INDEPENDENT TRIAL

2001
Higher School Certificate
Trial Examination

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Board approved calculators may be used
- Write using black or blue pen
- Draw diagrams using pencil
- Write your student number and/or name at the top of every page

Section I - Pages 3 – 12
Total marks (75)
This section has two parts, Part A and Part B

Part A
Total marks (15)
Attempt questions 1 – 15
Allow about 30 minutes for this part

Part B
Total marks (60)
Attempt questions 16 – 28
Allow about 1 hour 45 minutes for this part

Section II - Pages 14 – 20
Total marks (25)
Attempt ONE question from Questions 29-33
Allow about 45 minutes for this section

This paper MUST NOT be removed from the examination room

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Section I

Total marks (75)

Part A
Total marks (15)
Attempt questions 1 – 15
Allow about 30 minutes for this part

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
1				
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14				
15				

1. The process by which organisms maintain a relatively stable internal environment is called:

   (A) respiration
   (B) enantiostasis
   (C) homeostasis
   (D) homeothermy

2. Which of the following statements best describes an animal that is an ectotherm?

   (A) An ectotherm is always cold to touch.
   (B) An ectotherm always lives in cold harsh conditions.
   (C) An ectotherm is capable of changing its body temperature using heat from the environment.
   (D) An ectotherm regulates its body temperature by generating metabolic heat.

3. The pH of the blood in mammals is kept constant by the action of a buffer system. This system is needed to control the effects of carbon dioxide concentration in the blood. If the buffer system was not present, the effect of increasing dissolved carbon dioxide concentration in the blood would be:

   (A) increase in the pH of the blood
   (B) decrease in the pH of the blood
   (C) doubling of in the pH of the blood
   (D) no change in the pH of the blood

4. John F. Kennedy, the president of the United States of America, who was assassinated in 1963, had Addison's disease. This meant that his adrenal glands did not secrete enough of the hormone aldosterone and he needed to have hormone replacement therapy to regulate.

   (A) the levels of carbon dioxide in his blood
   (B) his ability to maintain metabolic and physiological responses to his environment
   (C) his body temperature
   (D) the correct salt concentration in his blood

5. Humans excrete urea as their major nitrogenous metabolic waste product. However, this requires a lot of water to be lost in its excretion. Many animals living in dry areas excrete a less toxic and less soluble nitrogenous waste while those that live in water often produce and excrete a very poisonous nitrogenous waste which must be dissolved in lots of water. Which statement is correct?

   (A) Reptiles excrete ammonia and bony fish excrete uric acid
   (B) Insects and birds both excrete uric acid
   (C) Birds excrete uric acid and insects excrete ammonia
   (D) Insects excrete ammonia and reptiles excrete uric acid

6. You have studied living or fossil organisms, which have characteristics of different groups. These are often called transitional forms and they include organisms like the fossil mammal-like reptiles, the early bird species *Archaeopteryx* and the modern platypus. Transitional forms are important to the understanding of the process of evolution as they indicate that

   (A) one of the two groups evolved from the other
   (B) evolution occurred in jumps, rather than gradually
   (C) all organisms are related to each other
   (D) Darwin and Wallace were absolutely correct in their ideas of evolution

7. In cats the gene for black coat is dominant to the gene for tan coat. What is the chance of black kittens being born to two parent cats, one of which is homozygous for black coat colour and the other heterozygous?

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

8. The inheritance of sex-linked genes was first shown by the work of:

   (A) Theodor Boveri and Walter Sutton
   (B) Thomas Hunt Morgan
   (C) Gregor Mendel
   (D) James Watson and Francis Crick

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9. The process of crossing-over or recombination occurs during the first stage of meiosis and results in greater variation in the possible genetic make-up of the gametes produced. This is because:

(A) genes are assorted independently of each other during the meiosis process
(B) there is random segregation of chromosomes during meiosis
(C) linked genes can be separated and not combined together in gametes
(D) any possible combination of gametes can result from random mating

10. A horticulturist took 20 cuttings from one flowering shrub. Ten of these were planted in one area of the property and the other ten in a different area. When they eventually grew into shrubs and flowered, it was found that the flower colour was different between the two groups. The difference in flower colour was most likely to have been because:

(A) something in the soils in the different areas had led to a mutation in the gene for flower colour
(B) taking the cuttings had an effect on the genetic material of the new plants
(C) environmental conditions had affected the expression of the gene for flower colour
(D) the cuttings must have been taken from different parts of the original plant

11. If an organism is said to be a pathogen it must:

(A) survive at human body temperature
(B) be capable of causing disease
(C) be a microorganism
(D) be a bacterium, virus, fungus or prion

12. Robert Koch's work was important because it:

(A) demonstrated that microorganisms were present in the air and in water
(B) showed that microorganisms caused disease
(C) established a way of determining what specific pathogen caused a disease
(D) developed a vaccine for serious diseases like anthrax and smallpox

13. Antibiotics are useful in the control of some diseases because they:

(A) assist the immune response of the body
(B) reduce the number of infectious people in the community
(C) get rid of the infectious organism in a human population
(D) destroy all types of microorganisms to reduce the number of people infected

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14. Toxic chemicals produced by certain Tolymphocytes are capable of destroying cells. The action of these chemicals is called:

(A) cell-mediated immunity
(B) phagocytosis
(C) antibody-mediated immunity
(D) a first-line defence mechanism

15. The field of epidemiology gathers statistics on the incidence of disease and often relates this incidence to a number of "risk factors" for a particular disease. These studies are often important to the understanding of non-infectious diseases as they:

(A) allow people to avoid getting the diseases by avoiding the risk factors
(B) can identify possible causes of the diseases, which can be investigated by research
(C) can be applied to inherited, nutritional and environmental disease research
(D) usually directly show the actual cause of specific diseases.

Section I

Part B

Total marks (60)
Attempt questions 16 – 28
Allow about 1 hour 45 minutes for this part

Answer the questions in the spaces provided

Marks

16. Explain how TWO responses or adaptations of named Australian endothermic species assist the organisms with regulation in response to changes in ambient temperatures. **4**

17. You performed first-hand investigations to demonstrate the effect of increased temperature, change in pH and change in substrate concentration on the activity of enzymes. Outline and justify the experimental procedure you used to investigate ONE of these factors and describe your results. **7**

18. (a) Describe the use of ONE named product extracted from donated human blood. **1**

(b) Report on the current research into the development of artificial blood. Propose ONE reason why artificial blood would be useful. **2**

19. Describe ONE process used by a named Australian plant in a saline environment to regulate its internal salt concentration. **2**

20. Explain how the process of filtration and reabsorption in the nephron of the mammalian kidney regulates body fluid concentration. **4**

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21. (a) Compare the observations you made of a range of vertebrate forelimbs and describe how their comparative anatomy supports the theory of evolution. 3

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(b) Explain using an example how Darwin and Wallace's theory of evolution by natural selection accounts for convergent evolution. 4

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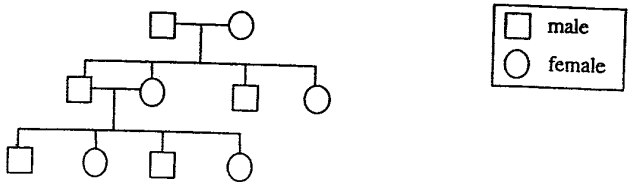
22. The gene for eye colour in the fruit fly, *Drosophila melanogaster*, is sex-linked. In an experiment with these animals, a researcher first crossed white-eyed male fruit flies with pure-breeding red-eyed females and then took the red-eyed male offspring from this cross and bred them to red-eyed females from the original cross.

Complete the family tree (or pedigree) below for the inheritance of the white-eye characteristic showing the phenotypes (by shading) and genotypes (by letters or symbols) of all individuals in the family tree. 6



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23. (a) Use a simple labelled diagrams to describe the process of DNA replication. 2

(b) Outline how a change in the DNA sequence can result in a change in cell activities. 2

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24. (a) Outline how artificial insemination OR artificial pollination has the potential to alter the genetic composition of a population. 1

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(b) Discuss ONE ethical issue arising from the development and use of a NAMED transgenic organism you have studied. 2

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25. Outline how Pasteur used scientific methodology in the design of his classic experiment and how the results of this experiment changed the direction of scientific thinking about the nature of living organisms. 4

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26. (a) For a NAMED human disease identify a pathogen and its insect vector. 3

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(b) Draw a simple diagram of the life cycle of the pathogen. Identify where control or prevention of the disease would be most effective and justify your decision. 5

27. (a) Compare how ONE named first-line defence barrier and the process of phagocytosis each can prevent pathogens affecting the human body 4

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(b) Explain how an understanding of the immune response has improved the success of organ transplants. 2

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28. Legionnaire's disease is caused by a bacterium, *Legionella pneumophilia*. This is an infectious disease that is transmitted by air. The pathogen is commonly spread by wet air conditioning systems in large buildings or shopping centres. The following table provides data on the incidence of the disease in the United States of America.

Year	Number of cases per year
1976	200
1978	750
1980	820
1982	300
1984	350
1986	550
1988	800
1990	1000
1992	1050
1994	1350
1996	1375
1998	1400
2000	1450

Identify the trend in these data and propose a possible explanation for this trend. 2

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Question 31 – Genetics: the Code Broken? (25 marks) **Marks**

(a) Outline the steps involved in the production of a protein or polypeptide in the cell, naming the cell organelles involved in this process. **6**

(b) An Rh positive (Rh^+) man and his Rh negative (Rh^-) wife have an Rh^- child.

(i) Identify the genotypes of both parents of the Rh^- child and predict the probability that their next child will be Rh^+?
Show your working. **3**

(ii) Define what is meant by polygenic inheritance. **1**

(c) Outline the work being done by the Human Genome Project and discuss TWO potential benefits of this project. **5**

(d) For a NAMED example outline at least THREE steps in the procedure for ONE of the following:

- Gene cloning
- Whole organism cloning

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(e) In fruit flies, the allele for red eyes is dominant to the allele for white eyes and the allele for long wings is dominant to the allele for short wings. A white eyed fly, which is heterozygous for long wings, is mated to another fly which is heterozygous for both eye colour and wing length.

Select appropriate letters and identify the genotypes of both parents. Predict what would be the proportion of the offspring that had the phenotype of white eyes and short wings.
Show all genotypes and phenotypes in your working. **4**

(f) Describe a use of cloning in animals OR plants that is beneficial to humans.. **2**

End of Question 31