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Level 5 Exemplar 1

2023-DSE
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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.



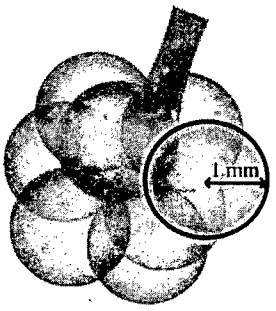
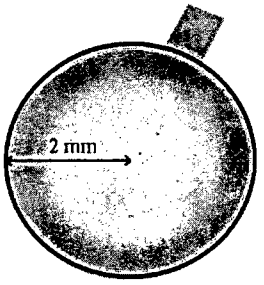


* A 1 3 0 E 0 1 B *

## 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)

total surface area = $12.6 \times 8 = 100.8\ mm^2$

(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)

The total surface area of 8 small spheres is double of that of 1 large sphere, which ~~sh~~ shows that having smaller air ~~sac~~ sacs have a larger total surface area ~~to volume ratio~~ than that of bigger air sacs, therefore, diffusion of gases are more efficient.

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

Air sacs are surrounded by blood ~~vess~~ capillaries which carry oxygen away and carbon dioxide towards air sacs, to maintain steep concentration gradient ~~fo~~ of gas for diffusion. more efficient

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Answers written in the margins will not be marked.

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)

As organelles are not transparent ~~th~~ ~~e~~, ~~e~~ cells forming lens of eye with organelles will block the light, which lower the ability for light to pass through the lens and focus onto retina, the image formed will be dimmer.

(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)

Xylem. It is formed by dead cells which don't contain end walls to form ~~hollo~~ ~~a~~ continuous hollow tube to reduce friction during ~~tran~~ transporting water.

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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***

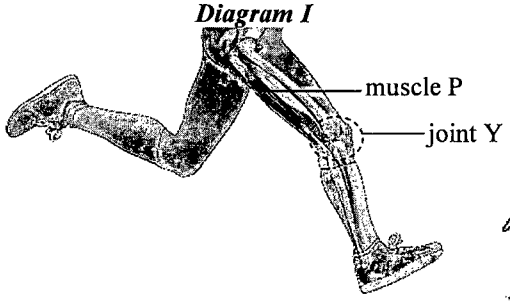
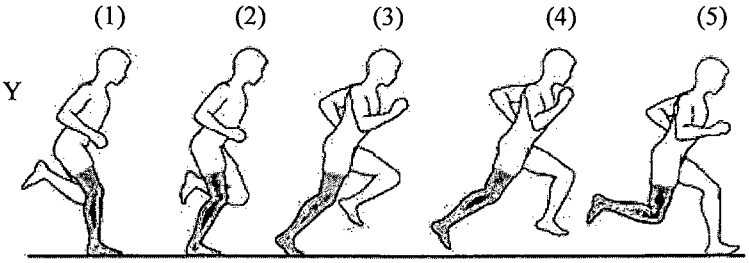



***Diagram II***




(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)

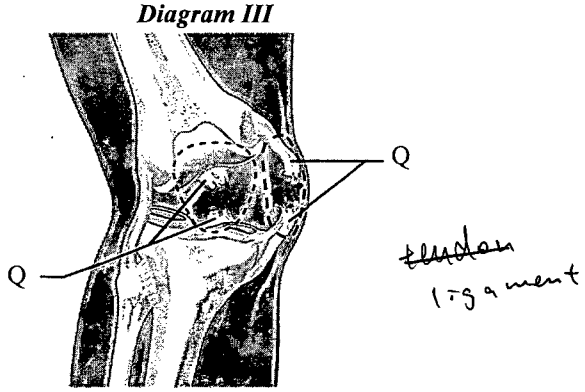
Muscle P is contracting.

(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 to bend the leg.

(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)

As structure Q was torn, while structure Q is responsible for the prevention of dislocation during moving, the bones in joint Y will be dislocated during ~~movement~~ movement. ~~Then~~ The person may not be able to ~~walk~~ 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)

Through mosquito

(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)

In tropical and subtropical regions, there are lots of moist environment, which allow larvae to grow and ~~mosquito~~ provide a breeding site for mosquito. The number of mosquito increase, which have more vector to transmit Dengue fever, leading to higher risk of contracting dengue fever.

(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)

Phagocyte engulf the DENV and digest DENV.
Plasma cell produce specific antibody to DENV which form clumps with DENV for easy engulf of phagocyte.
Killer T cells directly kill DENV.

(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)

Different subtypes of DENV have different shape of antigen, while memory cells and antibodies are specific, memory cells and different antigen can no longer bind together to bring about immune response toward different subtypes of DENV.

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

Vaccination

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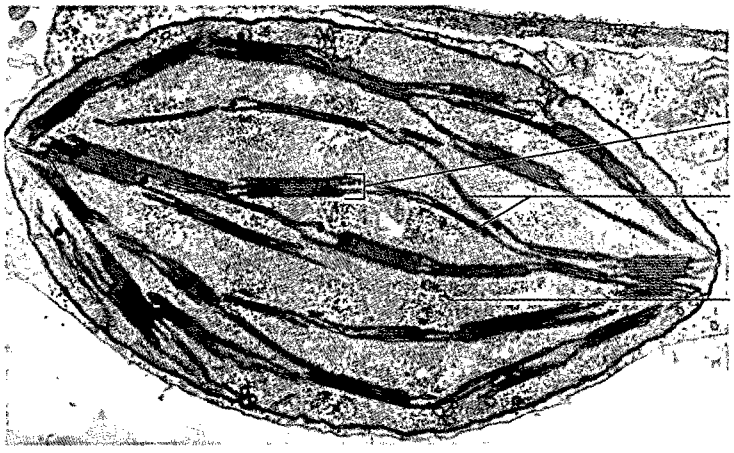
stroma Calvin cycle

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




Y: Thylakoid

(a) Label structure Y. (1 mark)

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

Light energy is ~~the~~ converted into chemical energy. Light energy is captured by chlorophyll so as to release ~~the~~ excited electron, which pass through electron transport chain and release energy in stepwise manner, the energy is trapped by ADP and $P_i$ to form ATP, which is used for light-independent reaction in photosynthesis.

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

Anabolism. 5-C compound combine with carbon dioxide to form two 3-C compound and eventually become triose phosphate, which is a building process ~~of forming bonds~~.

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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)

~~Ans~~. Glucose produced in photosynthesis ~~in~~ in leaves convert into sucrose, which is translocated to underground tubers of potato plants by phloem. Sucrose is then converted into starch and stored in the underground tubers.



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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 caused by improper functioning of red and green cone cell while total colour blindness is caused by non-functioning red, green, and blue cone cells.

(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 carry only one X chromosome, while women carry two X chromosome. As the only X chromosome of men carry recessive allele for red-green colour blindness, the men have disease. While for women, the women ~~get~~ is red-green colour blindness only when both of two X chromosome of women carry recessive allele for red-green colour blindness respectively, the women have red-green colour blindness. The ~~percentage change~~ chance for women to have red-green colour blindness is $\frac{1}{4}$, while for men, it is $\frac{1}{2}$. Therefore, the chance for women to have red-green colour blindness is lower than that of men, the occurrence of red-green colour blindness in men is higher than that of women. However, the allele for total colour blindness is located on autosome, both men and women have the same chance for them to carry two recessive allele for total ~~&~~ colour blindness at the same time as they have same number of autosome. The occurrence of total colour blindness is the same in men and women.

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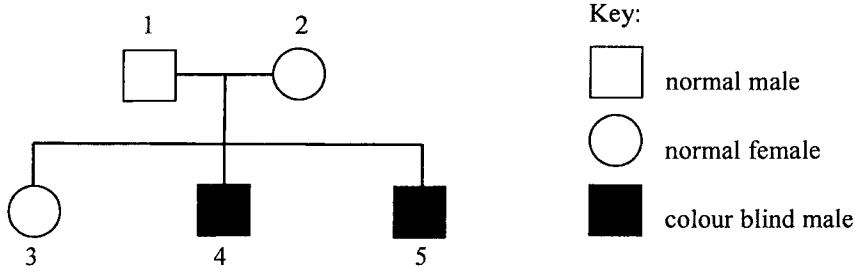
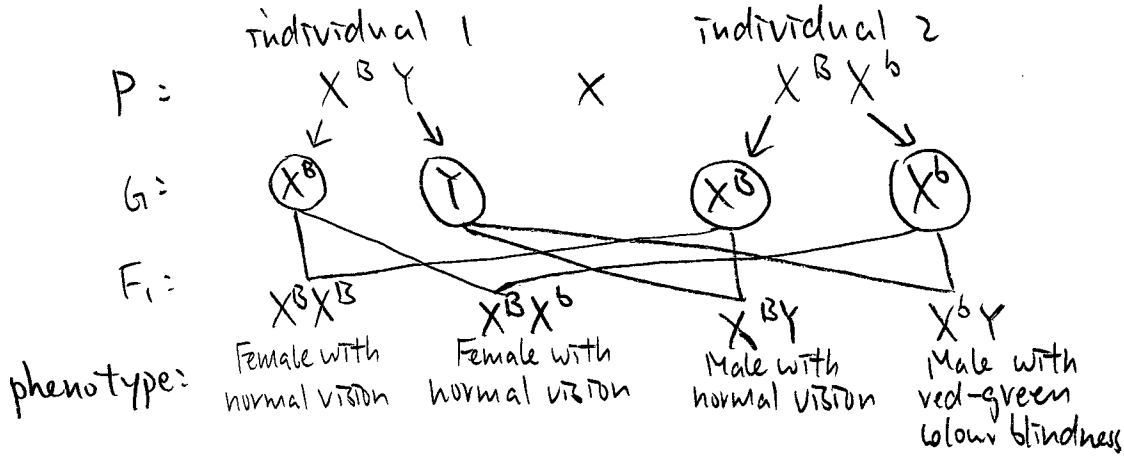
(c) The pedigree below shows the inheritance of red-green colour blindness in a family:




(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.)




∴ probability of the newborn being a girl with red-green colour blindness = 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. Both identical twins and fraternal twins can have two individuals with red-green colour blindness at the same time

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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)

Romer's Tree Frog ~~can~~ only consume small insects as food while Greenhouse Frog consume small insects and snails as food, there will be more food supply for Greenhouse Frog than that of Romer's Tree Frog. Greenhouse Frog have more food supply so that they can grow better and reproduce faster ~~than that of~~, increasing population of Greenhouse Frog, ~~so~~ which compete with Romer's Tree Frog, posing a threat to Romer's Tree Frog. Both Romer's Tree Frog and Greenhouse Frog can breed and live in shrubland and woodland, ~~which~~ ~~so~~ they will have competition toward breeding site and habitat, posing a threat to the Romer's Tree Frog.

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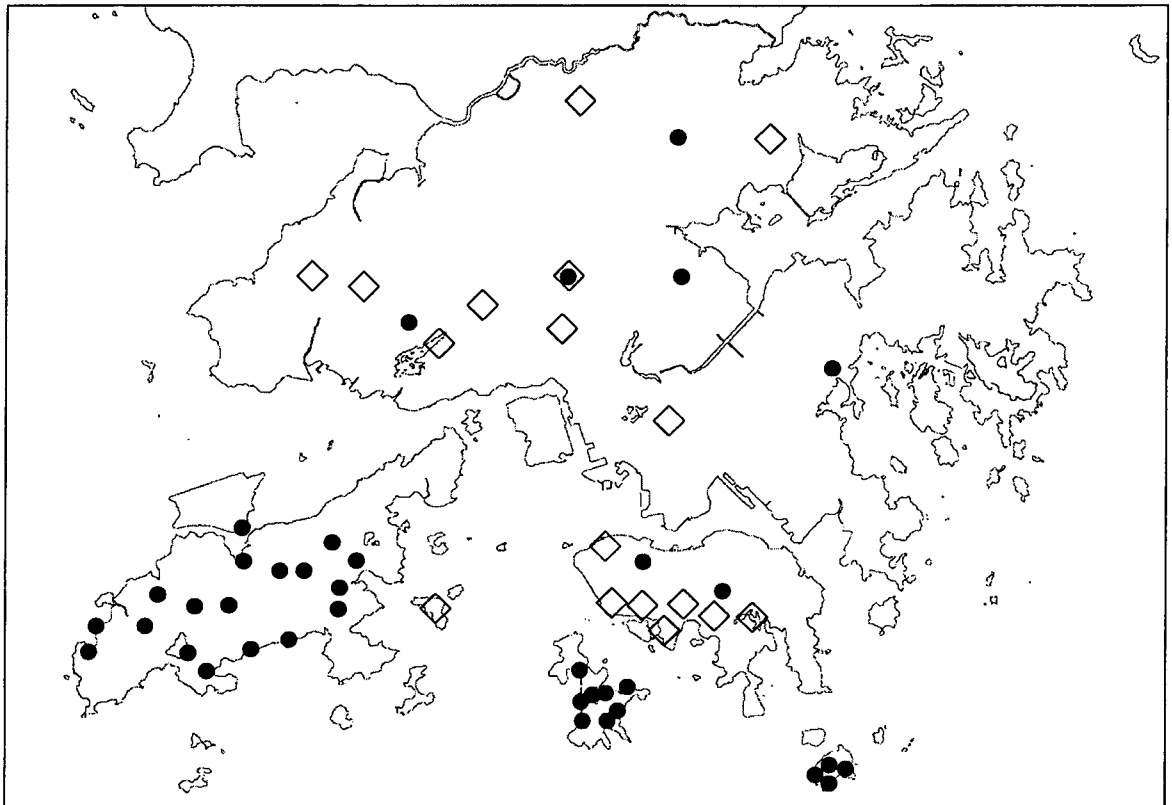
(b) The map below shows the distribution of the two frog species in Hong Kong:



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)

The locations of greenhouse frogs and habitats of Romer's Tree Frog is not the same for almost all position.

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

Put greenhouse frogs to ~~to~~ one of the habitats of Romer's Tree Frog, measure the population of both frogs before and after one months. As there are significant decrease in ~~the~~ population of Romer's Tree Frog, Romer's Tree Frogs are facing a real threat from greenhouse ~~fr~~ frogs.

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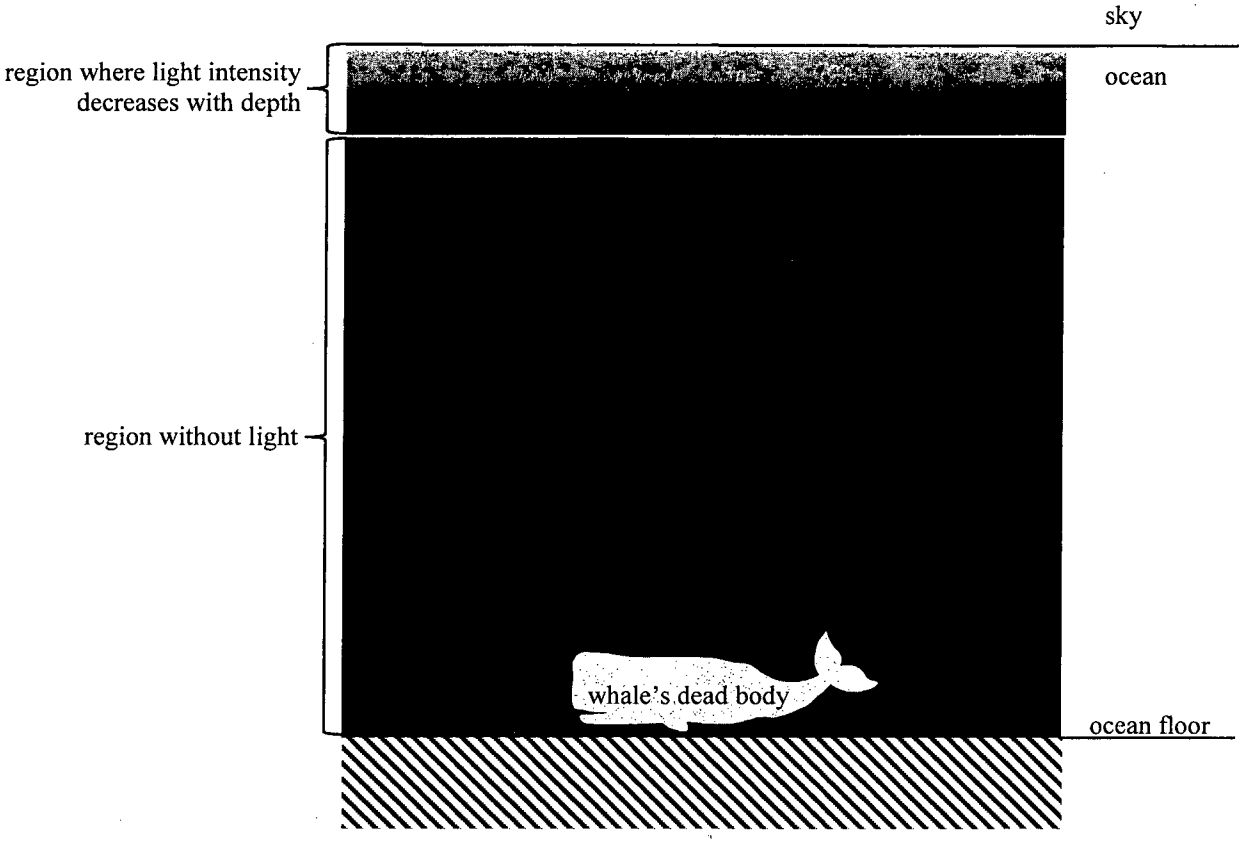
8. When whales die, their dead bodies sink to the bottom of the ocean. The whale carcasses support a unique community known as whale fall community. The diagram below shows different regions of the ocean and the location of a whale's dead body:




(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 organic matters

(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)

Decomposers decompose organic matters into inorganic matters, providing inorganic matters for plants to absorb for photosynthesis to produce food so as to cycle ~~matter~~ materials.

(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)

~~It~~ They convert organic matters into inorganic matters for absorption ~~of~~ in plant for photosynthesis to start the cycle.



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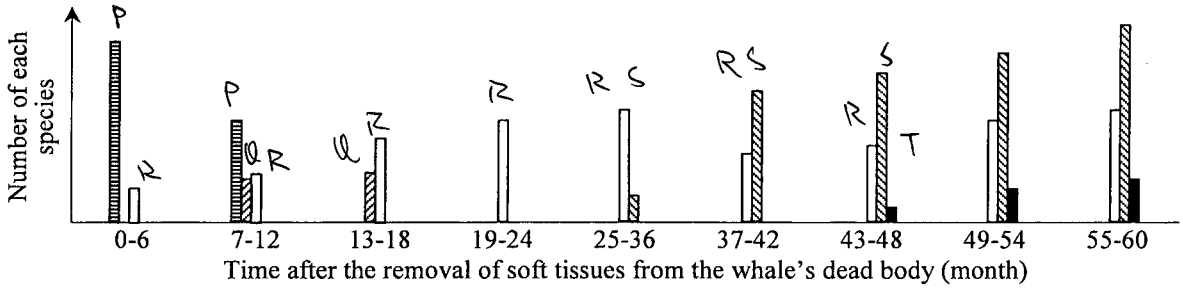
(c) After the soft tissues of the whale's dead body have been consumed, another group of organisms start to feed on the remaining nutrients from the skeleton. For an average-sized whale, it could have 2 000 – 3 000 kg lipid stored inside its skeleton. The bar chart below shows the abundance of different 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) There are different dominant species at different time. | From 0 - 12 month after the removal of soft tisswes from the whale's dead body, the dominant species is species P. From 13-36 month, the dominant species is R. From 37-60 months, the dominant species is species S. |
| (ii) Some species are eliminated, while new species are found. | Species P disappears after 13 months and species Q disappears after 18 months. While species S appears after 25 months and species T appears after 43-48 month. |

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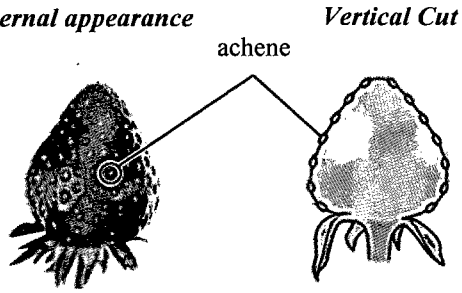
9. The diagram below shows the external appearance of a strawberry and its vertical cut. The achenes found on the surface of the strawberry are the fruits:




(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 responsible for the growth of strawberry. |
| 2 versus 3 | Auxin is produced by achenes which is responsible for the growth of strawberry. |
| 1 versus 3 | Achenes produce chemicals other than auxin, which is responsible for the appearance of strawberry. |

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

Achenes produce auxin which can stimulate enlargement of 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<br>  <br>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 show that the result of Treatment 1 and 2 in only one treatment and experiment, so that treatment 4 can reduce lost of strawberry.

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

Auxin produced by shoot tips stimulate growth of shoot tip so as to obtain maximum sunlight for photosynthesis by green leaves to produce food.

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11100

250 → 100 → 2675

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.

(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 |

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)

$\frac{11100}{2675} \times 250 = 1037\ g$

(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)

$\frac{1037}{250} \times 3.5 = 14.5\ g$

(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 daily requirement for the boy is 52 g, which is much larger than that it obtain everyday, the blood protein level of this boy will be much lower than that of normal healthy boys of the same age.

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

As the blood protein level is low, the water potential in blood at venule end of capillary is not sufficiently low enough, which lead to the decrease in net water movement from tissue fluid back into blood by osmosis. As water in tissue fluid cannot be drawn back to the blood, the volume of tissue fluid increase, leading to accumulation of tissue fluid.

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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)

Inner membrane of mitochondria.

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

As oxidative phosphorylation stops, there will be no regeneration of NAD and FAD ~~for glycolysis~~, the body cell undergo anaerobic respiration. Pyruvate convert into lactic acid, which accumulate and is released into blood, leading to increase in his blood lactate level.



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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. 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)

8

As the ~~its~~ average global temperature increase, there will be a more favourible environment for vegetative organs to grow. Activity of enzyme increase as optimum temperature is reached, food stored in vegetative organ is used to develop new plants as enzyme such as amylase breakdown starch into glucose for respiration to provide energy for new plant to grow. Enzyme are also responsible for metabolism such as photosynthesis. As enzyme activity increase, photosynthesis rate increase, ~~more to~~ rate of food ~~production~~ production increase and crops can grow better, leading to a increase in crop yield.

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Asexual reproduction produce genetically identical offspring, which do not have genetic variation. Due to lack of genetic variation, the offspring will have lower chance to survive in changing environment such as higher temperature, and hence, the new plants may die and cannot survive and reproduce, leading to extinction. ~~As temperature increase, there may be a more suitable environment for~~ Moreover, as the offspring is genetically identical to parents, the genetic ~~dis~~ disease may ~~be~~ inheritated to offspring, the offspring will have disease. Parents and offsprings may die due to the genetic disease ~~and~~ and ~~he~~ hence, there will be high ~~ris~~ risk of extinction as ~~plant~~ crops cannot reproduce to produce new offspring.



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Answers written in the margins will not be marked.

**END OF PAPER**

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

Answers written in the margins will not be marked.

# 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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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.

1ai) Ovary ~~so~~ could have been affected as the oestrogen level is ~~be~~ always below the normal range. As ovary is affected, there may not have developing follicles, which is responsible for the secretion of oestrogen, thus there is ~~be~~ low secretion of oestrogen, leading to a lower oestrogen level than normal range.

ii) ~~Be~~ High concentration of oestrogen inhibit the secretion of FSH by pituitary gland, ~~&~~ while FSH ~~se~~ stimulate the developing of follicle. As no follicle can develop, there is a low oestrogen level, which can no longer inhibit the secretion of FSH. FSH keep secreted by pituitary gland into blood, the FSH level is always higher than normal range.

iii) ~~As there is no ovulation due to the low level of oestrogen, there is no inhibition of oestrogen secretion by LH~~ As there is no ovulation due to the low level of oe

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Start each question on a new page.

(a iv) LH. LH level is suddenly increase to a high level to stimulate ovulation. If there is ovulation, the LH level should be very high.

b i) ~~As the temperature in room is higher than that of body temperature~~ As body temperature increase due to the net heat gain by convection, conduction, radiation from the room, the thermoreceptor in hypothalamus detect the change. Heat loss centre in thermoregulatory centre in hypothalamus send more nerve impulse ~~to~~, causing dilution of arteriole under skin, leading to more blood flow to the skin so as to increase heat loss to surrounding, to lower the body temperature. ~~back to normal~~

ii) (1) As body temperature increased from 36°C to 37°C, the ~~amount~~ average amount of skin blood flow of exercise group decrease, showing that the arterioles ~~are~~ constrict.

(2) As the exercise group is exercising, there is a increasing demand for oxygen from blood, arterioles constrict to reduce blood flowing to skin, hence increase amount of blood flow to muscle, increasing oxygen supply for muscle

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16 iii) (2) contraction.

iii) Exercise group produce more sweat than that of resting group. The breathing rate of exercise group is faster than that of resting group.

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Start each question on a new page.

4ai) Restriction enzyme P and R. They can cut the plasmid A open to form sticky end which have complementary base pair with sticky end of DNA fragment with GFP gene.

ii) To select transformed bacteria that pick up plasmid. As bacteria ~~that~~ that ~~didn't~~ didn't pick up any plasmid die in agar plate with ampicillin as they don't ~~have~~ carry ampicillin resistance gene, while bacteria that pick up plasmid can survive in agar plate with ampicillin as they carry ampicillin resistance gene.

iii) (1) Some plasmid rejoin themselves without inserting DNA fragment with GFP gene, which is the non-recombinant plasmid, while some plasmid carry inserted DNA fragment with GFP gene, ~~&~~ which is recombinant plasmid. Bacteria that pick up non-recombinant plasmid don't have ~~&~~ GFP gene, which cannot emit ~~&~~ green fluorescence when exposed to UV light, ~~which~~ while bacteria pick up recombinant plasmid carry GFP gene, which can emit green floresence when exposed to UV light, therefore, only some bacterial colonies glow under UV light.

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Start each question on a new page.

4a iii) (2) To produce GFP to be added to samples for testing under UV light.

b i) ~~the~~ ~~To~~ Tissue culture

ii) (1) W, X and Z

(2) As ~~the~~ DNA band in sample Y is absent in Gel I which indicate that sample Y don't ~~have~~ carry ALT1N gene, ~~At the same, sample the DNA band in sample Y is absent in~~ which is present in all rice plants, the sample Y may ~~have~~ not ~~carry~~ contain any DNA from rice line Y, the result in Gel II is not accurate.

iii) (1) Group 2. Most of the leaf area have 0% of visible injury and only 10 leaves have 1-20% ~~of~~ ~~area~~ leaf area with visible injury, which ~~shows that~~ is the least ~~the~~ injured compare with other 3 groups. Therefore, group 2 shows the highest herbicide resistance as group 2 is least damage by herbicide.

(2) Y. As Y don't carry HR gene as there is no DNA band in Gel II, rice line Y don't ~~can~~ have herbicide resistance, which ~~can~~ will be most damaged by ~~the~~ herbicide, while the other three rice line shows DNA band in

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Start each question on a new page.

(4b iii) (2) Gel II, they ~~have~~ have herbicide resistance. While Group I have the most percentage of leaf area with visible injury, which show that Group I have lowest herbicide resistance.

(3) The HR gene cannot expess out, therefore cannot produce herbicide resistance.

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Level 5 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.



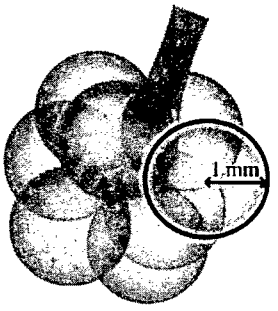
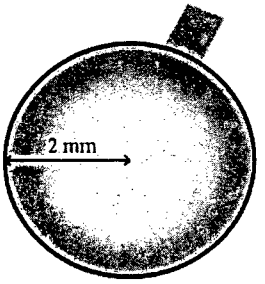


* A 1 3 0 E 0 1 B *

## 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.

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

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

$4\pi r^2 \times n = 4\pi(1)^2 \times 8$ $8 \times 12.6$

$= 101 \text{ mm}^2$ $= 100.8 \text{ mm}^2$

(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)

The total surface area of smaller air sacs is larger, the rate of diffusion of respiratory gases during gas exchange is higher.

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

It has one cell thick epithelium to provide short diffusion distance for respiratory gases

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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)

The organelles will block the pathway of light entering the eye, so the lens fail to focus the light onto retina to give image.

(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)

Xylem vessels. When mature, it has no end wall and no cell content to allow continuous flow of water column with little resistance



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Go on to the next page

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***

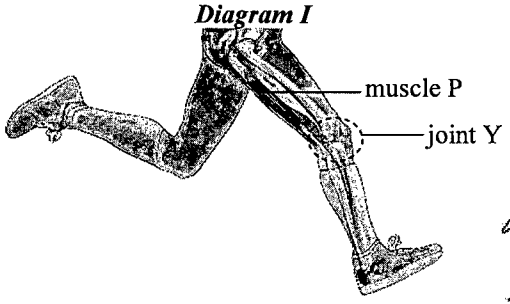
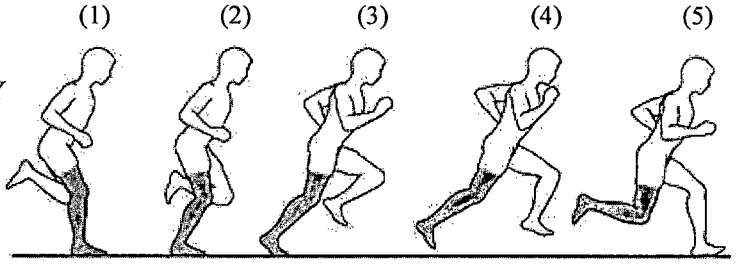



***Diagram II***




(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)

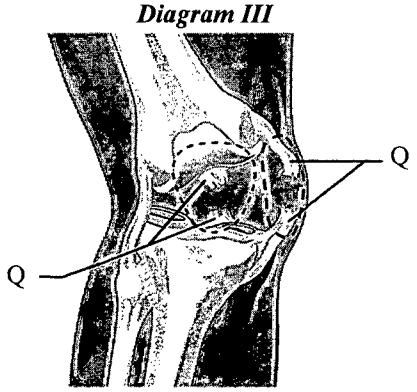
muscle P contracts

(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 it contracts, it bends the right leg.

(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)

Q is ligament. When it was torn, it fails to bind bones together and there may be dislocation of joints, joint Y cannot allow movement of right leg for a while.



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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)

mosquito

(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 environmental temperature is higher, which increases metabolic activity of mosquito, so they can reproduce to a large number. There are lots of rainings in these regions, which provide stagnant water which are the breeding places for mosquitoes.

(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)

Phagocytes, they engulf pathogens and form food vacuole and digest the virus with enzymes. Plasma B cells, they produce antibodies specific to that virus. Killer T cells, they kill the infected cells directly.

(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)

The immune response and the memory cells produced during primary response is highly specific. The other subtypes of DENV may have another antigen, thus fail to activate

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

using insecticides to kill mosquito.

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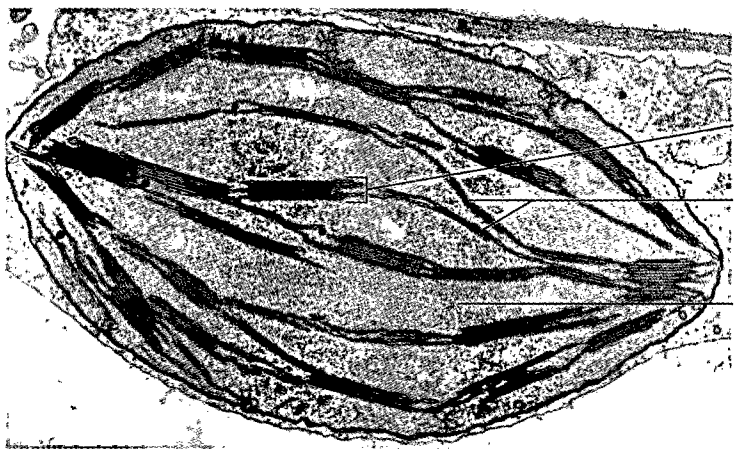
5. An electron micrograph of a chloroplast is shown below:




intergranal thylakoid

(a) Label structure Y. (1 mark)

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

Light energy converts to chemical energy. Photochemical reactions provide ATP and NADPH for formation of triose phosphate / glucose in Calvin cycle.

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

Anabolism. Because it requires energy released from ATP to form a more complex organic nutrients (triose phosphate) from a simple inorganic compound ($CO_2$).



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Answers written in the margins will not be marked.

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

The glucose produced in photosynthesis is first converted to sucrose. Phloem transports sucrose to the base of underground stem. The sucrose is then converted to starch for storage in tuber.

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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)

Answer: Only cone cells distinguish red and green colours. There are three types of cone cells, red, green, blue. The blue cone cells can still function properly in red-green colour blindness and gain colour vision - they

(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)

Answer: (the allele is X-linked), For red-green colour blindness, the percentage occurrence in men is higher than women. Since men has one X chromosome and one Y chromosome, if men inherits X chromosome with recessive allele men will have the disease. Whereas women need to inherit two X chromosomes with recessive allele in order to have the disease, so the chance is smaller. While for total colour blindness, men and women have the same percentage of occurrence, since the allele lies on autosomes, so the chance of men and women being homozygous recessive (receiving two total colour blindness allele) is the same.

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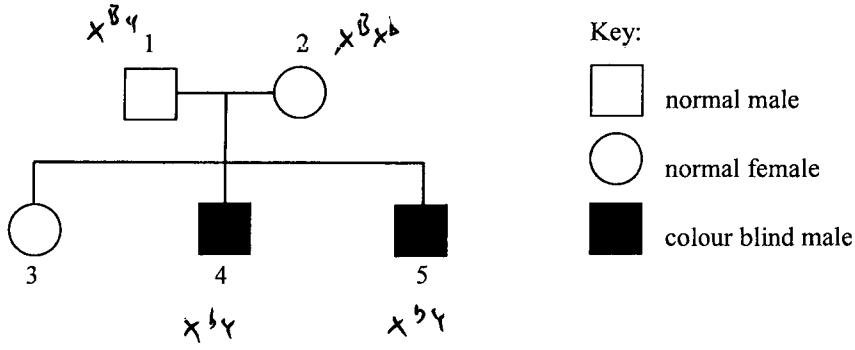
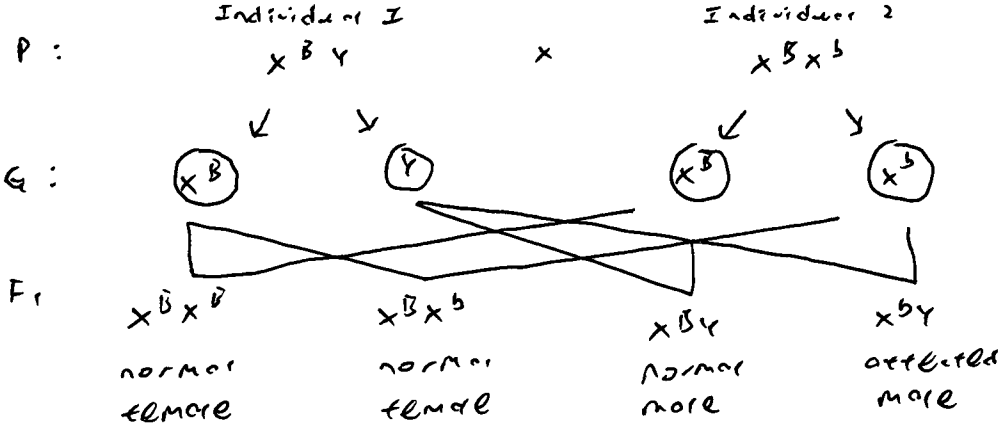
(c) The pedigree below shows the inheritance of red-green colour blindness in a family:




(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.)




probability of red-green colour blindness girl = 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, I only know that they have the same sex and are colour-blind, but identical twins are genetically identical, I don't have sufficient information to ensure their genetic combination for other traits are still the same.

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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)

They require similar breeding site and habitat, such as woodland, shrubland. They require the same food, such as small insects. Their ecological niche overlap, so the ecological relationship between Romer's Tree frog and greenhouse frog is competition. Romer's Tree frog may not have sufficient shelter and food to survive, death rate is higher than birth rate. Their number decreases.

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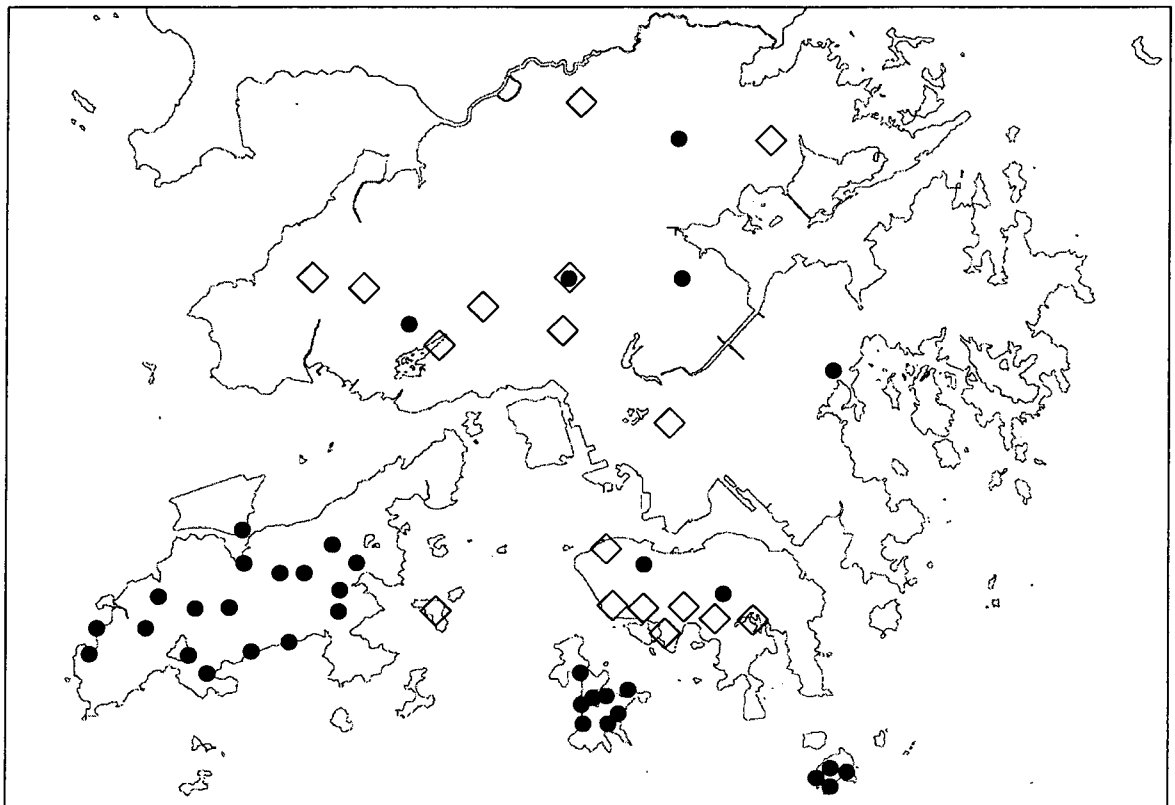
(b) The map below shows the distribution of the two frog species in Hong Kong:



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)

In general, these two species live in different places, so they do not have to compete for similar resources.

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

carry out a laboratory study by rearing Romer's Tree Frogs and greenhouse frogs separately, also rear both of them together. If the reduction in number of Romer's Tree Frogs in rearing together compared to rearing alone is larger than that of greenhouse frogs, it shows that greenhouse frog is a stronger competitor, and Romer's Tree Frog is facing real threat.

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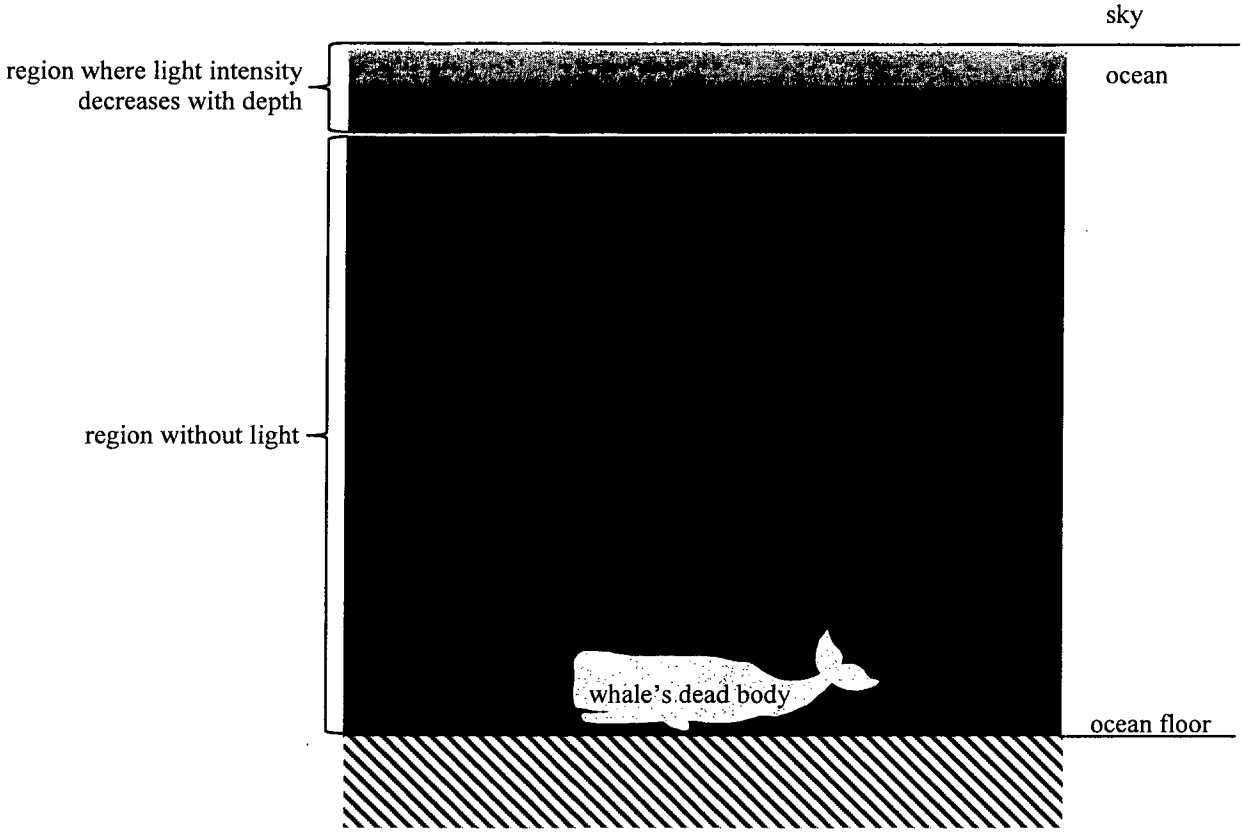
Answers written in the margins will not be marked.

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)

solar energy.

(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)

At the bottom region, there is no light. Producers such as plants cannot carry out photosynthesis to synthesize organic nutrients to support the lives of whale fall communities. By eating the organic nutrients inside whales dead body, they can get enough energy to survive.

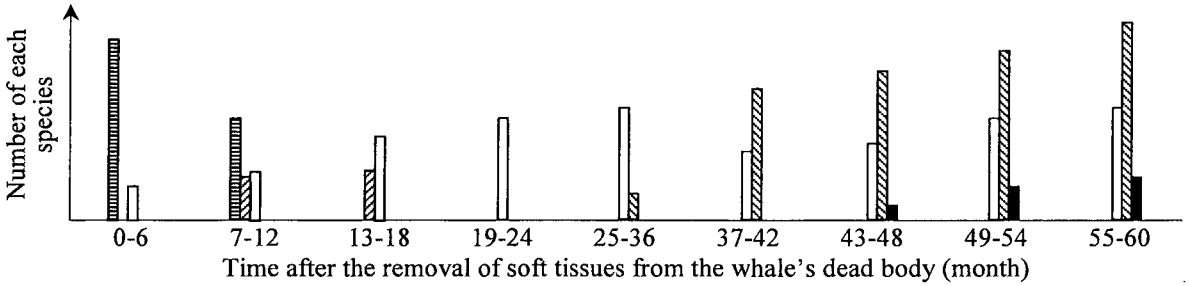
(b) What is the role of the organisms that feed on the soft tissues of the whale's dead body in the cycling of materials? (1 mark)

Decomposers break down organic nutrients inside the whales dead body into inorganic compounds, such as nutrients, which are then absorbed and used by plants.



Answers written in the margins will not be marked.

(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 types and relative abundance of species keep changing with time. (The pioneer community may not be the same as the climax community) | At 0-6 months, the amount of species P is highest and there is no species S. But 55-60 months, the amount of P drops to zero and the number of S is highest |
| (ii) It requires a long period of time. | It takes 55-60 months. |
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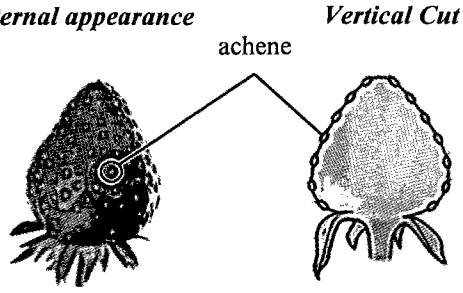
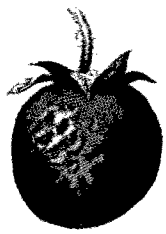
9. The diagram below shows the external appearance of a strawberry and its vertical cut. The achenes found on the surface of the strawberry are the fruits:




(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 | Removal of achenes hinder growth of strawberry. |
| 2 versus 3 | Spraying with auxins can promote the growth of strawberry. |
| 1 versus 3 | no conclusion can be made since there are two independent variables |

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

achene contains auxins which cause an increase in size of 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 uses the same strawberry which can minimize the individual difference in each strawberry so as to obtain a more accurate results.

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

shoot are positively phototropic which bend towards the unilateral light. It enables the shoot to hold leaves in favourable position to receive maximum amount of sunlight 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. , small intestine (pancreas + intestinal wall)

(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 |

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)

$\frac{11100}{2675} \times 250 = 1040\ g$

(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)

$\frac{1040}{250} \times 3.5 = 14.3\ g$

(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 protein obtained is less than the daily requirement, so the blood protein level of this boy is lower than that of normal healthy boys.

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

Since the blood protein level is lower, the blood water potential is higher than normal, this reduces water potential gradient across capillary wall at venous end between plasma and tissue fluid, fewer water in tissue fluid is reabsorbed by blood, so there is accumulation of tissue fluid.

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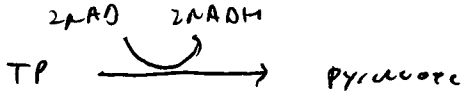
(c) Cassava contains a natural toxin. Consuming inadequately cooked cassava may result in cyanide poisoning. Cyanide shuts down the oxidative phosphorylation in mitochondria by inhibiting a key enzyme of the process.

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

cristae

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

Blood lactate level increases. Since oxidative phosphorylation is inhibited, pyruvate will become the final electron acceptor instead of oxygen, and pyruvate accepts electrons and is converted to lactic acid, which is then accumulated in blood.



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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. 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)

When temperature increases, the rate of photosynthesis increases as higher temperature promotes enzymatic activity. The rate of photosynthesis is higher than the rate of respiration, so there is a larger net gain in organic food for faster growth of the plant. Also, there will be more excess organic food being stored in vegetative organs, so it is sufficient to supply to the development of higher number of buds, which will then develop into new plants using food stored in vegetative organs. Hence, there is an increased yield. This reproduction is fast since there are large food storage for growth. Daughter plants produced from asexual reproduction is genetically identical to the parent plant without any genetic variation. Since it does not involve the production of gametes by meiotic cell division and fusion of gametes, so there is no different genetic recombination. The vegetative organ and

Answers written in the margins will not be marked.

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daughter plant are produced by mitotic cell division, so there is no genetic variation. Without genetic variation, the whole population may be non-resistant to a single disease or fail to adapt to the environmental change, so all plants die.



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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.

試題編號 Question No.

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

(ii) the previous memory cells, so insufficient number of antibodies and killer T cells specific to the new antigen of virus can be produced in a short period of time, so the virus are able to reproduce and multiply to a harmful level.



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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

| 由考生填寫<br>To be filled in<br>by the candidate | |
|---|---|
| 試題編號<br>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.

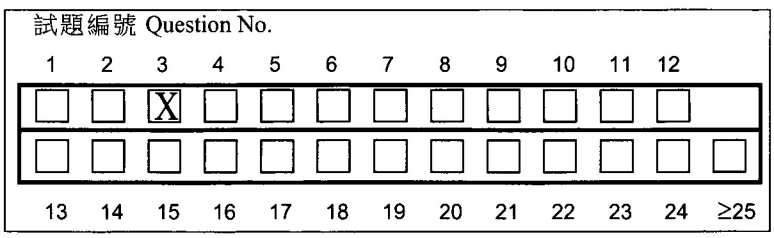
(3) Write on both sides using each line. Do not write in the margins. Answers written in the margins will not be marked.

(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.

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

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

1c (i) Ovaries. FSH stimulate development of follicles in ovaries, but due to injury of ovaries, her developing follicles fail to secrete sufficient amount of oestrogen, thus her oestrogen level is lower than normal range

(ii) Oestrogen inhibits FSH secretion from pituitary gland. But due to a lower oestrogen level than normal, it fails to inhibit the FSH secretion from pituitary gland, so FSH level is higher than normal range from day 1 - 28.

(iii) The oestrogen level is lower than the normal range, from day 12 - 16, her oestrogen level just near the normal range from day 1 - 11, so initially she doesn't have sufficient amount of oestrogen to initiate repairing and thickening of uterine lining, (so there is

(iv) progesterone - the level of progesterone will keep increasing.

(continuous breakdown of uterine lining and is discharged with blood)

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Answers written in the margins will not be marked.

試題編號 Question No.

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Start each question on a new page.

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Answers written in the margins will not be marked.

b (i) Arterioles leading to the skin surface dilate to increase blood flow to the skin surface, to bring more heat to the skin surface and raise its temperature, so as to steeper temperature gradient across skin surface, more heat can be lost by conduction, convection and radiation

(ii) (1) since the amount of blood flow decreases, arterioles leading to the skin surface constricts

(2) To increase the supply of blood to skeletal muscles to supply more nutrients and oxygen for the increase in rate of respiration to release more energy for increased muscle contraction during exercising and increase the removal of $CO_2$ produced by body cells

(iii) from 38°C to 36.5°C, the average amount of skin blood flow is higher than that of exercise group.

The average amount of skin blood flow of resting group starts to level off at lower temperature than exercise group.

(preventing increase in internal temperature since rate of heat loss equals to the rate of heat gain)

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a (i) P. When the plasmid is cut by restriction enzyme P, the sticky ends produced are compatible to that at the two ends of DNA fragment with GFP gene, so they joined together by complementary base pairing and form hydrogen bond between bases.

(ii) - To identify the transformed cell and
- To kill bacterial cell without getting any plasmid. If the bacteria cells can develop into a colony, there bacteria cells take up the plasmid. If they can't, they don't have that plasmid.

(iii) (1) not all the plasmids are being inserted by the GFP gene. Some bacterial cells may take up a plasmid without GFP gene. Thus the gene can't be expressed and cannot produce GFP. Thus under UV light, these bacterial cells fail to emit green fluorescence.

(2) used as marker gene for identification of transformed bacterial cells.

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b (i) tissue culture

(ii) (1) W, X, Z

(2) DNA band in sample Y is absent in gel 4, this indicates the ACTIN gene is damaged. During insertion, it may cause damage to both HR gene and ACTIN gene.

(iii) (1) Group 2, it has the highest percentage of leaf area without visible injury, this indicates they are not harmed by the herbicide.

(2) Y, since Y doesn't have the HR gene, so it is the most resistant to herbicide, so it would have the greatest damage. As reflected in the chart, group 1 only has 20% of leaf area are without visible injury which is the lowest compared to other groups.

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(3) some rice line maybe cannot expose the HA gene, so it may have not little resistance to herbicide.

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