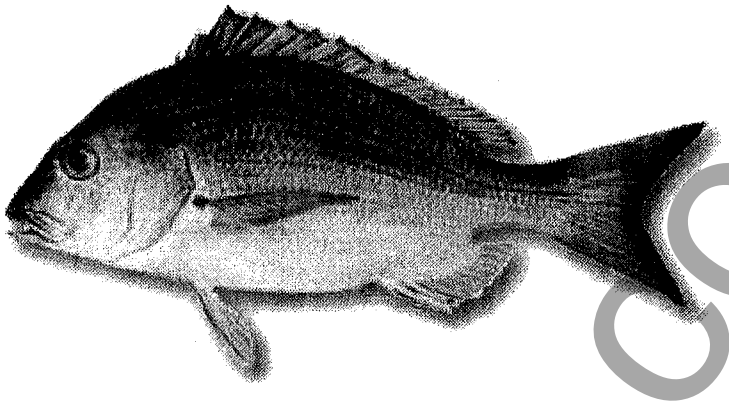
Question 20. (4 marks)

Marks



Source. www.conran.net.au

Some salt water fish such as bream (above) live in estuaries. At times of heavy rainfall the salinity (salt concentration) of the water decreases significantly.

(a) Outline the main problem that this would cause for the fish. **1**

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(b) Explain how the fish could survive this reduced salinity. **3**

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Question 21. (6 marks)

Marks

The relationship between the mineral fluoride in drinking water and tooth decay is well known today. **6**

Fluoride strengthens the enamel and dentine of teeth, reducing the incidence of decay.

Today fluoride is added to the water supply in most areas of Australia. In the past some towns had naturally high levels of fluoride in their water while levels in other towns were lower.

Design an epidemiological study which could have been used to investigate the relationship between fluoride levels in water and tooth decay.

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Question 22 (7 marks)

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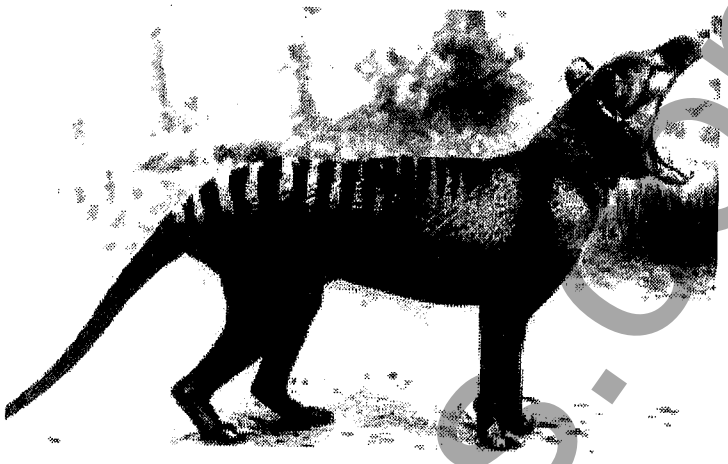
The Thylacine or Tasmanian Tiger is thought to have been extinct since the 1930s.



In recent years some scientists have suggested that the Thylacine could be 'brought back to life' through cloning. Thylacine DNA could be extracted from a museum specimen of a Thylacine foetus dating from 1866 and preserved in alcohol. This DNA could be used to clone a new Thylacine.

Other scientists consider the project to be impossible and have pointed out the following:

- There is only one Thylacine specimen suitable for extraction of DNA.
- The nuclear membranes in the specimen have broken down and the DNA is no longer enclosed in a nucleus.
- There are no living Thylacines and its nearest living relatives are the much smaller Tasmanian Devils.

(a) Using your knowledge of cloning techniques and the implications of cloning for genetic diversity, explain why EACH of the three points above make it very unlikely for a viable population of Thylacines to be produced from cloning. **3**

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Question 22 (continued)

(b) Discuss the ethical issues raised by the Thylacine cloning project. 4

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Question 23 (5 marks)

Assess the effect of social and/or political influences on the development of Darwin's Theory of Evolution by Natural Selection. 5

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Marks

Question 24. (8 marks)

During your study of Biology you performed a first hand investigation to study the effect of dissolved carbon dioxide on the pH of water. **8**

Describe how you did this.

In your description include:

- a hypothesis
- a list of equipment needed
- a step by step method used
- one safety procedure followed
- the measures you took to ensure that your results were valid and reliable
- the result you found

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Marks

Question 25 (4 marks)

The Human Immunodeficiency Virus (HIV) targets and destroys T4 lymphocytes (Helper T cells). 4

This can lead to people infected with HIV developing the symptoms of AIDS – including an inability to combat infection by other pathogens.

Using your knowledge of the human immune system, explain why a loss of T4 lymphocytes would have this effect.

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Question 26 (4 marks)

Using an example of a homeostatic mechanism in humans explain why homeostasis is necessary for optimal metabolic efficiency. 4

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Marks

Question 27 (3 marks)

The Rum Jungle mine in the Northern Territory opened over 40 years ago and discharged large quantities of copper rich waste into the Finnis River 3

Copper is toxic to most living things and large numbers of species have disappeared from the Finnis river.

However, one species of fish, the Black Rainbowfish has survived and can now tolerate much higher levels of copper than it could previously.

Explain how such an evolutionary change could have come about.

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Question 28 (4 marks)

Using a named example of a disease caused by an imbalance in microflora in humans, explain how the imbalance can arise and disease result.. 4

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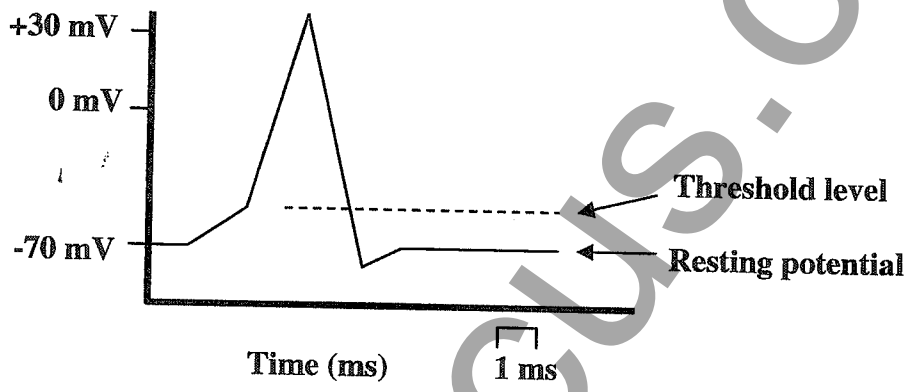
Question 29 --- Communication (25 marks)

Marks

(a) (i) Name a receptor used in human communication. 1

(ii) Describe how the structure of the human larynx is suited to the production of sound. 3

(b) The graph below represents an action potential.



(i) Explain what is meant by the term threshold level (or threshold potential). 2

(ii) Refer to the graph above to explain how a nerve impulse travels along a nerve cell. 4

(iii) Distinguish between a nerve and a neuron. 2

(c) Assess the potential of some named modern technologies to improve the hearing of people with hearing disorders. 7

(d) (i) Describe how light is refracted as it passes through the structures of the eye on its journey to the retina. 2

(ii) Explain how the human lens is able to focus an image whether looking at a distant or close object. 2

(iii) Explain how humans achieve depth perception. 2