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Level 3 Exemplar 1

2023-DSE
BIO
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B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2023

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.

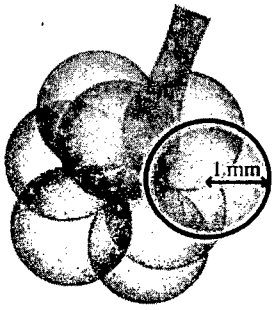
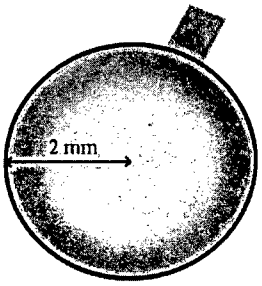
(8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* A 1 3 0 E 0 1 B *

SECTION B

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

1. The spheres shown in the diagram below represent the air sacs of different sizes in the lung. The total volume of the eight small spheres with a radius of 1 mm each is equal to the volume of one large sphere with a radius of 2 mm.

		
surface area of one sphere (mm^2)	12.6	50.3

(a) Calculate the total surface area of eight small spheres. (1 mark)

12.6 x 8 = 100.8 mm^2.

(b) With reference to the answer in (a), explain why having smaller air sacs in the lungs is more efficient than bigger air sacs for gas exchange. (2 marks)

~~How~~ Having smaller air sacs in the lungs increase the total surface area which can increase the rate of gas exchange.

(c) Apart from (b), explain how air sacs are specialised at tissue level for gas exchange. (1 mark)

It is one-cell-thick which reduce the diffusion distance.

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2. All cells are derived from stem cells. They undergo differentiation in which the cells change in form and shape which enable them to perform specialised functions.

(a) It is found that the lens of the eye is composed of cells without organelles. If the organelles of these cells had not been degraded during differentiation, describe how the functioning of the lens would have been affected. (2 marks)

Lens may no longer functionable, since the lens cells are not differentiated.

(b) Suggest a type of plant cell which also experiences degradation of cellular components during differentiation. Explain the significance of the degradation to the function of the cell type. (2 marks)

Root hair cell, it increase its length and surface area to absorb water after degradation.

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3. Diagram I below shows the right leg with the associated joints and muscles. Diagram II shows a series of motions during running with the right leg highlighted in grey.

Diagram I

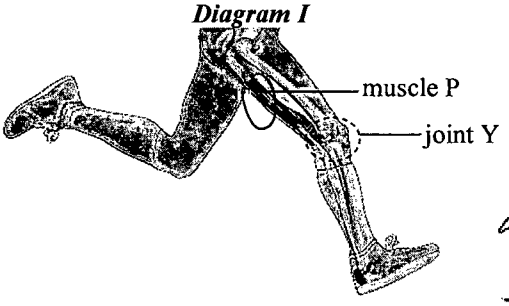
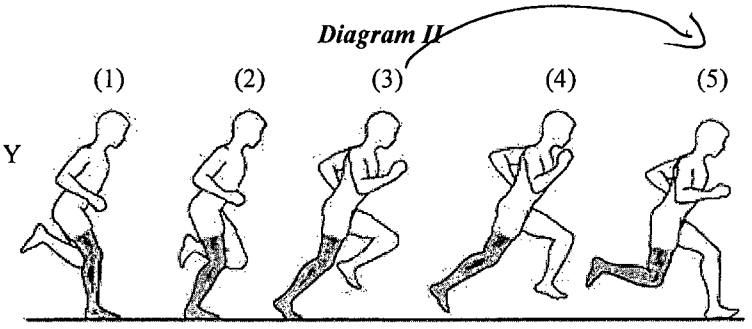


Diagram II



(a) In order to bring about the changes in motion from (3) to (5), what is the change of state of muscle P? (1 mark)

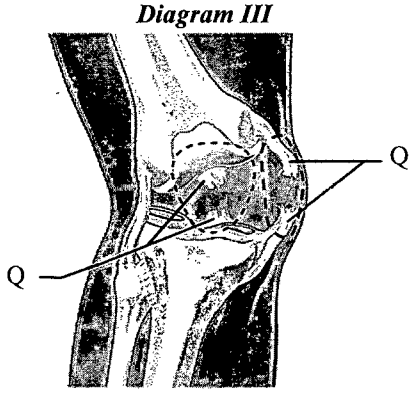
If change from contract to relax.

(b) With respect to the answer in (a), state the role of muscle P by circling the following choices in (i) and complete the sentence in space (ii). (1 mark)

Muscle P is a (i) flexor / extensor because (ii) it contract when it flexed.

(c) A person injured his knee while running. Diagram III shows the condition of joint Y after the injury:

Diagram III



Structure Q was torn. How would this affect joint Y and its functioning? (2 marks)

Structure Q binds ends of two bones together, when the ligament is torn. Two bones may can't be enclosed, and the patient may not be able to walk.

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4. Dengue fever is an infection caused by the dengue viruses (DENV). It is an endemic illness in many countries in tropical and sub-tropical regions. DENV encompasses four different subtypes. Each subtype can lead to dengue fever.

(a) What is the way of transmission for dengue fever? (1 mark)

Virus carried by the vector.

(b) Suggest ***two*** environmental factors in tropical and subtropical regions which lead to a higher risk of contracting dengue fever for people living in these regions. Explain your answer. (3 marks)

The environment of tropical and subtropical is warm and these 2 regions are rainy. Accuminated water and warmth condition provides a good environment for mosqitos (vector) to reproduce.

(c) Patients infected with a particular subtype of DENV for the first time can recover on their own after about a week without any treatment.

(i) Give ***three*** types of white blood cells that aid the recovery and describe each of their actions. (3 marks)

B-cell, T-cell and plasma cell.
B-cell and T-cell differentiate into memory B-cell and memory T-cell to that particular antigen, and plasma cell produce antibodies.

(ii) Explain why people who have recovered from infection with a particular subtype of DENV can still be infected with other subtypes of DENV in the future. (2 marks)

Since that two subtypes of DENV have different antigens, while memory cell can only 'remember' a particular antigen.

(d) Suggest ***one*** preventive measure against the spreading of dengue fever. (1 mark)

Wearing long clothings in countries site to prevent bite by vector.

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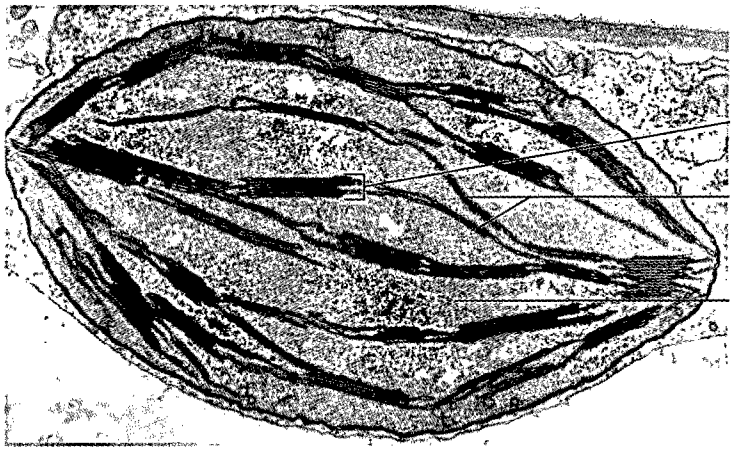
5. An electron micrograph of a chloroplast is shown below:



Y: Thylokoid.

(a) Label structure Y. (1 mark)

(b) State the energy conversion which takes place at X and its importance in photosynthesis. (2 marks)

Structure X contain chlorophyll which absorb light, and undergo photosynthesis to covert it into chemical energy. energy

(c) To which type of metabolism does the overall reaction at Z belong? Explain your answer. (2 marks)

Catabolism, as it breaks large molecules into smaller molecules.

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(d) Describe how the photosynthetic products of the leaves are stored in the underground tubers of a potato plant. (3 marks)

Glucose is produced by photosynthesis and it then transported to the root in form of sucrose. And it convert into starch for storage in the new storage organ, the seed of the potato for future use.

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X-linked.

6. Colour blindness is an inherited disorder due to defective functioning of the cone cells in the retina. There are many types of colour blindness. For example, people with red-green colour blindness fail to distinguish between red and green colours while those with total colour blindness experience total loss of colour vision.

(a) Based on the functioning of cone cells, suggest why the condition of red-green colour blindness is different from that of total colour blindness. (1 mark)

Cone cells are responsible to distinguish colour while it is a photoreceptor. Patient with red-green colour blindness are able to distinguish other colour apart from red and green. while total colour blindness can't.

(b) Red-green colour blindness is caused by a recessive allele on the X-chromosome while total colour blindness is caused by a recessive allele which is located on an autosome. The table below shows the percentage occurrence of red-green colour blindness and total colour blindness in men and women:

	Men	Women
Red-green colour blindness	8%	0.5%
Total colour blindness	0.00001%	0.00001%

With reference to the inheritance of the two types of colour blindness, suggest why the occurrence of red-green colour blindness in men as compared to women differs from that of total colour blindness. (4 marks)

Male contains 1 X-chromosome in the 23th pair, while female contains 2 X-chromosomes. Since the allele for red-green colour blindness is recessive, dominant allele will be presented in heterozygote condition, so a large amount of women can enjoy normal vision as they have 2 X-chromosomes. However, male are not able to escape from the colour blindness by having the dominant allele as they only contain 1. Therefore, a larger proportion of male has colour blindness than women.

red-green

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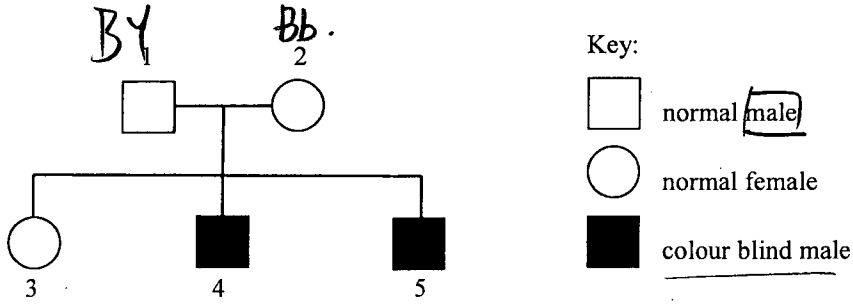
(c) The pedigree below shows the inheritance of red-green colour blindness in a family:



(i) The couple is expecting another child. Using 'B' to represent the allele for normal vision and 'b' to represent the allele for red-green colour blindness, construct a genetic diagram to find out the probability of this newborn being a girl with red-green colour blindness. (4 marks)
(Note: Punnett square is not accepted.)

F0: BY × Bb.

gamete: (B) (Y) (B) (b)

F1: BB bY BY Bb.

∴ The couple has no probability to have a girl with red-green colour blindness.

(ii) Individuals 4 and 5 are twins. Can you determine whether they are identical twins or fraternal twins? Explain your answer. (2 marks)

They are identical twins, as they have same gender and red-green colour blindness. Since they are divised from the same zygote, they share the same chromosomes & inherited by their parents.

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predator.

7. Greenhouse frog is a foreign species which is now found in many local areas according to a recent survey. There is a concern that these greenhouse frogs might threaten a local endangered species, Romer's Tree Frog.

(a) The table below provides some information about the two frog species:

Name	Romer's Tree Frog	Greenhouse Frog
Size	1.5-2.5 cm	1.2-3.0 cm
Breeding site and habitat	Wetland, small and temporary water bodies; woodland; shrubland; plantations	Woodland; shrubland; agricultural field; urban park
Food	Small insects	Small insects and snails

By comparing the ecological niche of the two frog species, give ***two*** pieces of evidence that support the possibility of the greenhouse frog posing a threat to the Romer's Tree Frog. Explain your answer.

(3 marks)

They have the same food demand, they are both feed on small insects. The decrease in the number of prey may lead to a decrease in number of Romer's Tree Frog, while Greenhouse Frog can feed on smalls, but Romer's Tree Frog can't. The largest size of Greenhouse Frog is larger than that of Romer's Tree Frog. Romer's Tree Frog may be less competitive than Greehouse Frog as they are smaller.

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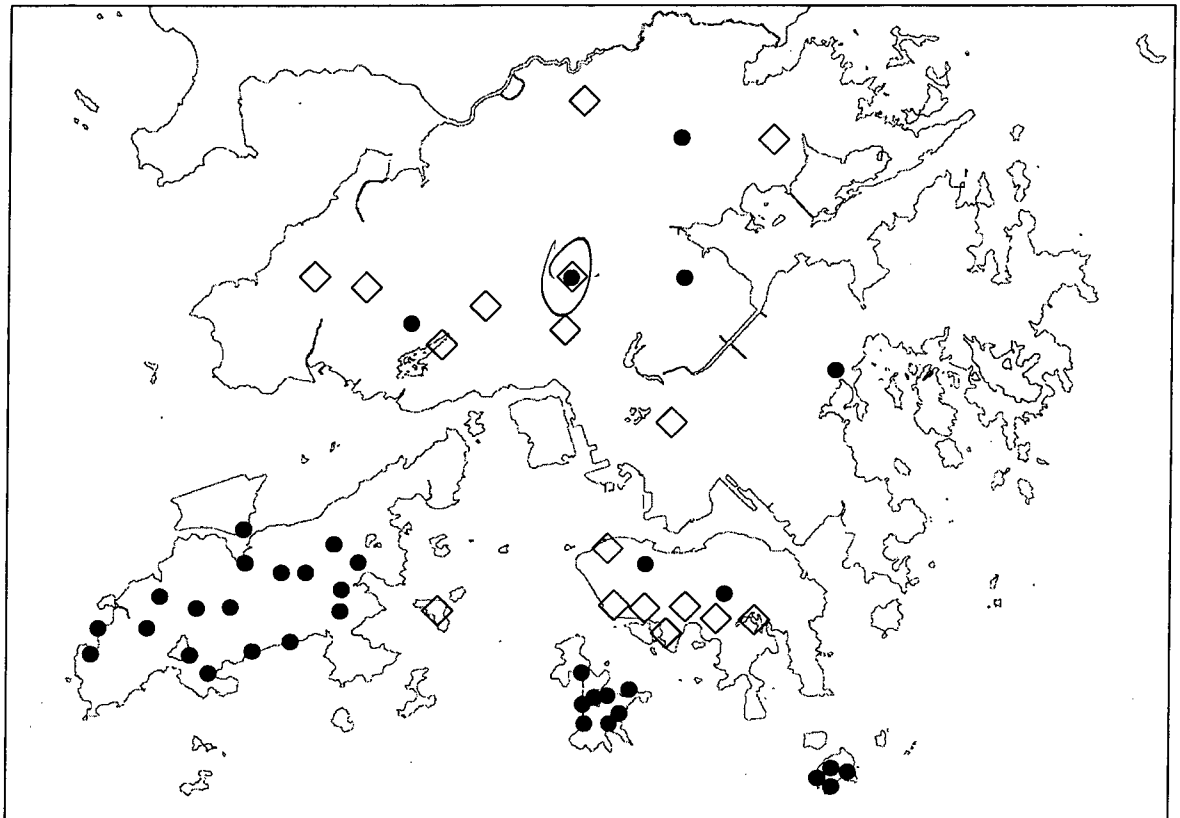
(b) The map below shows the distribution of the two frog species in Hong Kong:



Suggest why the information above ***cannot*** prove that the Romer's Tree Frog is facing a real threat from the greenhouse frogs. (1 mark)

Mostly, they have the different habitats. They live in different location, so they are not likely to be competition.

(c) Suggest how you could collect data to show if Romer's Tree Frogs are facing a real threat from greenhouse frogs. (2 marks)

Calculate the relative abundant of the habitat they live together and share the same resources.

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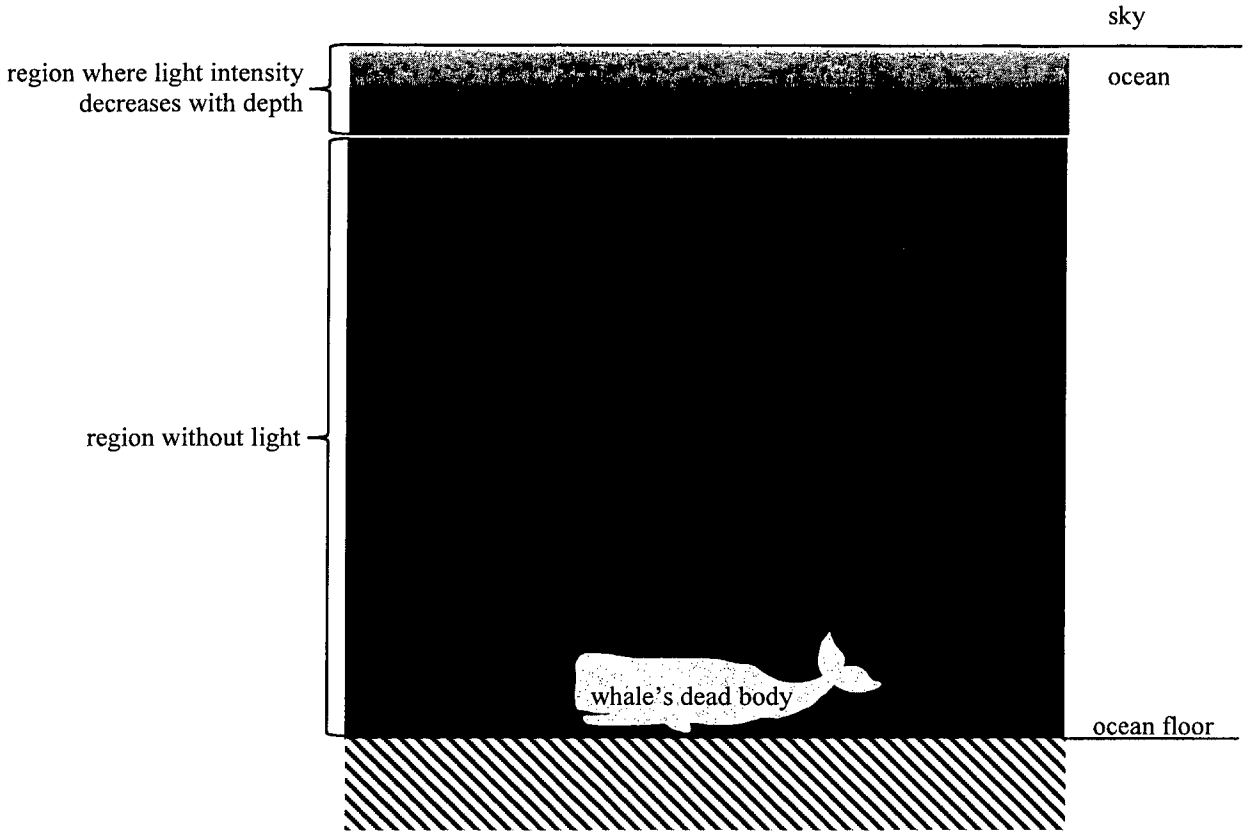
8. When whales die, their dead bodies sink to the bottom of the ocean. The whale carcasses support a unique community known as whale fall community. The diagram below shows different regions of the ocean and the location of a whale's dead body:



(a) (i) With reference to the energy flow in the ecosystem, what is the ultimate source of the energy stored inside the whale's dead body? (1 mark)

Its body fat, the eatable part. and muscle.

(ii) With reference to the above diagram, explain the importance of the whale's dead body to the whale fall community on the ocean floor. (2 marks)

The whale's dead body provides food supply to the whale fall community as a producer. Water plant are not able to grow in the region without light, so fishes may face insufficient food supply.

(b) What is the role of the organisms (decomposer) that feed on the soft tissues of the whale's dead body in the cycling of materials? (1 mark)

Consumers.

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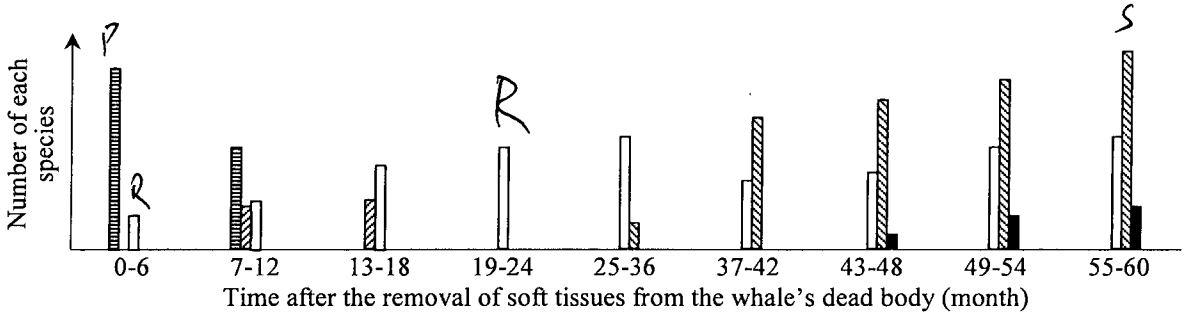
(c) After the soft tissues of the whale's dead body have been consumed, another group of organisms start to feed on the remaining nutrients from the skeleton. For an average-sized whale, it could have 2 000 – 3 000 kg lipid stored inside its skeleton. The bar chart below shows the abundance of different species that feed on the skeleton of the whale over time:



Key:

- species P
- species Q
- species R
- species S
- species T

Complete the following table with evidence from the bar chart to support that the above case is an example of ecological succession. (4 marks)

Characteristics of ecological succession	Evidence from the bar chart
(i) It is occupied by organisms in a short period of time.	In the period of 0-6 month after the removal of soft tissues, whale's dead body is started to be consumed.
(ii) Organisms can grow in a fast rate.	The number of each species increase a lot in a short period of time.

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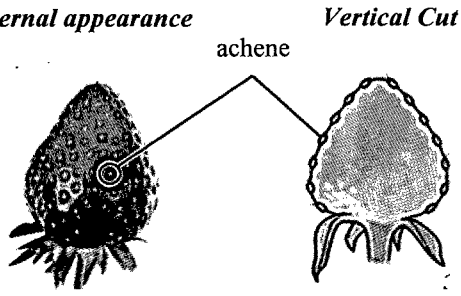
9. The diagram below shows the external appearance of a strawberry and its vertical cut. The achenes found on the surface of the strawberry are the fruits:



(a) An investigation into the role of achenes in the development of a strawberry was carried out as shown below:

Treatment	Relative size and appearance of the strawberry	
	Day 1	Day 20
1. Achenes remained intact.		
2. All achenes were removed on Day 1.		
3. All achenes were removed on Day 1 and the strawberry was then regularly sprayed with auxins.		

Achenes. ~~Seed~~ contains auxin?

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(i) Complete the following table to show what deduction can be made by comparing results of the following treatments: (3 marks)

Treatment	Deduction
1 versus 2	The effect of achenes on the growth of the strawberry. present
2 versus 3	The effect of sprayed auxins on the growth of the strawberry. present
1 versus 3	The effect on growth of the strawberry in condition with achenes and sprayed auxins.

(ii) Based on the results, suggest ***one*** hypothesis for the enlargement of the strawberry. (1 mark)

Achenes promote growth of the strawberry.

(iii) Study another treatment as follows:

Treatment	Relative size and appearance of the strawberry	
	Day 1	Day 20
4. Achenes were removed from the lower part of the strawberry on Day 1.	Achenes remained on the upper part  Achenes removed from the lower part	

In terms of experimental design, what is the advantage of Treatment 4 as compared to Treatments 1 and 2? (1 mark)

It can compare the growth of achene containing part and achenes removed part together.

(b) Give ***one*** example of a growth response induced by auxins and state its significance to plants. (2 marks)

Phototropism, it allows plant to absorb more light for photosynthesis.

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10. Cassava is a crop which grows in areas with poor soil and a low rainfall. It produces starchy root tubers which serve as a major food source in Africa.

(a) Give the location(s) where the chemical digestion of starch takes place in the human digestive tract. (1 mark)

Mouth cavity and small intestine.

(b) Table I below shows some nutritional information of cassava while Table II lists the daily energy and protein requirements recommended for boys at age 16:

415g 1486g.

Table I

Fresh weight (g) from which 100 g dry weight is yielded	250
Energy (kJ per 100 g dry weight)	2 675
Protein (g per 100 g dry weight)	3.5

Table II

	Daily requirement
Energy (kJ)	11 100
Protein (g)	52

In Africa, some low-income families may rely only on cassava for food for a long period.

(i) A 16-year-old boy relies only on cassava for food. Calculate the fresh weight of cassava he needs to consume so as to meet the recommended daily energy requirement. (1 mark)

415 g.

(ii) After consuming cassava only for a period of time, this boy develops swollen feet due to the accumulation of tissue fluid.

(1) How much protein can he obtain from the amount of cassava consumed in (i)? (1 mark)

14.525 g.

(2) According to Table II, predict the difference of the blood protein level of this boy when compared with that of normal healthy boys of the same age. Explain your answer. (2 marks)

The blood protein level of that boy is lower than other normal healthy boys, since he uptake insufficient protein everyday.

(3) Based on your answer in (2), explain why this would lead to the accumulation of tissue fluid in his feet. (2 marks)

The protein concentration of tissue fluid and blood are similar, nutrient can't diffuse out by blood vessel or lymph vessel because of the low concentration difference. The tissue fluid is accuminate in the ~~body~~ boy's feet.

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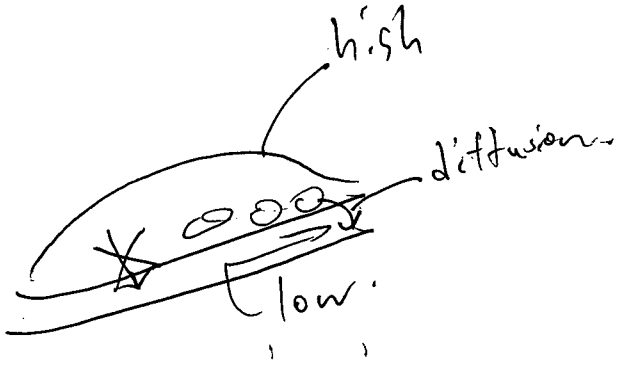
(c) Cassava contains a natural toxin. Consuming inadequately cooked cassava may result in cyanide poisoning. Cyanide shuts down the oxidative phosphorylation in mitochondria by inhibiting a key enzyme of the process. Acetyl-CoA ? Respi-

(i) Name the structure of the mitochondrion where this enzyme is located. (1 mark)

Mitochondrial matrix.

(ii) A man accidentally consumed some raw cassava. How will his blood lactate level change? Explain your answer. (3 marks)

The man's blood lactate level will increase. As the cyanide in the raw cassava inhibit the aerobic respiration. The man may have insufficient energy supply. Therefore, anaerobic respiration is carried out to release ATP, while lactatic acid is produced, and which will diffuse to the blood, leading to a increase in the blood lactate level.



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Asexual
↳ 1

photosy 4

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. In agricultural practice, some crops are reproduced asexually to improve production efficiency. An increase in yield of these crops is observed in recent years due to a steady increase in the average global temperature. Meanwhile, some scientists worry that crops reproduced asexually are at high risk of extinction due to environmental changes and diseases if global warming persists.

Explain the increased yield of these crops due to global warming and the rationale behind the concern of the scientists. (11 marks)

The asexual reproduction decrease the genetic variation by random fertilization. The offspring of the asexual reproduction is identically same as it mother plant, which means that the diseases that carried by the mother plant will inherit to the offspring. It is sure that the asexual reproduction can increase the yield, but it might lead to plant's extinction because of the inherited disease.

Besides, under global warming, the carbon dioxide (CO_2), which is a kind of green house gas, concentration in atmosphere increase. The increase in concentration of CO_2 leading to a higher rate of photosynthesis, and plant is able to produce more food and faster, which means that, the plant grow faster, the yield increase. However, global warming leading to an increase in temperature, plant may not be tolerant in high temperature, although their stomata open a wider in hot condition, and which can further increase the photosynthesis rate, plant may dies in hot under

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high temperature. ~~And~~ Thus, plant may extinct when the temperature is keep increasing.

Moreover, CO_2 trapping more heat energy in the atmosphere, the heat will leading to an increase in the evaporation rate. There maybe insufficient water supply for plant on ground. They may even die because of drought. Therefore, they are at a high risk of extinction.

To conclude, although asexual reproduction and ~~en~~ global warming can increase the yield of plants, it might cause an extinction of plants due to environmental changes and diseases if global warming persists.

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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.

2023 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	☐	☐	☐	☐	☐	☐	☐	☐	☐	
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
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(a)
	1(b)
	2(a)
	2(b)

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). Susan's oestrogen level is much lower than the normal range in the whole menstrual cycle. Her ovary may be damaged in the traffic accident, which is responsible to secret and release oestrogen to blood to thicken and maintain the uterine lining.

(ii). The oestrogen inhibit the secretion of FSH by the pituitary gland. However, Susan's oestrogen level in blood is low, she has insufficient oestrogen released to the blood. The blood FSH level remains at a high level as there is no an effective inhibition.

(iii) The low oestrogen and high FSH level in blood may be the cause. They might lead to a long menstrual flow.

(iv) Oestrogen, as follicle will convert into yellow body after ovulation, and yellow body will release as oestrogen to blood.

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Start each question on a new page.

1(b) (i) The average amount of skin blood flow of resting group increase since their body temperature increase. The temperature in the room is higher than human body's. More blood is flow to the skin to release heat to maintain an optimum temperature for enzymes' efficient working.

(ii) (1) The arterioles open wider and the elastic tissue of the arteriole expands for thermoregulation when volunteers' body temperature increase.

(2) It allows more blood to flows to other parts of the body and allows blood to flows faster.

(iii). They sweat and their heart rate increase since the rate of the pumping action of the heart increase.

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2(a)(i) The concentration of pollutant X in breast milk increase when the age group of the mother increase. It shows that women who are older contains more pollutant X, which indicate pollutant X can't be metabolized or released and accumulate in human body.
Besides, the concentration of pollutant X in breast milk increase when the frequency of seafood consumption of mother is larger. Seafood contain pollutant X and with more consumption, a larger amount of pollutant X will accumulate in human's body.

(ii)(1) If can't be metabolized, it can't be egestised, and it is hard to break down and detoxified.

(2) As milk contains protein which is made of amino acid, which seafood also contains a large amount of protein, it will be absorbed in form of amino acid and to produce protein in human, e.g. breast milk.

(iii) Release polluted waste to the ocean, and consumption of seafood.

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2(b) (i).

Comparison of the result of two treatments.	Deduction.
The number of invertebrate species found on the seawall of the original seawall surface and with installing the eco-engineered tiles.	The number of invertebrate species found on the surface increase after the install of the tiles, with all 3 different kind of surface.
The number of invertebrate species found on the seawall of tiles with deeper crevices, thiner crevices and no crevice.	There is more invertebrate species found on the surface of the tiles with crevices. And more is found in the deeper crevices.

(ii) (1) More species can stay in / stick on the surface of the seawall.

(2) More species won't be flushed by the wave when they can stay in the crevices.

(iii) (1) The relative abundant of different species lived in region A.

(2) The relative abundant increase and the species richness increase. / of different species.

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Level 3 Exemplar 2

2023-DSE
BIO
PAPER 1B

B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2023

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.

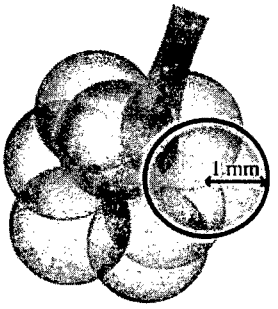
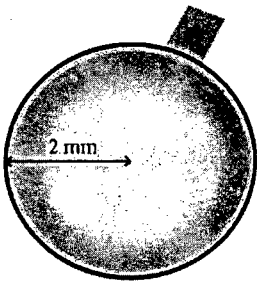
(8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* A 1 3 0 E 0 1 B *

SECTION B

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

1. The spheres shown in the diagram below represent the air sacs of different sizes in the lung. The total volume of the eight small spheres with a radius of 1 mm each is equal to the volume of one large sphere with a radius of 2 mm.

		
surface area of one sphere (mm^2)	12.6	50.3

(a) Calculate the total surface area of eight small spheres. (1 mark)

Total surface area of eight small sphere;
$12.6 \times 8 = 100.8 (mm^2)$,,

(b) With reference to the answer in (a), explain why having smaller air sacs in the lungs is more efficient than bigger air sacs for gas exchange. (2 marks)

Smaller air sacs have a larger total surface area than bigger air sac per volume. The large total surface area allows smaller air sac to have a faster gas exchange,

(c) Apart from (b), explain how air sacs are specialised at tissue level for gas exchange. (1 mark)

Air sacs have 1 cell thick wall, this allows for a shorter diffusion distance between the air sac and red blood cells in capillaries,

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2. All cells are derived from stem cells. They undergo differentiation in which the cells change in form and shape which enable them to perform specialised functions.

(a) It is found that the lens of the eye is composed of cells without organelles. If the organelles of these cells had not been degraded during differentiation, describe how the functioning of the lens would have been affected. (2 marks)

If the organelles of these cells had not been degraded during differentiation, the lens would not be able to refract the light onto the retina, the vision would be blinded as a result.

(b) Suggest a type of plant cell which also experiences degradation of cellular components during differentiation. Explain the significance of the degradation to the function of the cell type. (2 marks)

Root hair cells. During differentiation, root hair cells lose it's cell wall. This allows root hair cells to absorb substance more easily and more rapidly for nutrition of plants.

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3. Diagram I below shows the right leg with the associated joints and muscles. Diagram II shows a series of motions during running with the right leg highlighted in grey.

Diagram I

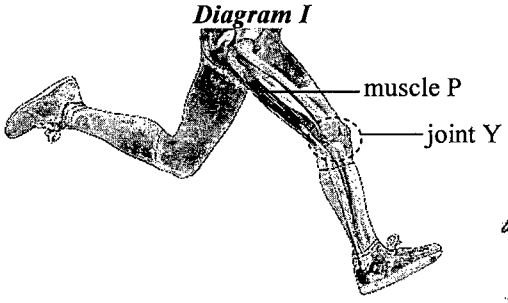
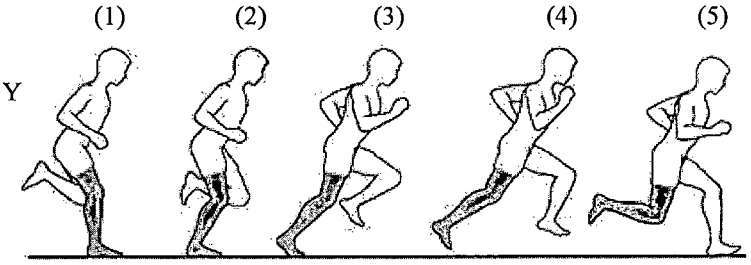


Diagram II



(a) In order to bring about the changes in motion from (3) to (5), what is the change of state of muscle P? (1 mark)

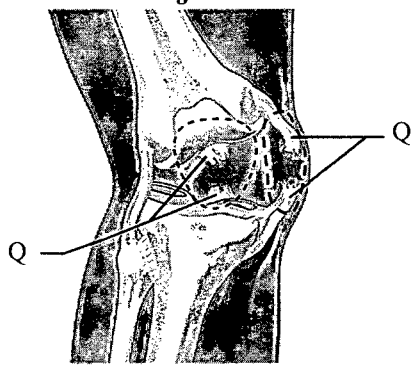
At motion (3), muscle P relax, when changing from motion (3) to (5), muscle P contracts.

(b) With respect to the answer in (a), state the role of muscle P by circling the following choices in (i) and complete the sentence in space (ii). (1 mark)

Muscle P is a (i) (flexor) / extensor because (ii) when muscle P contracts, the legs move inwards.

(c) A person injured his knee while running. Diagram III shows the condition of joint Y after the injury:

Diagram III



Structure Q was torn. How would this affect joint Y and its functioning? (2 marks)

joint Y would not be able to move in a 1 dimensional plane. It is because structure Q is responsible for binding the 2 end of the bones together for muscle contraction.

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4. Dengue fever is an infection caused by the dengue viruses (DENV). It is an endemic illness in many countries in tropical and sub-tropical regions. DENV encompasses four different subtypes. Each subtype can lead to dengue fever.

(a) What is the way of transmission for dengue fever? (1 mark)

physical contact

(b) Suggest ***two*** environmental factors in tropical and subtropical regions which lead to a higher risk of contracting dengue fever for people living in these regions. Explain your answer. (3 marks)

Tropical and subtropical regions have high humidity and have a lot of ponds, which are favorable for mosiquitos to survive and reproduce.

(c) Patients infected with a particular subtype of DENV for the first time can recover on their own after about a week without any treatment.

(i) Give ***three*** types of white blood cells that aid the recovery and describe each of their actions. (3 marks)

Memory cells, killer T-cell and plasma cells. Memory cells would memorise and remember the antigen of the pathogen of DENV. Memory cells will then multiply and differeniate rapidly into killer T-cells and plasma cells. Killer T-cells will kill the pathogen of DENV while plasma cell will inhibit the growth of pathogen.

(ii) Explain why people who have recovered from infection with a particular subtype of DENV can still be infected with other subtypes of DENV in the future. (2 marks)

Memory cells will only remember and recognize the antigen of the pathogen of the particular subtype of DENV. As other subtypes of DENV have different types of antigen. Memory cells will not recognize the antigen of the pathogen of the other subtypes of DENV.

(d) Suggest ***one*** preventive measure against the spreading of dengue fever. (1 mark)

Regularly dispose of piles of water to prevent reproduction of mosiquitos.

Immunity against other subtypes of DENV will not be developed as a result.

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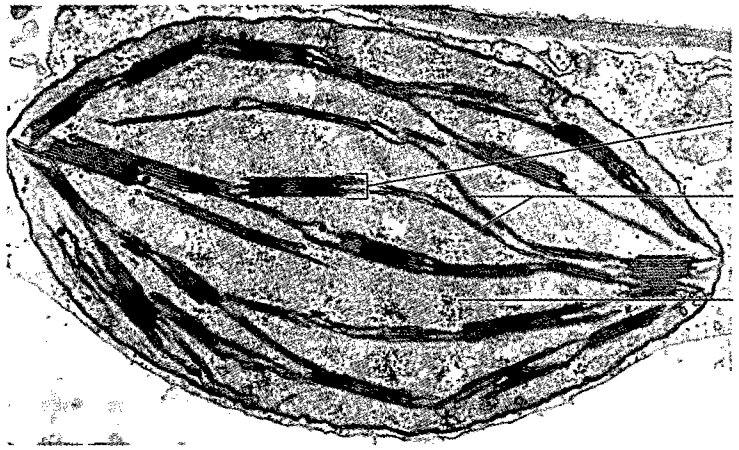
5. An electron micrograph of a chloroplast is shown below:



(a) Label structure Y. (1 mark)

(b) State the energy conversion which takes place at X and its importance in photosynthesis. (2 marks)

Kreb cycle, it produces ATP to provide energy for photosynthesis

(c) To which type of metabolism does the overall reaction at Z belong? Explain your answer. (2 marks)

Catabolism, it is because

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(d) Describe how the photosynthetic products of the leaves are stored in the underground tubers of a potato plant. (3 marks)

When starch is produced, they are transported from the leaves to the underground tubers through the stem. It is to act as energy reserves and for reproduction.

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6. Colour blindness is an inherited disorder due to defective functioning of the cone cells in the retina. There are many types of colour blindness. For example, people with red-green colour blindness fail to distinguish between red and green colours while those with total colour blindness experience total loss of colour vision.

(a) Based on the functioning of cone cells, suggest why the condition of red-green colour blindness is different from that of total colour blindness. (1 mark)

Red-green colour blindness is due inability to absorb red and green coloured light by cone cell while total colour blindness is due to the absent of cone cell.

(b) Red-green colour blindness is caused by a recessive allele on the X-chromosome while total colour blindness is caused by a recessive allele which is located on an autosome. The table below shows the percentage occurrence of red-green colour blindness and total colour blindness in men and women:

	Men	Women
Red-green colour blindness	8%	0.5%
Total colour blindness	0.00001%	0.00001%

With reference to the inheritance of the two types of colour blindness, suggest why the occurrence of red-green colour blindness in men as compared to women differs from that of total colour blindness. (4 marks)

Men contains 1 X-chromosome and 1 Y-chromosome while Women contains 2 X-chromosomes. When giving birth to a male offspring, the male offspring must receive 1 X-chromosome from the mother and 1 Y-chromosome from the father. If the X-chromosome received by the male offspring contains recessive allele, the male offspring must have recessive phenotype and have Red-green colour blindness. While when giving birth to a female offspring, the female offspring must receive 1 X-chromosome each from her mother and father. As Red-green colour blindness is caused by recessive allele on the X-chromosome. If both X-chromosome from the mother and the father have recessive allele, the female offspring must contain recessive phenotype and have red-green colour blindness. Otherwise, if only one of the X-chromosome the female offspring received from her mother and father is recessive. Than the female offspring will have normal phenotype and have normal vision. In heterozygous, the dominant allele will be presented while the recessive allele will be hidden. That why men is more likely to have

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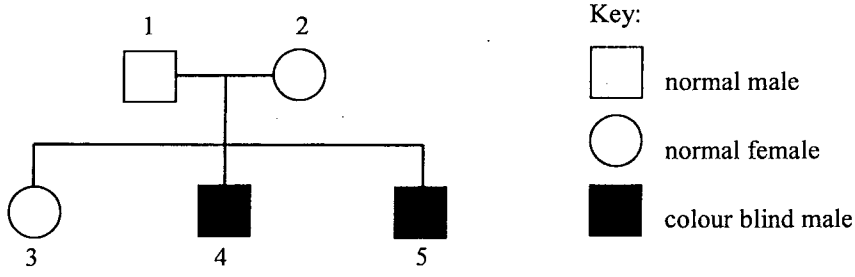
(c) The pedigree below shows the inheritance of red-green colour blindness in a family:



(i) The couple is expecting another child. Using 'B' to represent the allele for normal vision and 'b' to represent the allele for red-green colour blindness, construct a genetic diagram to find out the probability of this newborn being a girl with red-green colour blindness. (4 marks)
(Note: Punnett square is not accepted.)

Genetic diagram

Parents (female carrier mother) X^BX^b X^BY (normal male father)

Genotype X^B X^b X^B Y

Offspring X^BY (normal male) X^BX^b (female carrier) X^BX^B (normal female) X^bY (male with colour blindness)

∴ Probability of newborn being a girl with Red green colour blindness is 0%.

(ii) Individuals 4 and 5 are twins. Can you determine whether they are identical twins or fraternal twins? Explain your answer. (2 marks)

No, it is because although both individual 4 and 5 have colour blindness, we don't know the blood group types of individual 4 and 5. As such not enough information have been given to determine whether they are identical twins or fraternal twins.

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7. Greenhouse frog is a foreign species which is now found in many local areas according to a recent survey. There is a concern that these greenhouse frogs might threaten a local endangered species, Romer's Tree Frog.

(a) The table below provides some information about the two frog species:

Name	Romer's Tree Frog	Greenhouse Frog
Size	1.5-2.5 cm	1.2-3.0 cm
Breeding site and habitat	Wetland, small and temporary water bodies; woodland; shrubland; plantations	Woodland; shrubland; agricultural field; urban park
Food	Small insects	Small insects and snails

By comparing the ecological niche of the two frog species, give ***two*** pieces of evidence that support the possibility of the greenhouse frog posing a threat to the Romer's Tree Frog. Explain your answer.

(3 marks)

Greenhouse Frog and Romer's Tree Frog have the same food sources. As such, Greenhouse Frog and Romer's Tree Frog will compete for food, Leading to a decline in the number of Romer's Tree Frog due having insufficient food source. Greenhouse Frog and Romer's Tree Frog also have similar breeding sites and habitat. As such, Green house Frog and Romer's Tree Frog will compete for breeding sites and habitat. The numbers of Romer's Tree Frog will decrease due to a decrease in suitable habitat and breeding sites.

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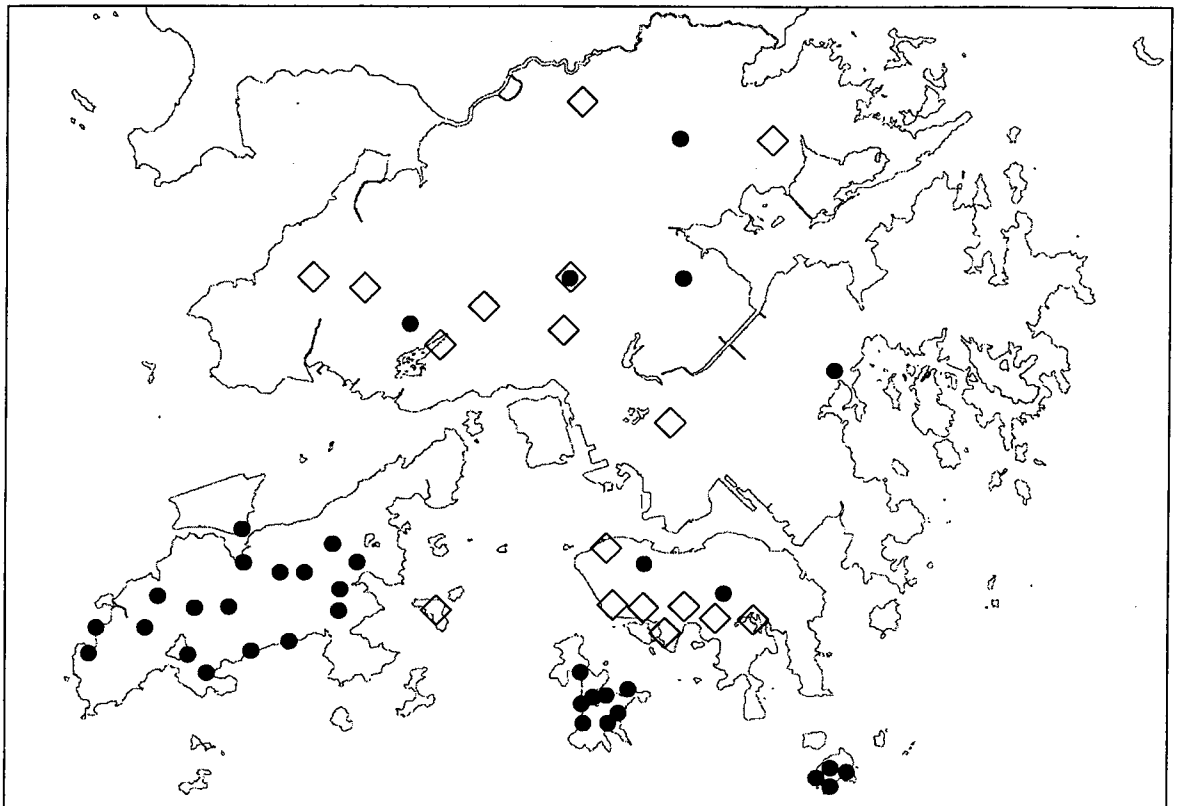
(b) The map below shows the distribution of the two frog species in Hong Kong:



Key:

● habitats of Romer's Tree Frog

◇ locations where greenhouse frogs were spotted in the survey

Suggest why the information above ***cannot*** prove that the Romer's Tree Frog is facing a real threat from the greenhouse frogs. (1 mark)

It is because most of the habitats of Romer's Tree Frog does not have greenhouse frogs spotted nearby.

(c) Suggest how you could collect data to show if Romer's Tree Frogs are facing a real threat from greenhouse frogs. (2 marks)

We can

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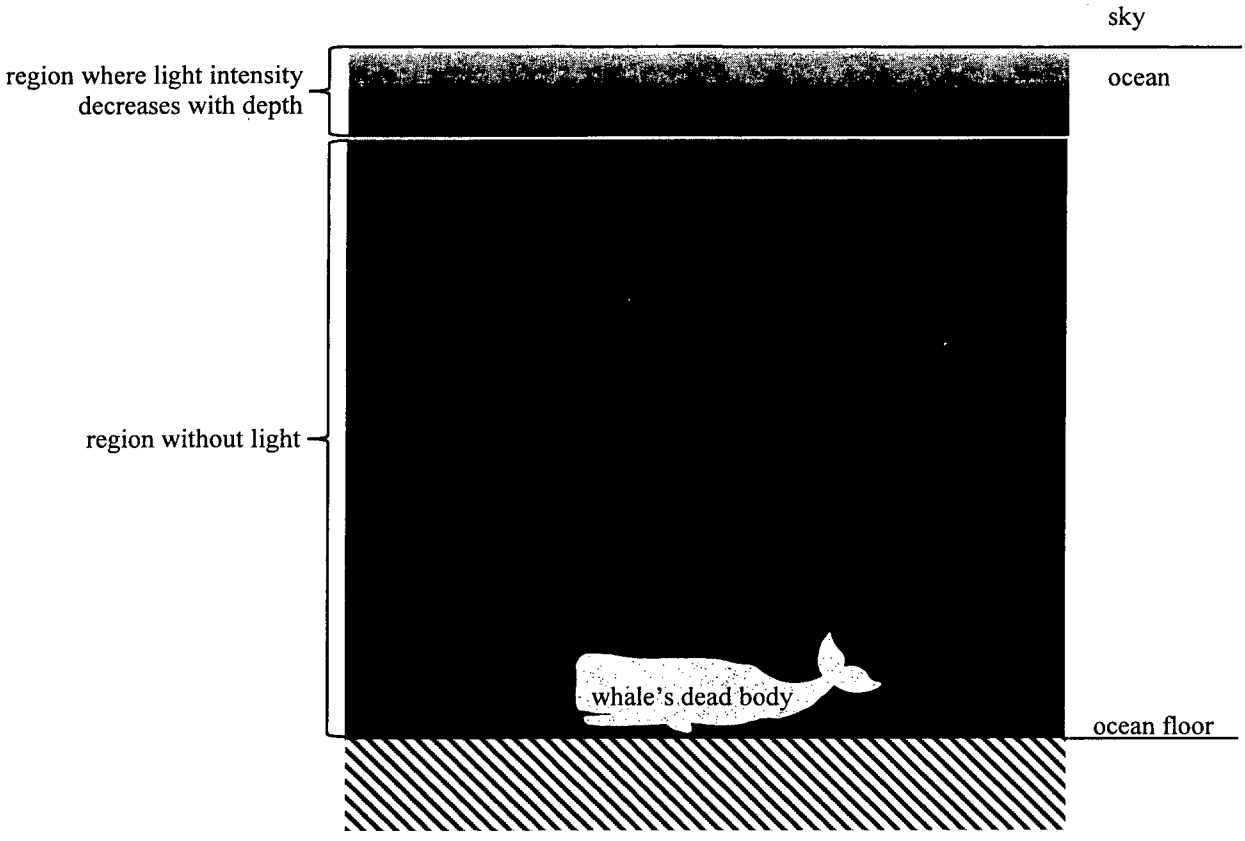
8. When whales die, their dead bodies sink to the bottom of the ocean. The whale carcasses support a unique community known as whale fall community. The diagram below shows different regions of the ocean and the location of a whale's dead body:



(a) (i) With reference to the energy flow in the ecosystem, what is the ultimate source of the energy stored inside the whale's dead body? (1 mark)

The soft tissue of the whale's dead body

(ii) With reference to the above diagram, explain the importance of the whale's dead body to the whale fall community on the ocean floor. (2 marks)

The whale's dead body will be consumed by the whale fall community, providing the whale fall community sufficient energy to survive

(b) What is the role of the organisms that feed on the soft tissues of the whale's dead body in the cycling of materials? (1 mark)

Decomposer

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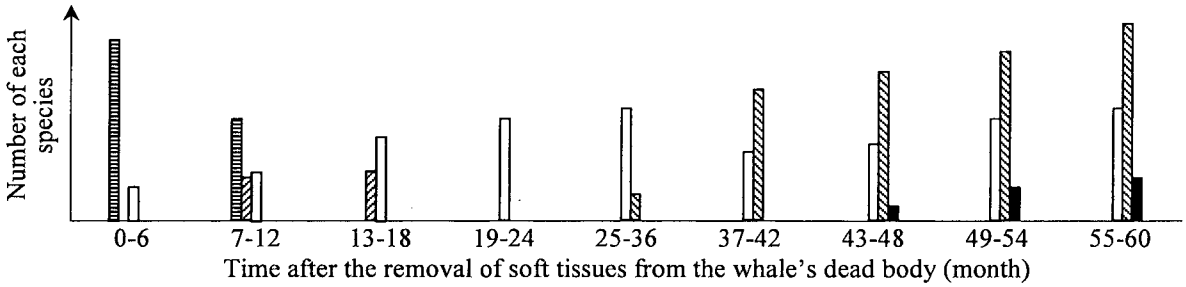
(c) After the soft tissues of the whale's dead body have been consumed, another group of organisms start to feed on the remaining nutrients from the skeleton. For an average-sized whale, it could have 2 000 – 3 000 kg lipid stored inside its skeleton. The bar chart below shows the abundance of different species that feed on the skeleton of the whale over time:



Key:

- species P
- species Q
- species R
- species S
- species T

Complete the following table with evidence from the bar chart to support that the above case is an example of ecological succession. (4 marks)

Characteristics of ecological succession	Evidence from the bar chart
(i) The	
(ii) Competition of food	The number of species P decreases while the number of species R increase from 0-24 months after the removal of soft tissue

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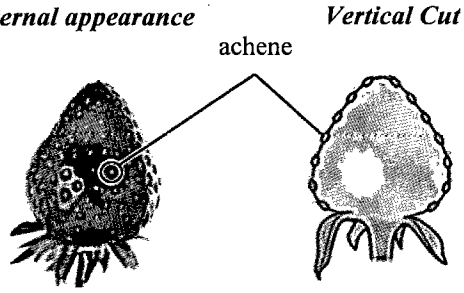
9. The diagram below shows the external appearance of a strawberry and its vertical cut. The achenes found on the surface of the strawberry are the fruits:



(a) An investigation into the role of achenes in the development of a strawberry was carried out as shown below:

Treatment	Relative size and appearance of the strawberry	
	Day 1	Day 20
1. Achenes remained intact.		
2. All achenes were removed on Day 1.		
3. All achenes were removed on Day 1 and the strawberry was then regularly sprayed with auxins.		

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(i) Complete the following table to show what deduction can be made by comparing results of the following treatments: (3 marks)

Treatment	Deduction
1 versus 2	Achenes are needed for the growth of strawberry
2 versus 3	Auxins are needed for the growth of strawberry
1 versus 3	Achenes contains auxins which allows for the growth of strawberry

(ii) Based on the results, suggest ***one*** hypothesis for the enlargement of the strawberry. (1 mark)

The more auxin provided to the strawberry, the faster the growth of the strawberry

(iii) Study another treatment as follows:

Treatment	Relative size and appearance of the strawberry	
	Day 1	Day 20
4. Achenes were removed from the lower part of the strawberry on Day 1.	Achenes remained on the upper part  Achenes removed from the lower part	

In terms of experimental design, what is the advantage of Treatment 4 as compared to Treatments 1 and 2? (1 mark)

It shows that achenes is needed for the growth of strawberry without comparing to other treatment

(b) Give ***one*** example of a growth response induced by auxins and state its significance to plants. (2 marks)

When under sunlight, auxin (inside the stem of plants) will move away from the sunlight and enhance the growth rate of one side of the stem. Allowing the plant to grow towards the sunlight and absorb sunlight for photosynthesis more efficiently.

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Go on to the next page

10. Cassava is a crop which grows in areas with poor soil and a low rainfall. It produces starchy root tubers which serve as a major food source in Africa.

(a) Give the location(s) where the chemical digestion of starch takes place in the human digestive tract. (1 mark)

Mouth cavity, Stomach, small intestine

(b) Table I below shows some nutritional information of cassava while Table II lists the daily energy and protein requirements recommended for boys at age 16:

Table I

Fresh weight (g) from which 100 g dry weight is yielded	250
Energy (kJ per 100 g dry weight)	2 675
Protein (g per 100 g dry weight)	3.5

Table II

	Daily requirement
Energy (kJ)	11 100
Protein (g)	52

1.82

In Africa, some low-income families may rely only on cassava for food for a long period.

(i) A 16-year-old boy relies only on cassava for food. Calculate the fresh weight of cassava he needs to consume so as to meet the recommended daily energy requirement. (1 mark)

11100 ÷ 2675 × 250 = 1037.4 (g)

(ii) After consuming cassava only for a period of time, this boy develops swollen feet due to the accumulation of tissue fluid.

(1) How much protein can he obtain from the amount of cassava consumed in (i)? (1 mark)

11100 ÷ 2675 × 3.5 = 14.5 (g)

(2) According to Table II, predict the difference of the blood protein level of this boy when compared with that of normal healthy boys of the same age. Explain your answer. (2 marks)

The blood protein level of this boy would be lower than that of normal healthy boys of the same age. It is because this boy have not consume enough protein for the daily requirement

(3) Based on your answer in (2), explain why this would lead to the accumulation of tissue fluid in his feet. (2 marks)

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(c) Cassava contains a natural toxin. Consuming inadequately cooked cassava may result in cyanide poisoning. Cyanide shuts down the oxidative phosphorylation in mitochondria by inhibiting a key enzyme of the process.

(i) Name the structure of the mitochondrion where this enzyme is located. (1 mark)

Granum

(ii) A man accidentally consumed some raw cassava. How will his blood lactate level change? Explain your answer. (3 marks)

When a man accidentally consumed some raw cassava, lactose is inhibited. As a result, lactate can not be build up into lipid through anabolism by lactose and store on the surface of the men skin, His blood lactate level will increase.

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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. In agricultural practice, some crops are reproduced asexually to improve production efficiency. An increase in yield of these crops is observed in recent years due to a steady increase in the average global temperature. Meanwhile, some scientists worry that crops reproduced asexually are at high risk of extinction due to environmental changes and diseases if global warming persists.

Explain the increased yield of these crops due to global warming and the rationale behind the concern of the scientists. (11 marks)

As the average global temperature increases due to global warming, the rate of photosynthesis of plants also increase. When temperature increases, the rate of evaporation of water vapour increase. The difference in water potential between the atmosphere and the plant increase. The rate of transpiration increase. Meanwhile, scientist are concern that crops that reproduced asexually are at high risk of extinction due to environmental changes. It is because asexually reproduced plants have little genetic variation. Plants that reproduced asexually would not have offsprings that contain the genes of another plant. Also random fertilization will not occur and there are no independent assortment of homologous chromosome. As a result, asexually reproduced plants can't adapt to the changing environment and The survival rate of asexually reproduced plants might decrease due to the increase in temperature and changes to their habitat.
↑ environmental

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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.

香港考試及評核局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
補充答題紙 **(A)** Supplementary answer sheet **(A)**

試題編號 Question No.

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1. 每題另起新頁作答。
   Start each question on a new page.
2. 補充答題紙不可撕開使用。
   Do not tear the supplementary answer sheet apart.

6b. Red-green colour blindness than female,

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2023 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	
試題編號 Question No.	1
	2

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.

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Answers written in the margins will not be marked.

lai, Susan's ~~[illegible]~~ ovum could have been affected after the abdominal injury. At the start of the menstrual cycle, FSH will be released by pituitary gland to stimulate the growth of follicle into matured follicle. When matured follicle is formed, the non-matured follicle will become yellow body and release oestrogen to stimulate the thickening of uterine lining and inhibit the secretion of FSH. As the ~~[illegible]~~ ovum are damaged, not enough oestrogen will be released, leading to having a lower osetrogen level than usual, and can't release enough follicle during the start of menstrual cycle.

aii. As not enough oestrogen have been released, the pituitary gland can't be inhibited and continue to release FSH. As such the overall FSH level in Susan's blood test is higher than normal.

aiii. ~~[illegible]~~ Due to the low level of progesterone and oestrogen, the thickness of the uterine lining can't be maintain the uterine lining will breakdown continuously, leading to increase wall of length in menstrual flow.

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aiv. The LH level should be measured. If ovulation occurs, than the LH level in blood should decrease.

bi. At 38°C, the atmospheric temperature is greater than the body temperature. The increase in temperature is detected by the thermoreceptors on the skin. Nerve impulse is than transmited to the hypothalamus. The hypothalamus is stimulated to stimuli the sympathetic nerve, to transmit nerve impulse to atrial body and cardiac body. The heart will be stimulated to pump more strongly and more rapidly to pump blood to the skin. The cardiac output increase.

bii(1). The arteriole is constricted when body temperature increased from 36°C to 37°C. Thus the average amount of skin blood flow decrease.

bii(2). It allows more blood flow to muscle to provide enough energy for muscle contraction.

biii. The resting group will shiver to gain heat while the exercise group will sweat to lose heat.

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試題編號 Question No.

Question 1 marked: ☒ 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.

b)ii ~~The resting group would take to curl up to reduce~~

The resting group's hypothalamus will secrete acetylance to reduce heat loss. While ~~exer~~ exercise group will secrete ~~noradren~~ nonadrenaline to increase heat loss.

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2ai. The concentration of pollutant X in breast milk continously increase when the age grouop increase. Also, the concentration of pollutant X in breast milk increase when the participants have a higher frequency of seafood consumption. It is because fish contains pollutant X, therefore the higher the frequency of seafood consumption. The higher the concentration of pollutant X in breast milk.

It is because as human age, more pollutant X will be accumulated inside the human body.

aii(1). Non-digestable, non-excretable, non-egestable

aii(2) It is because milk contains enzyme. If the pollutant can bioaccumulation, than the enzyme in milk would not be able to breakdown the pollutant.

aiii. Disposing trash into the ocean, feeding bioaccumulative pollutants to wild animals.

2bi.

Comparison of the results of 2 treatment	deduction
Treatment 1 and treatment 2	Tiles allow invertebrates to live on the surface of the tiles

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

bi. Treatment 2 and treatment 3	Crevices in tiles provides a better living condition to invertebrates

bii(1). Crevices provides a place for invertebrates to hide from pradators

bii(2). Crevices provide a surface that prevent the invertebrater from being wash away by the waves.

biii(1). The number of invertebrates on the eco-engineered tiles.

biii(2). Able to prove the existance of invertebrate in the eco-engineered tiles, able to see the biodiversity in the eco-engineered tiles.

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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.

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

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