HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2017

BIOLOGY PAPER 1

8.30 am – 11.00 am (2 hours 30 minutes)

This paper must be answered in English

GENERAL INSTRUCTIONS

(1) There are **TWO** sections, A and B, in this Paper. You are advised to finish Section A in about 35 minutes.

(2) Section A consists of multiple-choice questions in this question paper. Section B contains conventional questions printed separately in Question-Answer Book **B**.

(3) Answers to Section A should be marked on the Multiple-choice Answer Sheet while answers to Section B should be written in the spaces provided in Question-Answer Book **B**. **The Answer Sheet for Section A and the Question-Answer Book B for Section B will be collected separately at the end of the examination.**

INSTRUCTIONS FOR SECTION A (MULTIPLE-CHOICE QUESTIONS)

(1) Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.

(2) When told to open this book, you should check that all the questions are there. Look for the words '**END OF SECTION A**' after the last question.

(3) All questions carry equal marks.

(4) **ANSWER ALL QUESTIONS**. You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

(5) You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

(6) No marks will be deducted for wrong answers.

Not to be taken away before the end of the examination session

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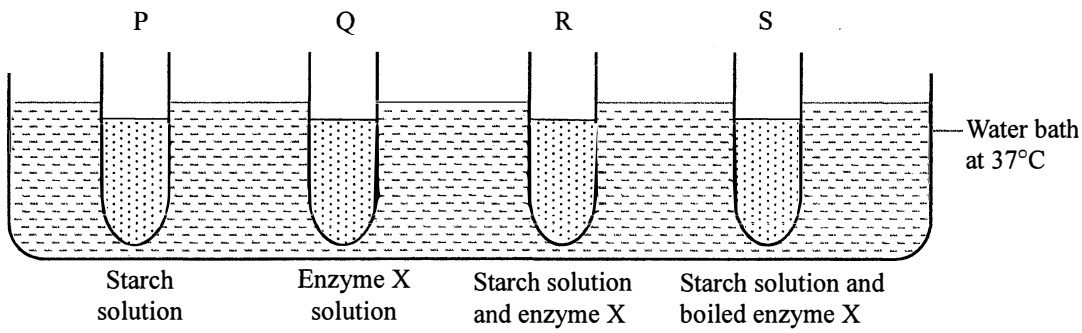
There are 36 questions in this section.
The diagrams in this section are NOT necessarily drawn to scale.

1. Which of the following combinations correctly matches the process with the type of metabolism involved?

	Process	*Type of metabolism*
A.	digestion of lipids in the small intestine	anabolism
B.	storage of excess energy in the form of glycogen	catabolism
C.	assimilation of amino acids to form muscle fibres	anabolism
D.	absorption of digested food in the small intestine	catabolism

Directions: Questions 2 to 4 refer to the diagram below, which shows four test tubes prepared by a student to investigate the action of a starch-digesting enzyme X:



2. In which of the following regions of the human alimentary canal can enzyme X be found?

(1) mouth cavity
(2) stomach
(3) small intestine

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

3. The student conducted some tests on the content of each test tube at the beginning and after 30 minutes. Which of the following correctly shows the results of the tests for tube R at the beginning?

	Benedict's test	*Iodine test*	*Test for proteins*
A.	negative	positive	positive
B.	negative	positive	negative
C.	positive	negative	negative
D.	positive	negative	positive

4. Which of the following is ***not*** the purpose of the experimental design?

	Design	*Purpose*
A.	setting up tube P	to show the result of iodine test if starch is present
B.	setting up tube Q	to show that enzyme X alone cannot give positive result in Benedict's test
C.	setting up tube S	to show that enzyme X is denatured after boiling
D.	setting up water bath	to simulate the temperature of the human body

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5. Different animals produce different maltases to digest maltose. The maltases produced have different molecular sizes. Which of the following descriptions of these maltases is correct?

A. Their active sites have similar shape.
B. Their amino acid sequences are the same.
C. They have the same optimum temperature.
D. They have the same three-dimensional structure.

6. Which of the following reactions in photosynthesis takes place on the thylakoid membrane?

A. regeneration of carbon dioxide acceptor
B. reduction of 3-C compound
C. photolysis of water
D. carbon dioxide fixation

7. Which of the following combinations correctly matches the reaction in aerobic respiration with the location where it takes place?

	Reaction in aerobic respiration	***Location***
A.	regeneration of NAD	cytoplasm
B.	production of carbon dioxide	cytoplasm
C.	conversion of pyruvate to acetyl-CoA	mitochondrion
D.	conversion of triose phosphate to pyruvate	mitochondrion

8. In humans, blood group B is dominant to blood group O. In a family, the father and mother are of blood groups O and B respectively. They have two children who are of blood group B. The father concludes that his wife must be homozygous for blood group B. Is this conclusion correct?

A. No, because there are other blood groups besides blood groups B and O.
B. No, because even if the mother is heterozygous, each child has a 50% chance to be of blood group B.
C. Yes, because the father has no allele for blood group B, all alleles for blood group B must have come from the mother.
D. Yes, because if the mother is heterozygous, one child should be of blood group B and the other should be of blood group O.

9. If the base sequence on the coding strand of the DNA is AAC, which of the following combinations correctly shows the mRNA codon and the tRNA anticodon?

	mRNA codon	***tRNA anticodon***
A.	AAC	UUG
B.	AAC	TTG
C.	UUG	AAC
D.	TTG	AAC

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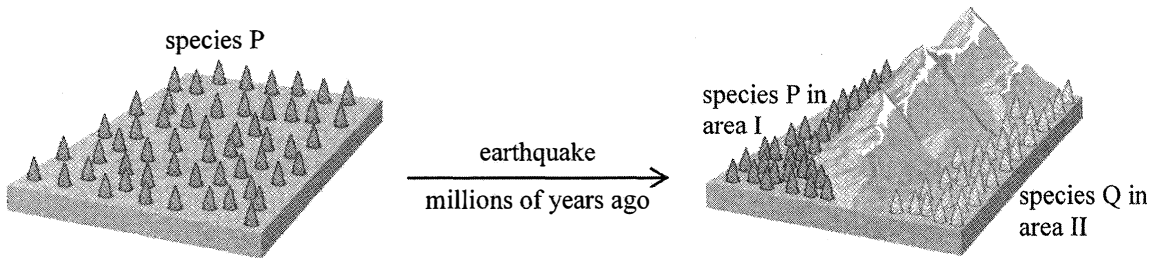
Directions: Questions 10 and 11 refer to the diagram below. A high mountain resulting from an earthquake millions of years ago has led to the separation of areas I and II. A new tree species Q is found in area II:



10. Which of the following processes were likely to have been involved in the formation of new species Q?

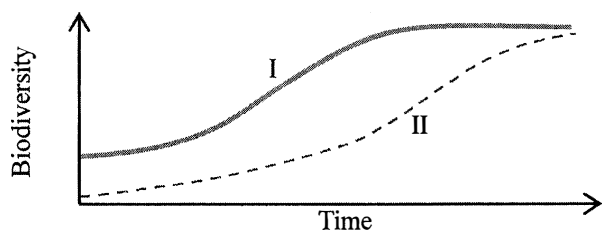
(1) mutation
(2) isolation
(3) natural selection

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

11. Which of the following descriptions of the above incident is most likely to be correct?

A. Q is more adaptive than P.
B. P grows equally well in areas I and II.
C. Areas I and II have similar environmental conditions.
D. P and Q belong to the same Family in the classification system.

12. The following graph shows the predicted change in biodiversity during the processes of primary and secondary succession in an ecosystem:



Which of the following combinations is correct?

	Type of succession	***Explanation***
A.	I is primary succession.	A climax community is reached in I.
B.	I is secondary succession.	I has a higher biodiversity than II at the beginning.
C.	II is primary succession.	Pioneer community is involved in II.
D.	II is secondary succession.	II shows a slow increase in biodiversity.

13. Water absorbed by trees is mostly used

A. to replenish water loss.
B. for storage in vacuoles.
C. as a raw material in photosynthesis.
D. as a medium for reactions to take place.

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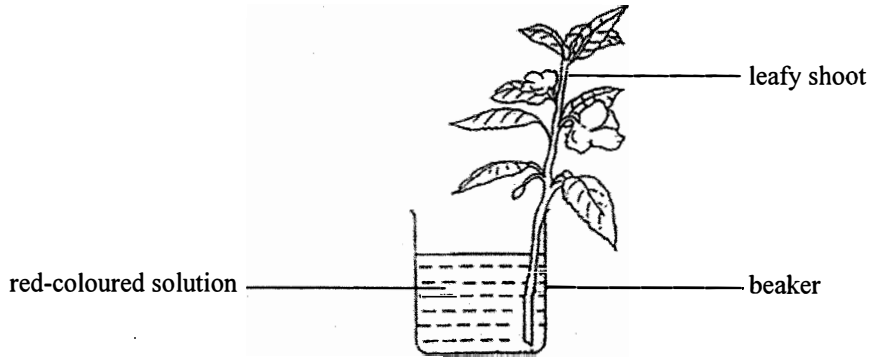
Directions: Questions 14 to 16 refer to the set-up below, which is used to investigate the effect of environmental factors on the transpiration rate of a leafy shoot. The leafy shoot was put into a beaker of red-coloured solution. After five hours, cross-sections of the shoot were cut starting from the top until red colour appeared in the cut section. The length of the remaining shoot was then measured.



14. Which of the following step(s) is / are necessary when preparing the set-up?

(1) Smear vaseline onto the lower surface of the leaves.
(2) Add a layer of oil on the surface of the red-coloured solution.
(3) Cut the lower end of the leafy shoot under the red-coloured solution.

A. (1) only
B. (3) only
C. (1) and (2) only
D. (2) and (3) only

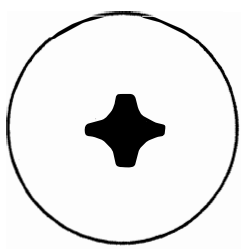
15. The length of the remaining shoot will be the longest if the experiment is conducted in

A. hot and bright conditions.
B. hot and humid conditions.
C. cold and bright conditions.
D. cold and humid conditions.

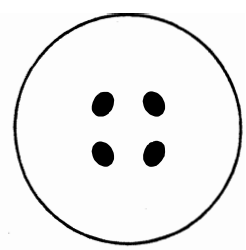
16. A section of the remaining shoot was observed under a microscope. Which of the following diagrams correctly shows the appearance of the shoot section?

Key: ■ Stained red

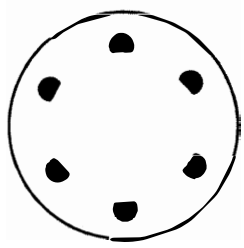
A.



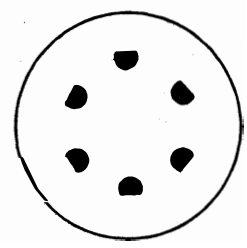
B.



C.



D.



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17. Which of the following cell types contribute(s) to the support of a leaf in a woody flowering plant?

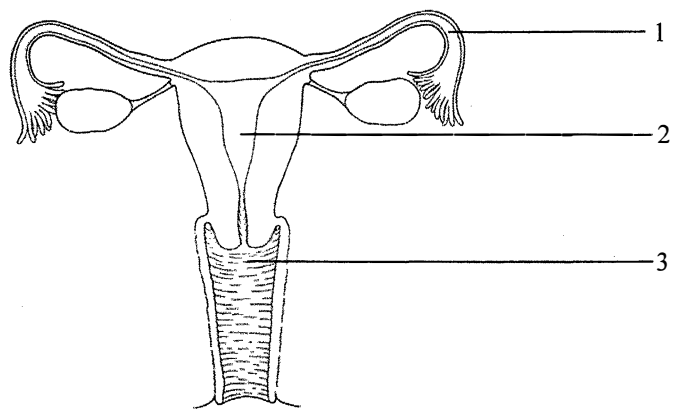
(1) guard cells
(2) xylem vessels
(3) mesophyll cells

A. (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

18. Which of the following descriptions of the circulatory system is correct?

A. Veins have a large lumen because the blood pressure inside them is low.
B. Arteries have a thick layer of elastic tissue because they have smaller lumen.
C. The aorta has the highest blood pressure because it supplies blood to the whole body.
D. The capillary network is a suitable site for material exchange because capillaries have the thinnest walls.

Directions: Questions 19 and 20 refer to the diagram below, which shows some structures of the female reproductive system in humans:



19. Which of the following combinations correctly shows the location where fertilisation and discharge of semen normally take place?

	Fertilisation	***Discharge of semen***
A.	1	2
B.	1	3
C.	2	2
D.	2	3

20. If location 1 is blocked in a 14-year-old girl, which of the following is most likely to occur?

A. There is no ovulation.
B. Her fertility decreases.
C. There is no menstruation.
D. Her breasts fail to develop.

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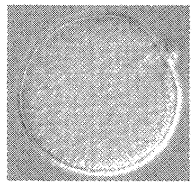
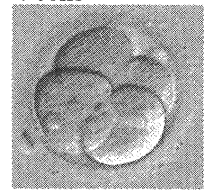
Directions: Questions 21 to 23 refer to the following photomicrographs of the same magnification. The photomicrographs show some early stages of embryo development:

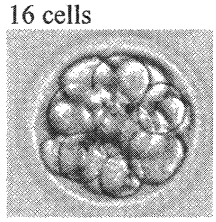
I. 1 cell



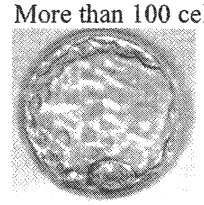
II. 4 cells



III. 16 cells



IV. More than 100 cells



21. Which of the following processes are taking place from stage I to stage IV?

(1) cell division
(2) cell enlargement
(3) cell differentiation

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

22. How many cell cycles has the cell in stage I gone through to reach stage III?

A. 2 cycles
B. 3 cycles
C. 4 cycles
D. 5 cycles

23. Which of the following stages is ready for implantation?

A. I
B. II
C. III
D. IV

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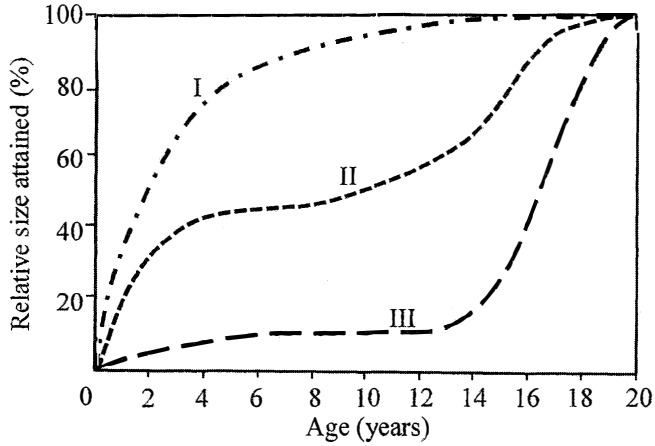
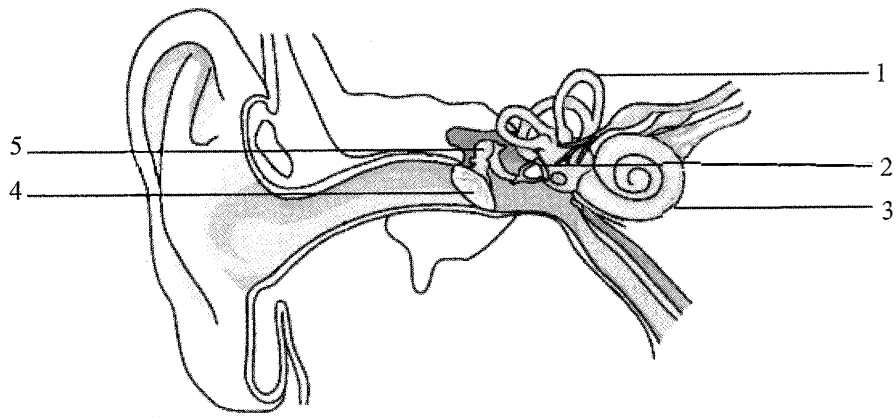
24. The graph below shows the growth curves of the head, reproductive system and whole body in humans:



Which of the following combinations correctly identifies curves I, II and III?

	I	*II*	*III*
A.	whole body	reproductive system	head
B.	head	reproductive system	whole body
C.	head	whole body	reproductive system
D.	reproductive system	whole body	head

Directions: Questions 25 and 26 refer to the diagram below, which shows the structures of a human ear:



25. Which of the following structures is ***not*** involved in hearing?

A. 1
B. 2
C. 3
D. 4

26. Which of the following structures will vibrate when there are sound waves?

A. 1 and 3 only
B. 2 and 3 only
C. 2, 3 and 4 only
D. 2, 4 and 5 only

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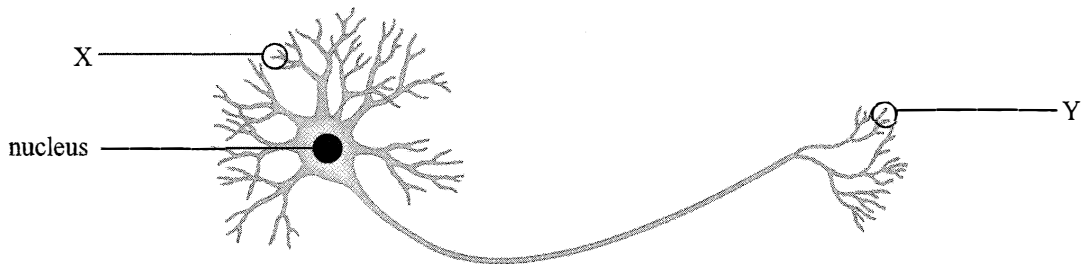
27. Which of the following combinations correctly matches the problem of short sightedness and its correction?

	Problem	***Correction***
A.	image focussed behind the retina	wear concave lens
B.	image focussed behind the retina	wear convex lens
C.	image focussed in front of the retina	wear concave lens
D.	image focussed in front of the retina	wear convex lens

28. Which of the following correctly explains why our eyes feel tired if we have been reading a book for a long time?

A. The ciliary body has contracted for a long time.
B. The photosensitive cells have been over-stimulated.
C. The lens has maintained a curved state for a long time.
D. The suspensory ligament has been under tension for a long time.

29. The diagram below shows a motor neurone:



Which of the following statements correctly describes the motor neurone?

A. X is connected to a muscle fibre.
B. Electrical impulses are transmitted from Y to X.
C. Synapses can be found at the end of both X and Y.
D. Electrical impulses are sent out at Y to the next neurone.

30. Which of the following ***does not*** belong to the central nervous system?

A. medulla oblongata
B. spinal cord
C. cerebellum
D. eye

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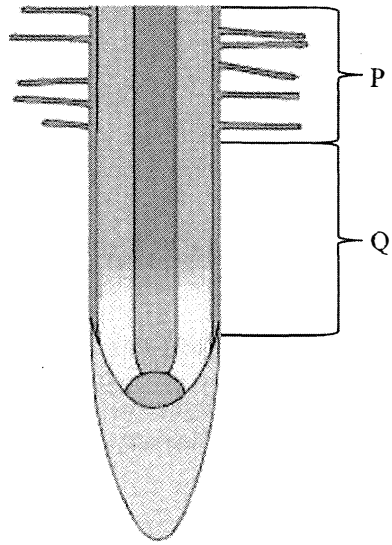
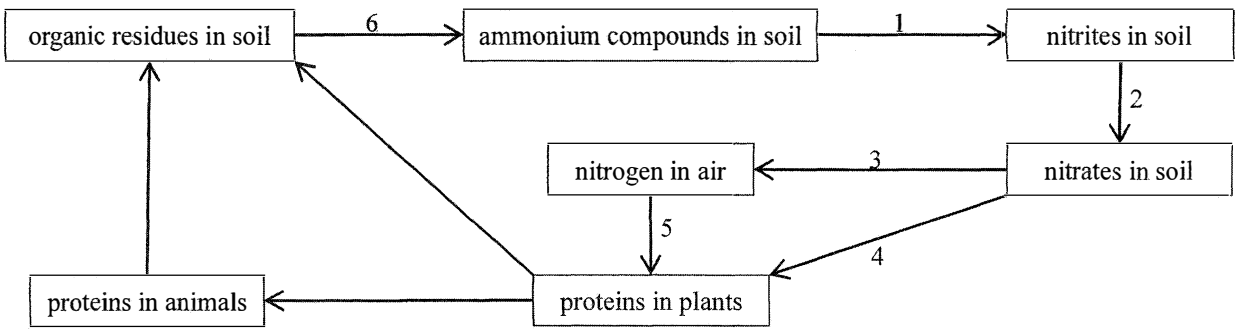
31. The diagram below shows a low power drawing of the cut section of a root:



Which of the following correctly describes the relationship of auxin and different regions of the root?

A. It affects cell division at P.
B. It affects cell division at Q.
C. It affects cell elongation at P.
D. It affects cell elongation at Q.

Directions: Questions 32 and 33 refer to the diagram below, which shows some processes in the nitrogen cycle in nature:



32. Which of the following combinations correctly matches the microorganism involved in processes 3 and 6?

	3	***6***
A.	denitrifying bacteria	nitrogen-fixing bacteria
B.	nitrogen-fixing bacteria	fungi
C.	fungi	denitrifying bacteria
D.	denitrifying bacteria	fungi

33. Which of the following processes ***does not*** require the action of bacteria?

A. 1
B. 2
C. 4
D. 5

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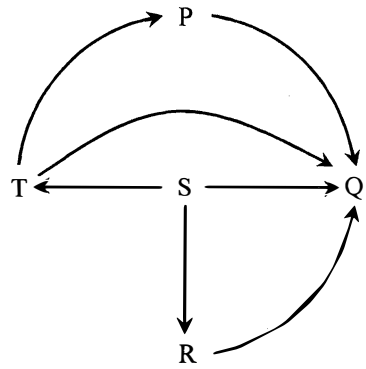
Directions: Questions 34 and 35 refer to the diagram below, which shows the flow of energy among organisms found in a grassland:



34. Which of the following statements correctly describe(s) the above organisms?

(1) S is a heterotroph.
(2) P is the secondary consumer.
(3) Q has the largest total biomass.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

35. If there is a decomposer in this group of organisms, it is most likely to be

A. Q.
B. R.
C. S.
D. T.

36. Which of the following combinations correctly matches the type of diabetes with its description?

	Type of diabetes	***Description***
A.	Insulin-dependent (type I)	Heredity is the major cause.
B.	Insulin-dependent (type I)	Blood insulin level remains high.
C.	Non-insulin-dependent (type II)	Blood insulin level remains low even after meal.
D.	Non-insulin-dependent (type II)	Blood glucose level will drop significantly after insulin injection.

END OF SECTION A
Go on to Question-Answer Book B for questions on Section B

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BIO
PAPER 1B

B

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HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2017

Candidate Number

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.

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SECTION B

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

1. For each of the components of the musculoskeletal system listed in Column I, select from Column II one phrase that correctly describes it. Put the letter in the space provided. (3 marks)

Column I		*Column II*
Ligament	.....	A. Inelastic tissue found at the two ends of a skeletal muscle
Tendon	.....	B. Elastic tissue found at the two ends of a long bone
Cartilage	.....	C. Inelastic tissue that surrounds a joint
		D. Elastic tissue that binds bones together

2. Denise ate a piece of pineapple preserved in a sugar solution and noticed that it was softer than fresh pineapple. Explain this phenomenon. (3 marks)

.....

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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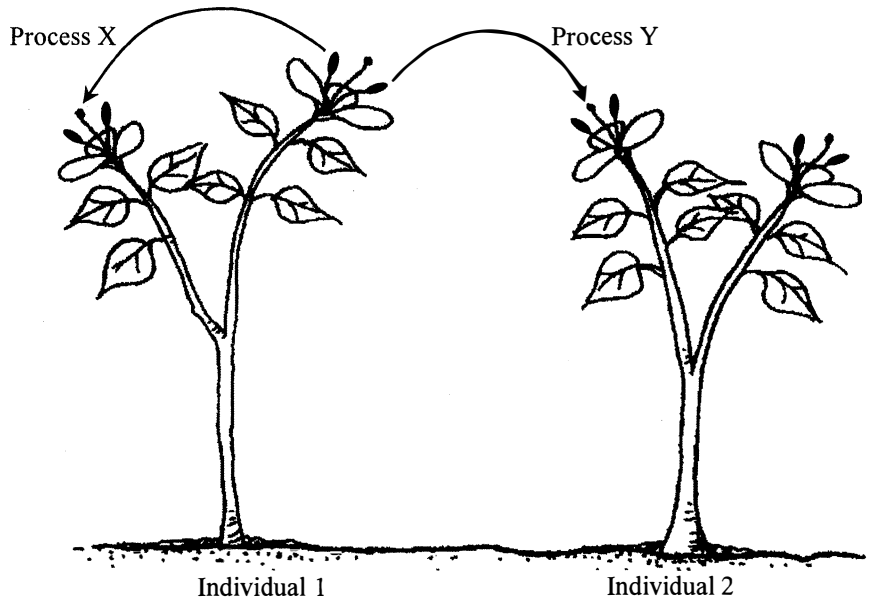
3. The diagram below shows certain processes occurring in a species of flowering plant:



(a) What is process Y? (1 mark)

(b) Describe the sequence of events leading to fertilisation after process Y has completed. (4 marks)

(c) Explain briefly why process Y is better than process X in terms of evolution. (2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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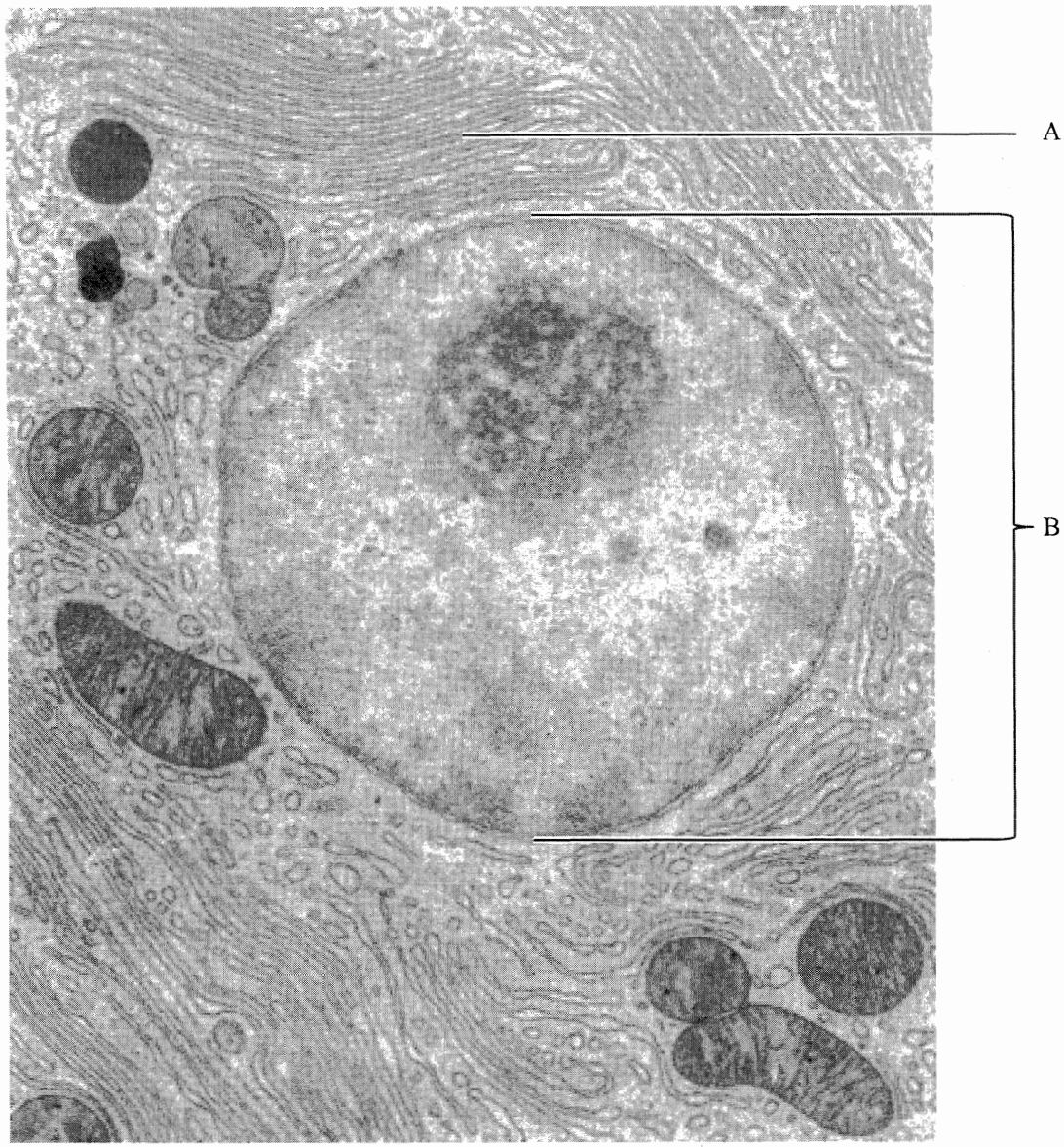
Answers written in the margins will not be marked.



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4. The electron micrograph on the opposite page shows some structures of a human cell.

(a) Label A and B. (2 marks)

A: _____ B: _____

(b) Which stage of the cell cycle is shown in this photomicrograph? Give a reason to support your answer. (2 marks)

(c) The cell was obtained from the pancreas. How do A and B work together such that this cell can perform its function? (4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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5. (a) Briefly describe the breathing actions that bring air into the lungs. (4 marks)

(b) In the following diagrams, Diagram I shows some structures of a human lung while Diagram II shows a collapsed lung if it is ruptured at location Y:

Diagram I

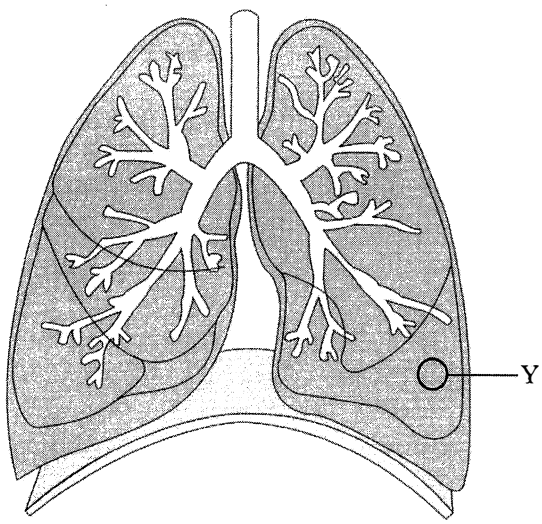
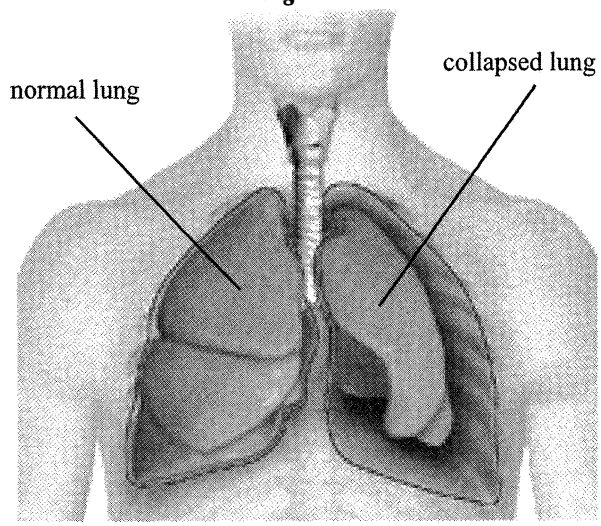


Diagram II



Explain why the lung collapses if it is ruptured at location Y. (2 marks)

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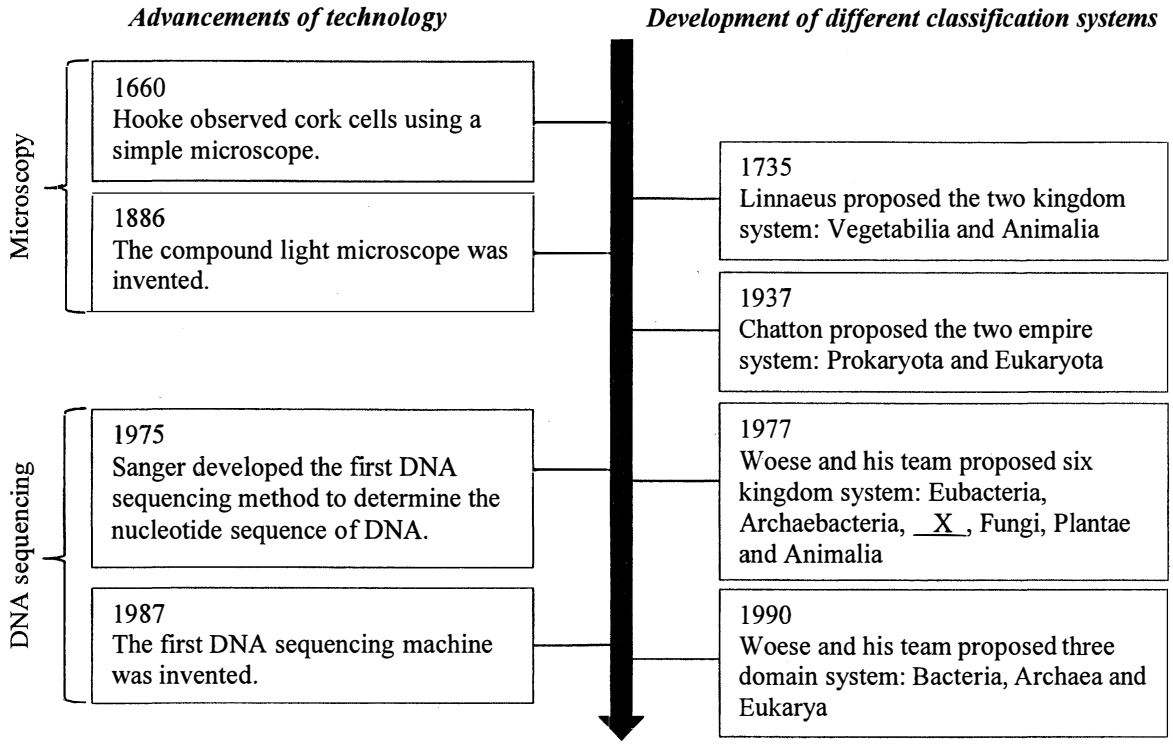
6. The chart below shows the timeline of some major advancements of technology and the development of different classification systems:



(a) Name kingdom X in the six kingdom system proposed by Woese and his team in 1977. (1 mark)

(b) How did the following technological advancements contribute to the development of different classification systems? (4 marks)

Microscopy:

DNA sequencing:

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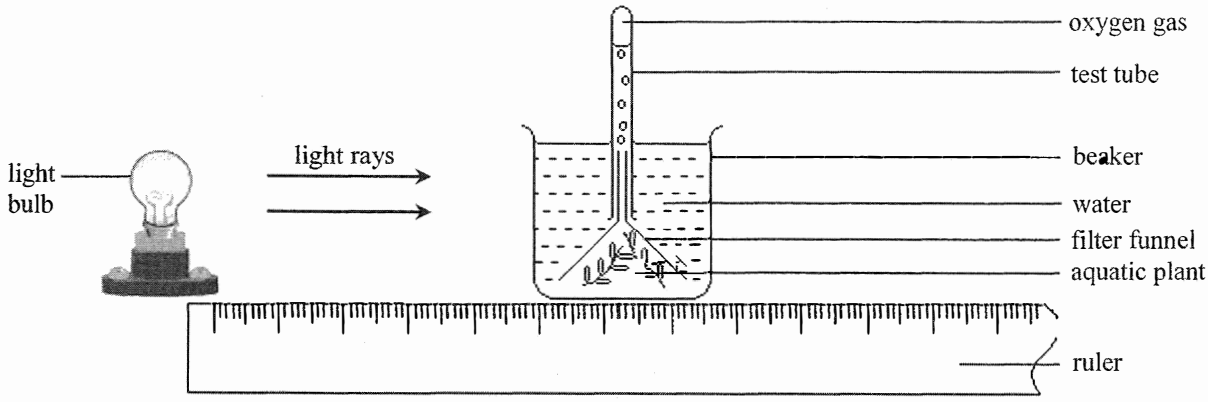
7. The diagram below shows an experimental set-up for investigating the effect of light intensity on the rate of photosynthesis:



(a) What is the assumption behind using the volume of oxygen released per unit time to indicate the photosynthetic rate? Explain your answer. (2 marks)

(b) Suggest ***one*** modification to this experimental set-up to make sure that the result is due to the independent variable only. Explain your answer. (3 marks)

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(c) What is the significance of the *two* products of the photochemical reactions to the whole photosynthetic process? (4 marks)

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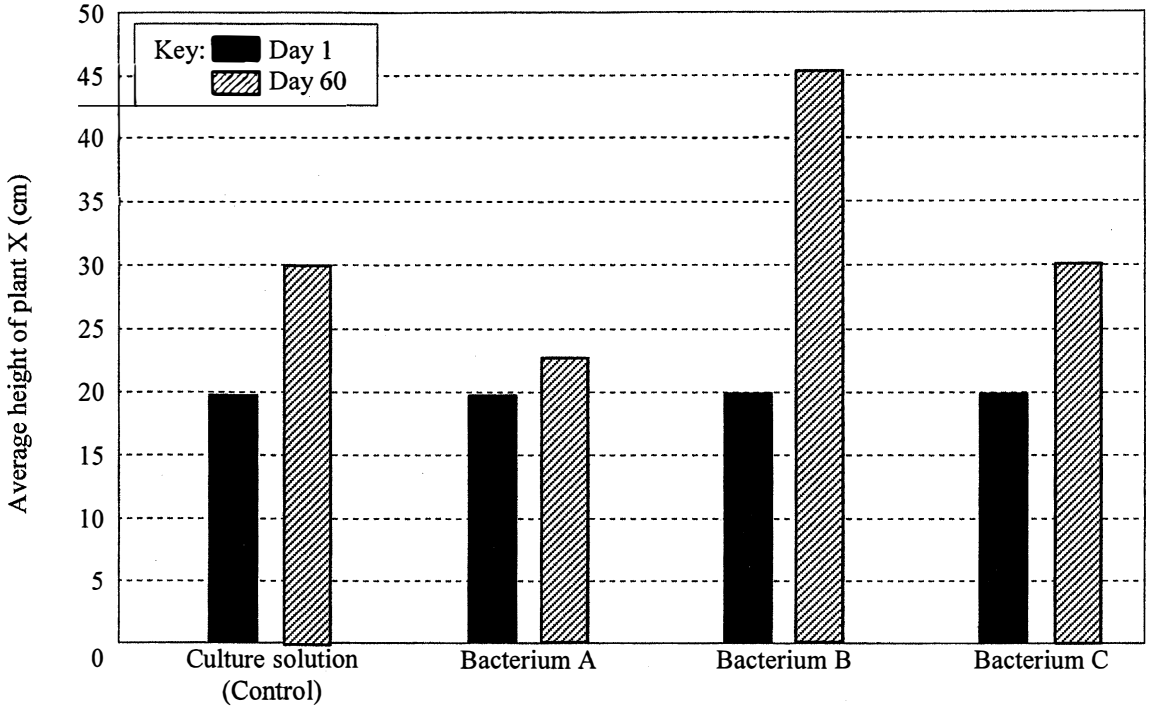
8. In an investigation about the effect of soil bacteria on the growth of plant X, three types of soil bacteria (A, B and C) were grown separately in one type of culture solution. After this, each bacterial culture was added to the soil of separate pots of plant X. A control was prepared by adding the culture solution only. The average height of plant X was recorded at day 1 and day 60 of the experiment. The results are shown in the chart below:



(a) With reference to the above results, state the effect of each type of bacterium on the growth of plant X. (3 marks)

Bacterium A: .....

Bacterium B: .....

Bacterium C: .....

(b) It is known that both bacteria A and B are able to colonise the root of plant X and obtain nutrients from the root for growth. Suggest the possible ecological relationships between each type of bacterium and plant X. (2 marks)

Bacterium A: .....

Bacterium B: .....

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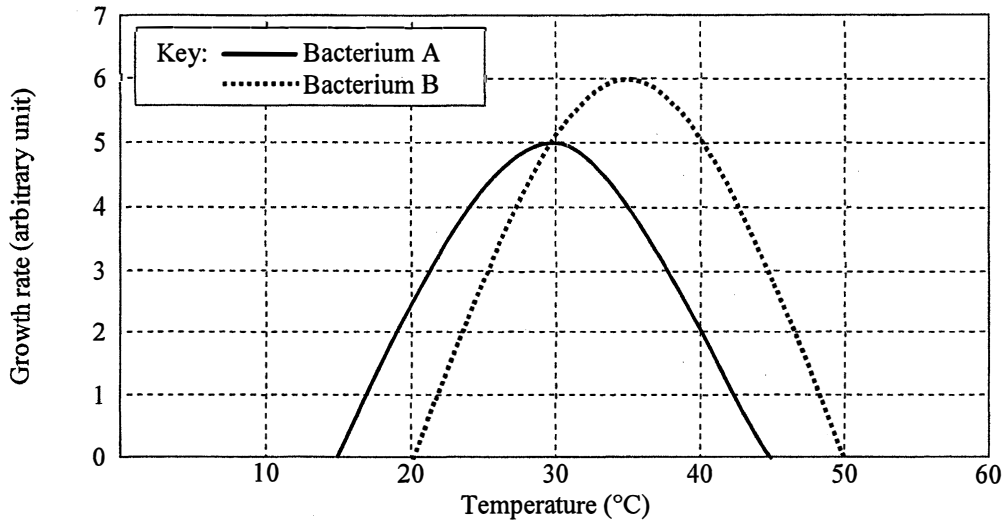
(c) In a subsequent experiment, the effect of temperature on the growth of bacteria A and B was tested and the results are shown in the graph below:



(i) Indicate the optimum temperature for the growth of bacteria A and B respectively. (1 mark)

Bacterium A: .....

Bacterium B: .....

(ii) Normal soil temperature in Hong Kong is around 30°C in summer. Global warming has led to an increase in soil temperature within 2°C. With reference to the above graph, predict the changes in the population sizes of bacteria A and B in soil in summer. (2 marks)

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(d) Plant X is a foreign species that is more competitive than the native plant species in Hong Kong. With reference to your answers in (a) and (c)(ii), suggest a possible impact of global warming on the native plant community. Explain your answer. (2 marks)

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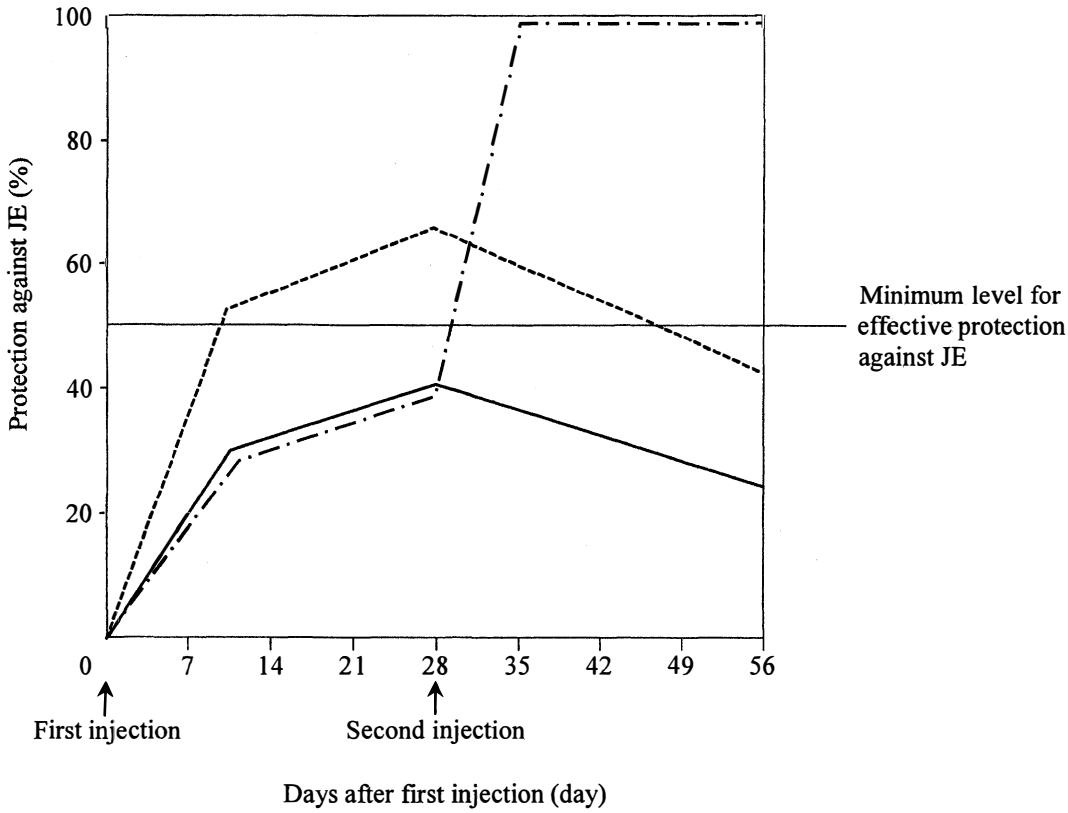
9. Japanese encephalitis (JE) is an inflammation of the brain caused by a viral infection. Scientists have developed a vaccine against the JE virus. In a study of the effectiveness of the vaccine, three groups of healthy people received different vaccination treatments and the level of protection against JE was monitored over a period of time. The results are shown in the graph below:

Key:

——— Treatment A: one injection of 6 μg vaccine on day 0

---------- Treatment B: one injection of 12 μg vaccine on day 0

—·—·— Treatment C: two injections of 6 μg vaccine each on day 0 and day 28 respectively



(a) What is the vector for transmitting the JE virus? (1 mark)

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(b) For treatment C, explain why there is a sharp rise in protection against JE from day 28 to day 35. (4 marks)

(c) Give ***one*** more benefit of treatment C. (1 mark)

(d) Mathew plans to visit a country with many JE cases in 10 days and will stay there for 15 days.

(i) With reference to the graph, which vaccination treatment (A, B or C) should he receive at this moment? Explain your answer. (2 marks)

(ii) As a responsible citizen, Mathew will continue to use insect repellant as a precaution for two weeks after he is back from that country. Suggest a rationale for this precaution. (1 mark)

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10. (a) In 1940, scientist Alfred Sturtevant hypothesised that the ability to roll one's tongue is determined by a single gene. His hypothesis was based on the data below:

Case	Characters of parents	Tongue rolling offspring	Non-tongue rolling offspring
I	tongue rolling x tongue rolling	28	5
II	tongue rolling x non-tongue rolling	33	22

(i) Does the trait of tongue rolling ability show continuous or discontinuous variation? Explain your answer. (2 marks)

(ii) Sturtevant concluded that tongue rolling is the dominant phenotype while non-tongue rolling is the recessive phenotype. With reference to the above table, explain how he arrived at this conclusion. (2 marks)

(b) In 1965, the offspring of a group of non-tongue rolling parents were studied. It was found that more than 30% of the offspring were tongue rollers. Does this finding support Sturtevant's conclusion in (a)(ii)? Explain your answer. (2 marks)

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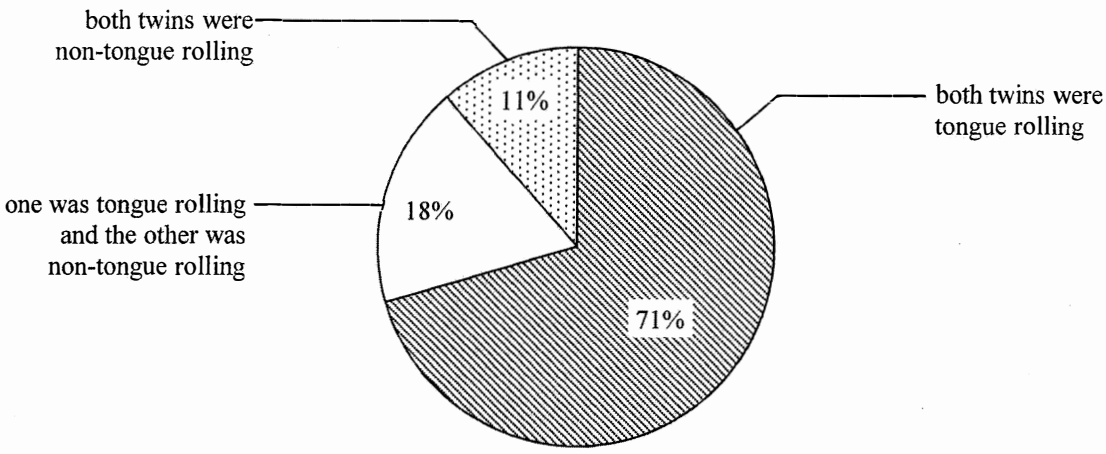
(c) In 1971, another study on identical twins was carried out to further explore the factors influencing the tongue rolling trait. The results are summarised in the chart below:



(i) What is the advantage of using identical twins as the subjects for the study? (2 marks)

(ii) With reference to the above chart, complete the following table with data that support the conclusions. (2 marks)

Conclusion	Evidence
Genetic factors play a significant role in the determination of the tongue rolling trait.	
There are other factors influencing the tongue rolling trait.	

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(d) (i) In the above case regarding the development of knowledge about the inheritance of the tongue rolling trait, which of the following ideas about science is demonstrated? (2 marks)

Ideas about science	Put a '✓' in the appropriate spaces below
Science is a process of ongoing inquiries.	
Science is affected by social and cultural factors.	
Scientists may not arrive at the same conclusions about the same set of data.	
Scientific investigations may not require doing experiments in laboratories.	

(ii) Elaborate on how the development of knowledge about the inheritance of the tongue rolling trait can be used to demonstrate that scientists have to be open-minded. (1 mark)

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

11. Some natural therapists claim that applying pressure along one's limbs toward the body trunk can improve the circulation of lymph and result in reduced body weight. However, the effects of this treatment are controversial. Briefly describe how lymph is formed from blood and returned to the blood circulatory system. For each of the claims above, discuss whether it is scientifically valid. (11 marks)

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END OF PAPER

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

Answers written in the margins will not be marked.

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