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Level 1 Exemplar 1

2024-DSE
BIO
PAPER 1B

B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2024

BIOLOGY PAPER 1

SECTION B: Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer **ALL** questions.

(4) Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) Supplementary answer sheets will be supplied on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(6) Present your answers in paragraphs wherever appropriate.

(7) The diagrams in this section are **NOT** necessarily drawn to scale.

(8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* A 1 3 0 E 0 1 B *

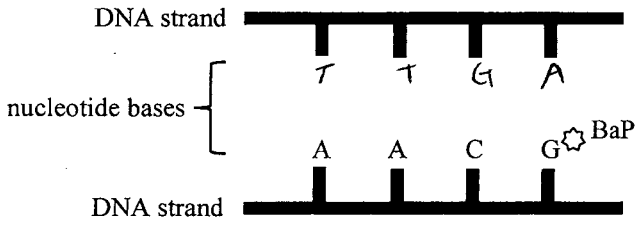
SECTION B

Answer **ALL** questions. Write your answers in the spaces provided.

1. Fill in the table below to compare the characteristics of nervous and hormonal controls. (3 marks)

		Nervous control	*Hormonal control*
(a)	Signalling molecule	fast	slow
(b)	Transmission pathway	fast	slow
(c)	Comparison of the time taken to induce responses	same	

2. BaP is a carcinogenic chemical which is commonly found in grilled meats. It can attach randomly to the nucleotides of DNA molecules. When it is attached to guanine (G), this G will be misread as thymine (T). The diagram below shows part of nucleotide sequence of one strand of a DNA molecule with BaP attached to a G:



(a) On the above diagram, write down the nucleotide sequence found in the opposite strand of the DNA when misreading happens. (1 mark)

(b) Suggest ***one*** reason why this type of mutation may ***not*** affect the functioning of the protein formed. (1 mark)

(c) If this type of mutation accumulates over time in the DNA molecules, there is a chance that it will affect the functioning of the protein formed and subsequently lead to tumour formation. Suggest which cellular process this protein controls. (1 mark)

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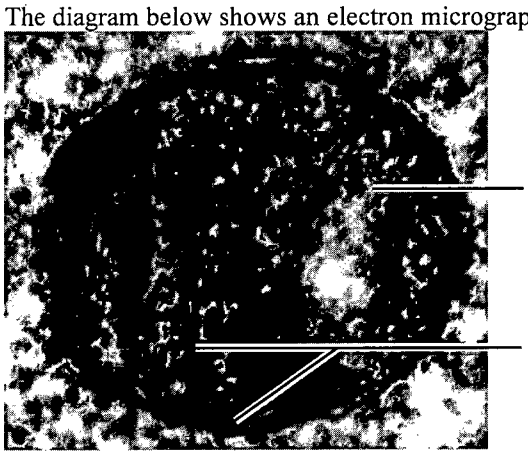
Answers written in the margins will not be marked.

3. The diagram below shows an electron micrograph of a mitochondrion:



(a) Label X in the above diagram. (1 mark)

rough ER

(b) Describe ***one*** observable feature of Y and explain how this feature is related to the functioning of mitochondria. (2 marks)

double inner membrain, provide large surface area

(c) Chemical Z can inhibit an enzyme found in X.

(i) Which key process of respiration would be inhibited? (1 mark)

pyrphare

(ii) If chemical Z is added to a plant cell culture, how would this affect the respiratory pathway? (3 marks)

stop produce 5-C compound

accumulate 3-C compound

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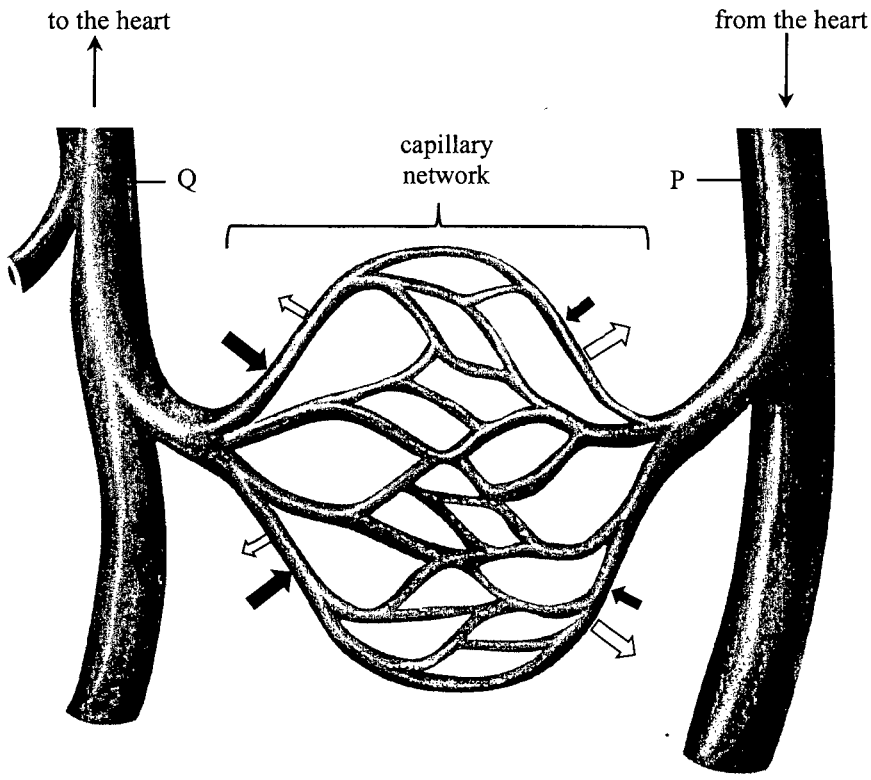
Answers written in the margins will not be marked.

4. The schematic diagram below shows the arrangements of some blood vessels:



(a) The two types of arrows (black and white) represent two factors which govern the movement of fluid into or out of the capillary network. Identify these two factors. (2 marks)

➡ : tissue fluid

⟹ : blood

(b) The sizes of the arrows in the above diagram represent the magnitudes of the factors. Explain the change in the factors denoted by ⟹ as the blood flows from P to Q. (3 marks)

capillary near the a pressure is higher then capillary. It will force out plasma with white blood cell. capillary near the vein pressure is smaller than capillary. Most water at capillary will back to capillary near the a by osmosis.

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Answers written in the margins will not be marked.

(c) The capillary network is the location where exchange of materials occurs between the blood and tissue fluid. When the blood flows through the capillary network of a particular organ, some substances will be taken up into the blood.

Complete the table below to show the organ where the capillary network is found. Provide your explanation. (3 marks)

	Organ	***Substance taken up into the blood***	***Explanation***
(i)	liver	insulin	Insulin is secreted from the organ in response to the change of the blood glucose level.
(ii)	kidned	urea	

Answers written in the margins will not be marked.

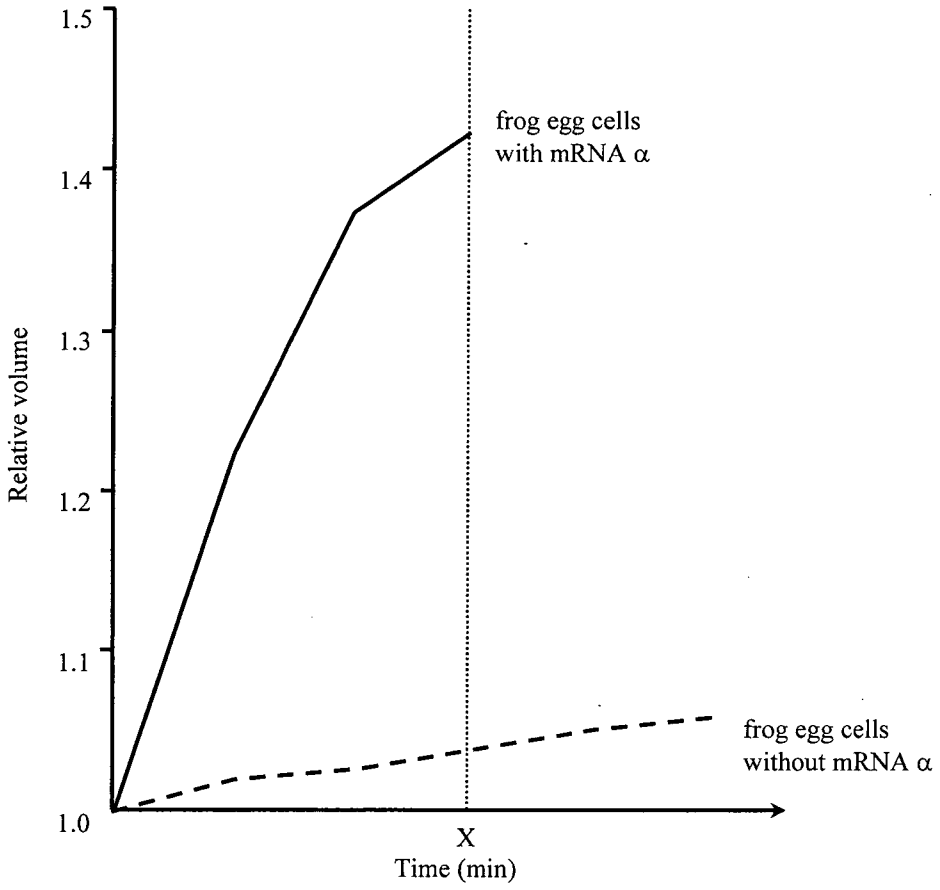
Answers written in the margins will not be marked.

Go on to the next page

5. In an experiment, mRNA α was isolated from a mammalian cell and then injected into a frog egg cell. The expression of mRNA α eventually led to the presence of protein α on the cell membrane of the frog egg.

(a) Describe how the injected mRNA α led to the presence of protein α on the cell membrane of the frog egg. (3 marks)

(b) In another experiment, frog egg cells received an injection of a fixed amount of water with or without mRNA α. After that, these two types of frog egg cells were transferred to pure water. The changes in the relative volumes ($\frac{\text{new volume}}{\text{original volume}}$) of these two types of frog egg cells are shown in the graph below:



Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

(i) Explain why there was an increase in the relative volume of the frog egg cells without mRNA α after they were transferred to pure water. (2 marks)

pure water has higer water protenial. than frog egg cell. water will in frog egg cell by osmosis.

(ii) Based on the difference shown in the results of the two types of frog egg cells, deduce the function of protein α on the cell membrane. (3 marks)

frog egg cells with mRNA α relative volume is higher and faster than frog egg cell without mRNA α. Protein α can increase the premeable to water of cell membrane. A large amount of water in frog egg cell with mRNA α by osmosis.

(iii) Suggest why no data were obtained from frog egg cells with mRNA α after X minutes. (1 mark)

frog egg cell turrgent

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Answers written in the margins will not be marked.

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6. Shirley came across an article about some beans containing an amylase inhibitor as a defence against insects. She wondered if the amylase inhibitor would also work in the human body and if it did, whether it could be used as a food supplement for weight management. She discussed the idea with her classmate Johnson. They had different ideas:

Shirley: I think we should test if the bean extract can inhibit pancreatic amylase.

Johnson: Perhaps we can use salivary amylase instead of pancreatic amylase.

(a) With reference to the process of digestion, which amylase would produce more valid results for developing a food supplement that targets weight management? Explain your answer. (3 marks)

pancreatic amylase. Most food energy are absorb in small intestine by pancreatic amylase. so use panireatic amylase could show the developing a food supplement.

(b) The table below shows the reaction mixtures prepared for the investigation:

Solution	*Volume of solution used in each set-up (mL)*	
	Set-up I	*Set-up II*
1% starch solution	15	15
Amylase solution	5	5
Bean extract	0	5
Buffer solution (to maintain the pH)	5	5
Water	5	0

(i) Explain the purpose of adding water to set-up I. (2 marks)

to compare the set-up II

(ii) Suggest ***one*** method to determine the rate of starch digestion and state clearly the measurement taken to show the rate of starch digestion. (2 marks)

IN test

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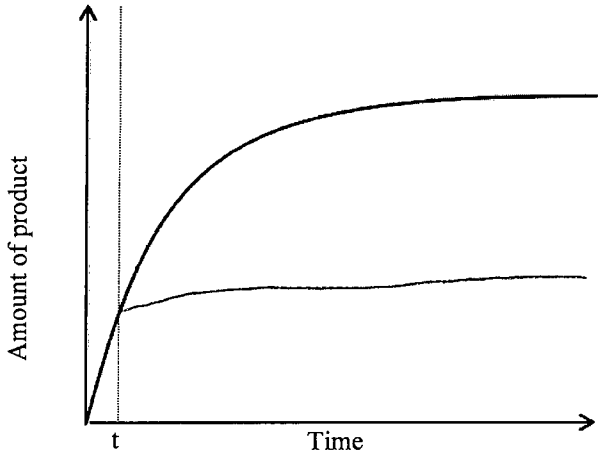
(c) The graph below shows the amount of product formed over time when amylase is working normally:



The experiment was repeated with the addition of bean extract at time t. If the bean extract can inhibit the amylase being studied, what will be the change in the amount of product formed? On the above graph, sketch a line to show the results. (1 mark)

(d) Shirley and Johnson shared their ideas with their professor. Their professor suggested that they should conduct an *in vivo* experiment using mice with the control group fed with starchy food and the experimental group fed with a mixture of starchy food and bean extract.

(i) Explain why the result of an *in vivo* experiment is more valid than that of *in vitro* experiment in this case. (1 mark)

(ii) Apart from monitoring the change in body weight of the mice, their professor suggested that they should take blood samples from the mice after the meals for analysis. Which component of the blood should they monitor? What would be the expected results of the control group and the experimental group if their ideas actually worked? (2 marks)

liver

rate of starch of control group is lower than experimental group.

(e) Suggest how the amylase inhibitor helps the bean defend against insects. (1 mark)

no food for ~~them~~ insects

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Answers written in the margins will not be marked.

7. The following photograph was generated by an artificial intelligence programme using the following sentence:

'A photograph capturing Hong Kong students on a field trip to a rocky shore, studying the distribution and abundance of organisms along the shore.'

(a) The photograph does not truly reflect the requirement in the sentence because two pieces of essential equipment are missing.

(i) List the ***two*** pieces of essential equipment for the study. (1 mark)

water , rock

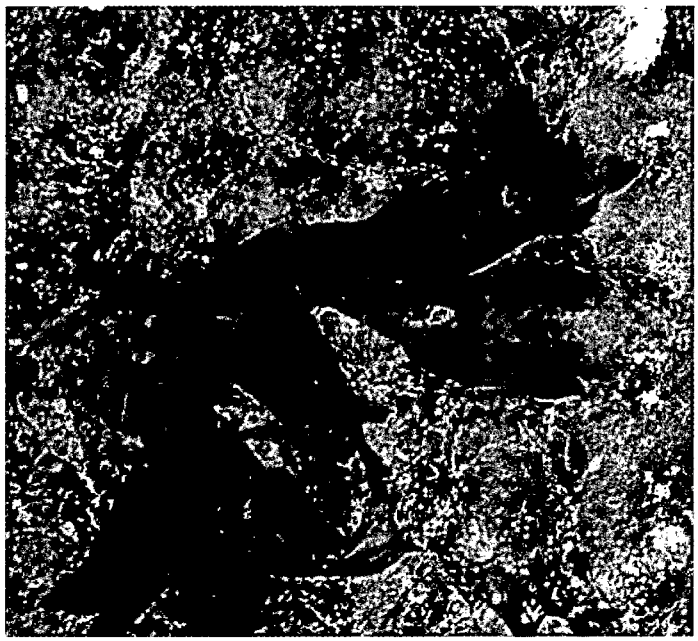
(ii) How could you use the equipment listed in (i) to collect the data needed for the study? (2 marks)

collect the organisms from water and under rock

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

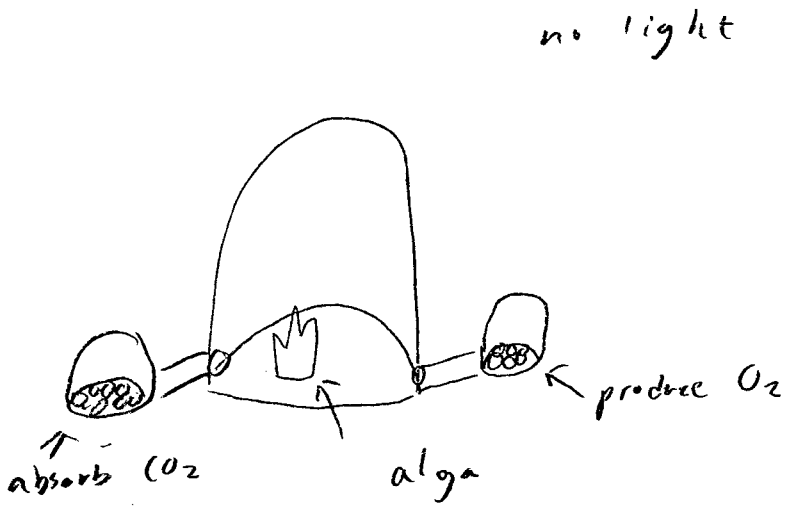
(b) In a field trip to a rocky shore, a student found a thin brown sheet lying on a rock. The student suspected that it was an alga. A small piece of the sample was taken back to school for further study.



5 cm

Using apparatus and reagents available in a school laboratory, design a set-up which can be used to show whether the sample of this thin sheet can undergo respiration. In the space below, draw a simple labelled diagram of this set-up. (3 marks)

Title: A set-up for demonstrating if respiration occurs in the sample



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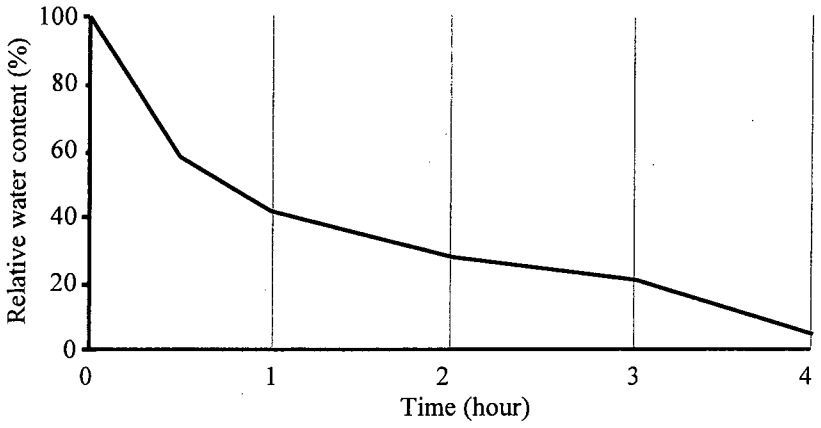
Answers written in the margins will not be marked.

(c) Under normal circumstances, the level of free radicals in algal tissues is kept at a certain level as a result of homeostasis. In response to dehydration, algal tissues will be stimulated to produce free radicals which can cause damage to the cell components if there is an accumulation.

Graph I shows the change in relative water content of algal tissue samples during a period of four hours of dehydration:

Graph I



With reference to Graph I, what would be the expected change in the level of free radicals found in the algal tissue samples during the four hours of dehydration? (1 mark)

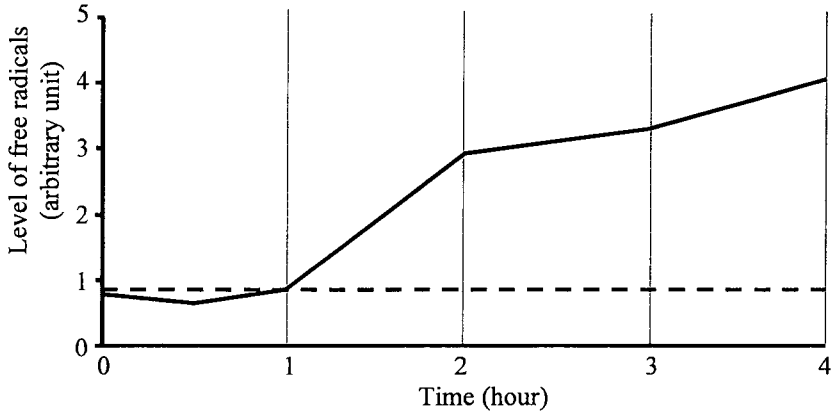
increase

Answers written in the margins will not be marked.

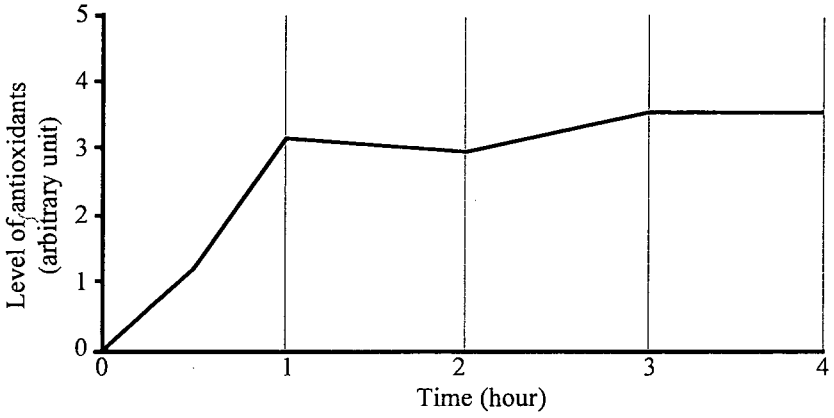
Answers written in the margins will not be marked.

(d) Graph II and Graph III respectively show the actual change in the level of free radicals and the change in the level of antioxidants found in the algal tissue samples of the alga during the same period of dehydration:

Graph II



Graph III



Based on your answer in (c) and the data shown in Graph II and Graph III, suggest the role of antioxidants in helping the algae to cope with the dehydration. Give ***two*** pieces of evidence from the data shown. (3 marks)

In Graph II, Level of free radical is lower than 1 in one hour, keep increasing in 1 to 4 hours. it is higher than average level of free radicals found in algae under normal circumstances.

In Graph III, level of antioxidants increase quickly in one hour, and keep increasing in 1 to 4 hours.

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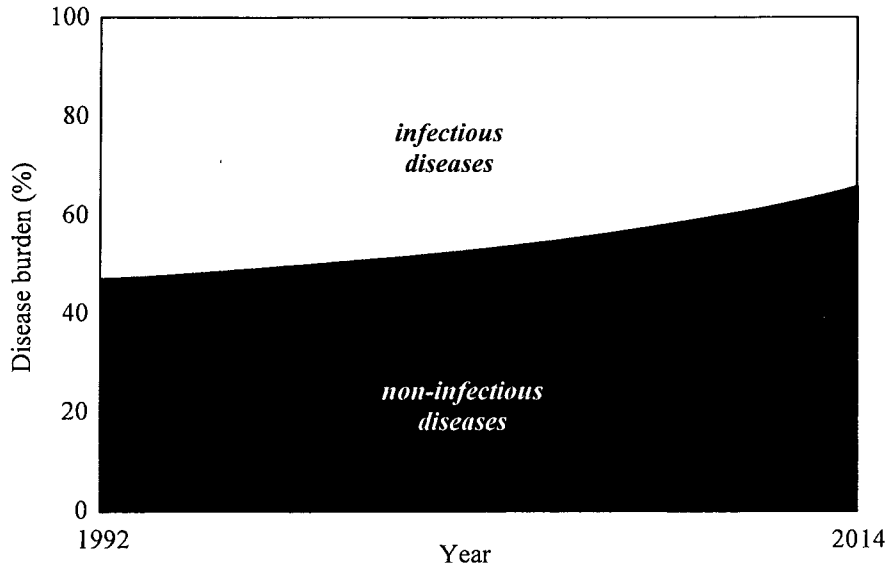
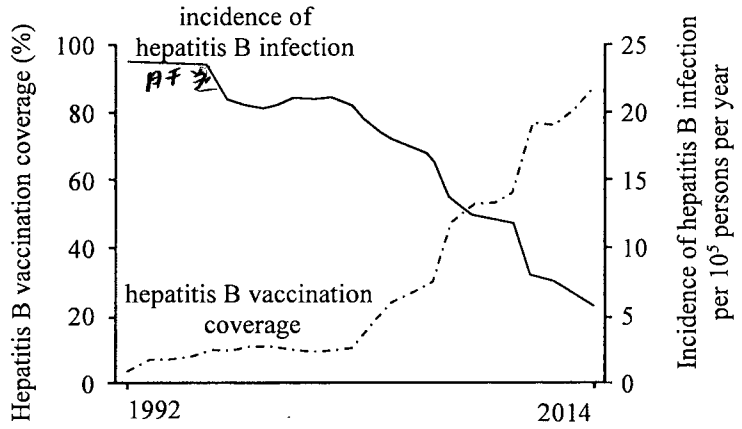
8. Disease burden is a measure of population health that aims to quantify the potential loss of lifespan and health outcomes due to illness as compared to the ideal of living to a ripe old age and in good health. The graph below shows the percentage share of disease burden caused by infectious diseases and non-infectious diseases in Country X from 1992 to 2014:



(a) Describe the change in the percentage shares of the disease burden of Country X from 1992 to 2014.
(1 mark)

Infectious diseases burden is decreasing from 1992 to 2014
non-infectious diseases burden is increasing from 1992 to 2014

(b) The graph below shows the impact of hepatitis B vaccination on the incidence of hepatitis B infection in Country X from 1992 to 2014:



With reference to the principle of vaccination, explain the relationship shown in the above graph.
(4 marks)

Incidence of hepatitis B infection per 10^5 peresons per year is slowly decrease from 1992 to 2014.
Hepatitis B vaccination coverage

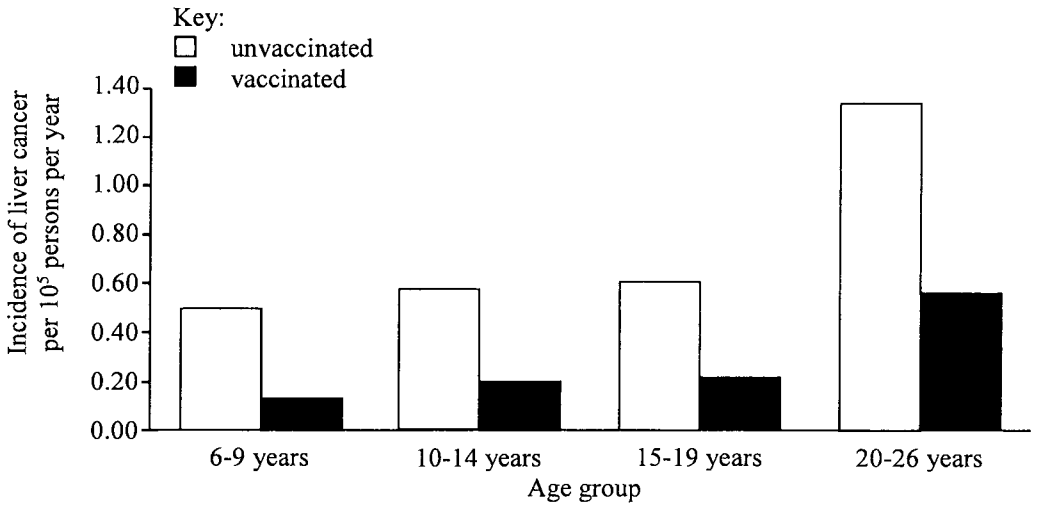
are keep increase from 1992 to 2014, quicky increase in 2003.

when incidence of hepatitis B infection decrease, hepatitis B vaccination coverage increase.

(c) With reference to the information from (a) and (b), suggest the role of vaccination in the change of disease burden in Country X. (1 mark)

rate of liver disease are non-infectious disease higher

(d) The graph below shows the incidence of liver cancer among different age groups who have or have not been vaccinated against hepatitis B in Country X:



What can you conclude about the relationship between hepatitis B and liver cancer? Support your answer with evidence from the graph. (2 marks)

when incidence of liver cancer increase, hepatitis B increases. 15-26 years, liver cell from 60000 increase to 130000. In 15-26 years, hepatitis B from 20000 increase to 60000.

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

9. Hormone X is a plant hormone which is produced in leaves of plant P when water supply is inadequate. A student detached some leaves from plant P and placed them in either water or a 10 μM solution of hormone X. After two hours, the student examined the lower epidermis of the leaves under a light microscope. The photomicrographs below show the images obtained:

Water

10 μM hormone X

(a) Based on the above information, explain the importance of hormone X to the drought tolerance in plant P. (2 marks)

the hall of 10 μM hormone X is smaller than water.

(b) In nature, there are varieties of plant P which produce different amounts of plant hormone X in response to drought stress. The student measured the fresh leaf masses of two different varieties (A and B) of plant P after drought treatment for two weeks. The results are shown in the table below:

Plant variety	*Treatment*	*Leaf fresh mass (g)*
A	Control	0.20
	Drought	0.18
B	Control	0.21
	Drought	0.08

Which variety will have a higher level of hormone X produced? Explain your answer. (3 marks)

A, control leaf fresh mass is 0.20g, and after drought is 0.18g. B is 0.21g decrease to 0.08g.

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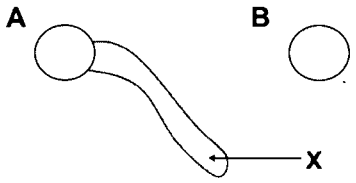
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

10. In an investigation, pollen grains collected from a single flower were cultured in an artificial medium. After 48 hours incubation, they were observed under a light microscope. Two types of pollen grains with different appearances were observed, as shown in the diagram below:



(a) The number of each type of pollen grains is approximately the same. It is known that the formation of structure X is controlled by a single gene. Deduce the genotype of the parent plant producing these two types of pollen grains. (4 marks)

(b) If these two types of pollen grains land on a stigma of the flower of the same species, which type of pollen grains will lead to formation of seed? Explain your answer. (3 marks)

smooth and light.

(c) 100 seeds were collected from the parent plant in (a) after self-pollination. According to your answer in (b), complete the following table to show the proportion of genotypes in these seeds. (1 mark)

Genotype	Homozygous dominant	Heterozygous	Homozygous recessive
Proportion (%)	25	50	25

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Go on to the next page

You are required to present your answer to the following question in essay form. Criteria for marking will include relevant content, logical presentation and clarity of expression.

11. Carbon footprint is an estimation of the total amount of greenhouse gases (including carbon dioxide and methane) generated by our actions, e.g. our choice of food. For instance, skipping meat one day per week will help to reduce the carbon footprint.

Discuss why the practice of eating a vegetarian diet rather than a mixed diet can reduce your personal carbon footprint by referring to the biological aspects of the practice. Briefly discuss ***two*** other personal actions that you can do to reduce your carbon footprint from other perspectives. (11 marks)

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Answers written in the margins will not be marked.

END OF PAPER

Sources of materials used in this paper will be acknowledged in the *HKDSE Question Papers* booklet published by the Hong Kong Examinations and Assessment Authority at a later stage.

Answers written in the margins will not be marked.

2024 DSE (C)

香 港 考 試 及 評 核 局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

香 港 中 學 文 憑 考 試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

答 題 簿
ANSWER BOOK

考生須知

(一) 宣布開考後，考生須首先在第 1 頁之適當位置填寫考生編號，並在第 1、3 及 5 頁之適當位置貼上電腦條碼。
(二) 每題(非指分題)必須另起新頁作答，並須在每一頁的相應試題編號方格填畫「X」號，以表示選答的題號(見下例)，並在第一頁之適當位置填寫作答的試題編號。
(三) 紙張兩面均應使用，並應每行書寫。不可在各頁邊界以外位置書寫。寫於邊界以外的答案，將不予評閱。
(四) 如有需要，可要求派發方格紙及補充答題紙。每一紙張均須填寫考生編號、填畫試題編號方格、貼上電腦條碼，並用繩縛於**簿內**。
(五) 試場主任宣布停筆後，考生不會獲得額外時間貼上電腦條碼及填畫試題編號方格。

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3 and 5.
(2) Start each question (not part of a question) on a new page. Put 'X' in the corresponding question number box on each page to indicate the appropriate question number (see the example below), and write the question number(s) of the question(s) attempted in the space provided on Page 1.
(3) Write on both sides using each line. Do not write in the margins. Answers written in the margins will not be marked.
(4) Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.
(5) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

例 **Example:**

試題編號 Question No. = 3

試題編號 Question No.												
1	2	3	4	5	6	7	8	9	10	11	12	
☐	☐	X	☐	☐	☐	☐	☐	☐	☐	☐	☐	
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13	14	15	16	17	18	19	20	21	22	23	24	≥25

由考生填寫 To be filled in by the candidate	
試題編號 Question No.	1
	4

試題編號 Question No.

1	2	3	4	5	6	7	8	9	10	11	12
X											

13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

1(a)i) In Graph II, Level of LH keep low from 0 to 80 days not enough LH stimulate ovary.

In Graph I, Level of FSH does not increase a lot or decrease a lot. FSH help to stimulate follicle.

ii) oestrogen, it can inhibit LH.

iii)

iv) In Graph III, Level of oestrogen when take the pill daily is lower than during normal cycles. oestrogen can break down the uterine lining.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。
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試題編號 Question No.

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X											

13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

(b) i) sum three groups of accumulated volume in 0, 20, 40, 60, 80, 100, 120, 140, 160, 180

ii) Accumulated volume of fluid of drinking sports drink with salt is faster and higher increase than drinking water only.
sports drink with salt in body has higher concentration, water will be absorb by diffition.
Osmoreceptor detect water protential in blood in high than nomal. release lower ADH, release a large amount of urine.

iii) because marathon runners need to run for a long time. He will keep lost water by sweeting. so retain more water is advantageous to marathon runners.

iv)

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Answers written in the margins will not be marked.

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試題編號 Question No.

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13	14	15	16	17	18	19	20	21	22	23	24	≥25

每題另起新頁作答。
Start each question on a new page.

(iv) man will use glucose for energy use.
drink with glycerol help absorb glucose.

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Answers written in the margins will not be marked.

寫於邊界以外的答案，將不予評閱。
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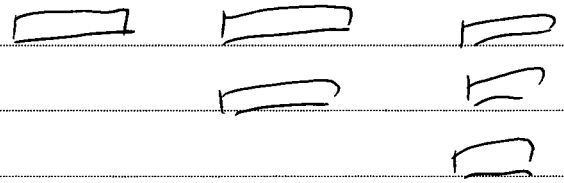
4 b ii) P

iii)



iv) cathode, because it is negative.

4 a iii) GMA, content of PUFAs is the highest.

iii) there was a wild relative of such GM crop near the propose area.

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Level 1 Exemplar 2

2024-DSE
BIO
PAPER 1B

B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2024

BIOLOGY PAPER 1

SECTION B: Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer **ALL** questions.

(4) Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) Supplementary answer sheets will be supplied on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this Question-Answer Book.

(6) Present your answers in paragraphs wherever appropriate.

(7) The diagrams in this section are **NOT** necessarily drawn to scale.

(8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* A 1 3 0 E 0 1 B *

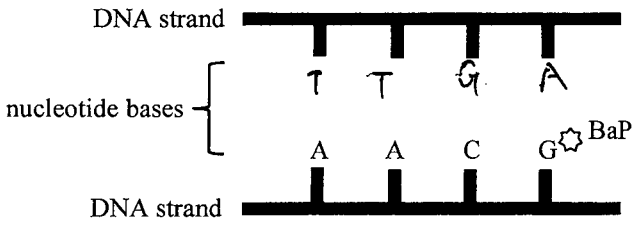
SECTION B

Answer **ALL** questions. Write your answers in the spaces provided.

1. Fill in the table below to compare the characteristics of nervous and hormonal controls. (3 marks)

		Nervous control	*Hormonal control*
(a)	Signalling molecule		
(b)	Transmission pathway	sensory neurone, motor neurone	sensory neurone, interneurone, motor neurone
(c)	Comparison of the time taken to induce responses	nervous control takes less time than hormonal control to induce responses	

2. BaP is a carcinogenic chemical which is commonly found in grilled meats. It can attach randomly to the nucleotides of DNA molecules. When it is attached to guanine (G), this G will be misread as thymine (T). The diagram below shows part of nucleotide sequence of one strand of a DNA molecule with BaP attached to a G:



(a) On the above diagram, write down the nucleotide sequence found in the opposite strand of the DNA when misreading happens. (1 mark)

(b) Suggest ***one*** reason why this type of mutation may ***not*** affect the functioning of the protein formed. (1 mark)

there is only one base is changed.

(c) If this type of mutation accumulates over time in the DNA molecules, there is a chance that it will affect the functioning of the protein formed and subsequently lead to tumour formation. Suggest which cellular process this protein controls. (1 mark)

translation

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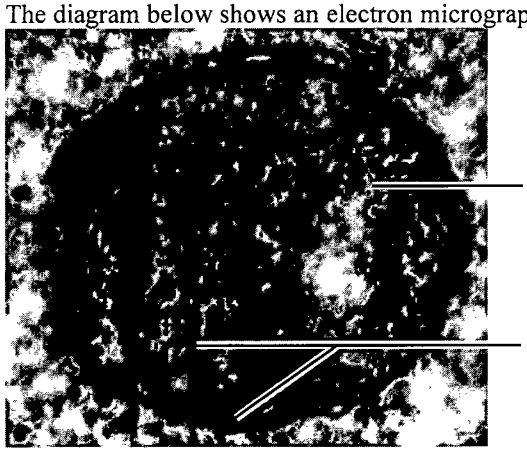
3. The diagram below shows an electron micrograph of a mitochondrion:



(a) Label X in the above diagram. (1 mark)

(b) Describe ***one*** observable feature of Y and explain how this feature is related to the functioning of mitochondria. (2 marks)

it is one cell think that enables the synthesis of protein.

(c) Chemical Z can inhibit an enzyme found in X.

(i) Which key process of respiration would be inhibited? (1 mark)

Krebs Cycle

(ii) If chemical Z is added to a plant cell culture, how would this affect the respiratory pathway? (3 marks)

enzyme act as a catalyst to a process. If the enzyme is inhibited, the Krebs cycle can not produce NADH, FADH, ATP, carbon dioxide in a fast pace. This may affect the process of oxidative phosphorylation.

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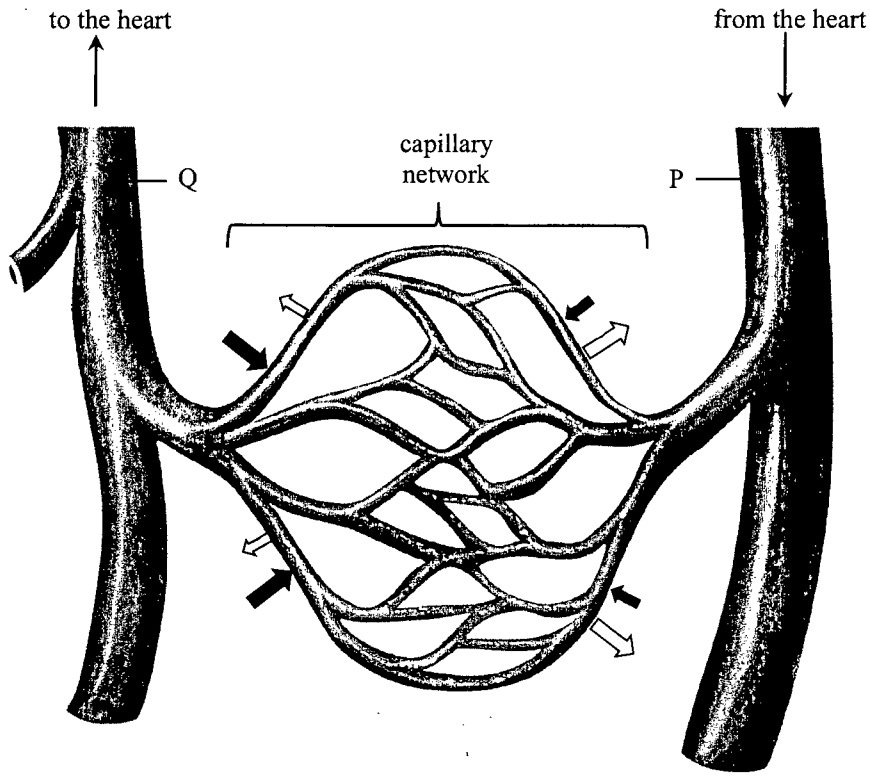
4. The schematic diagram below shows the arrangements of some blood vessels:



(a) The two types of arrows (black and white) represent two factors which govern the movement of fluid into or out of the capillary network. Identify these two factors. (2 marks)

➡ : tissue fluid

⇨ : blood

(b) The sizes of the arrows in the above diagram represent the magnitudes of the factors. Explain the change in the factors denoted by ⇨ as the blood flows from P to Q. (3 marks)

This process is worked by pressure. There is a higher pressure in the capillaries than the tissue fluid, more blood will diffuse out. The end of the capillary network, there is a higher pressure in tissue fluid than that in blood, more tissue fluid will diffuse into the capillaries.

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(c) The capillary network is the location where exchange of materials occurs between the blood and tissue fluid. When the blood flows through the capillary network of a particular organ, some substances will be taken up into the blood.

Complete the table below to show the organ where the capillary network is found. Provide your explanation. (3 marks)

	Organ	*Substance taken up into the blood*	*Explanation*
(i)	pancreas	insulin	Insulin is secreted from the organ in response to the change of the blood glucose level.
(ii)	kidney	urea	kidney secreted urea to balance the urea level.

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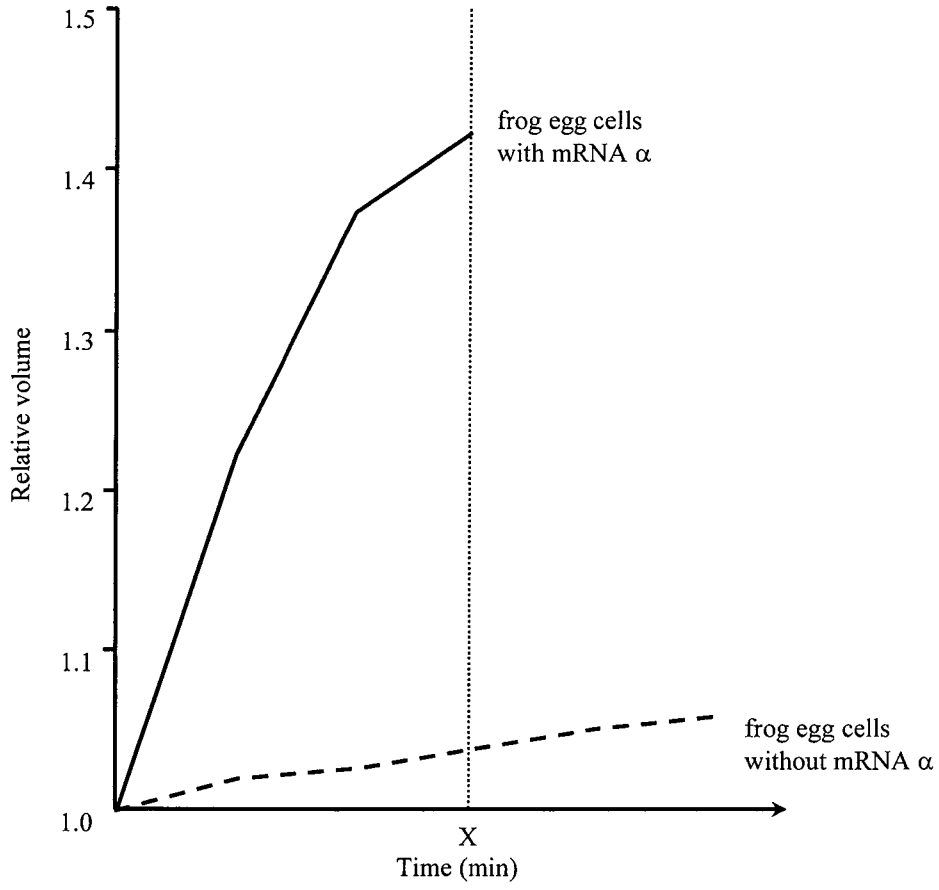
5. In an experiment, mRNA α was isolated from a mammalian cell and then injected into a frog egg cell. The expression of mRNA α eventually led to the presence of protein α on the cell membrane of the frog egg.

(a) Describe how the injected mRNA α led to the presence of protein α on the cell membrane of the frog egg. (3 marks)

the mRNA α binds to the ribosome, specific amino acid is carried by the tRNA, the anticodon then binds to the codon on mRNA, then protein α is formed.

(b) In another experiment, frog egg cells received an injection of a fixed amount of water with or without mRNA α. After that, these two types of frog egg cells were transferred to pure water. The changes in the relative volumes ($\frac{\text{new volume}}{\text{original volume}}$) of these two types of frog egg cells are shown in the graph below:



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(i) Explain why there was an increase in the relative volume of the frog egg cells without mRNA α after they were transferred to pure water. (2 marks)

the water that injected to the frog egg cells has a larger volume than the water in the frog egg cells, so the relative volume increases.

(ii) Based on the difference shown in the results of the two types of frog egg cells, deduce the function of protein α on the cell membrane. (3 marks)

the frog egg cells that injected water with mRNA α has a higher relative volume than those don't. frog egg cells that injected mRNA α have a higher water potential than the cell outside, the cell membrane can control more materials into or out of the cell.

(iii) Suggest why no data were obtained from frog egg cells with mRNA α after X minutes. (1 mark)

the frog egg cells burst.

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6. Shirley came across an article about some beans containing an amylase inhibitor as a defence against insects. She wondered if the amylase inhibitor would also work in the human body and if it did, whether it could be used as a food supplement for weight management. She discussed the idea with her classmate Johnson. They had different ideas:

Shirley: I think we should test if the bean extract can inhibit pancreatic amylase.

Johnson: Perhaps we can use salivary amylase instead of pancreatic amylase.

(a) With reference to the process of digestion, which amylase would produce more valid results for developing a food supplement that targets weight management? Explain your answer. (3 marks)

Salivary amylase would produce more valid results. Since most of the starch is broken down in the saliva with salivary amylase.

(b) The table below shows the reaction mixtures prepared for the investigation:

Solution	*Volume of solution used in each set-up (mL)*	
	Set-up I	*Set-up II*
1% starch solution	15	15
Amylase solution	5	5
Bean extract	0	5
Buffer solution (to maintain the pH)	5	5
Water	5	0

(i) Explain the purpose of adding water to set-up I. (2 marks)

there is no bean extract in set-up I, and no water in setup II. we can observe the difference between these two set-up.

(ii) Suggest ***one*** method to determine the rate of starch digestion and state clearly the measurement taken to show the rate of starch digestion. (2 marks)

add the starch solution and amylase solution into the test tube, use the iodine to test if there is any starch left. Use a timer to count the rate of starch digestion.

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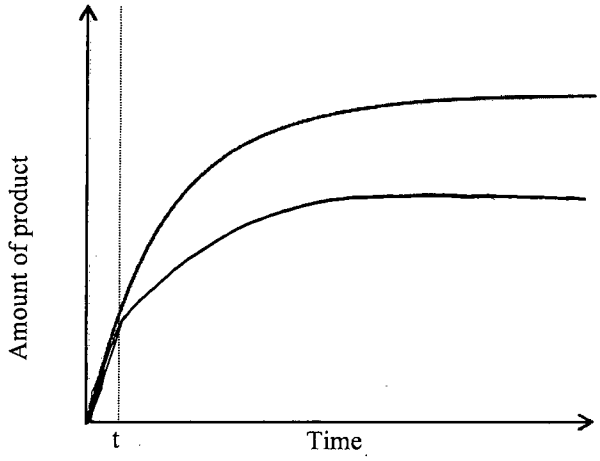
(c) The graph below shows the amount of product formed over time when amylase is working normally:



The experiment was repeated with the addition of bean extract at time t. If the bean extract can inhibit the amylase being studied, what will be the change in the amount of product formed? On the above graph, sketch a line to show the results. (1 mark)

(d) Shirley and Johnson shared their ideas with their professor. Their professor suggested that they should conduct an *in vivo* experiment using mice with the control group fed with starchy food and the experimental group fed with a mixture of starchy food and bean extract.

(i) Explain why the result of an *in vivo* experiment is more valid than that of *in vitro* experiment in this case. (1 mark)

more fair

(ii) Apart from monitoring the change in body weight of the mice, their professor suggested that they should take blood samples from the mice after the meals for analysis. Which component of the blood should they monitor? What would be the expected results of the control group and the experimental group if their ideas actually worked? (2 marks)

insulin, The mice that fed with starchy food can stay alive, but the mice Fed with starchy food and bean extract may died because the starch is not absorbed.

(e) Suggest how the amylase inhibitor helps the bean defend against insects. (1 mark)

the starch can't be broken down, the insects can't absorb it.

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7. The following photograph was generated by an artificial intelligence programme using the following sentence:

'A photograph capturing Hong Kong students on a field trip to a rocky shore, studying the distribution and abundance of organisms along the shore.'

(a) The photograph does not truly reflect the requirement in the sentence because two pieces of essential equipment are missing.

(i) List the ***two*** pieces of essential equipment for the study. (1 mark)

rulers / pen

(ii) How could you use the equipment listed in (i) to collect the data needed for the study? (2 marks)

use the rulers to estimate the distance between the area that contains organisms. Use the pen to note that how many organisms are in the area.

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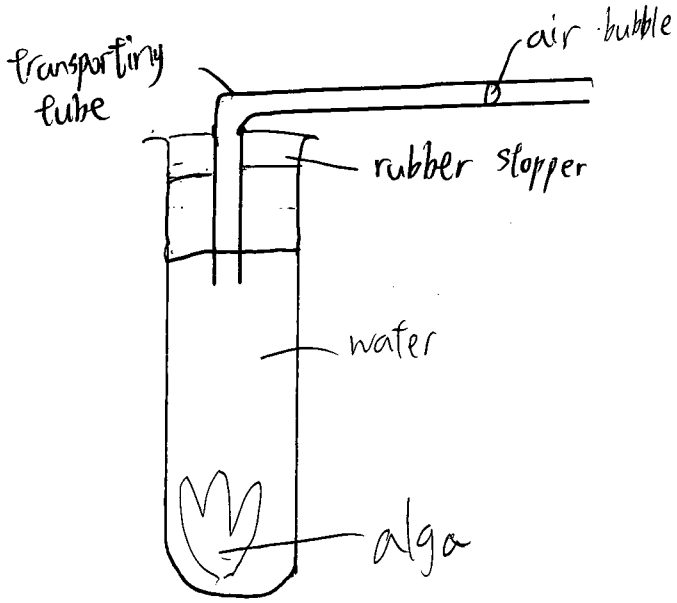
(b) In a field trip to a rocky shore, a student found a thin brown sheet lying on a rock. The student suspected that it was an alga. A small piece of the sample was taken back to school for further study.

5 cm

Using apparatus and reagents available in a school laboratory, design a set-up which can be used to show whether the sample of this thin sheet can undergo respiration. In the space below, draw a simple labelled diagram of this set-up. (3 marks)

Title: A set-up for demonstrating if respiration occurs in the sample



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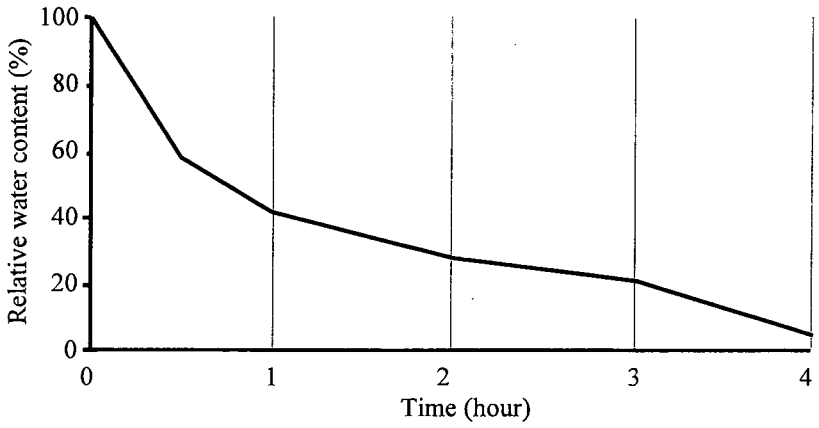
(c) Under normal circumstances, the level of free radicals in algal tissues is kept at a certain level as a result of homeostasis. In response to dehydration, algal tissues will be stimulated to produce free radicals which can cause damage to the cell components if there is an accumulation.

Graph I shows the change in relative water content of algal tissue samples during a period of four hours of dehydration:

Graph I



With reference to Graph I, what would be the expected change in the level of free radicals found in the algal tissue samples during the four hours of dehydration? (1 mark)

stop growing

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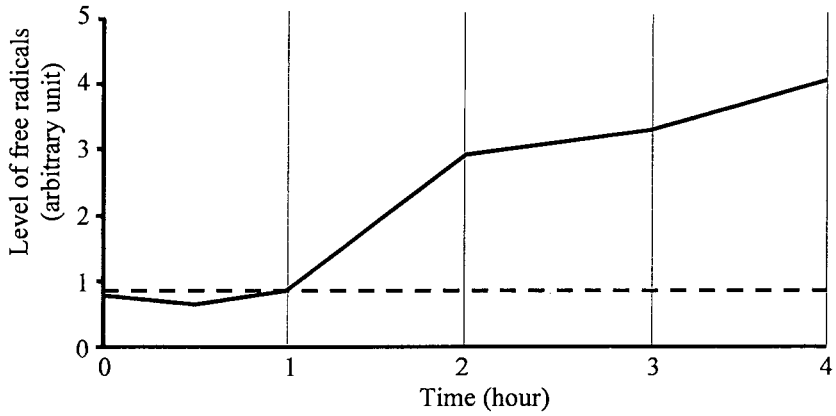
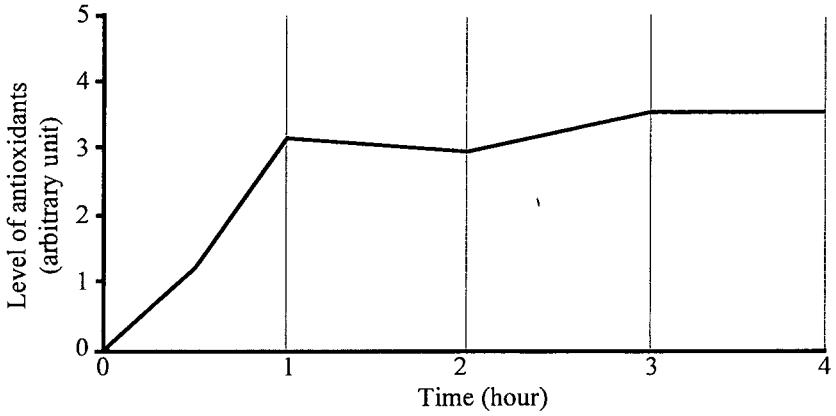
(d) Graph II and Graph III respectively show the actual change in the level of free radicals and the change in the level of antioxidants found in the algal tissue samples of the alga during the same period of dehydration:

Graph II



Graph III



Based on your answer in (c) and the data shown in Graph II and Graph III, suggest the role of antioxidants in helping the algae to cope with the dehydration. Give ***two*** pieces of evidence from the data shown. (3 marks)

the antioxidants act as a catalyst to increase the level of free radicals. After the level of antioxidants increasing in the first hour, the level of free radicals start to increase between the first and second hour. The level of free radicals is significantly higher than the average level of free radicals.

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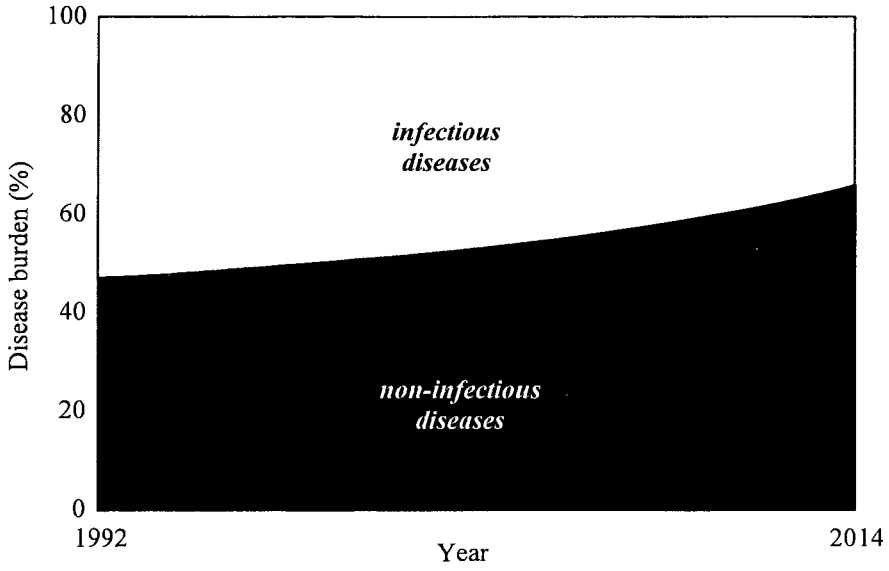
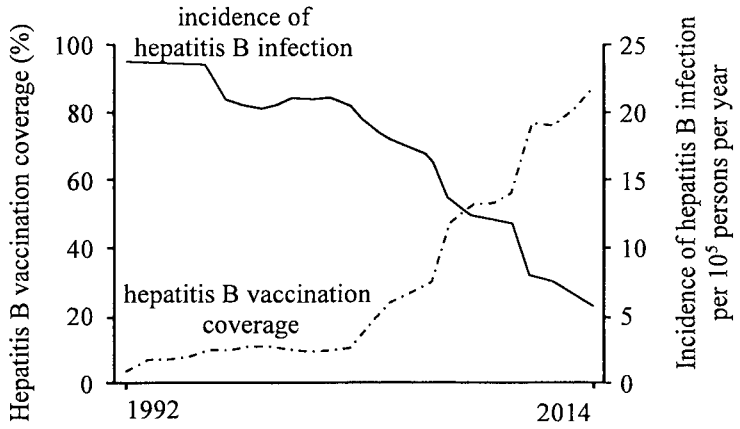
8. Disease burden is a measure of population health that aims to quantify the potential loss of lifespan and health outcomes due to illness as compared to the ideal of living to a ripe old age and in good health. The graph below shows the percentage share of disease burden caused by infectious diseases and non-infectious diseases in Country X from 1992 to 2014:



(a) Describe the change in the percentage shares of the disease burden of Country X from 1992 to 2014.
(1 mark)

the disease burden percentage of non-infectious diseases is keep increasing, while the infectious diseases is keep decreasing.

(b) The graph below shows the impact of hepatitis B vaccination on the incidence of hepatitis B infection in Country X from 1992 to 2014:



With reference to the principle of vaccination, explain the relationship shown in the above graph.
(4 marks)

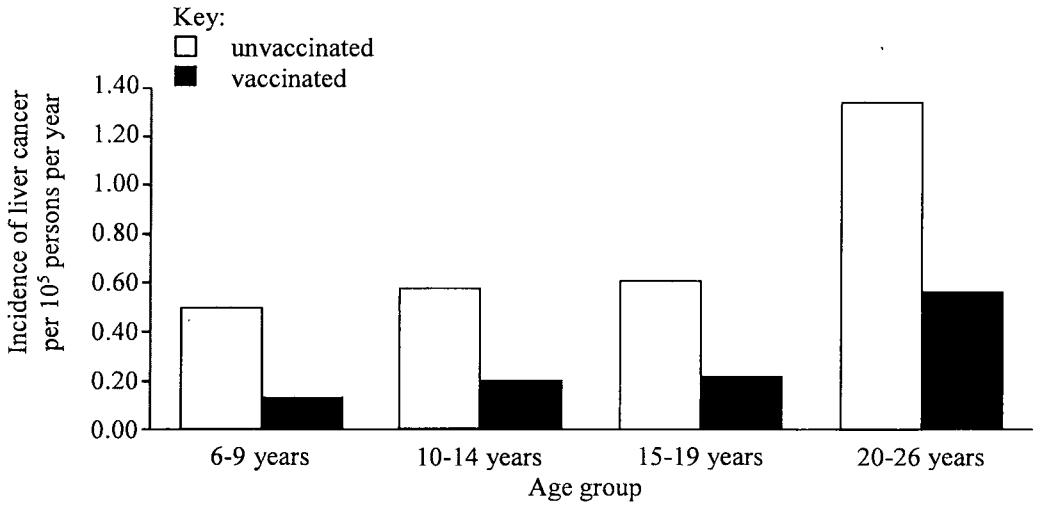
In 1992, hepatitis B vaccination coverage is lower than 20%, the incidence of hepatitis B infection is 25×10^5 people per year. As the hepatitis B vaccination starting to increase,

the incidence of hepatitis B is decreasing, the higher hepatitis B vaccination coverage the lower incidence of hepatitis B. In 2014, the hepatitis B vaccination coverage had increased above 80%, the incidence of hepatitis B infection was only $5/10^5$ people per year.

(c) With reference to the information from (a) and (b), suggest the role of vaccination in the change of disease burden in Country X. (1 mark)

Inhibitor

(d) The graph below shows the incidence of liver cancer among different age groups who have or have not been vaccinated against hepatitis B in Country X:



What can you conclude about the relationship between hepatitis B and liver cancer? Support your answer with evidence from the graph. (2 marks)

the people who have hepatitis B may also have liver cancer. there are people have liver cancer who were unvaccinated of hepatitis B.

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9. Hormone X is a plant hormone which is produced in leaves of plant P when water supply is inadequate. A student detached some leaves from plant P and placed them in either water or a 10 μM solution of hormone X. After two hours, the student examined the lower epidermis of the leaves under a light microscope. The photomicrographs below show the images obtained:

Water

10 μM hormone X

(a) Based on the above information, explain the importance of hormone X to the drought tolerance in plant P. (2 marks)

it enables a faster photosynthesis rate.

(b) In nature, there are varieties of plant P which produce different amounts of plant hormone X in response to drought stress. The student measured the fresh leaf masses of two different varieties (A and B) of plant P after drought treatment for two weeks. The results are shown in the table below:

Plant variety	*Treatment*	*Leaf fresh mass (g)*
A	Control	0.20
	Drought	0.18
B	Control	0.21
	Drought	0.08

Which variety will have a higher level of hormone X produced? Explain your answer. (3 marks)

A. the leaf fresh mass is longer in the drought stress.

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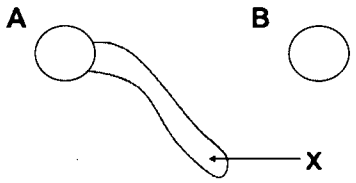
10. In an investigation, pollen grains collected from a single flower were cultured in an artificial medium. After 48 hours incubation, they were observed under a light microscope. Two types of pollen grains with different appearances were observed, as shown in the diagram below:



(a) The number of each type of pollen grains is approximately the same. It is known that the formation of structure X is controlled by a single gene. Deduce the genotype of the parent plant producing these two types of pollen grains. (4 marks)

(b) If these two types of pollen grains land on a stigma of the flower of the same species, which type of pollen grains will lead to formation of seed? Explain your answer. (3 marks)

(c) 100 seeds were collected from the parent plant in (a) after self-pollination. According to your answer in (b), complete the following table to show the proportion of genotypes in these seeds. (1 mark)

Genotype	Homozygous dominant	Heterozygous	Homozygous recessive
Proportion (%)	25%	50%	25%

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Go on to the next page

You are required to present your answer to the following question in essay form. Criteria for marking will include relevant content, logical presentation and clarity of expression.

11. Carbon footprint is an estimation of the total amount of greenhouse gases (including carbon dioxide and methane) generated by our actions, e.g. our choice of food. For instance, skipping meat one day per week will help to reduce the carbon footprint.

Discuss why the practice of eating a vegetarian diet rather than a mixed diet can reduce your personal carbon footprint by referring to the biological aspects of the practice. Briefly discuss ***two*** other personal actions that you can do to reduce your carbon footprint from other perspectives. (11 marks)

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END OF PAPER

Sources of materials used in this paper will be acknowledged in the *HKDSE Question Papers* booklet published by the Hong Kong Examinations and Assessment Authority at a later stage.

Answers written in the margins will not be marked.

2024 DSE (C)

香 港 考 試 及 評 核 局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

香 港 中 學 文 憑 考 試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

答 題 簿
ANSWER BOOK

考生須知

(一) 宣布開考後，考生須首先在第 1 頁之適當位置填寫考生編號，並在第 1、3 及 5 頁之適當位置貼上電腦條碼。

(二) 每題(非指分題)必須另起新頁作答，並須在每一頁的相應試題編號方格填畫「X」號，以表示選答的題號(見下例)，並在第一頁之適當位置填寫作答的試題編號。

(三) 紙張兩面均應使用，並應每行書寫。不可在各頁邊界以外位置書寫。寫於邊界以外的答案，將不予評閱。

(四) 如有需要，可要求派發方格紙及補充答題紙。每一紙張均須填寫考生編號、填畫試題編號方格、貼上電腦條碼，並用繩縛於**簿內**。

(五) 試場主任宣布停筆後，考生不會獲得額外時間貼上電腦條碼及填畫試題編號方格。

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3 and 5.

(2) Start each question (not part of a question) on a new page. Put 'X' in the corresponding question number box on each page to indicate the appropriate question number (see the example below), and write the question number(s) of the question(s) attempted in the space provided on Page 1.

(3) Write on both sides using each line. Do not write in the margins. Answers written in the margins will not be marked.

(4) Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.

(5) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

例 **Example:**

試題編號 Question No. = 3

試題編號 Question No.

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由考生填寫 To be filled in by the candidate	
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試題編號 Question No.

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每題另起新頁作答。
Start each question on a new page.

寫於邊界以外的答案，將不予評閱。
Answers written in the margins will not be marked.

a i) the contraceptive pill will inhibit the FSH hormone level, it is lower than the hormone level during normal cycles. It will also inhibit the level of LH, the LH level is lower than the hormone level during normal cycles when she taking pill daily.

a ii)

a iii) the oestrogen level is low

a iv) when the oestrogen level is low, less blood is produced, the uterine lining becomes thinner.

b i) the volume of drinking every time x the times of drinking = accumulated volume

ii)

iii) retaining more water can let body to be sweaty, the sweat can remove heat, more retaining water can remove more heat. Marathon runners won't lose consious.

iv) let the participants to run

v) more sugar is absorbed

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ai) hunting

~~(a)~~

ii) (1) habitat management can increase the average number of birds and number of different bird species.

(2) more bird species can increase genetic information

bi) it is more easier to monitor the immovable organisms. Scientists can regconize which region they lived and more convenient to do research.

ii) species C. since it is seperated in different habitat. Species C has a higher possibility to reach the pollution.

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b(iii) R. Species R contains some 10-99 μm MPs in the guts which is very small and hard to remove.

(iv) No. the larvae that fed with plastic has a decreasing survival rate.

(v) feed the larvae that is already an adult, observe the result that if they can survive after feeding with plastic.

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