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Level 2 Exemplar 1

2024-DSE
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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 *

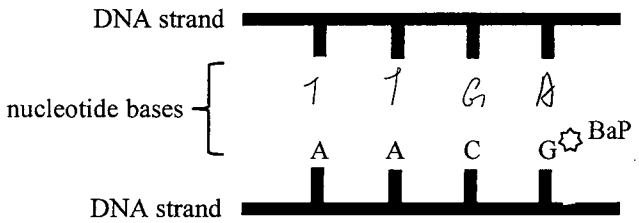
SECTION B

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	neurotrasmitter.	hormone
(b)	Transmission pathway	Through nerve system from receptor to effector	Through blood
(c)	Comparison of the time taken to induce responses	Nervous control faster than hormonal control	

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)

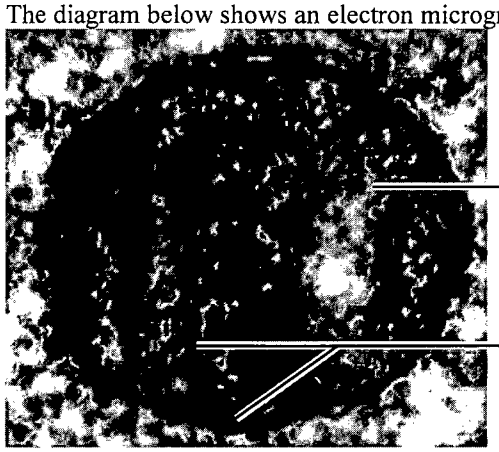
The sequence of protein are the same, as the mutation not affect the condon, as a result, protein can formed.

(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)

Nuclears

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)

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

Y is for protein synthesis, which provide enzyme for the anabolism of mitochondria. Thus, mitochondria can provide energy to the cells.

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

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

Kerb cycle

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

The glycolysis can't process to Kerb cycle, as it is need enzyme to start kerb cycle. Therefore, only glycolysis can process, the pyruphate will accumulated.

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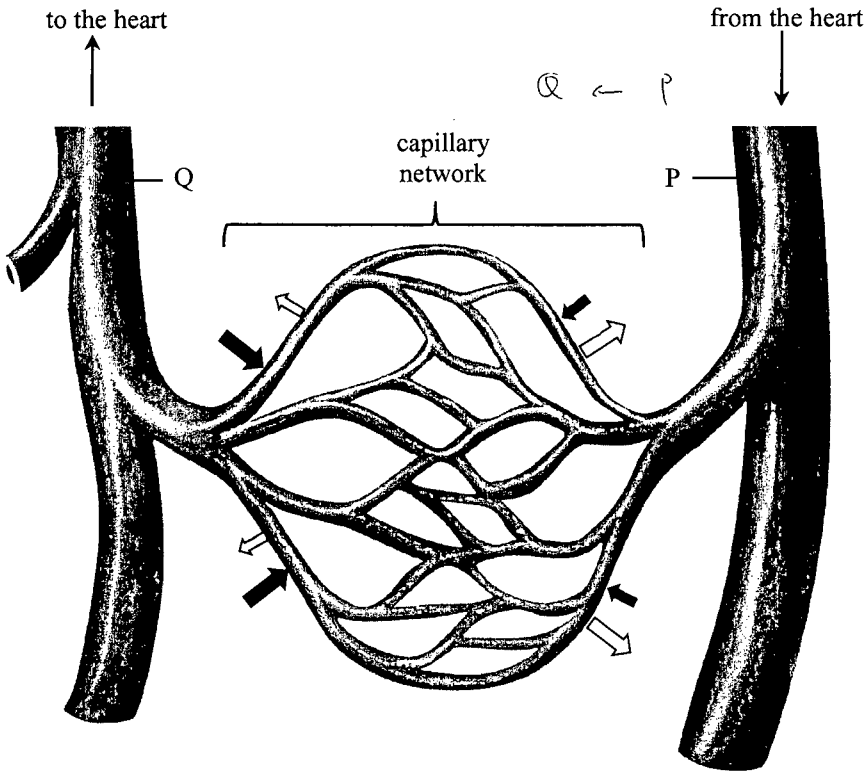
4. The schematic diagram below shows the arrangements of some blood vessels:



(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)

➡ : The oxygen content of blood.

⇨ : The deoxygenate content of 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)

When the blood pump out to the body, the deoxygenate blood content have to diffuse along the capillary network to the tissue fluid. And process gas exchanged to gain more oxygen content back to the blood stream to the heart. flow

Answers written in the margins will not be marked.

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)	kidney.	urea	urea can be found in kidney for regulate the water potential of body.

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Answers written in the margins will not be marked.

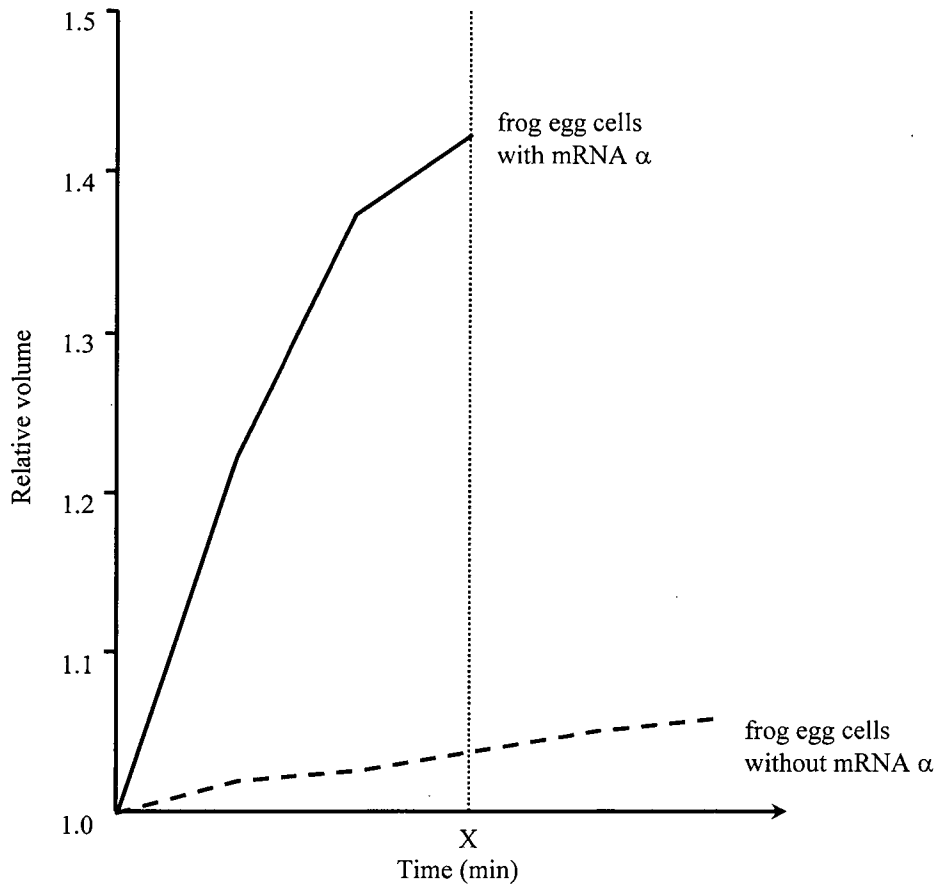
Go on to the next page

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)

While mRNA injected to a frog egg cell, it process transcription in nuclears and then translation in cytoplasm. After that, the somatic cell process mitosis division to form daughter cell. As a result, protein α can be found on the cell membrane.

(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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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)

The frog egg cells will undergo mitosis and meiosis cell division. Even without mRNA, the frog egg cells number will still increase.

(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)

Protein α act as an enzyme speed up the cell membrane formation, and enlarge the size of the cell membrane.

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

There is a mutation of frog egg cells with mRNA α

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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, digestion is a process that occur in mouth instead of stomach.

(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)

Water act as an solvent, as a control 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)

Monitoring the body weight at a specific time. If the body weight is lighter, the rate of digestion is higher.

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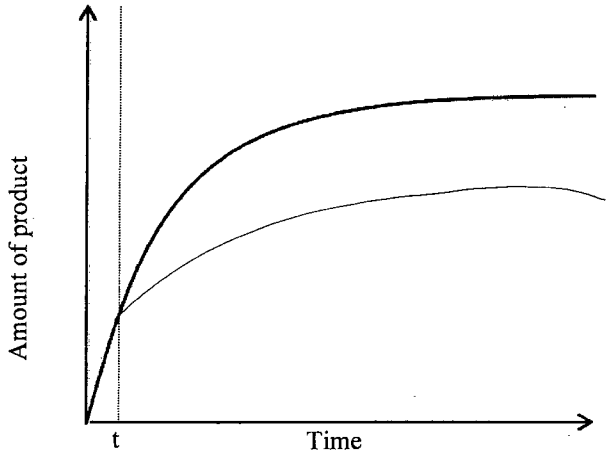
Answers written in the margins will not be marked.

(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)

Reduce the time-consuming of the experiment.

(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)

The glucose content, There will be a lower glucose blood level of the experimental group is worked.

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

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Answers written in the margins will not be marked.

Go on to the next page

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)

Temperature thermometer and the humidity detector

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

Monitoring the temperature of the niche.
and monitoring the humidity of the niche.

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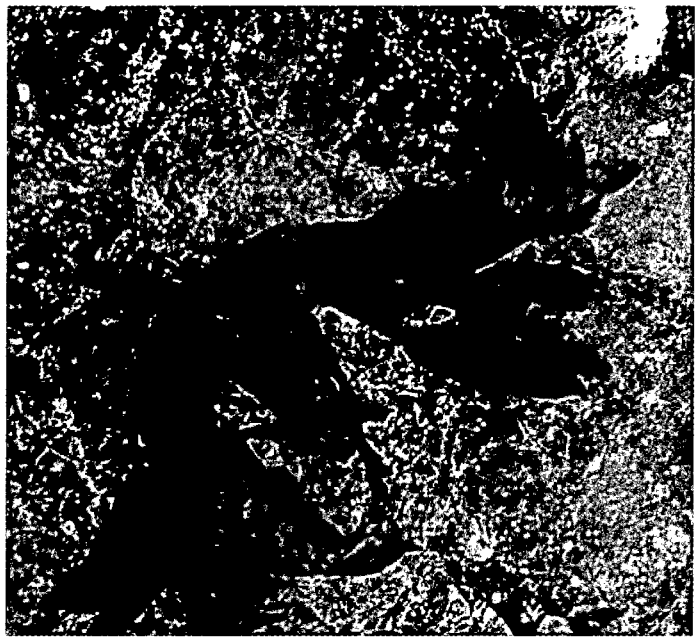
Answers written in the margins will not be marked.

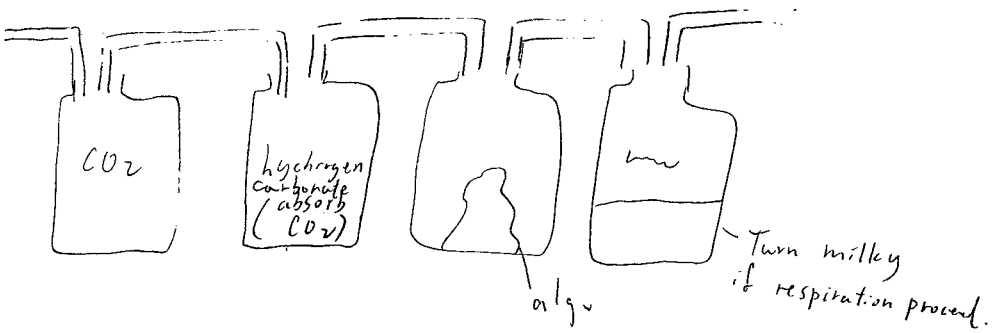
(b) In a field trip to a rocky shore, a student found a thin brown sheet lying on a rock. The student suspected that it was an alga. A small piece of the sample was taken back to school for further study.



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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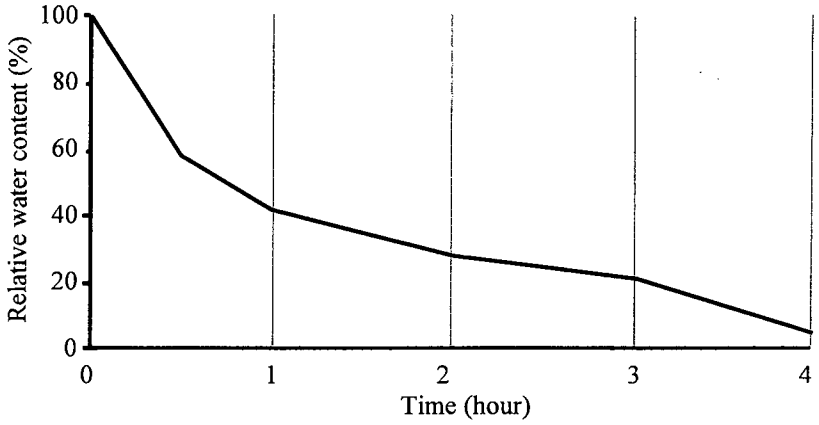
Answers written in the margins will not be marked.

(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)

CO_2 content decrease.
of the algal

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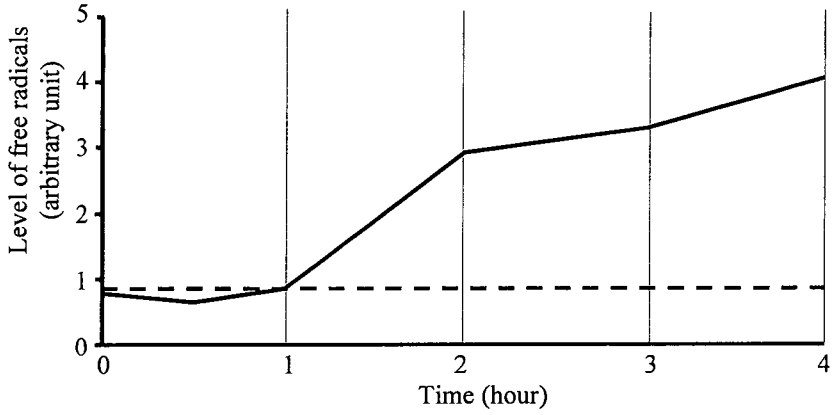
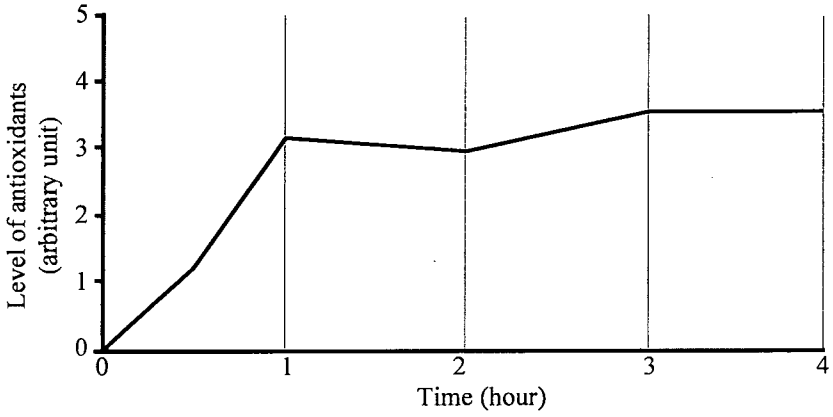
(d) Graph II and Graph III respectively show the actual change in the level of free radicals and the change in the level of antioxidants found in the algal tissue samples of the alga during the same period of dehydration:

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)

Antioxidants can stimulate alga to process photosynthesis.

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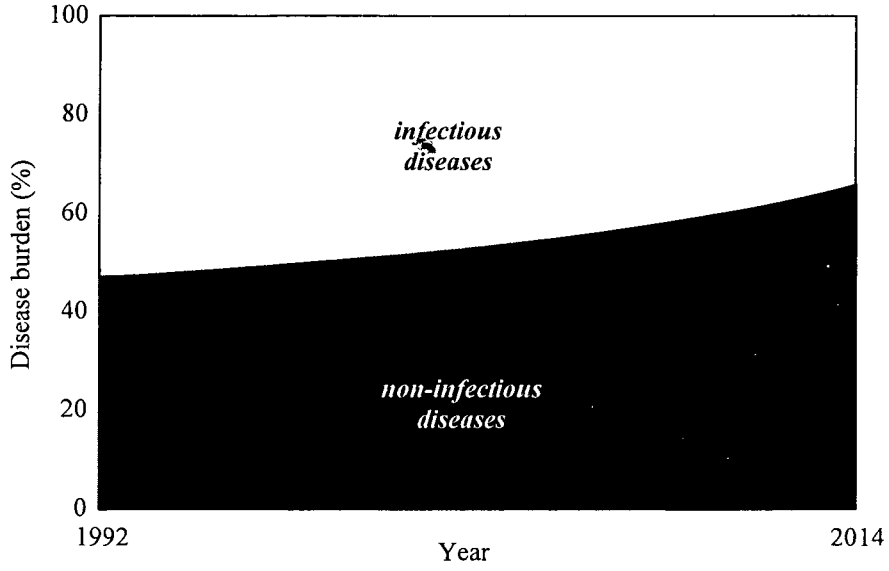
Go on to the next page

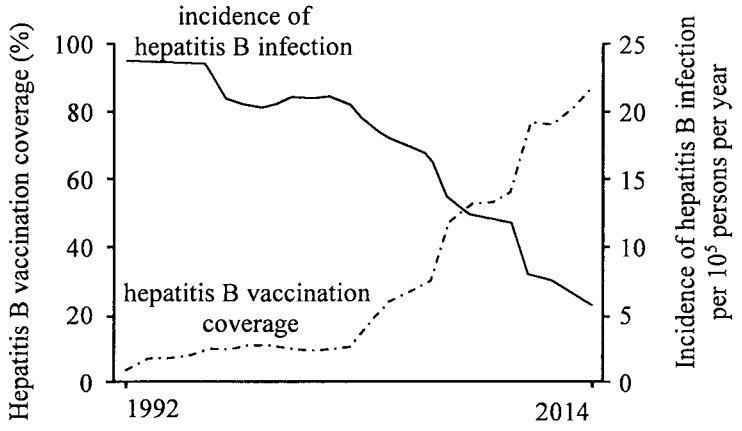
8. Disease burden is a measure of population health that aims to quantify the potential loss of lifespan and health outcomes due to illness as compared to the ideal of living to a ripe old age and in good health. The graph below shows the percentage share of disease burden caused by infectious diseases 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 infectious disease and non-infectious disease both increase from 45% to 60%

(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)

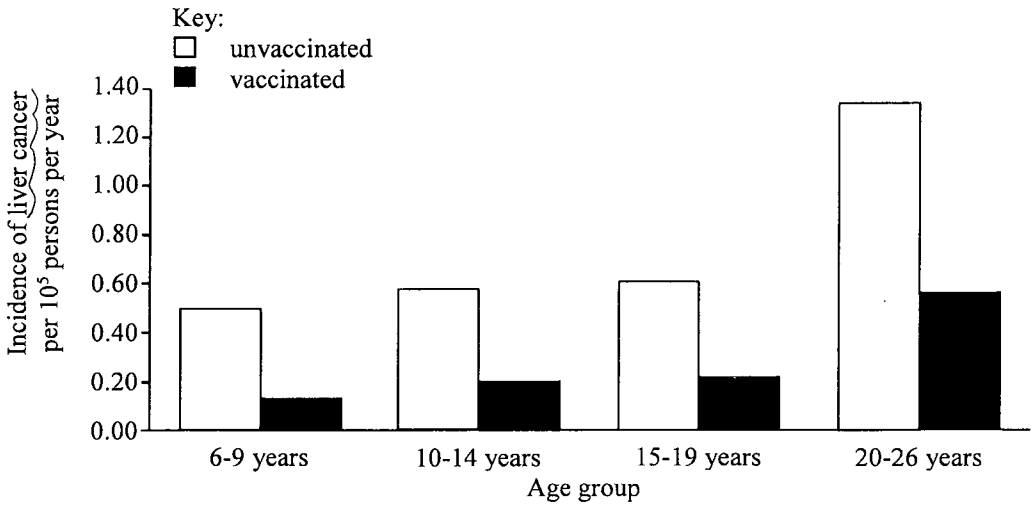
There is a negative relationship. The Hepatitis B vaccination coverage increase from 0% to 23% in 1992 to 2014. The lower infection rate of Hipatitus B, from 100% to 5% in

1992 to 2014. After vaccinated, the primary respone occur when the weak antigen is infected to our body, our white blood cell differciate to plasma cell and memory cell. When people infected, memory b cells recognise the antigen fastly and differeciate to plasma cell to produce antibody till the pathogen more faster. As a result, people can against Hepatitis B through vaccination.

(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)

Vaccination provide a prevention of disease burden in Country X

(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)

Hepatitis B is a pathogen that can mutate to liver cancer. As people who vaccinate against hepatitis B, the infection rate of liver cancer is lower.

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Answers written in the margins will not be marked.

Go on to the next page

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)

Hormone X can help plant P regulate the guard cell open or close regularly. At drought tolerance, hormone X help plant P to regulate guard cell to prevent water loss and conserve water to maintain the water potential of plant X.

(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)

Plant variety A, at drought condition, variety A has the 0.18 Leaf fresh mass while variety B only has 0.08. It dedude that variety A can conserve more water than variety B due to it's mass is more heavier. As the variety A have a higher level of hormone X to close the guard cell more frequently to conserve the water.

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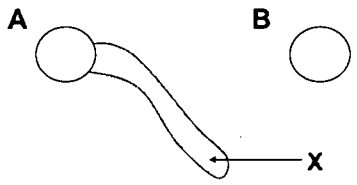
Answers written in the margins will not be marked.

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)

As type A pollen grains inherited the phenotype that the pollen grain involve a tail. Type B inherited the phenotype do not involve the tail. As least one of their parent's phenotype involve a tail. Thus, the genotype of the parent should be heterozyges.

(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)

Type A,

(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 (%)	0	50 %	50 %

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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)

For the cattle growing process, cattle feed on the grass where contain carbon dioxide. After digestion and absorption, there is a large amount of CO_2 emission to the atmosphere. When we consume the meet, it is large amount of footprint produce.

Vegetarian, who is just feed on plant. Plant do not emited large amount of CO_2 as the cattle due to the stage is diminished.

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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

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

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

試題編號 Question No.

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

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.

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

1 (a) (i) Contraceptive pill contains a synthetic hormone X, which similar work as FSH and LH. FSH is the hormone stimulate follicle to develop, while FSH is inhibit, follicle can no longer to develop as a mature follicle. LH is the hormone that stimulate ovulation, while LH is inhibited, low level of LH will stimulate Progestrogen rise to a high level. As a result, this pill prevent follicle development and prevent ovulation.

(ii) FSH, low level of the female sex hormones not enough to stimulate the follicle development, and the follicle development is unsuccess.

(iii) FSH stimulate follicle to develop, follicle secrete oestrogen to maintain the thickness of uterine lining. But follicle fail to develop so as no oestrogen have secreted. Menstration occur, so as uterine lining continously thinner.

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

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.

(iv) There is a low level of LH, LH stimulate the development of yellow body and yellow body secrete progestrogen to thicken the uterine lining. Low level of LH fail to develop a yellow body. No progestrogen to maintain the thickness of uterine lining.

(b) (i)

(ii) For the group which consumed water, after 80 minute, they only retained around 1000 volume of fluid.
For the group which drinking sports drinks with salt, they can retained around 1440 ml accumulated volume of fluid. The sport drinks contain higher salt content, during reabsorption, the granular filtrate have higher water potential, and along the concentration gradient, water is reabsorb back to the blood. As a result, the group which drinking sports drinks can conserve more water, reduce the water loss.

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

(iii) Maratho runners have to run long distance and they can't drink water anytime. The ability of stay hydrated help them to conserve water more effiiency, which is help them to adapted the marathon running.

(iv) Drinking sport drink with salt help us to retained water when stay hydrated.

(v) Glycerol can help their body process metabolism more faster, conserve glucose.

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Start each question on a new page.

4(a)(i) Plasmid, It can be use as a vector combine with the target gene to form transformed gene.

(ii)(1) GM-B, the time required to reach seed harvest stage is the shortest as only 3 month. The content of PUFAs only 3 arbitary unit per g needed, which is cost-saving. Also, the seed yield is highest that is 150.

(2)

(iii)(1) It may disturb the ecosystem, damage the balance of ecosystem. Reducing the species diversity.

(2) Plant the GM seed on the area and observe that for severe months. Count the number of surrounding plants. If the other plants number decrease, the GM seeds is unsafe as it leads to 'superbug'. If do not, the seed is safe.

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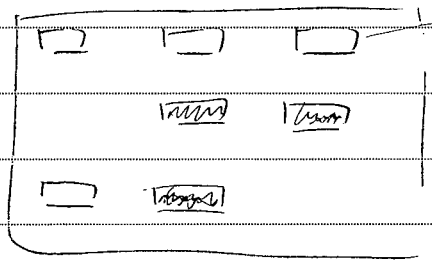
Start each question on a new page.

4(b)(i) Compare the length of the DNA fragment.

If the length is similar, the same genotype for their genes

(ii) Primer P, it is not on the position where DNA extension involved.

(iii)



(iv) cathode, because the shorter DNA fragment more faster to the negative.

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Level 2 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 *

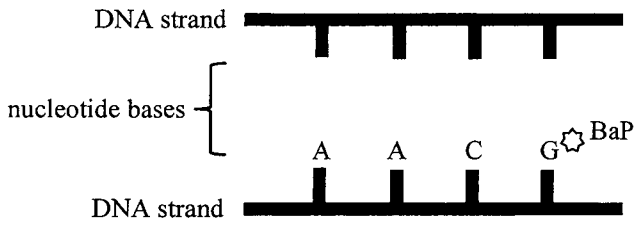
SECTION B

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	Stimulus	
(b)	Transmission pathway	Axons	
(c)	Comparison of the time taken 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)

.....

.....

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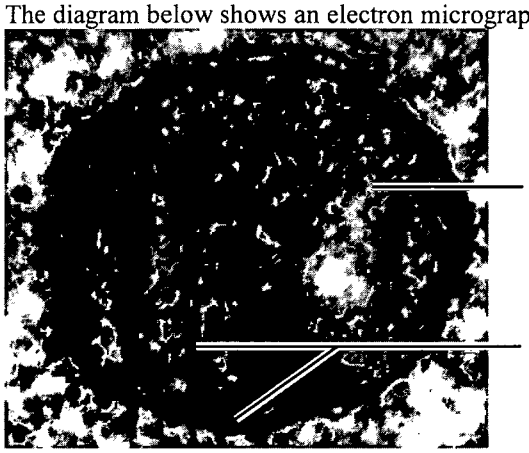
3. The diagram below shows an electron micrograph of a mitochondrion:



(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)

As it provides energy to help the functioning of mitochondria which is to provide energy.

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

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

Ventilation

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

Yes it would because the normal respiratory pathway of a plant cell is from xylem to deliver oxygen while this chemical Z is added it affects the functioning of the plants.

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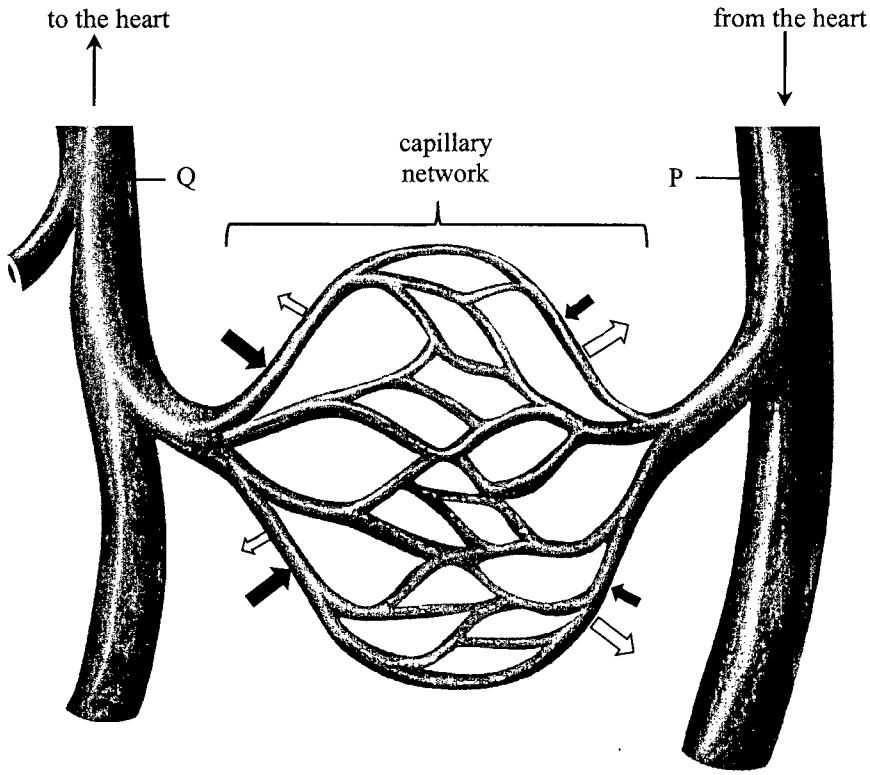
4. The schematic diagram below shows the arrangements of some blood vessels:



(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)

➡: Osmosis. As the water potential in the tissue fluid is higher than in the capillary, it goes into the capillary network through osmosis.

⟹: Hydrostatic pressure. As the blood pressure in the capillary is larger than tissue fluids, the molecules goes out.

(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)

Blood flow from P is from the aorta which has high blood pressure and more materials in it thus more materials are out due to hydrostatic pressure. After the blood has go through most of the capillary network, the materials in the capillary has become less thus the materials going out become less and the materials going into is more due to osmosis. The materials going out of the capillary in blood flow from P is more than Q.

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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)	Pancrease	insulin	Insulin is secreted from the organ in response to the change of the blood glucose level.
(ii)	Liver	urea	Urea is taken up into the blood through liver and the remaining excretes from

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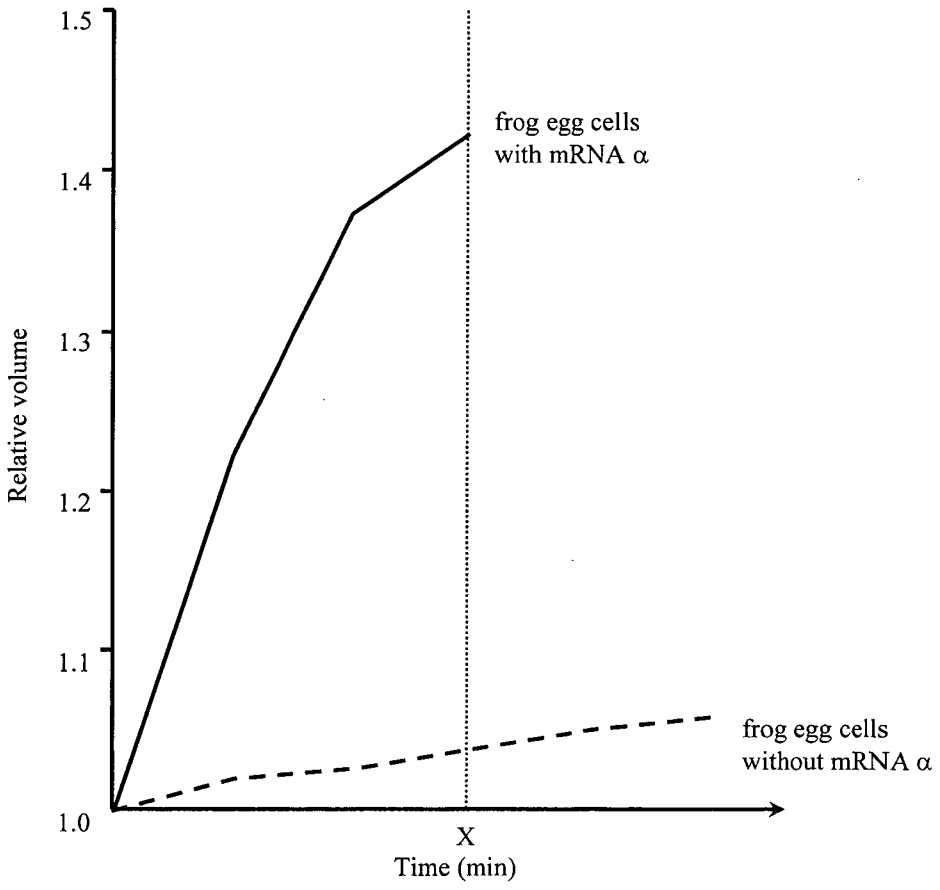
5. In an experiment, mRNA α was isolated from a mammalian cell and then injected into a frog egg cell. The expression of mRNA α eventually led to the presence of protein α on the cell membrane of the frog egg.

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

mRNA α includes hormones which is a kind of protein and through injection the protein is also injected to the cell membrane of the frog.

(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)

It will grow better in pure water

(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)

It will increase the relative volume of the frog egg, the frog egg will grow bigger with protein a on the cell membrane.

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

The frog egg has grown to the biggest size and the frog broken out of the egg.

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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 do. It is because pancreatic juice does not only include amylase but also carbohydreate, lipase, protease which might affect the accuracy of the experiment.

(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 maintain a balance between Set-up I and II. Reduce the individual variance, to make the volume of two set-up the same.

(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)

Iodine test. If it turns from brown to blue black represents it contains stach.

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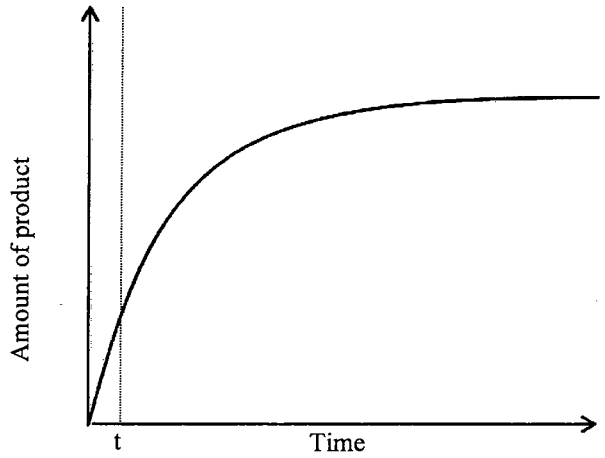
(c) The graph below shows the amount of product formed over time when amylase is working normally:



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)

It reduces random error and improves the reliability of the experiment. More similar to human's digestive system.

(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)

The blood glucose level. The mice's body weight will decrease if their ideas actually worked.

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

The insects cannot take the pH value of the amylase.

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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)

Microscope

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

To have a clearer vision of the organism.

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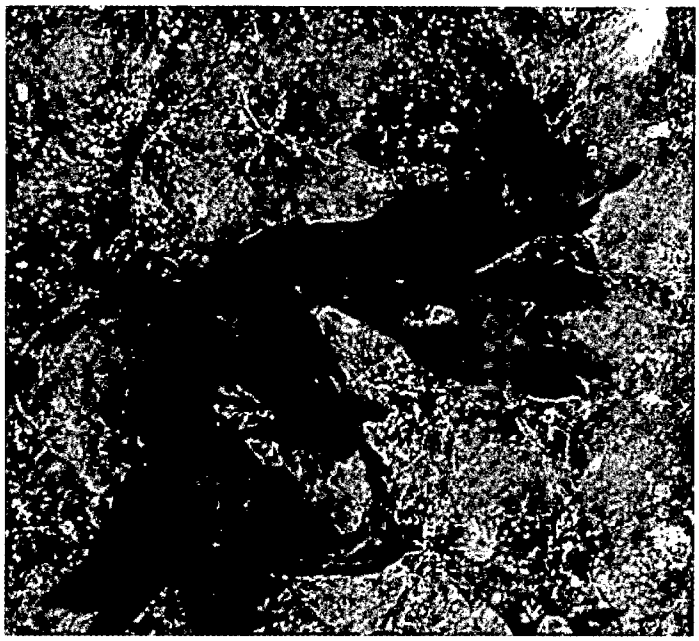
(b) In a field trip to a rocky shore, a student found a thin brown sheet lying on a rock. The student suspected that it was an alga. A small piece of the sample was taken back to school for further study.



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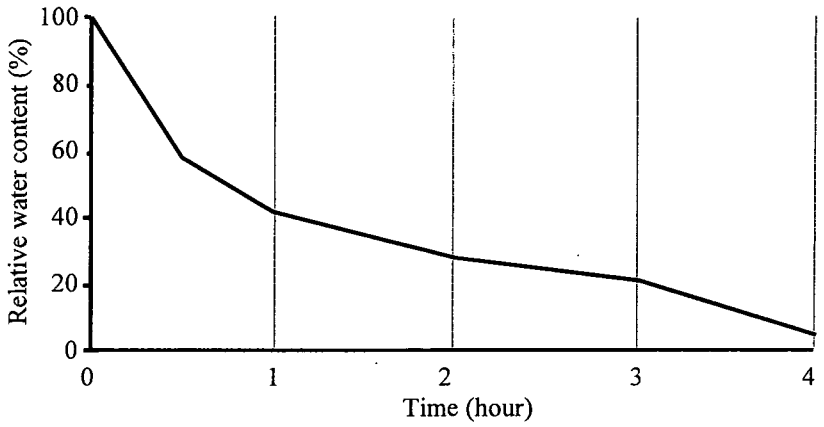
(c) Under normal circumstances, the level of free radicals in algal tissues is kept at a certain level as a result of homeostasis. In response to dehydration, algal tissues will be stimulated to produce free radicals which can cause damage to the cell components if there is an accumulation.

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)

It will decrease.

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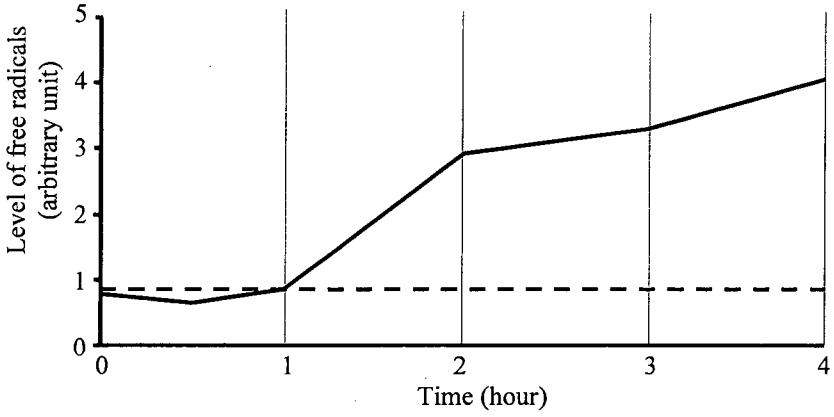
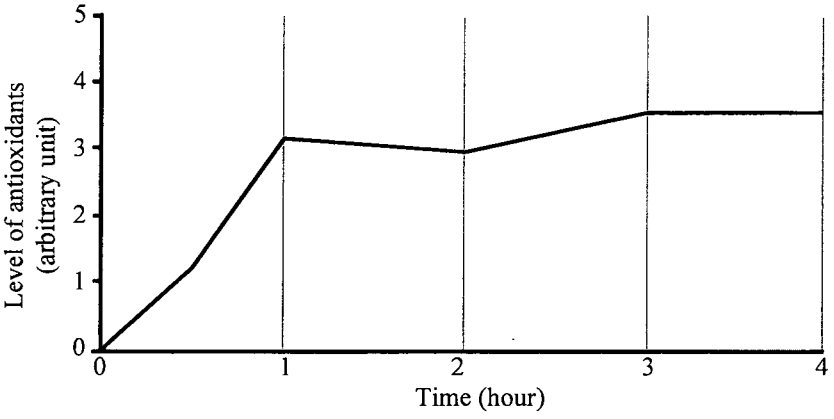
(d) Graph II and Graph III respectively show the actual change in the level of free radicals and the change in the level of antioxidants found in the algal tissue samples of the alga during the same period of dehydration:

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 level of antioxidants is high which helps the level of free radicals to increase. The level of free radicals with the help of antioxidants in much higher than the average level of free radicals found in algae under normal circumstances.

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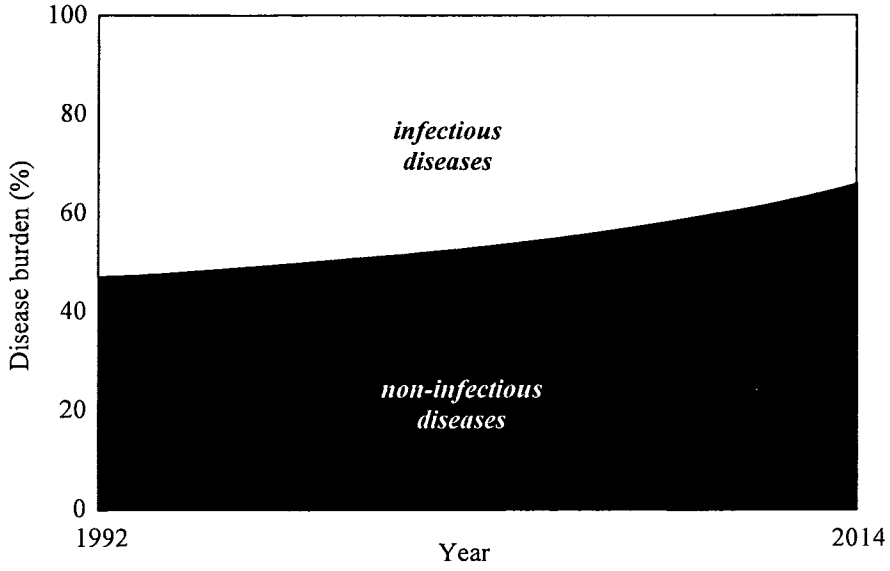
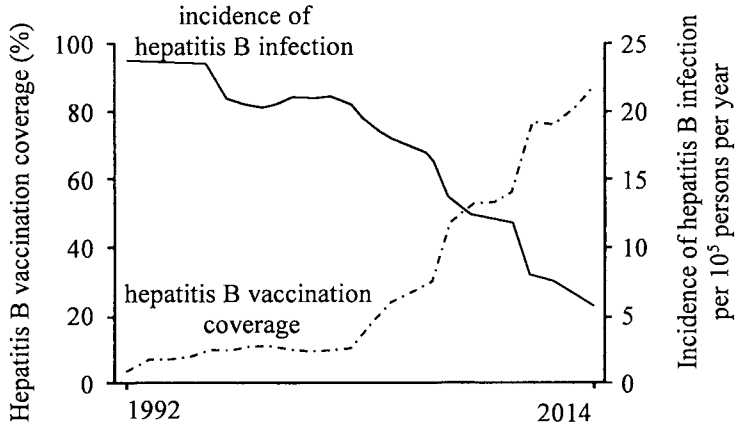
8. Disease burden is a measure of population health that aims to quantify the potential loss of lifespan and health outcomes due to illness as compared to the ideal of living to a ripe old age and in good health. The graph below shows the percentage share of disease burden caused by infectious diseases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

(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)

While the number of hepatitis B vaccination coverage increase the incidence of hepatitis B infection per 10^5 persons per year decrease due to more people vaccinated. More people have the antigen from vaccine

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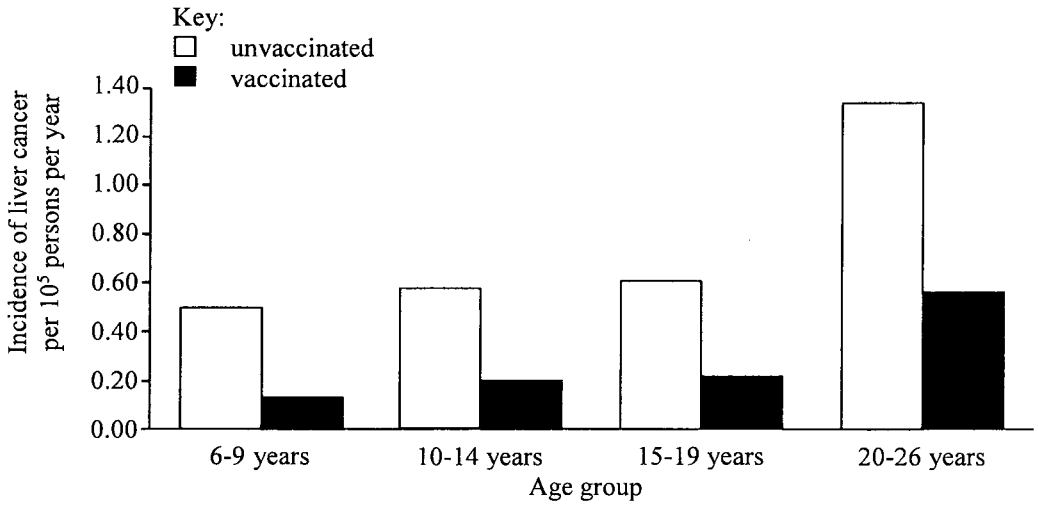
to against the infections.

(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)

It helps to prevent people from having infections.

(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)

Hepatitis B would or may lead to liver cancer. The people who have vaccinated against hepatitis B has less incidence of liver cancer according to the graph. Which represent prevention of hepatitis B will decrease th chance of having liver cancer.

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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)

Hormone X helps the plant P to maintain or gain more water and reduce drought. It keeps the epidermis of plant P close in order to reduce the water to evaporate in drought. To keep it moisten. The guard cell is closed to avoid evaporation.

(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)

Variety A. It is because the leaf fresh mass in drought in variety A is heavier than B. Which represents the hormone X produced is more as the water in it is kept more than B thus the weight is heavier.

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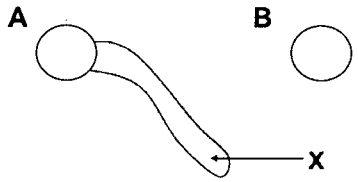
10. In an investigation, pollen grains collected from a single flower were cultured in an artificial medium. After 48 hours incubation, they were observed under a light microscope. Two types of pollen grains with different appearances were observed, as shown in the diagram below:



(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)

. Through meiotic cell division the two different pollen grain is out. Sexual repoduction. The genotype of the parent plant is homozygous dominant.

(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)

Autotrophic. Through meiotic cell division it will have sexual reproduction.

(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 (%)			

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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)

First, carbon footprint which means the amount of natural resources that we have used by our actions. Eating meat will also increase our personal carbon footprint as it release carbon dioxide and the farming method to grow an animal such as cow or sheep will also release carbon footprint. In farming, cow eat grass which reduces the grass that takes in carbon dioxide and the method of farming includes chemical fertilizers or other chemical which may release toxic substances. When the photosynthesis rate decrease and the carbon dioxide rate increases, it will lead to an increase in carbon footprint. Thus eating a vegetarian diet which reduces the number of animals being killed and reduces the carbon dioxide released but also increased the oxygen rate. When carbon footprint increases, the amount of green house gases will also increase due to the air pollutions.

Secondly, other than eating a vegetarian diet, grow plants at home will also reduce our personal carbon footprint. As the photosynthesis rate will increase and more oxygen will be released.

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Thirdly, take public transport instead of private transport will also reduce carbon footprint. As the carbon dioxide released will be less if less people decide to use private transport. The oxygen level will increase.

When the carbon footprint increases, the greenhouse gases will also increased which will affect and harm our health. We might breathe in air includes toxic which will harm our lungs,

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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.

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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

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	Q2

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

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Answers written in the margins will not be marked.

a i). Refer to graph I, taking the follicle stimulating hormone did the hormone level when not make big difference compare to the hormone level during normal cycles. As follicle stimulating hormone stimulates the follicle not to remove from the immature ovum, not to turn into yellow body. When follicle remains, mensuration won't occur. Refer to graph II, the level of LH has increased gradually but sometimes remains same as the level of normal cycles. This contraceptive pills controls the level of oestrogen and LH and FSH.

a ii).

a iii). As the follicle did not turn into yellow body and ovulation did not occur, the uterine linning become thinner

a iv). As the effectiveness of the pills will accumulate through time, no mensuration or ovulation occurs, the uterine linning became thinner.

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b i).

b ii). The accumulated volume of fluid retained in body of the group consumed water is lower than the group which consumed salt solution. Both the group has the highest volume retained at 80 minutes but then the group who consumed water dropped significantly through time. And the group which consumed salt solution dropped only little.

b iii). As during exercise, water loss is increased due to sweat and energy output. Retaining more water is advantageous to marathon runners as they can remain hydrated in order to reduce the chance of fainting due to dehydrated.

b iv). Provide the same experiment on normal people. The weight of marathon runners.

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b v). Drinking sport drinks with glycerol can provide more energy for marathon runners. Runners use up lots of energy and through the energy output, lipids are used up for providing energy. Lipids provide the biggest energy while drinking glycerol can provide lipids for runners to run better with more energy

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aii). Argriculture, farmers put chemical fertilizers for the growth of plants but the chemical waste and chemical residuce will harm the yellow-breasted bunting. As these chemical waste will be abondened to water and water pollution occurs. If the birds drink the water or eat the food or plants that have chemical residue, if will threatened the yellow-breasted bunting. Industrialization.

aii, 1) Based on the data, the average number of birds and bird species has significantly increased from 2006-2015 in Long Valley. In this period, habitat management measure is exercised which show that habitat management helps on the conservation for migratory birds. As the environment has improved, more food and better nutrients for birds are provided.

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(aii 2). As habitat management will provide a better environment and habitat for birds and also the food, nutrients, water provided will be more and better which will attract more birds to stay in this habitat.

(b i). As we can track where the monitor is and can adjust or fix when there is error. sessile organisms will also be more steady than movable organisms which can provide a clearer image.

(bii). Species C should be chosen. If is because it is the only species that commoly found in most of the site in Hong Kong waters. Others species did not appeared in all 3 habitats. Species C appeare in all 3 habitats.

(biii). Species R should be used for monitoring. As it is the only one that contains all four size of MP's which can be more accurate and reliable. If is also possible to check more different MP's than other species.

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(biv 1) No it did not. As the survival rate of larvae eating plastic is decreasing. Also the survival rate of larvae eating plastic is much lower than natural food.

(biv 2).

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