HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2015

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.

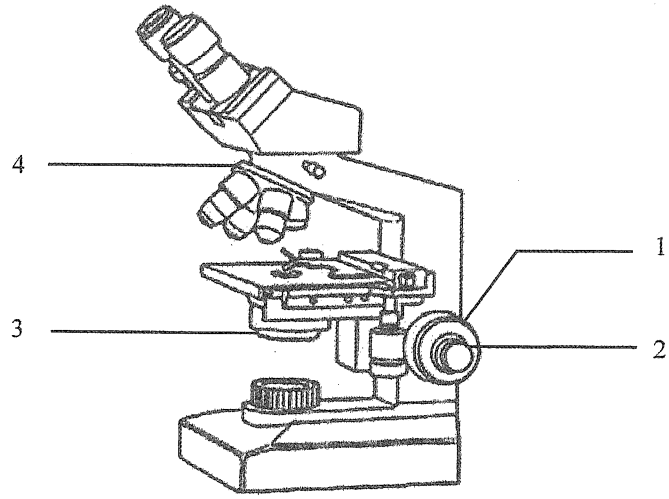
(5) You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

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

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

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

1. Which of the following parts of the microscope should be adjusted to obtain a clear and sharp image when you switch from low-magnification to high-magnification observation?

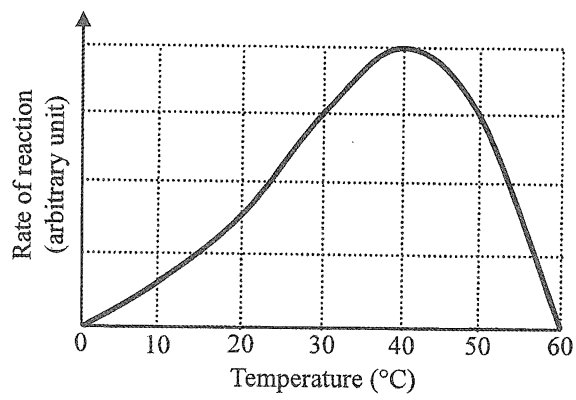


A. 1 and 4 only
B. 2 and 3 only
C. 1, 3 and 4 only
D. 2, 3 and 4 only

2. Which of the following processes requires metabolic energy?

A. glucose moves across the epithelium of the ileum
B. carbon dioxide moves across the wall of air sacs
C. oxygen moves into mesophyll cells
D. water moves along the xylem

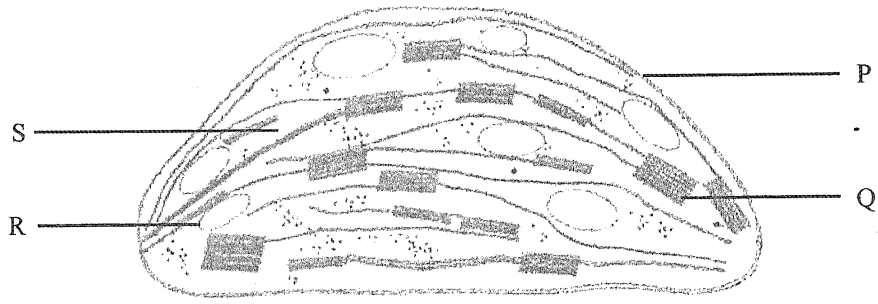
3. The graph below shows the effect of temperature on enzyme activity:



Which of the following statements correctly describes the enzyme reaction?

A. The enzyme is denatured at 0°C and 60°C.
B. The reaction taking place at 50°C is faster than that at 20°C.
C. There are more collisions between substrate and enzyme molecules at 40°C than 60°C.
D. The amount of product collected at the end of the reaction is greatest if the reaction takes place at 40°C.

Directions: Questions 4 and 5 refer to the schematic diagram below, which shows the structures of a chloroplast:



4. Regeneration of the carbon dioxide acceptor takes place at

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

5. Which of the following kingdoms contain organisms that possess the above organelle?

(1) Eubacteria
(2) Protista
(3) Plantae

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

6. Which of the following combinations correctly compares the aerobic respiration and anaerobic respiration of muscle cells?

	Aerobic respiration	*Anaerobic respiration*
A.	occurs only when oxygen is present	occurs only when oxygen is absent
B.	produces more NADH	produces less NADH
C.	glycolysis takes place	no glycolysis
D.	takes place only inside the mitochondria	takes place only in the cytoplasm

7. Which of the following combinations correctly matches the gland, the enzyme secreted and the optimum pH of the enzyme?

	Gland	*Enzyme*	*Optimum pH*
A.	gastric gland	carbohydrase	2
B.	liver	lipase	8
C.	salivary gland	amylase	11
D.	pancreas	protease	11

8. After eating a hamburger, chemical digestion begins in the

A. mouth cavity.
B. oesophagus.
C. stomach.
D. small intestine.

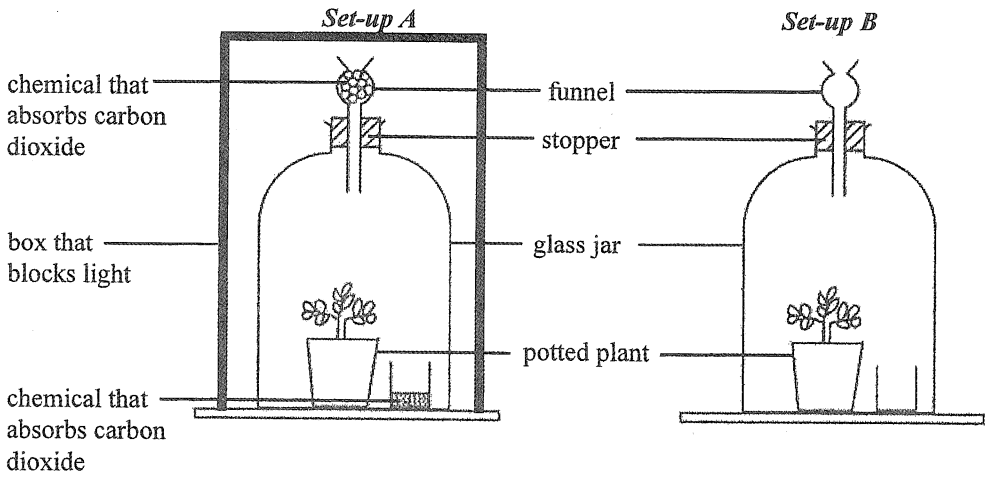
9. Which of the following combinations correctly describes the absorption of water in the alimentary canal?

	Occurs mostly in	*Major reason*
A.	ileum	it is the longest part of the digestive tract
B.	ileum	most digested food is absorbed in this region
C.	large intestine	its function is water absorption
D.	large intestine	absorption of food has completed in this region

10. After absorption in the small intestine, most fat is first transported to the

A. large intestine.
B. pancreas.
C. heart.
D. liver.

Directions: Questions 11 and 12 refer to the following experiment. A student put two similar plants in darkness for 24 hours and then placed them in the following set-ups to conduct an investigation on photosynthesis:



11. At the end of the experiment, leaves were taken from the plants in set-ups A and B for the iodine test. Arrange the following steps in the correct order:

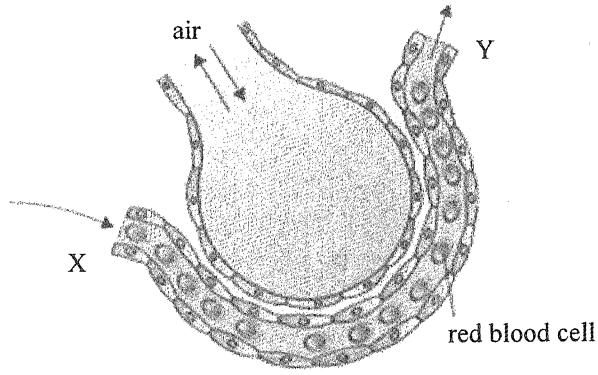
(1) Put the leaf in boiling water for 5 minutes.
(2) Add iodine solution to the leaf.
(3) Put the leaf in hot alcohol solution for 5 minutes.
(4) Put the leaf in water at room temperature for a few seconds.

A. (1), (2), (3), (4)
B. (1), (3), (4), (2)
C. (2), (3), (4), (1)
D. (4), (3), (2), (1)

12. After the iodine test, the leaf taken from set-up A was brown while the leaf taken from set-up B was blue-black. Which of the following conclusions can be drawn from the results?

A. Light is necessary for photosynthesis.
B. Carbon dioxide is necessary for photosynthesis.
C. Both light and carbon dioxide are necessary for photosynthesis.
D. Photosynthesis occurs in the plant in set-up B but not in set-up A.

Directions: Questions 13 and 14 refer to the diagram below, which shows a section of an air sac and its associated blood capillary in humans:



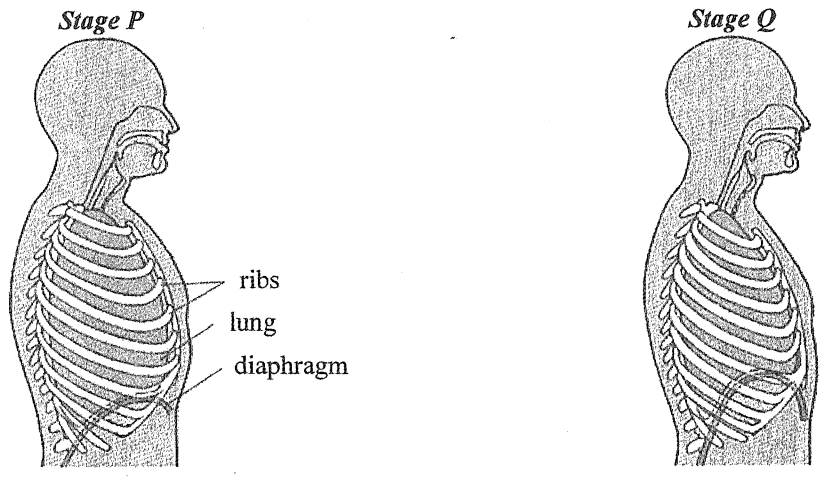
13. Which of the following combinations correctly describes the changes in blood composition when blood flows from X to Y?

	Oxygen content	*Glucose content*	*Urea content*
A.	increases	remains unchanged	increases
B.	increases	decreases	remains unchanged
C.	remains unchanged	decreases	remains unchanged
D.	remains unchanged	remains unchanged	increases

14. As the blood in the capillary continues to flow, the red blood cell will first return to the

A. left atrium.
B. right atrium.
C. left ventricle.
D. right ventricle.

15. The diagrams below show the relative positions of the human respiratory system and its associated structures in two different breathing stages:



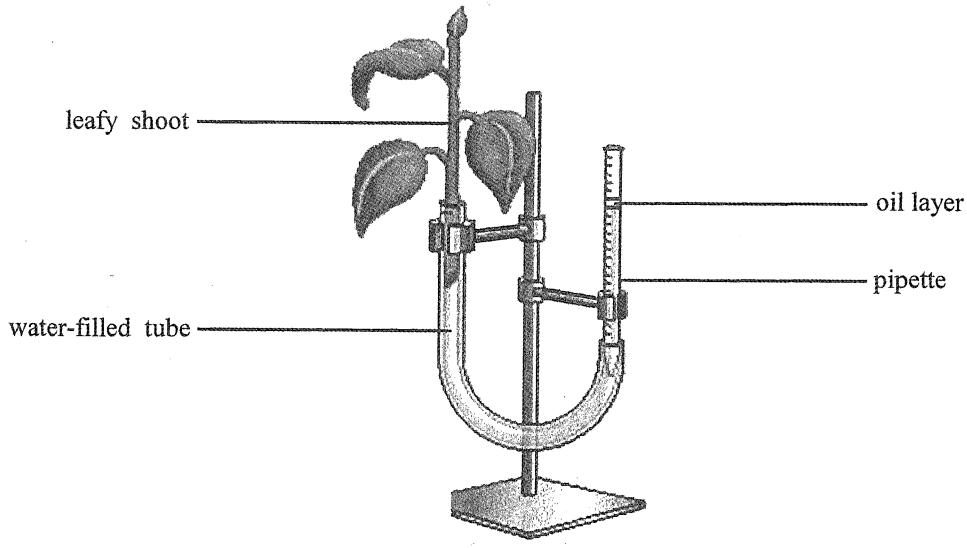
Which of the following statements correctly describes the change that takes place from stage P to stage Q?

A. Pressure inside the lungs is increasing.
B. Diaphragm muscle is contracting.
C. Volume of the lungs is increasing.
D. Rib cage is moving upward.

16. Variation in skin colour exists among different human races. Which of the following factors plays the major role in determining this variation?

A. exercise
B. nutrition
C. inheritance
D. exposure to sunlight

Directions: Questions 17 and 18 refer to the set-up below, which is used to measure the rate of transpiration of a leafy shoot:



17. The assumption behind the use of this set-up for measuring the rate of transpiration is that

A. the connections in the set-up are sealed off.
B. the rate of water uptake is equal to that of water loss.
C. the stomata of the leaves remain open throughout the experiment.
D. the cutting of the shoot does not introduce air bubbles into the xylem vessels.

18. Which of the following variables has the greatest influence on the rate of transpiration of the leafy shoot?

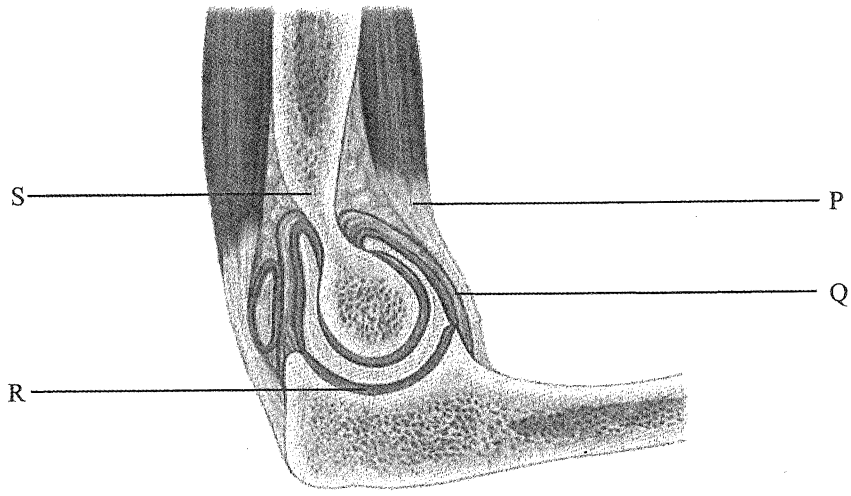
A. the area of the leaves
B. the thickness of the leaves
C. the length of the leafy shoot
D. the number of xylem vessels

19. Which of the following can be the functions of roots in flowering plants?

(1) anchorage
(2) absorption
(3) vegetative propagation

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

Directions: Questions 20 and 21 refer to the diagram below, which shows an elbow joint and its associated structures:



20. Which of the above structures are elastic?

A. P and R only
B. P and S only
C. Q and R only
D. Q and S only

21. Structure S is able to

(1) carry out respiration.
(2) store minerals.
(3) produce blood cells.

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

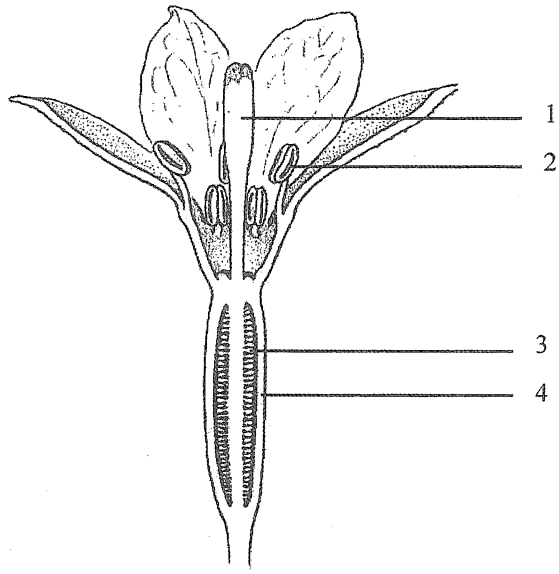
22. Toys are often used to develop children's fine motor skills. Which of the following parts is trained when children play with toys?

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

23. Which of the following correctly compares reflex actions and voluntary actions?

	Reflex actions	*Voluntary actions*
A.	responses may vary	responses are always the same
B.	stimulus is optional	stimulus is required
C.	initiated by receptors	initiated in the brain
D.	effectors must be muscles	effectors can be muscles or glands

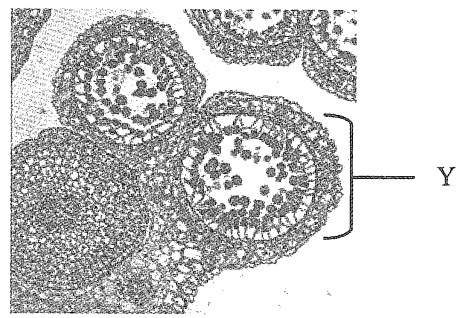
Directions: Questions 24 and 25 refer to the diagram below, which shows the structures of a flower:



24. Which structure will develop into the fruit wall?

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

25. The photograph below shows the cross section of structure 2.



Which of the following parts of the human reproductive system serves a function similar to that of Y?

A. ovum
B. sperm
C. testis
D. ovary

26. During pregnancy, amniotic fluid containing foetal cells can be obtained for karyotyping. This helps to determine whether the foetus

(1) is male or female.
(2) has Down syndrome or not.
(3) is a carrier of Sickle-cell anaemia.

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

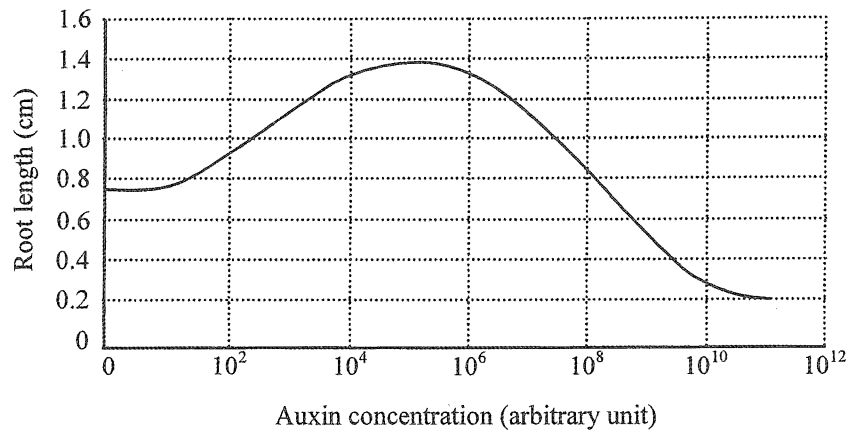
27. Which of the following combinations correctly shows the conditions of different parts of the eyes when a person is looking at an object moving towards him?

	Lens	*Suspensory ligament*
A.	becoming thinner	slackening
B.	becoming thinner	tightening
C.	becoming thicker	slackening
D.	becoming thicker	tightening

28. Which of the following parameters is best for measuring the growth of the broad bean after germination?

A. the length of the shoot
B. the area of the leaves
C. the weight of the embryo
D. the volume of the cotyledon

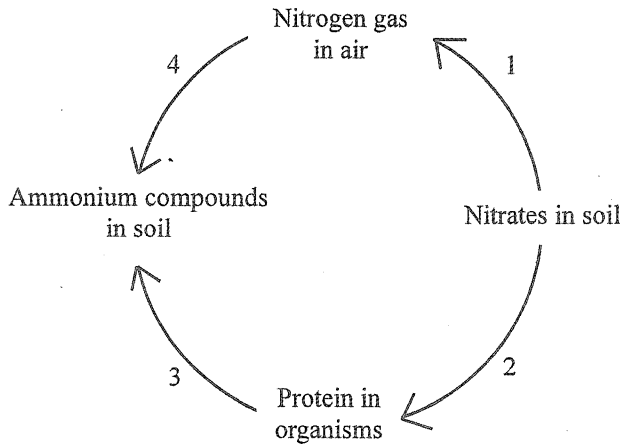
29. The graph below shows the average root length of germinating seeds irrigated with different auxin concentrations:



Which of the following can be deduced from the above graph?

A. Auxins promote the elongation of the root.
B. Auxins promote cell division that results in the elongation of the root.
C. Auxins promote water absorption that results in the elongation of the root.
D. Different concentrations of auxins result in differences in the extent of root elongation.

Directions: Questions 30 and 31 refer to the diagram below, which shows the conversion of some nitrogen-containing substances in nature:



30. Process 3 is

A. nitrification.
B. denitrification.
C. decomposition.
D. nitrogen fixation.

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

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

Directions: Questions 32 and 33 refer to the table below, which shows the results of blood tests for the presence of antigens and antibodies of hepatitis B in four individuals:

	Individual 1	Individual 2	Individual 3	Individual 4
Antigens of hepatitis B	Negative	Positive	Negative	Positive
Antibodies of hepatitis B	Negative	Negative	Positive	Positive

32. Which individual(s) would you recommend for vaccination against hepatitis B?

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

33. Hepatitis B is transmitted through

A. insects.
B. droplets.
C. body fluid.
D. skin contact.

Directions: Questions 34 and 35 refer to the list of factors shown below.

(1) Smoking
(2) Family history
(3) Overweight
(4) Radiation

34. Which of the above factors can be controlled by lifestyle adjustment?

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

35. Which of the above are risk factors for coronary heart disease?

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

36. Which of the following components of blood are involved in forming a blood clot?

(1) Blood platelets
(2) Red blood cells
(3) White blood cells

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

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

2015-DSE
BIO
PAPER 1B

B

Please stick the barcode label here.

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2015

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 ear parts listed in column 1, select from column 2 one phrase that matches it. Put the appropriate letter in the space provided. (3 marks)

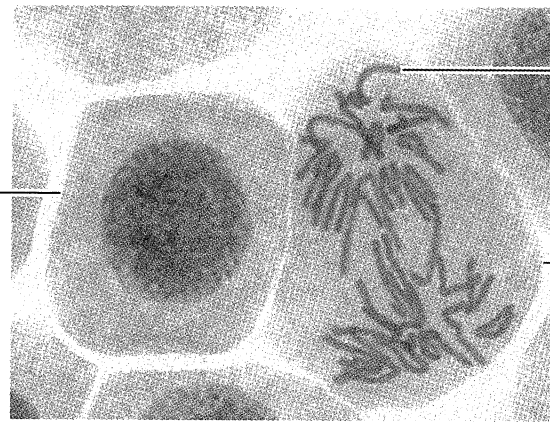
Column 1		Column 2	
Ear bones	.....	A.	Transmitting vibrations
Eustachian tube	.....	B.	Transmitting sound waves
Cochlea	.....	C.	Converting sound waves to vibrations
		D.	Converting vibrations to nerve impulses
		E.	Equalizing the air pressure on either side of the ear drum

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Please stick the barcode label here.

2. The photomicrograph below shows the appearance of genetic materials at two different stages of the cell cycle:



(a) Label structure X shown in the photomicrograph. (1 mark)

(b) With reference to the appearance of the genetic materials shown in the photomicrograph, at which stage, A or B, is transcription more likely to take place? Explain your answer. (2 marks)

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(c) In the space provided below, state the cause for the different outcomes of mitosis and meiosis. (2 marks)

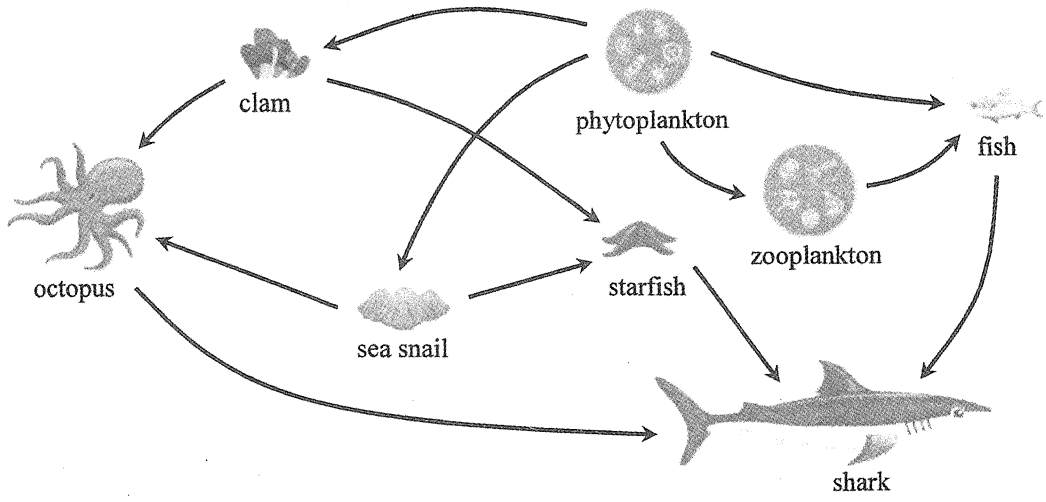
	Outcome		*Cause*
	Mitosis	*Meiosis*	
Number of daughter cells	2	4	
DNA content in daughter cells	2N	1N	

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.

3. The diagram below shows the feeding relationships among some organisms in a marine ecosystem:



(a) Write down the shortest food chain found in the diagram. (1 mark)

(b) In the space provided below, draw the pyramid of numbers for the food chain in (a). (2 marks)

(c) Explain the shape of the pyramid of numbers drawn in (b). (3 marks)

(d) Suggest *two* practical methods that allow you to confirm the feeding relationships among various organisms in this ecosystem. (2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Please stick the barcode label here.

4. Roger is found to be suitable for donating blood to recipients with blood types different from his own. However, he cannot receive a blood transfusion from his parents. The blood types of his father and mother are A and B respectively.

(a) What is Roger's blood type? (1 mark)

(b) Given that:

I^A represents the allele for producing antigen A on the surface of red blood cells
I^B represents the allele for producing antigen B on the surface of red blood cells
i represents the allele that does not lead to the production of any antigens on the surface of red blood cells

(i) Using the above symbols, state Roger's genotype. (1 mark)

(ii) Using the above symbols, state the genotypes of his parents. (2 marks)

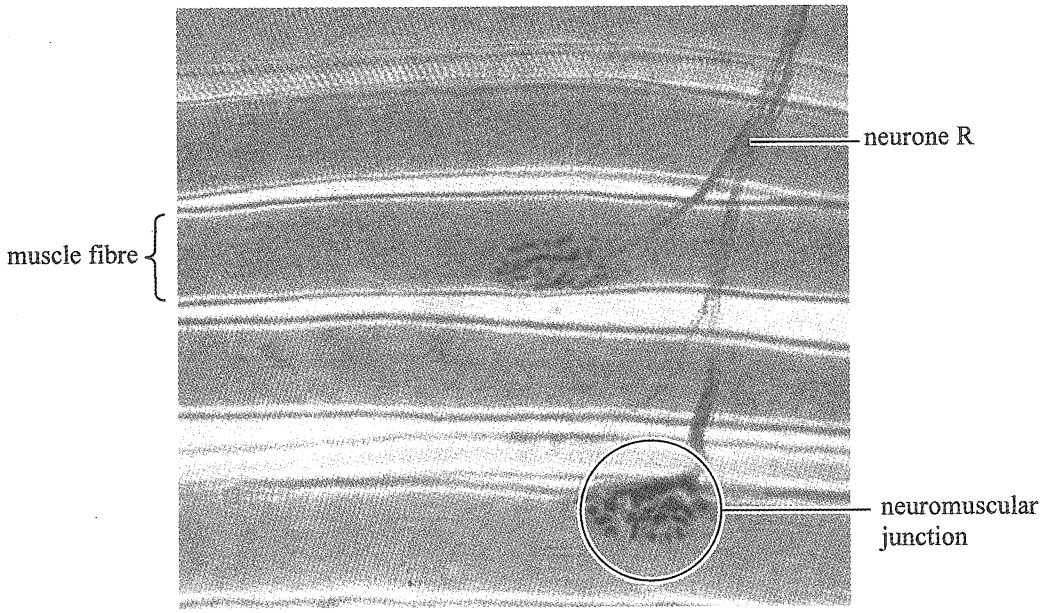
Father: _____ Mother: _____

(c) Explain why Roger cannot receive blood transfusions from his parents. (3 marks)

Answers written in the margins will not be marked.

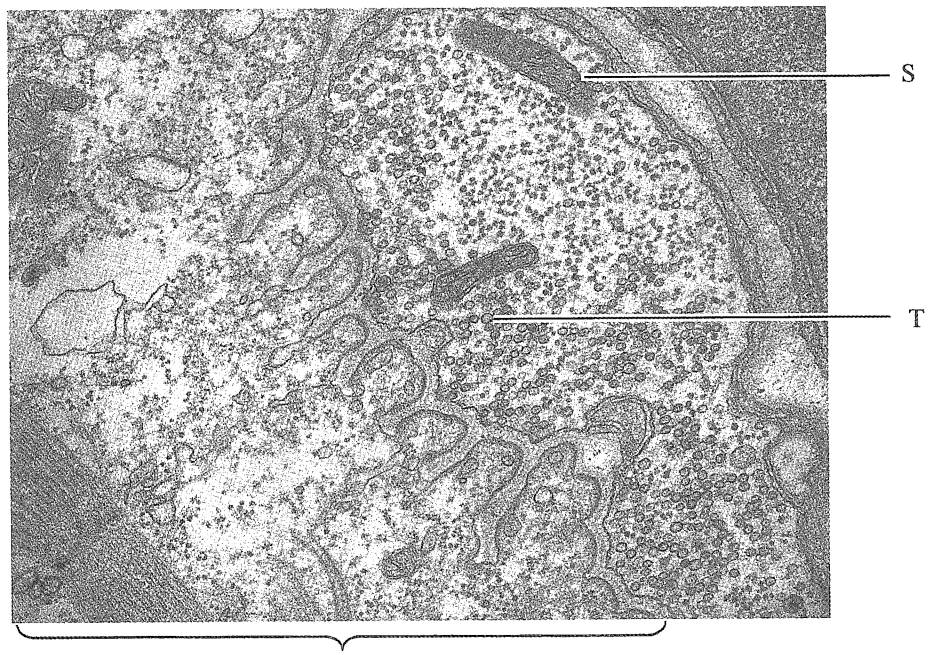
Answers written in the margins will not be marked.

Photograph P



(x 400)

Photograph Q



(x 4500) part of muscle fibre

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Please stick the barcode label here.

5. On the opposite page, Photograph P shows several muscle fibres associated with the terminal parts of neurone R and Photograph Q shows the detailed structure of a neuromuscular junction.

(a) Which type of neurones does R belong to? Give a reason for your answer. (2 marks)

(b) What is the functional relationship between S and T shown in Photograph Q? (2 marks)

(c) Describe how nerve impulses can be transmitted across the neuromuscular junction leading to muscle contraction. (3 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

6. The table below lists some historical developments about the discovery of the structure of cell membrane:

Year	*Scientists*	*Historical events*
1895	Overton	Discovered that lipid-soluble substances could penetrate cells easily
1917	Langmuir	Discovered that the major component of cell membrane exhibited both water-loving and water-hating properties
1925	Gorter & Grendal	Extracted lipids from the cell membrane of red blood cells and spread the lipids in a single layer on a water surface; found that the area of the layer was double the surface area of the cell membrane
1972	Singer & Nicolson	Proposed the Fluid Mosaic Model to explain the structure of cell membranes

(a) What is the major component noted by Overton and Langmuir? (1 mark)

.....

(b) Gorter and Grendal proposed that the major component identified in (a) existed as a bilayer (Bilayer Model). With reference to the observation of Langmuir, suggest how this major component is oriented and arranged in the cell membrane. Explain your answer. (3 marks)

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

(c) (i) The Bilayer Model proposed by Gorter and Grendal did not mention another major component of the cell membrane. What is this component? (1 mark)

.....

(ii) With reference to the Fluid Mosaic Model, briefly describe the orientation of this component in the cell membrane. (2 marks)

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(d) Models are often used by scientists to explain their findings. Complete the following table to elaborate on the aspects of the nature of science involved in the use of scientific models. (2 marks)

Nature of science	*Elaboration*
Science is evidence based	
	Models are used to simulate an invisible structure or illustrate a theory.

7. Hydrogen peroxide is a by-product of some metabolic reactions inside our body. If it were allowed to accumulate, it would kill our cells. Fortunately, we have an enzyme called catalase which speeds up the breakdown of hydrogen peroxide into water and oxygen. A student planned to investigate the effect of temperature on the activity of catalase. Below are the steps the student has drafted for his investigation:

(1) Extract catalase from an animal organ.
(2) Mix 5 mL 0.1% hydrogen peroxide solution with 1 mL catalase extract.
(3) Place the mixture in a water bath set at 0°C.
(4) Measure and record the volume of oxygen gas released in the first 5 minutes.
(5) Repeat steps (2) to (4) with the water bath set at 20°C, 40°C and 60°C.

(a) Suggest an animal organ in which catalase is present in great abundance and from which the enzyme can be obtained. Explain why this organ has so much catalase. (2 marks)

(b) The student has missed out an important step in his drafted procedure. What is it? Explain the importance of this step. (2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

(c) You are provided with the following apparatus and materials:

measuring cylinder, boiling tube, one-hole stopper, glass tubing, rubber tubing, pipette, ink, water trough, clip

Choose the appropriate apparatus and materials to assemble a set-up for measuring the rate of oxygen production. Draw the set-up in the space below. (3 marks)

Set-up for measuring the rate of oxygen production

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

8. In a health check, Lisa was found to have glucose in her urine. She undertook a further check in which she has fasted for 12 hours before a blood sample was taken for examination. The results of the blood tests are shown below:

Tests	Results	Normal range	Units
Blood glucose	8.4	4-6	mmol L^{-1}
Insulin	0.2	3-32	$\mu U\ mL^{-1}$
Glucagon	130	20-100	$\mu g\ L^{-1}$

(a) State the type of diabetes Lisa is suffering from. (1 mark)

(b) With reference to the production and actions of the two hormones, account for the results of Lisa's blood tests.

(i) Insulin (3 marks)

(ii) Glucagon (3 marks)

(c) Suggest *two* dietary habits that Lisa should establish. (2 marks)

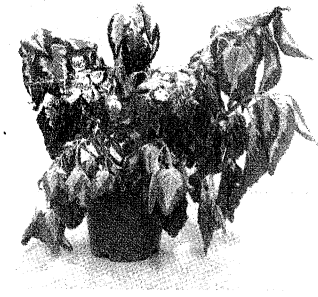
Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

9. The photographs below show the appearance of the leaves of a well-watered potted plant at 9 am and 1 pm on a sunny day in summer.

Photograph X (9 am)

Photograph Y (1 pm)



(a) Briefly describe how the appearance of the leaves shown in photograph X is maintained. (2 marks)

(b) Suggest an explanation for the appearance of the leaves at 1 pm (Photograph Y). (3 marks)

(c) With reference to the appearance of the leaves in the two photographs, which one is more effective for photosynthesis? Explain your answer. (4 marks)

Answers written in the margins will not be marked.

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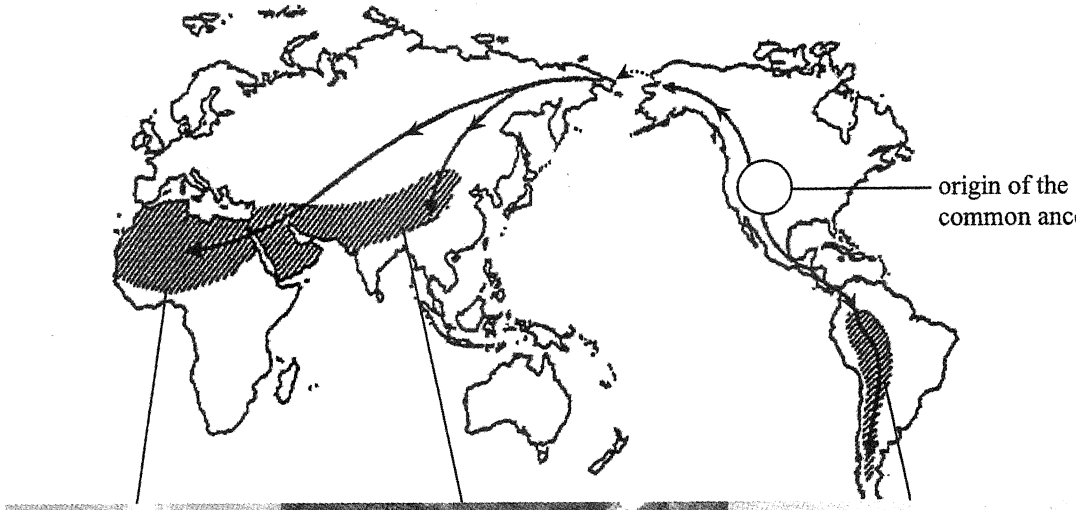
10. Fossil records suggest that camels in Africa and Asia and llamas in South America evolved from a common ancestor 6 million years ago. The diagram below shows the possible migration routes of the common ancestor at the time before the continents were separated and the locations (shaded areas) where the camels and llamas are found at present:



Camel in Africa | Camel in Asia | Llama in South America

(a) Based on the information given, draw a diagram to show the evolutionary tree of the three animals. (2 marks)

Evolutionary tree of camels in Africa and Asia and llamas in South America

Answers written in the margins will not be marked.

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(b) Explain how the common ancestor might have given rise to the two different animal species (camels and llamas) in the above case. (4 marks)

(c) Suggest another way to establish the evolutionary relationship among the above animals. (1 mark)

(d) Give *two* limitations of fossil records as evidence for evolution. (2 marks)

Answers written in the margins will not be marked.

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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. Although both arteries and veins are blood vessels, they are very different in their structure. Discuss how their structural differences are related to the different ways of maintaining blood flow inside the blood vessels. (11 marks)

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END OF PAPER

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

Answers written in the margins will not be marked.