HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

BIOLOGY PAPER 2

(Sample Paper)

Time allowed: 1 hour

This paper must be answered in English.

INSTRUCTIONS

(1) There are **FOUR** sections, A, B, C and D in this paper. Attempt **ALL** questions in **any TWO** sections.

(2) **You are provided with two answer books. Use a separate answer book for each section. Put the question number on the front cover of each answer book.**

(3) Each section carries 20 marks.

(4) Present your answers in paragraphs wherever appropriate.

(5) Illustrate your answers with diagrams wherever appropriate.

(6) The diagrams in this paper are **NOT** necessarily drawn to scale.

Not to be taken away before the end of the examination session

SECTION A Human Physiology – Regulation and Control

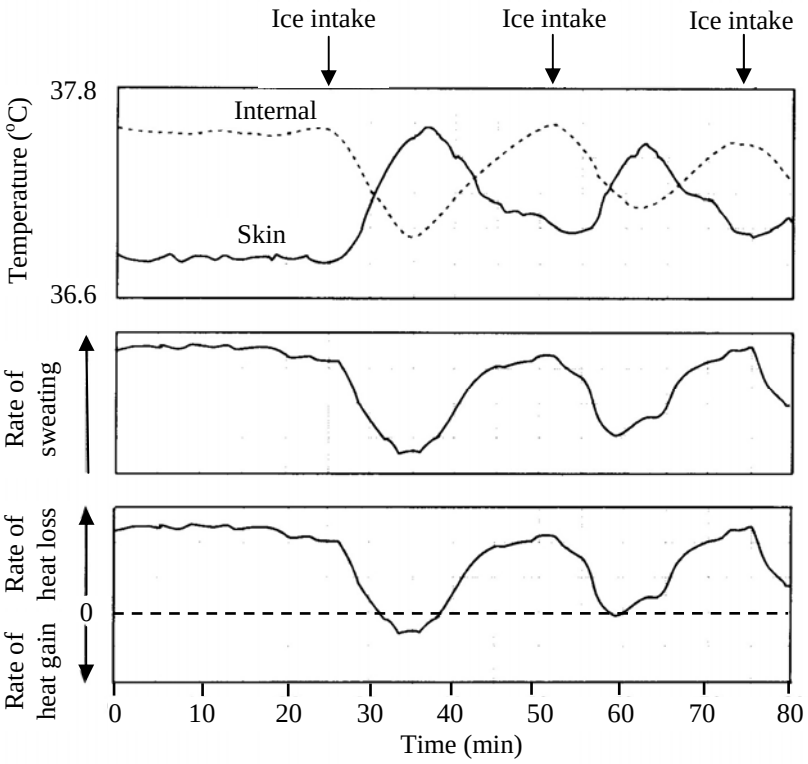
Answer **ALL** parts of the question. Put your answers in ***one*** of the answer books provided.

1.(a) In an experiment conducted in a room with an air temperature of 45℃, a healthy man was asked to consume a large quantity of crushed ice (about 500 g) from time to time. Measurement of the following parameters were taken from the man during the course of the experiment:

- internal body temperature (taken at the eardrum which indicates the temperature of the blood supplying the hypothalamus)
- skin temperature
- rate of sweating
- rate of body heat loss / gain

(N.B. It was noted that the metabolic rate of this person ***remained unchanged*** throughout the experiment.)

The data are presented in the following graphs:



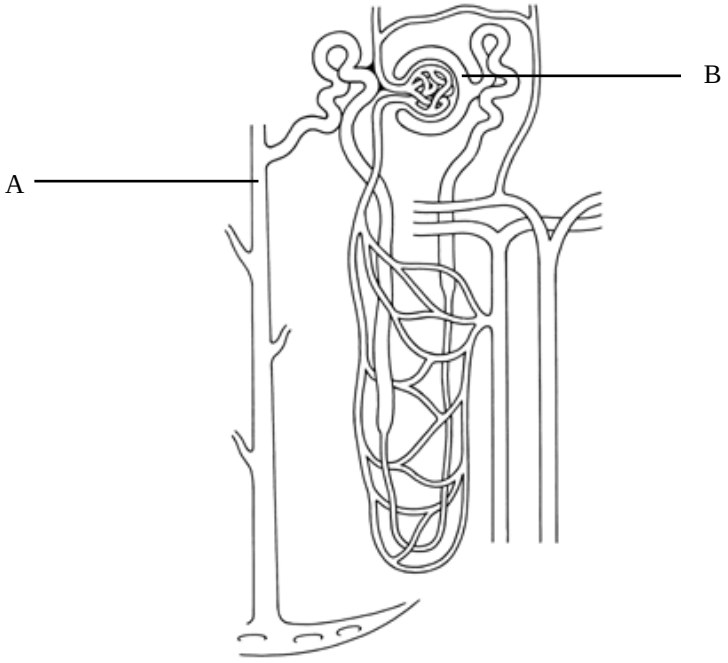
(i) Describe the changes in the man's internal body temperature and the skin temperature within the five minutes after the crushed ice was consumed. (2 marks)

(ii) Explain how the consumption of crushed ice had brought about the change in the internal body temperature you stated in (i). (2 marks)

(iii) The change in skin temperature within five minutes after the consumption of crushed ice was the result of homeostatic response. Explain the mechanisms involved in bringing about this change in skin temperature with reference to the graphs. (4 marks)

(iv) According to the findings of this experiment, the following deduction can be made: environmental temperature plays a less dominant role in causing sweating when compared to internal body temperature.
What evidence supports this deduction? (3 marks)

1.(b) The diagram below shows the structure of a nephron:



(i) Explain why the fluid in A has a lower percentage of glucose but a higher percentage of urea than that in B. (2 marks)

(ii) Explain the change in the concentration of the fluid in A after heavy sweating. (5 marks)

(iii) Patients suffering from kidney failure may need to receive treatments involving a dialysis machine which works on similar biological principles as the kidney. State ***one*** similarity and ***one*** difference between the functioning of the artificial membrane in the dialysis machine and that of the wall of nephrons. (2 marks)

SECTION B Applied Ecology

Answer **ALL** parts of the question. Put your answers in ***one*** of the answer books provided.

2.(a) The table below shows the total fish catch and the total number of days spent on catching tuna for all the fishing boats, i.e. the fishing effort, in the Atlantic Ocean from 1980 to 1987:

Year	Total fish catch (ton x 10^3)	Fishing effort (number of days x 10^3)	Fish catch per unit fishing effort (ton per day)
1980	40	5	8.00
1981	45	8	5.63
1982	44	12	3.67
1983	60	20	3.00
1984	80	30	2.67
1985	85	35	2.43
1986	90	40	*x*
1987	100	60	*y*

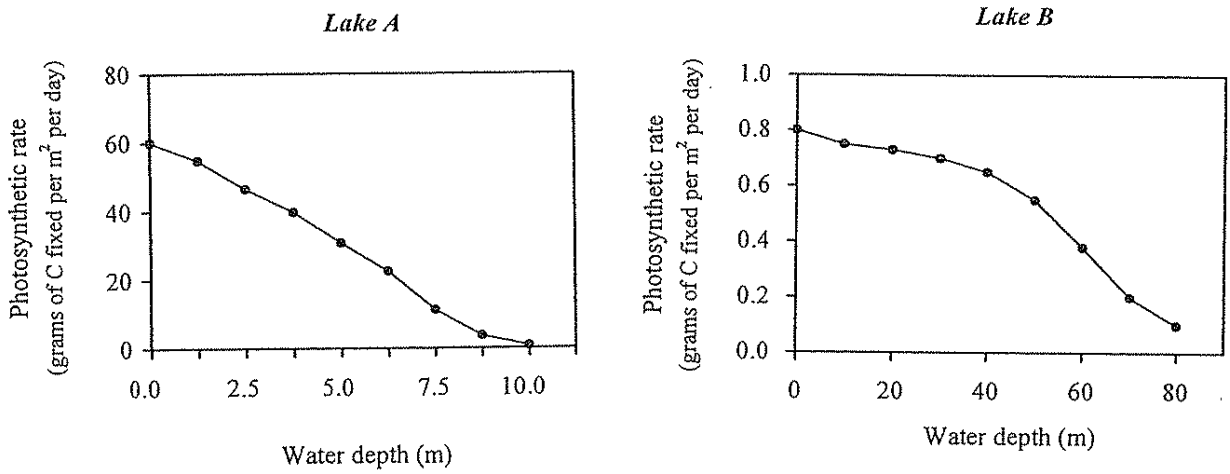
(i) Calculate the values of *x* and *y*, which represent the fish catch per unit fishing effort in the years of 1986 and 1987 respectively. (1 mark)

(ii) Plot a graph to show the fish catch per unit fishing effort from 1980 to 1987. (3 marks)

(iii) Referring to your graph and the data given above, explain the change in fish catch per unit fishing effort from 1980 to 1987. (3 marks)

(iv) Suggest ***two*** control measures for fishing and describe how each of them can help to maintain a sustainable supply of fish. (4 marks)

2.(b) The diagrams below show the changes in photosynthetic rate with water depth of two lakes, A and B. One of the lakes is polluted by chemical fertilizers leached from nearby farmlands.



(i) Explain the change in photosynthetic rate with increasing water depth in lake A. (2 marks)

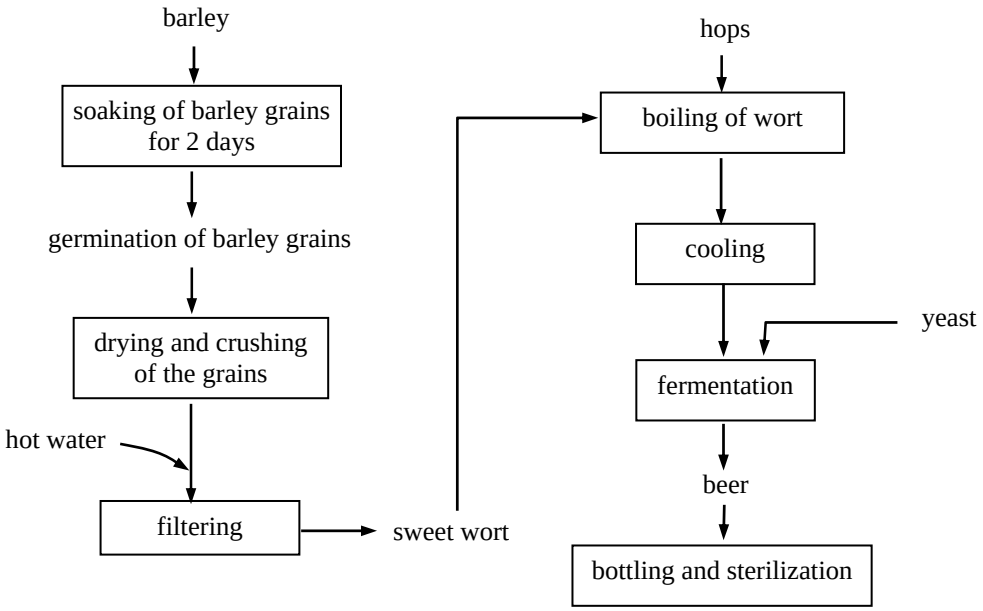
(ii) Which of these lakes is polluted by chemical fertilizers? Explain your answer. (3 marks)

(iii) Which lake is more likely to experience a greater diurnal fluctuation (i.e. between day and night) of dissolved oxygen content? Explain your answer. (4 marks)

SECTION C Microorganisms and Humans

Answer **ALL** parts of the question. Put your answers in ***one*** of the answer books provided.

3.(a) The diagram below outlines the sequence of processes involved in the brewing of beer:



(i) Explain the importance of soaking the barley grains in water for two days in the brewing of beer. (4 marks)

(ii) Give ***two*** reasons why it is necessary to boil the wort. (2 marks)

(iii) Describe how yeast can help in beer production. (2 marks)

(iv) Sketch a graph to show the change in the population of yeast from the time when it is added to the wort to the time of bottling and sterilization of the beer. (3 marks)

3.(b) Mary bought two boxes of fresh milk from the supermarket and put them in the refrigerator. After two weeks, she found that one box of milk had turned sour and curdled. The photograph below shows the appearance of the spoiled milk:

(i) Fresh milk is usually pasteurized before it is sent to the supermarket for sale. How does pasteurization help to preserve fresh milk? (1 mark)

(ii) Briefly explain how the milk became sour and curdled after being left for two weeks. (3 marks)

(iii) Mary found the other box of milk appeared normal and she drank the whole box. A few hours later, she suffered from diarrhoea as a result of food-borne infection.

(1) Explain how drinking this box of milk may bring about the above food-borne infection. (2 marks)

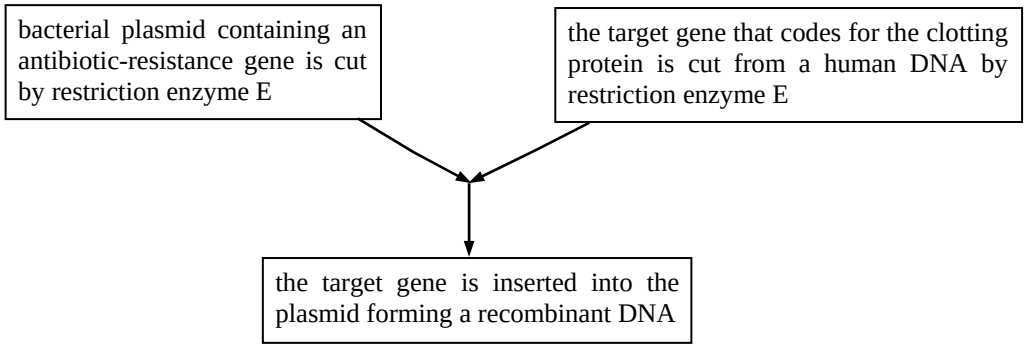
(2) Name a pathogen that causes food-borne infections. (1 mark)

(iv) Butter and cheese are products made from milk, but they can be kept unspoiled for a longer period of time than milk. Why? (2 marks)

SECTION D Biotechnology

Answer **ALL** parts of the question. Put your answers in ***one*** of the answer books provided.

4.(a) In some people, a gene mutation results in a failure to produce a blood clotting protein and this leads to the disease haemophilia. One way to treat this disease is by introducing an external source of the clotting protein into these people's blood. The clotting protein can be produced by recombinant DNA technology. The flow chart below outlines the major steps of producing the recombinant DNA:



(i) (1) What is a bacterial plasmid? (1 mark)

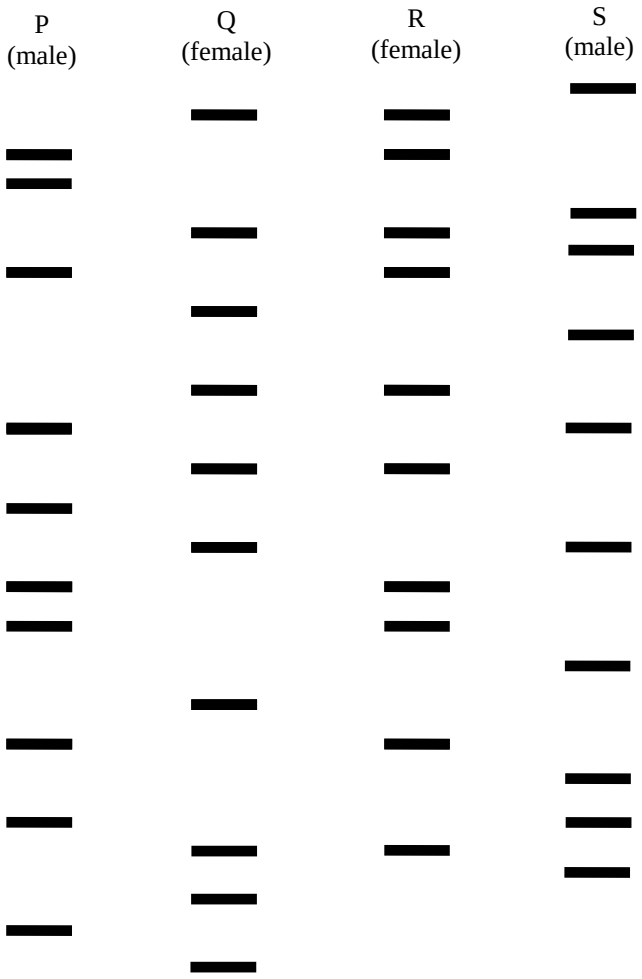
(2) Give ***two*** reasons why plasmids are commonly used as vectors in recombinant DNA technology. (2 marks)

(ii) In most cases, the restriction enzyme used to cut the target gene from the human DNA should be the same as that used for cutting the plasmid. Explain the importance of this in the formation of the recombinant DNA. (2 marks)

(iii) Outline how the clotting protein is produced on a large scale after obtaining the recombinant DNA. (4 marks)

(iv) Traditionally, the clotting protein is obtained by extraction from donated blood. Give ***two*** advantages of using the clotting proteins produced by recombinant DNA technology over that obtained from the traditional source. (2 marks)

4.(b) One application of DNA fingerprinting is to identify the relationship among members in a family. The diagram below shows the DNA fingerprints of four members in a family, which consists of a couple and their two children. One of the children is the couple's biological child, while the other child is adopted.



(i) Outline the DNA fingerprinting technique and state how it can be used to identify the relationship among members in a family. (4 marks)

(ii) Based on the information above, deduce, with reasons,

(1) the relationship of R with P. (2 marks)

(2) which one is the adopted child. (2 marks)

(iii) Suggest ***one*** other application of DNA fingerprinting. (1 mark)

END OF PAPER