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Level 4 Exemplar 1

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.

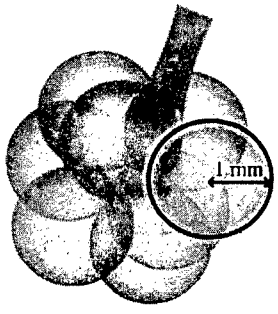
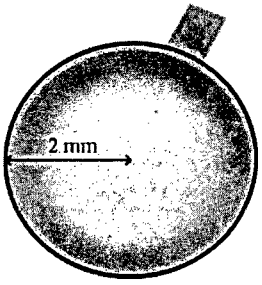
(8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* 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 = 12.6 × 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 eight small sphere is larger than that of one large sphere. There are more surface area for oxygen to diffuse into water film and more oxygen is able to diffuse into the air sac.

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

~~There are dense capillaries network covering the air sac~~ The wall of air sac are twin, diffusion distance is shorter for more effivient gas exchange.

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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 will be inelastic and also fail to refract and forms the light.

(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.
It will be able to absorb minerals and water from the soil.

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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

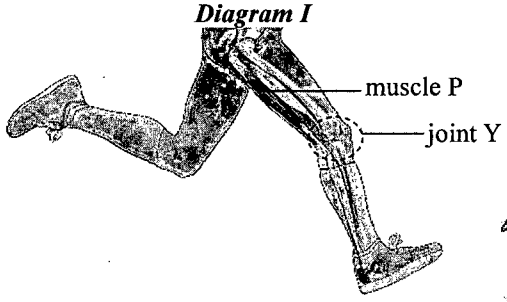
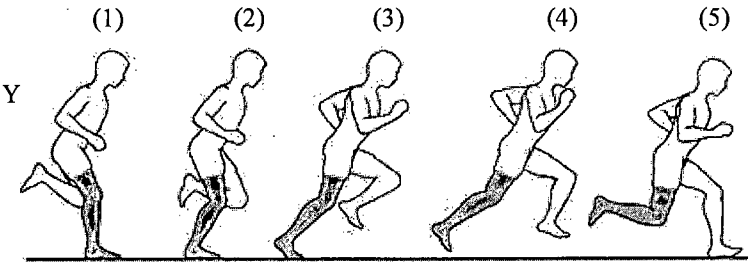


Diagram II



(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)

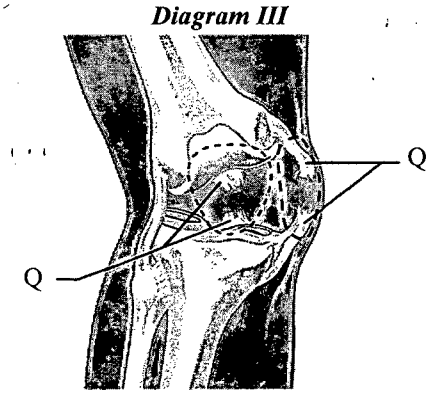
Muscle P is ~~relax instate to not~~ contract ~~in stages.~~ in an increasing power.

(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) tendon tension are decrease. and muscle P contracted.

(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 elastin to prevent dislocation of bones from moving. and join bones together If it is broken, bones are not join together and the ~~coordination of~~ bone fail to move.

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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)

by 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 temperature is usually high which is suitable for mosquitoes to interbreed. The humidity is also high which is suitable to mosquitoes growth.

(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. B-cell differentiate into memory B cell to recognise the specific antigen. T-cell. T-cell differentiate into killer-T cell to kill the infected cells. Finally, phagocytes, it undergoes phagocytosis to engulf the infected cells.

(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 level of memory cell will decrease for the time being. No large amount and quick response to produce antibodies happen after long period of time.

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

Wearing long-sleeves while having out-door activities.

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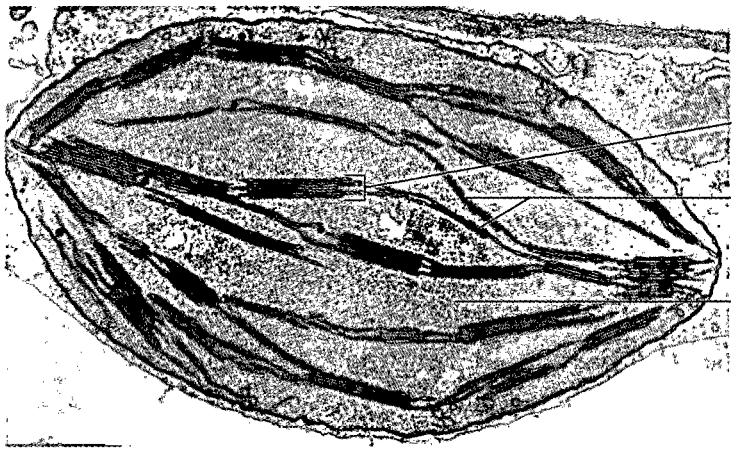
5. An electron micrograph of a chloroplast is shown below:



Y: thylakoids

(a) Label structure Y. (1 mark)

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

Photochemical reaction occur.
Heat energy convert into electrical energy.
To produce ATP and NADPH for the use in Calvin cycle.

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

Anabolism. because ADP + P → ATP.
It is forming 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)

Photosynthesis produce starch and it will store in stem tuber of the potato. This is vegetative propagation. After producing starch, food is transport down through phloem and store in the stem tuber.

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XY XX.

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 is ~~to~~ hicned. for the colour vision

(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)

Red-green colour blindness of men ~~is~~ has higher occurrence than that of women. As it is caused by a recessive allele on the X-chromosome. Men has only one X-chromosome and once that chromosome is recessive, the phenotype will be red-green colour blindness. However, women has two X-chromosome, only both of the chromosomes are recessive can the women get red-green colour blindness. Therefore, men has a higher chance to get red-green colour blindness.

On the other hand, total colour blindness are caused by a recessive allele which is located on an autosome, which mean both women and men have homozygous recessive, ~~so~~ will they have that diseases. Therefore, the chance of they getting total colour blindness are the same.

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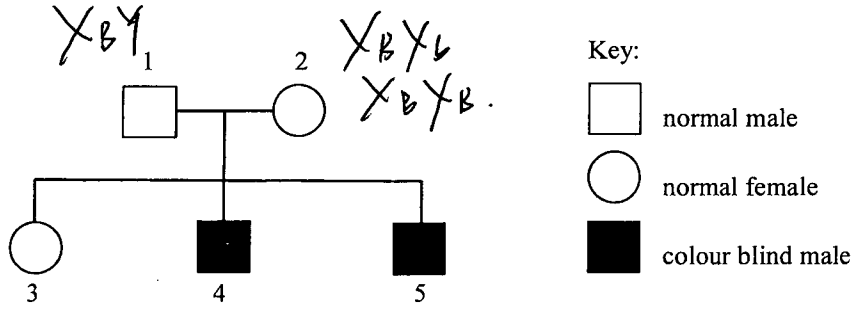
(c) The pedigree below shows the inheritance of red-green colour blindness in a family:



(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.)

Male
Normal vision
Female
Normal vision.
phenotype of parents
Genotypes.
Gamete
X^B Y
X^b X^B.
X^B Y
X^b X^B
Genotype of F1
X^BX^b. X^BX^B X^bY X^BY
Girl
Boy
For girl phenotype
Normal vision.
∴ The prob. 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. Even though they have the same genotype of colour blindness.~~ Yes, they are identical twins as they have the same genotype that they are form the same zygote which have the same genetic materials.

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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: larger

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 are competition relationship. They fight for the same food which is small insects. Also, they are compete for the same breeding site and ~~to~~ habitat which is shrubland. Greenhouse ~~Frog~~ Frog is in larger size and it will be more competitive that the Romer's Tree Frog may lack of food source or not sufficient habitat and breeding site. It will be posed a threat to them.

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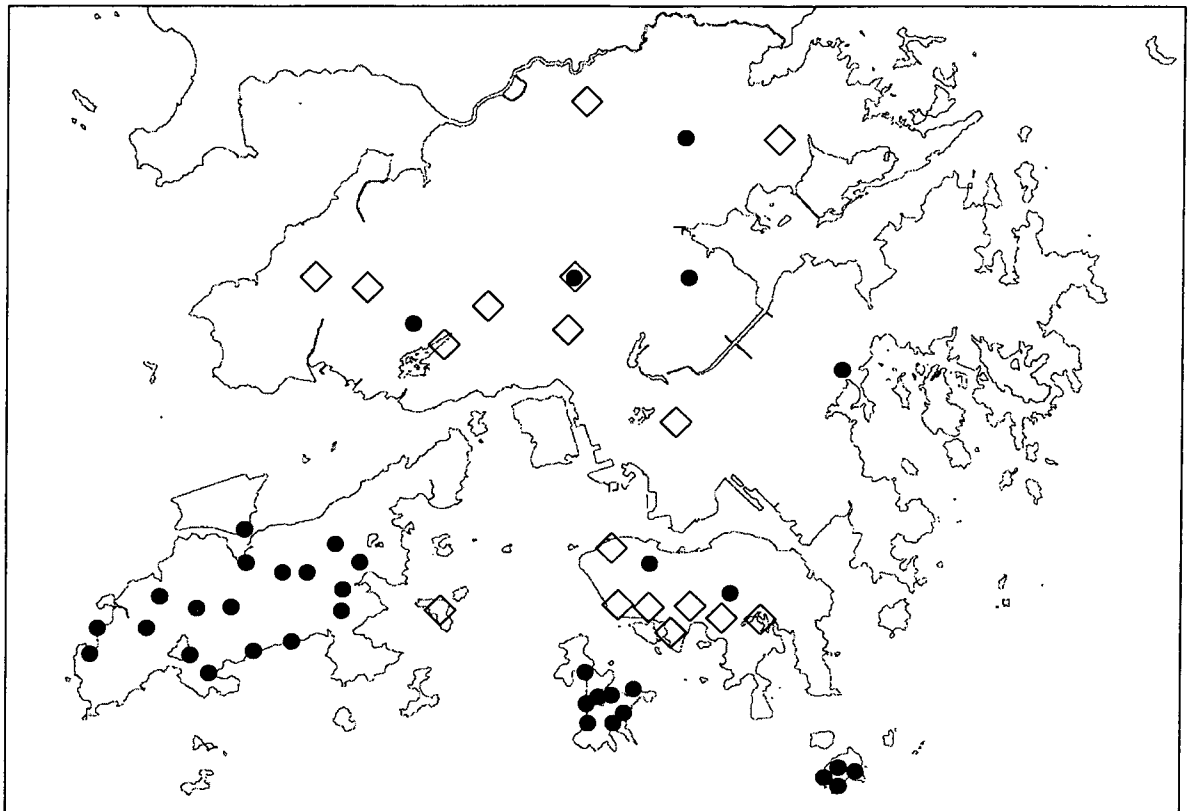
(b) The map below shows the distribution of the two frog species in Hong Kong:



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)

Most of their habitats are not in the same location, no competition for habitat occur.

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

Having counting number in the only location that found both of the species and having another counting in the place they live seperately. If the population of both result is different, it prove the threat occur.

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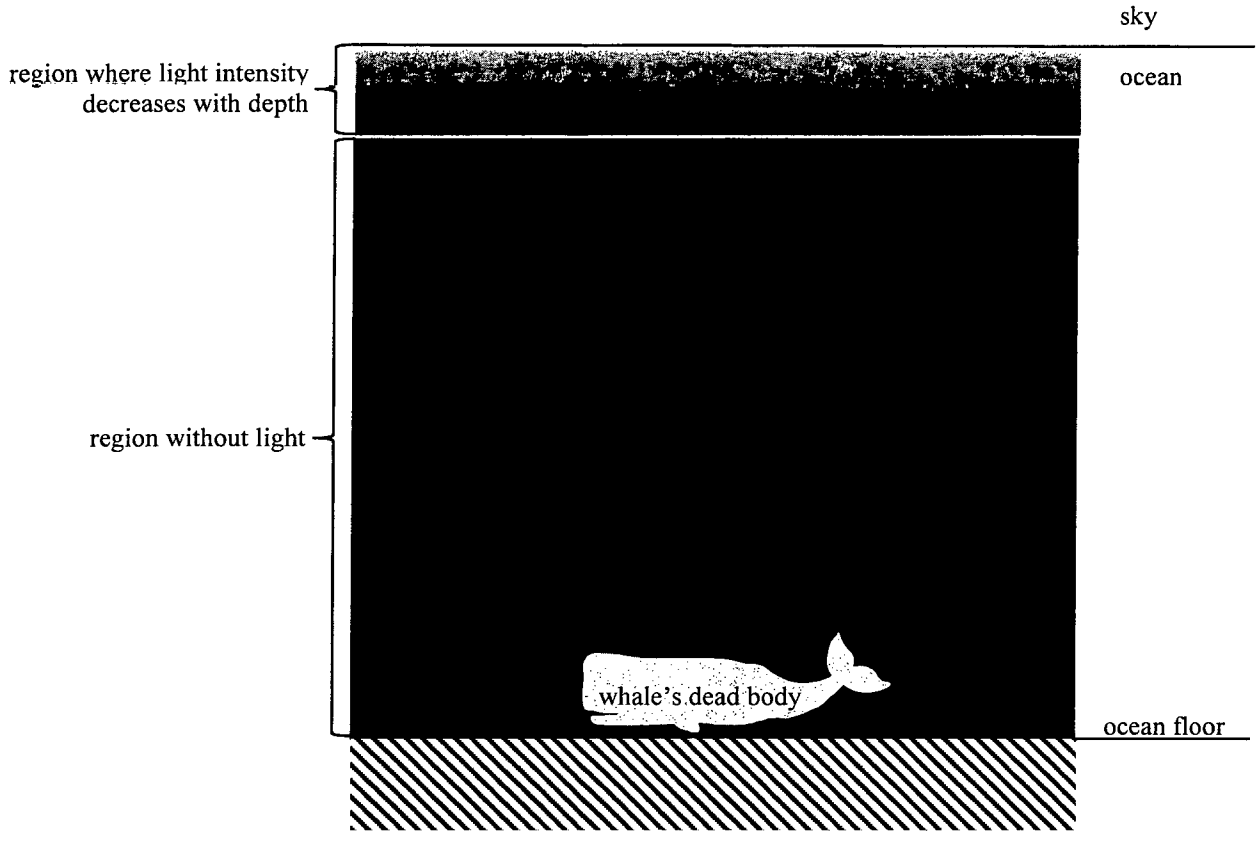
Answers written in the margins will not be marked.

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)

Sun.

(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)

Decomposition occur and provide humus. The region with low light intensity is good for bacteria and fungi to work.

(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~~ Decomposer.

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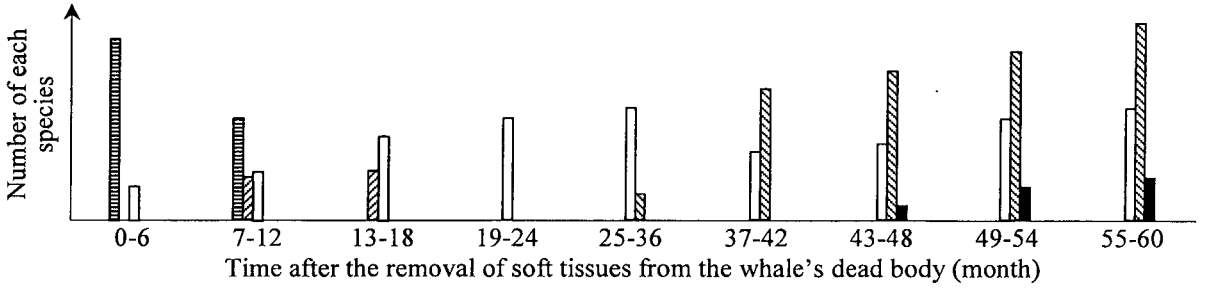
(c) After the soft tissues of the whale's dead body have been consumed, another group of organisms start to feed on the remaining nutrients from the skeleton. For an average-sized whale, it could have 2 000 – 3 000 kg lipid stored inside its skeleton. The bar chart below shows the abundance of different 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) Biodiversity increase	There are only 2 species in 0-6 ~~years~~ month and even one species in 19-24 ~~years~~ month. At the end, there are 3 species and larger population in 55-60 ~~years~~ month.
(ii) ~~It takes a long period of time.~~ Dominant species will ~~not~~ change.	The dominant species at the beginning is species P and in the end is species S.

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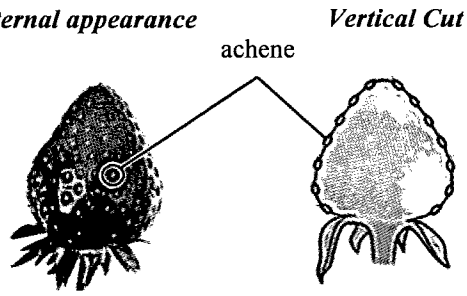
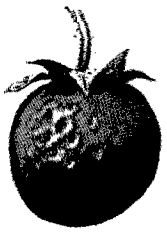
9. The diagram below shows the external appearance of a strawberry and its vertical cut. The achenes found on the surface of the strawberry are the fruits:



(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 in the surface promote growth of strawberry.
2 versus 3	Auxins promote growth while spraying in the strawberry surface.
1 versus 3	Auxins is better sources for growth than achenes.

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

Gene. Mutation occur.

(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)

The result is more ~~obse~~ ~~covers~~ ~~obvious~~ obvious, can compare them more dempsenty!

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

Auxins favours light. ~~Literal~~. It promote the growth of plant towards light, to allow larger amount of light is captured and led to a ~~higher the~~ higher rate of 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 ~~cava~~ 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:

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)

1037 g (convert to nearest 4 sig fig)

(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)

14.5 g (3 sig fig)

(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)

Blood protein level will be lower in the boy compare to normal boy. The normal boy are ~~food~~ require consume 52g protein per day but the boy can only ~~to~~ obtain 14.5g which is much less than the requirement.

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

low blood protein level will lead to high water potential in the blood. Tissue ~~fluid is~~ ~~fluid~~ Fluid is failed to return into capillaries by osmosis and thus it will accumulate.

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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 mitochondrion.
membrane.

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

His blood lactate level will increase as extra energy is needed for detoxification in liver. ~~If~~ ~~And~~ Anaerobic respiration occur to produce extra energy and the product will be ~~lactic~~ ~~acid~~ lactic acid and it cause the blood lactate level change.

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Answers written in the margins will not be marked.

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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)

Firstly, vegetative propagation take a short period of time to growth and the product can harvest after short period. It lead to the increase yield of these crops. However, crops undergoes photosynthesis at daytime, net consume of carbon dioxide and net release of oxygen occur. Net uptake of carbon dioxide can reduce global warming as carbon dioxide trap heat radiatim from the Sun and cause the temperature rise. Therefore, increase yield will cause lower population of plants undergoes photosynthesis. and result in ~~not~~ promoting global warming.

Regard the concerns of scientists. He is right. Asexual reproduction's offspring have the same genetic materials from its parents, it preserved the genetic material And it will reduce the genetic variation. On the

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

other hand, sexual reproduction's offspring have two ~~gam~~ gemates from different individuals and the genetic materials are different from their counterparts. Genetic variation increase and it able to face natural ~~selec~~ selection which will have a lower chance to exist. If the genetic composition are the same, the variation between species are low and they are unable to face different environmental pressure and the chance to survive and reproduce will decrease, finally, it will result in extinction.

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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

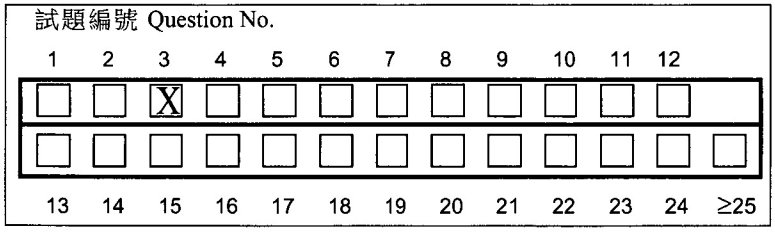
考生須知

(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



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.

1	2	3	4	5	6	7	8	9	10	11	12	
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Start each question on a new page.

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(a)(i) Pituitary gland was injured. It serete FSH to ~~Pituitary gland~~ stimulate the yellow body to serete more oestrogen and progesterone. In the figure ~~shown~~ above, the FSH level in Day 1-28 all higher than.

Yellow body serete oestrogen and ~~oestrogen~~ progesterone. High level of oestrogen will ~~that~~ inhibit the secretion of FSH. However, the oestrogen level remain low in day 1-28 and unable to inhibit the serection of ~~oestrogen~~. FSH Therefore, the ~~oes~~ FSH level remain very high in Day 1-28. The pituitary gland was affected as pituitary gland serete FSH ~~and~~ and it to stimulate yellow body to serete oestrogen. No yellow body stimulation led to low level of oestrogen.

(ii) low ~~FSH~~ Oestrogen level enhance the secretion of FSH. Therefore, the FSH level is ~~higher~~ higher than that of normal. FSH will also stimulate the development

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of yellow body and its secretion of oestrogen. Only high level of oestrogen can inhibit the secretion of FSH. In ~~the~~ Susan, no high level of oestrogen so the FSH level always remain higher than normal.

(iii) Progesterone ~~is used to~~ maintain the thickness of uterine ~~lingir~~ lining. In the graph shown, the level of progesterone is low that it is unable to maintain the thickness of ~~uterine~~ uterine lining. Finally, the uterine lining break down more easily and led to a longer ~~menstr~~ period of menstruation.

(iv) Oestrogen. Before ~~ovulation~~, ovulation, level of oestrogen will reach to the peak and stimulate the ~~to~~ secretion of LH that ~~LH~~ sudden surge of LH level will lead to ovulation. Therefore, oestrogen level will rise to the peak right before ovulation.

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(b)(i) When the people are doing exercise, increase rate of respiration produce large amount of heat and the body temperature are increase. It is detected by thermoreceptors in medulla and it will cause ~~vasodilation~~ vasodilation of blood ~~of~~ vessel to increase the blood flood near the skin surface. Increasing blood flow will led to the heat lost by more conduction, convection and radiation. Finally, the body temperature will derrease or prevented to reach to high temperature.

(ii)

(b)(i) The temperature of the room is higher than the body temperature. External ~~temperature~~ temperature rise is detected by thermoreceptors in ~~medulla~~ medulla. It cause ~~vas~~ ~~vas~~ vasodilation that the blood flow near the skin surface increase in order to loss more heat by convection, radiation and conduction. Finally, it prevent the body temperature

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to reach too high temperature.

(iii)(1). The arterioles constricts.
In order to reduce heat loss by
blood flow by convection, conduction
and radiation.

(2) ~~There are muscle contractions~~
Prevent too vigious blood flow and
may lead to the breakage of vessel
during muscle contraction.

increase of
(iii) The blood flow of resting group
is more vigions than that of exercise group.
The level of stable blood flow of resting
group is higher than that of the
exercise group.

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Start each question on a new page.

(a) (i) Regard graph 3, the older the person, the higher concentration of pollutant Y is high. As the pollutant Y cannot be ~~exerted~~ excreted or metabolised ~~or~~ for the time being. It is accumulate. Then, the ~~as~~ higher frequency of seafood consumption lead to higher concentration of pollutant Y. It's mean the pollutant Y accumulate in the seafood product and the more seafood the people consume, the higher concentration from the seafood ~~itself~~ itself accumulate.

(ii) (1) Cannot be ~~det~~ detoxified.
Cannot be excreted.
Cannot be metabolised.

(2) Milk contain metabolised waste and other nutrients of the mother.
Also, it is easy to get.

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(iii) ~~Reclamation~~

~~Monitoring~~

Reclamation.

Leaking industry chemical into the sea.

(b) (i)

Comparison of the results of two treatments.	Deduction.
Treatment ② has ~~higher~~ more number of species found on the surface than that of ~~a~~ treatment ①	Thicker seawall can promote biodiversity as thicker habitat is ~~provided~~ provide.
Deeper crevices in treatment ② ~~has~~ has higher ~~biodiversity~~ biodiversity than that of thinner crevices in treatment ③	Better shelter and breeding ground are provided to organisms, so thicker ~~crevices~~ crevices has higher biodiversity

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(b)(iii) (1) prevent organism lack of water to survive and die by the strong sun light.

(2) Provide a ~~to~~ good shelter for the organisms to escape from the wave to destroy their habitat.

(iv) (1) The population of ~~algae~~ algae. Algae is also important in a food chain that can go photosynthesis. and ~~or~~ consume by other organisms.

(2) The time taking record should in the same season.
The time collected the data should be in the same period of time.

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Level 4 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.

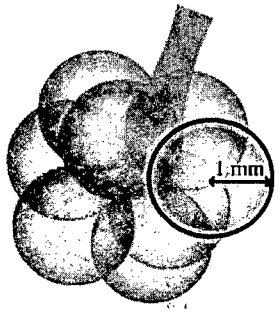
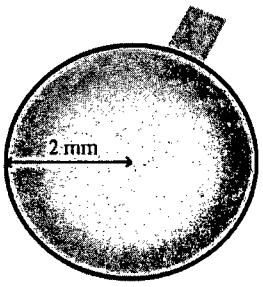
(8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

* 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)

$12.6 \times 8 = 100.8\ mm^2$

(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)

Having smaller air sacs in the lungs can increase the total surface area for the diffusion of gas. The amount of gas exchange with smaller air sacs will be larger than that with bigger air sacs in per unit time.

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

The air sacs secrete and a water surface on the walls of air sacs which allow the gas dissolve into the water and further diffuse into the 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)

The lens allow light ray to pass through so image can be formed onto the retina. The intensity of the transaprant will decrease if the cells have not been degraded during differentiation, leading a reduction of light ray passing through the lens.

(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 cell degrades into dead cells, the rigidity of these dead cells provide support to the stem, and allows the stem to stay upright.

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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

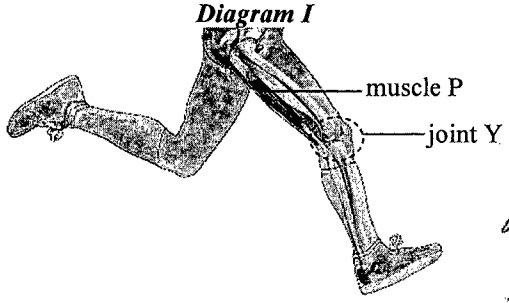
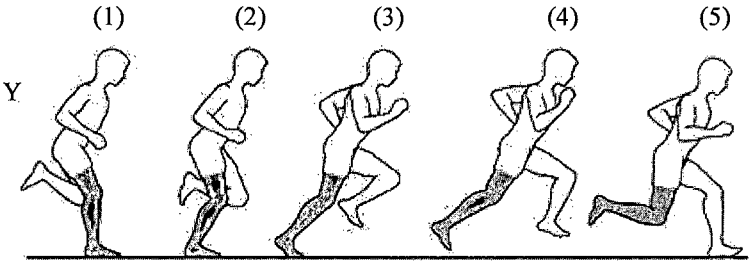


Diagram II



(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)

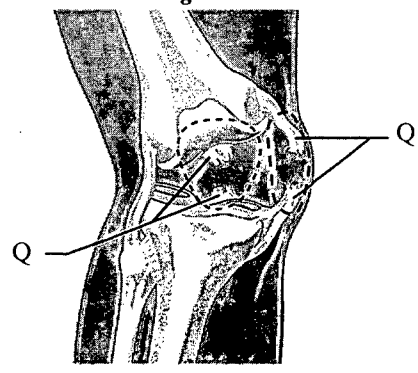
Muscle P changes from a relaxed state to a contracted state.

(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 contracts to move the lower leg upwards.

(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 may fails to move in one plane as Q holds the bones in position and prevent the dislocation of them.

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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)

Carrying of pathogens by vectors into the host cells.

(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 regions rain a lot which leads to accumlation of water where the vectors like mosquito, tend to breed. Tropical region is usually hot which favours the reproduction of vectors. The increasing population of vectors can lead to a higher risk of contracting dengue fever for people.

(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)

The phygocyte enguif the pathogens and digest them.

The white blood cell of killer T cells kill the pathogens 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)

It's because the antigen of other subtypes of DENV is different from the particular subtype of DENY. The memory B cells or T cells are not activated to activates other B or T cells.

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

Kill the vectors using pesticides

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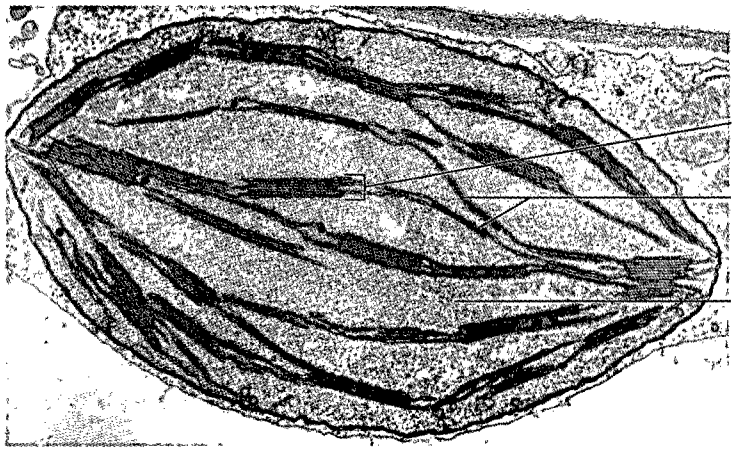
5. An electron micrograph of a chloroplast is shown below:



(a) Label structure Y. (1 mark)

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

X captures light energy from the sun. Some electrons are emitted from X, which then pass through the electron transport chain. Energy released from the chain, is used to combine a ADP with a phosphate group to form ATP. ATP is used in the dark reaction to make triose phosphate and glucose

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

It is anabolism. As energy is required as a reactant to form products. Energy is released from ATP to form triose phosphate.

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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)

The photosynthetic products of the leaves are transferred through the phloem vessels to the root. As the concentration of the photosynthetic products is low. In the underground tubers, Diffusion of these products occurs and transfer the products to 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 some types of the cone cells which are responsible to distinguish red and green colours

(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)

The percentage of Men having red-green colour blindness is much higher than that of women, since that men must have red-green colour blindness if his mother has the red-green colour blindness too. As the male contains one Y chronesome from his father and one X-chronosone with red-green colour blindness from his mom. The recessive X-chromosone is expressed so the men will higher chance of having red-green colour blindness due to the two X-chronosones in womens. The total colour blindness for men or women is equal since the offsprings having total colour blindness is due to the family inheritance while the chance of giving birth to male and female is equal.

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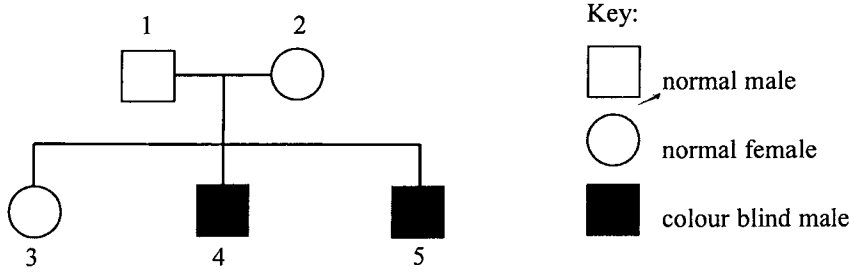
(c) The pedigree below shows the inheritance of red-green colour blindness in a family:



(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.)

Let X^B be the sex chromosome with normal vision
X^b be the sex chromosome with red-green colour blindness

Parents : Individual 1 : X^BY Individual 2 : X^BX^b

gametes : X^B, Y / X^B, X^b

offsprings : X^BX^B X^BY X^BX^b X^bY

∵ Only X^bX^b gives a girl with red-green colour blindness
∴ There's no genotype of X^bX^b is formed in this couple.
The probability of the 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, since the fraternal twins can result in two male with different genotypes but both have red-green colour blindness

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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 can feed on small insects as Romer's Tree frog which results in intercompetition of food. Some breeding site and habitat of greenhouse frog is the same as that of Romer's Tree frog. Therefore greenhouse frog may out compete the Romer's Tree Frog in space or food, posing a threat to the Romer's Tree Frog

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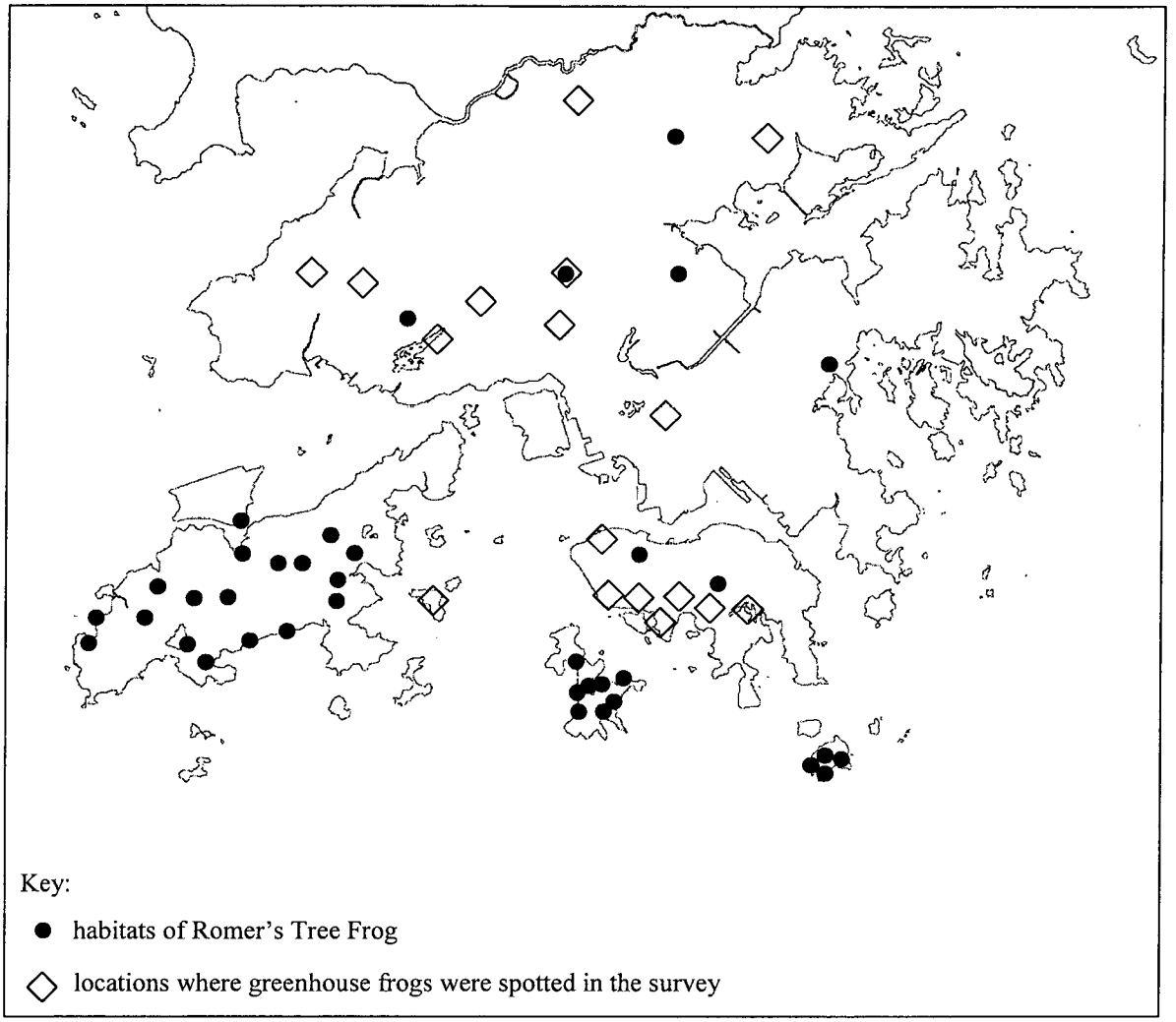
Answers written in the margins will not be marked.

(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)

Greenhouse frogs are not living in some places that Romer's Tree frogs live.

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

Using a quadrate in places where both frogs live. Study the effect of greenhous_ frogs on Romer's Tree frog by collecting data of the population of both frogs

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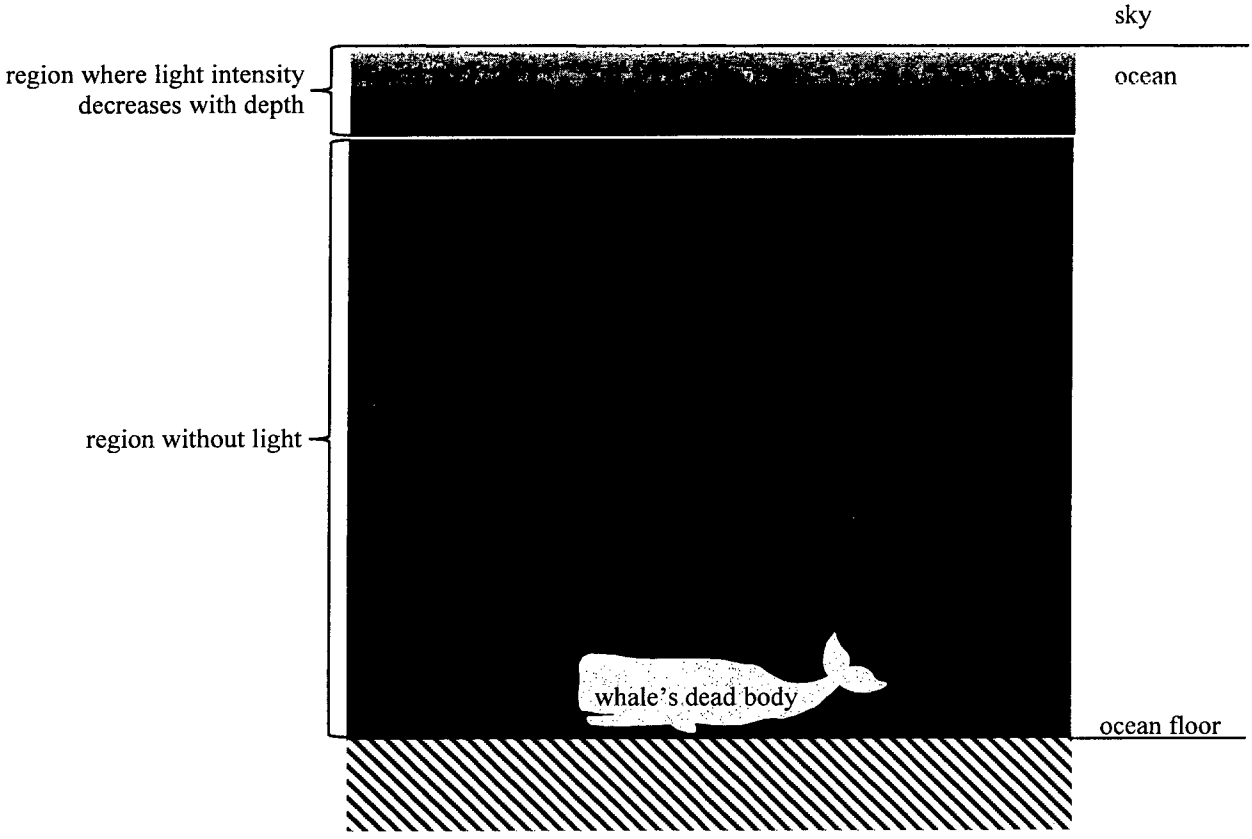
8. When whales die, their dead bodies sink to the bottom of the ocean. The whale carcasses support a unique community known as whale fall community. The diagram below shows different regions of the ocean and the location of a whale's dead body:



(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 matter in the dead body is decomposited Chemical energy is stored inside the 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 dead body is decomposed, inorganic matter is produced and then absorbed by the organism on the ocean floor. It allows the growth of organisms.

(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

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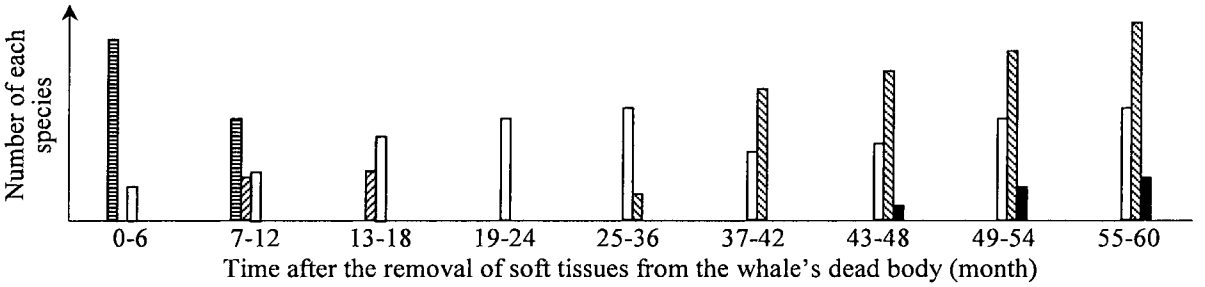
(c) After the soft tissues of the whale's dead body have been consumed, another group of organisms start to feed on the remaining nutrients from the skeleton. For an average-sized whale, it could have 2 000 – 3 000 kg lipid stored inside its skeleton. The bar chart below shows the abundance of different 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 changing dominant species in the same habitat over time	Species P is the dominant species from 0 - 12 months. Species R is the dominant species from 13 - 36 month. Species S is the dominant species from 37 - 60 months
(ii) There's pioneering species	Species P and R are the pioneering species.

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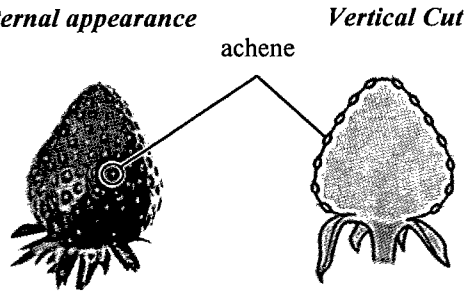
9. The diagram below shows the external appearance of a strawberry and its vertical cut. The achenes found on the surface of the strawberry are the fruits:



(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	The achenes promote the growth of the strawberry
2 versus 3	Auxins promote the growth of the strawberry.
1 versus 3	The effect of auxins on promoting the growth of strawberry is strong than that of achenes

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

The achenes release auxin to promote the growth 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)

To provide clearer evidance that the enlargement of strawberry is caused by the present of achenes

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

The shoot of a plant grows toward the light source as the auxin moves from the lighted side to the shaded side which high concentration of it promotes the growth of shoot. The shoot can bend to the light source to absorb maximum amount of sunlight.

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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)

In the mouth cavity and in the 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

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)

$(11100 \div 2675) \times 250 = 1037\ g$

(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)

14.5 g protein

(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 is much lower than that of healthy boy. As this boy absorbs too less protein.

(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 too low, the water potential in his blood increases. Water moves from his artery to the tissue fluid by osmosis. 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)

The inner membrane of mitochondrion

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

His blood lactate level will increase. As the cassava contains the toxin which inhibit the oxidative phosphorylation. rate of aerobic respiration then decreases. Anaerobic respiration occurs to produce extra energy to meet the energy requirement. Anaerobic respiration produces lactic acid which increases the 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)

Due to global warming, the factories emit more carbon dioxide to the atmosphere. The increasing carbon dioxide concentration increases the photosynthetic reaction of crops since the concentration of carbon dioxide is one of the limiting factors of the rate of photosynthesis. More carbon dioxide is absorbed by the crops. The crops can carry out more photosynthesis and produce glucose which is a food for the crops. More nutrients can be provided to the crops to carry out mitotic cell division and reproduce asexually. More offsprings can be produced which is harvested as food. As a result, the yield of these crops increase.

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The scientists worry about the asexually reproduction of crops. Since asexually reproduction results in no genetic variations between the parent crops and offspring crops. They are well adapted to the current environment but when the environment changes. The crops will be weaker and hard to survive as they are poorly adapted to the changing environment. The other species with favourable characters will out compete the crops. Therefore there is a high risk of extinction when the environment changes and diseases.

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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

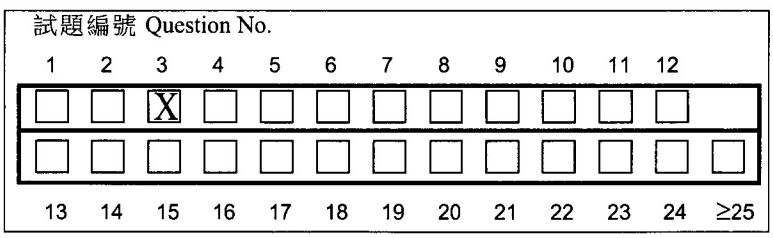
考生須知

(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



由考生填寫 To be filled in by the candidate	
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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.

ai) Susan's ovaries have been affected after the abdominal injury. Her oestrogen levels in her blood test results are much lower than the normal range, since that the ovary is responsible for the release of oestrogen.

ii) A low level of FSH stimulates the release of oestrogen by follicle cells. However a high level of FSH inhibits the release of oestrogen. Susan's FSH level is much higher than that in normal range. Causing an inhibit effect to the release of oestrogen.

iii) Progesterone is responsible for maintaining the thickness of uterine lining. However, from day 17 - 28, her progesterone level is low. Which makes menstruation occurs earlier and maintains longer.

iv) LH should be measured as a peak of LH triggers ovulation.

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Start each question on a new page.

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b i) As the people in the resting group continues to increase their body temperature. The vasodilation of the arterios allows more blood flow to the skin to increase the blood flows to capillaries. Body heat can be lost by conduction and convection, which allows the body temperature to decrease.

ii 1) The arterioles have less blood flow from 36°C to 37°C. It makes less blood flows to the capillories near the skin surface, then decreases the heat loss by conduction and conversion.

ii 2) To increase the blood flow to skeletal muscle. More oxygen and nutrients can be provided to the body cells to carry out respiration to provide energy for stronger contraction of muscles.

iii) The sweat glands of the exercise group become more active than the resting group. The erector muscle of the relax group stronger than the exercise group

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Start each question on a new page.

a i) The restriction enzymes cut the plasmid and produce to 2 sticky ends. The GFP gene can insert into the plasmid A with DNA ligase. because the one end of the DNA fragment is complementary to one end of the plasmid. Hydrogen bonds form between them, and the GFP gene is inserted into the plasmid.

ii) To allow selection of transformed bacteria. Non-transformed bacteria do not contain ampicillin resistance gene, and they cannot survive.

iii 1) The transformed bacteria with recombinant plasmid contain the GFP gene, which emits green fluorescence which glows when exposed to ultra-violet light. While the transformed bacteria with non-recombinant plasmid do not contain the GFP gene so they will not glow under UV light.

2) To save jellyfish with no GFP gene by affecting the jellyfish with the transformed bacteria with recombinant plasmid.

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b i) Cell differentiation

ii) Samples W, X, Z

ii2) As there's no DNA sample in gel I, no bands will appear in Gel II.

iii 1) Group 2 shows the highest herbicide resistance as 90 leaves show 0% visible injury and 10 leaves show 1-20% leaf area with visible injury. It's the group with lowest percentage with visible injury.

iii 2) Samples Y is most likely to represent group 1, as most of leaves show different percentage with visible injury, and sample Y does not contain the HR gene. The leaves from sample Y are damaged by the herbicide.

iii 3) The replication of HR genes cells are different in different sample, resulting in different injury level.

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