

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2012

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 tissue types has the greatest number of mitochondria?
 - A. the wall of an air sac
 - B. the wall of a capillary
 - C. the inner wall of a lymph vessel
 - D. the inner wall of the small intestine

2. Plants carry out photosynthesis to produce glucose which is required for the formation of
 - (1) cellulose.
 - (2) protein.
 - (3) starch.
 - A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

3. Which of the following is the major cause that accounts for the ascent of water in trees?
 - A. the loss of water from leaves
 - B. the absorption of water in roots
 - C. the thickness of tree trunks
 - D. the diameter of xylem vessels

4. Which of the following gives the correct direction of impulse transmission in a neurone?
 - A. axon → cell body → dendrites
 - B. dendrites → cell body → axon
 - C. cell body → axon → dendrites
 - D. dendrites → axon → cell body

5. Chemicals released at the synapse are responsible for the impulse transmission from
 - (1) sensory neurone to interneurone.
 - (2) interneurone to motor neurone.
 - (3) motor neurone to muscle.
 - A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

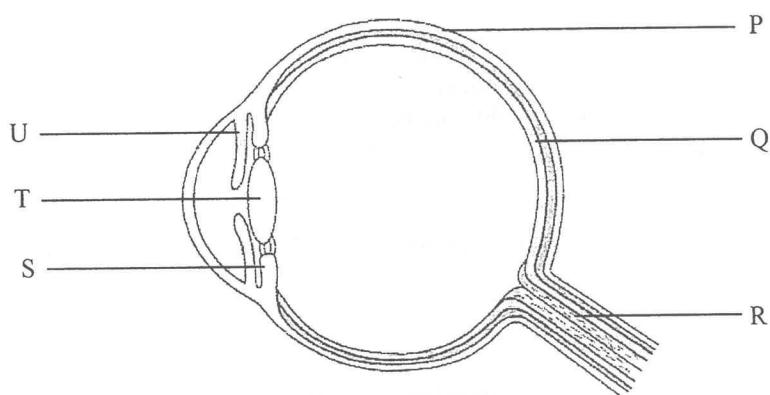
6. Which of the following activities is coordinated by the cerebellum?

- A. muscular movements during dancing
- B. breathing movements during sleeping
- C. secretion of digestive juices when one is hungry
- D. withdrawal of hand when one touches a hot object

7. In a movable joint, the tissue holding the bones together is called

- A. ligament.
- B. cartilage.
- C. muscle.
- D. tendon.

Directions: Questions 8 and 9 refer to the diagram below, which shows a section of the human eye:



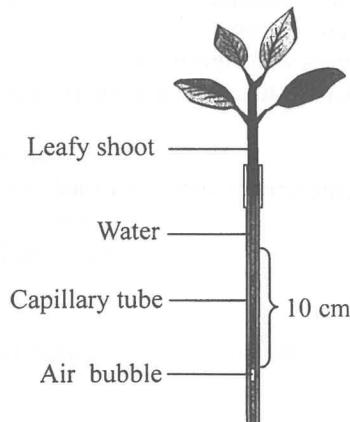
8. Which part of the eye is tough and white in colour?

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

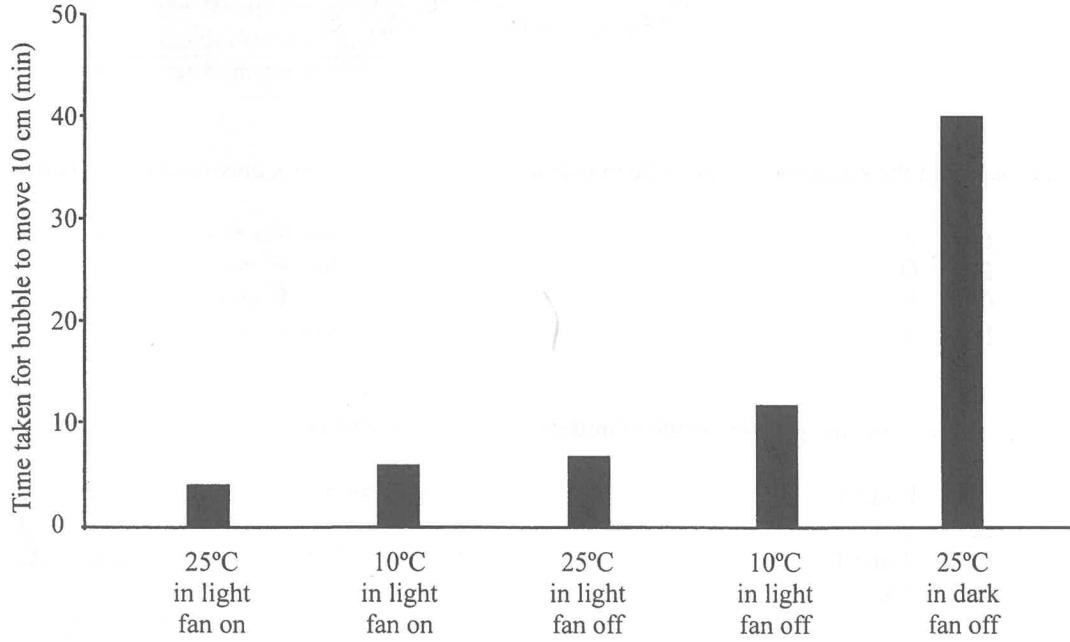
9. Which of the following parts are made of muscle?

- A. P and S
- B. Q and R
- C. R and T
- D. S and U

Directions: Questions 10 and 11 refer to the following set-up, which is used to investigate the effect of different environmental conditions on the rate of water loss from a leafy shoot:



10. It is important to cut the leafy shoot under water at the beginning of the experiment because this
- A. allows the leafy shoot to adjust to the new environment.
 - B. prevents the drying up of the cut end of the leafy shoot.
 - C. avoids the forming of air bubbles in the xylem of the leafy shoot.
 - D. makes sure that there is no water loss from the leafy shoot before the experiment.
11. The results of the experiment conducted under different environmental conditions are shown in the bar chart below:



Which of the following changes in conditions results in the greatest decrease in water loss from the leafy shoot?

- A. switching off the light
- B. switching off the fan
- C. increasing the temperature from 10°C to 25°C
- D. decreasing the temperature from 25°C to 10°C

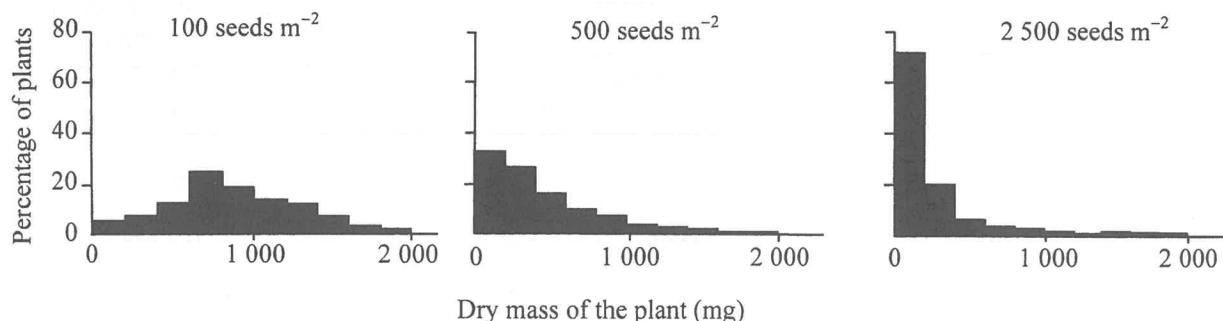
12. Leaves were taken from four different plants and the number of stomata was counted. The results are shown in the following table:

Plant	Mean number of stomata per cm ²	
	Upper surface of the leaf	Lower surface of the leaf
P	4 000	28 000
Q	0	800
R	8 500	15 000
S	8 000	26 000

Which plant will wilt first when it is grown in a very dry region?

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

Directions: Questions 13 and 14 refer to an investigation described below. Pots were planted with seeds at densities of 100, 500 and 2 500 m⁻² respectively. The soil, water and lighting conditions were similar for each pot. The dry masses of mature plants are shown in the following graphs:



13. The investigation was most likely performed to study

- A. the effect of symbiosis.
- B. the effect of competition.
- C. the success rate of seed germination.
- D. the optimum density for seed germination.

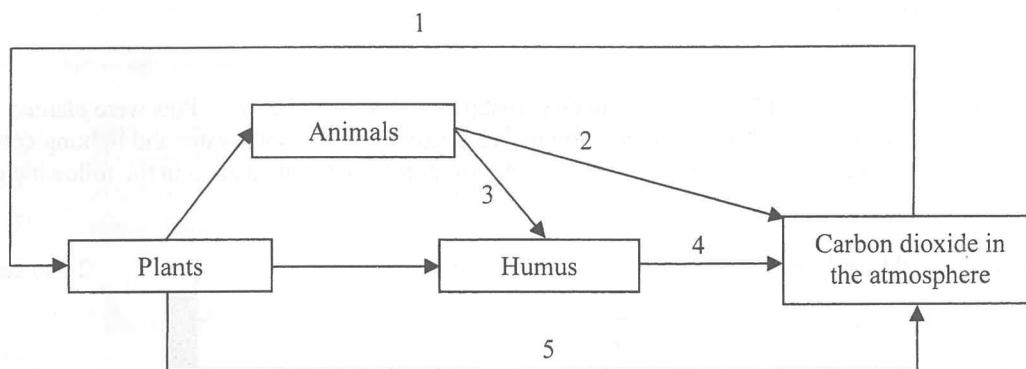
14. Which of the following best describes the effect on the plants as the density of seeds planted increases?

- A. biomass of individual plants is reduced
- B. genetic variability of the plants is increased
- C. dry masses of plants are normally distributed
- D. leaves become smaller and stems get thinner

15. Identical twins have the same

- (1) genotype.
 - (2) traits involving continuous variations.
 - (3) traits involving discontinuous variations.
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

Directions: Questions 16 and 17 refer to the following diagram, which shows the flow of carbon in an ecosystem:



16. Which of the following combinations correctly shows the processes indicated by labels 1, 4 and 5?

- | 1 | 4 | 5 |
|-------------------|----------------|---------------|
| A. respiration | photosynthesis | decomposition |
| B. photosynthesis | respiration | decomposition |
| C. photosynthesis | decomposition | respiration |
| D. decomposition | photosynthesis | respiration |

17. Saprophytes are involved in process

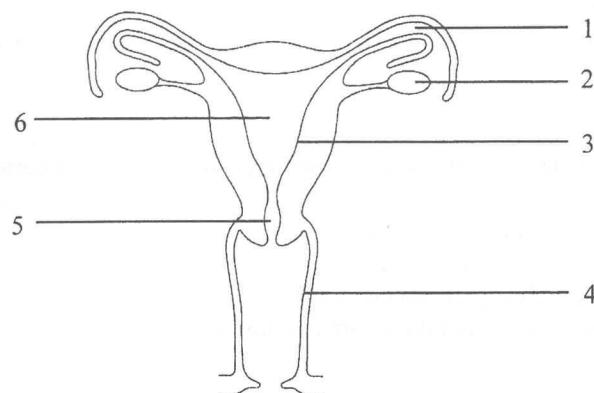
- A. 1.
- B. 2.
- C. 3.
- D. 5.

18. Which of the following descriptions about transcription is correct?

- A. tRNA pairs with ribosome to produce amino acids.
- B. mRNA pairs with ribosome to produce proteins.
- C. Free DNA nucleotides pair with DNA template strand to produce DNA.
- D. Free RNA nucleotides pair with DNA template strand to produce mRNA.

19. The tRNA anticodon for the sequence AGT on the coding strand of DNA is
- UCA.
 - AGU.
 - TCA.
 - AGT.
20. Which of the following descriptions about the function of the liver is correct?
- detects blood glucose level
 - breaks down red blood cells
 - secretes glucagon into the blood
 - secretes enzymes into the small intestine
21. A red blood cell leaves the aorta, travels through the body and arrives at the capillaries of the air sacs. The correct sequence of organs through which the red blood cell may have travelled is
- liver, lungs, small intestine and heart.
 - lungs, heart, small intestine and liver.
 - small intestine, heart, liver and lungs.
 - small intestine, liver, heart and lungs.
22. Which of the following descriptions about the function of the cilia lining the trachea is correct?
- to warm the incoming air
 - to moisten the incoming air
 - to move mucus away from the trachea
 - to produce mucus to protect the trachea
23. Which of the following descriptions about the role of light in photosynthesis are correct?
- (1) Activation of chlorophyll provides high energy electrons.
 - (2) Photolysis of water releases oxygen for use in carbon fixation.
 - (3) Photolysis of water releases hydrogen for the formation of NADPH.
- (1) and (2) only
 - (1) and (3) only
 - (2) and (3) only
 - (1), (2) and (3)
24. Which of the following descriptions about pollen grains is correct?
- Pollen grains are the male gametes of a plant.
 - Pollen grains can produce nectar to attract insects.
 - Pollen grains germinate when they land on the stigma of the same species.
 - Pollen grains of insect-pollinated flowers are usually smaller than those of wind-pollinated flowers.

Directions: Questions 25 and 26 refer to the following diagram, which shows part of the female reproductive system:



25. Which of the following structures undergo periodic changes?
- A. 1 and 3
 - B. 1 and 4
 - C. 2 and 3
 - D. 2 and 4
26. In which of the following structures does implantation normally take place?
- A. 1
 - B. 3
 - C. 5
 - D. 6
27. Which of the following contraceptive methods prevents the formation of mature gametes?
- A. using diaphragm
 - B. using rhythm method
 - C. intake of contraceptive pills
 - D. using intrauterine device
28. Which of the following pairs of reproductive structures in humans and flowering plants have the same function?

	<i>Humans</i>	<i>Flowering plants</i>
A.	sperm	anther
B.	penis	pollen tube
C.	uterus	carpel
D.	vagina	petal

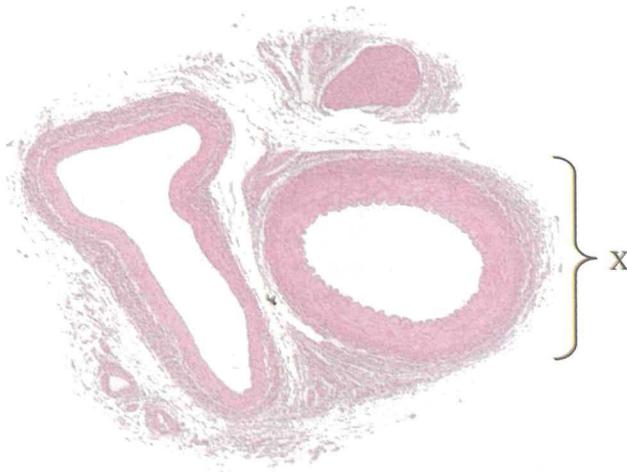
29. Which of the following is *not* a secondary sexual characteristic of a man?

- A. growth of beard
- B. production of sperms
- C. broadening of shoulders
- D. enlargement of larynx

30. Which of the following correctly describe the importance of phototropism to plants?

- (1) It ensures that the root can get water from the soil.
 - (2) It ensures that the root can anchor to the soil for support.
 - (3) It allows the shoot to reach a position where there is sunlight.
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

Directions: Questions 31 and 32 refer to the photomicrograph below, which shows some blood vessels found in the human body:



31. Blood vessel X is an artery because it has a

- A. thick muscular wall to withstand high blood pressure.
- B. thick muscular wall to generate high blood pressure.
- C. large lumen to slow down the blood flow.
- D. large lumen to accommodate more blood.

32. If blood vessel X is connected with the lung, it carries

- A. oxygenated blood towards the heart.
- B. oxygenated blood towards the lungs.
- C. deoxygenated blood towards the heart.
- D. deoxygenated blood towards the lungs.

33. In the circulatory system, the highest blood pressure is developed in the
- A. left atrium.
 - B. right atrium.
 - C. left ventricle.
 - D. right ventricle.
34. After consuming a boiled egg, chemical digestion begins in the
- A. mouth.
 - B. oesophagus.
 - C. stomach.
 - D. small intestine.
35. Which of the following belongs to humoral immune response?
- A. blood clotting
 - B. production of antibodies
 - C. phagocytosis of pathogens
 - D. production of memory T cells
36. After injury, the wound usually becomes swollen due to
- A. accumulation of bacteria at the wound.
 - B. accumulation of tissue fluid at the wound.
 - C. increased phagocytosis at the wound.
 - D. increased blood flow to the capillaries around the wound.

END OF SECTION A

Go on to Question-Answer Book B for questions on Section B

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2012

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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 and 7.
- (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.



SECTION B

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

1. For each type of the blood cells listed in column 1, select from column 2 **one** phrase that correctly describes its function. Put the appropriate letter in the space provided. (3 marks)

Column 1

Lymphocytes

Column 2

A. Involved in blood clotting

Blood platelets

B. Involved in oxygen transport

Red blood cells

C. Involved in antibody production

D. Involved in phagocytosis

E. Involved in transporting hormones

2. Dengue Fever is a vector borne disease transmitted by mosquitoes. The table below shows two methods adopted by the Government to break the transmission link of this disease. Complete the table below to show how each method works and comment on its advantage *or* disadvantage. (4 marks)

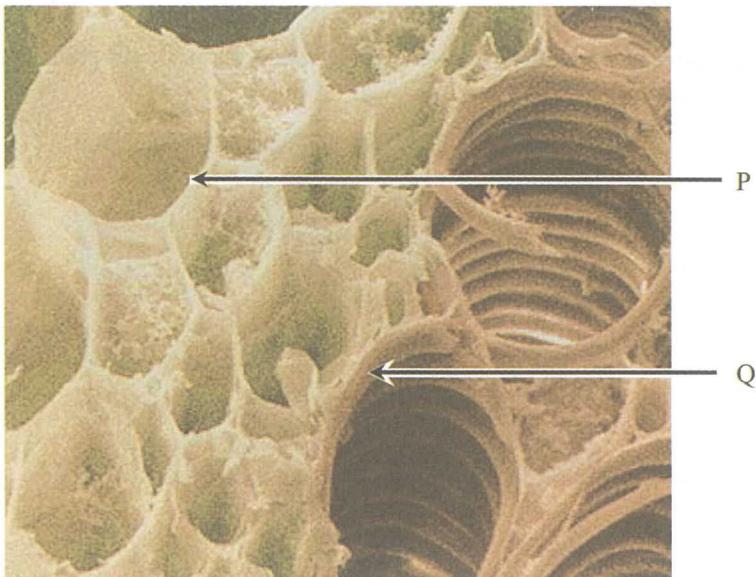
Method	How it works	Comment (advantage or disadvantage)
Spraying of pesticides or larvicultural oil around mosquito's habitat		
Clearance of accumulated water in a neighbourhood		

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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3. The electron micrograph below shows part of the stem of a plant containing two cell types, P and Q:



Answers written in the margins will not be marked.

- (a) Based on the photograph shown, state the difference between cell types P and Q in the structure indicated by the arrow heads. (1 mark)

- (b) Describe how these cells contribute to the support of the plant. (4 marks)

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Answers written in the margins will not be marked.

4. The following key can be used for identifying organisms under the same phylum:

1a	Absence of eyes	-----	2
1b	A pair of eyes	-----	3
2a	Six legs	-----	Class A
2b	More than six legs	-----	Class B
3a	Six legs	-----	Class C
3b	More than six legs	-----	Class D

- (a) Using the above key, identify which class organism X shown in the photograph below belongs to.
(1 mark)



- (b) Suggest a characteristic of the habitat of organism X. Explain your answer. (2 marks)

- (c) A newly found organism Y has a pair of eyes and fewer than six legs. Although it is believed that this organism belongs to this phylum, it cannot be identified by using the above key. Explain why this problem occurs.
(1 mark)

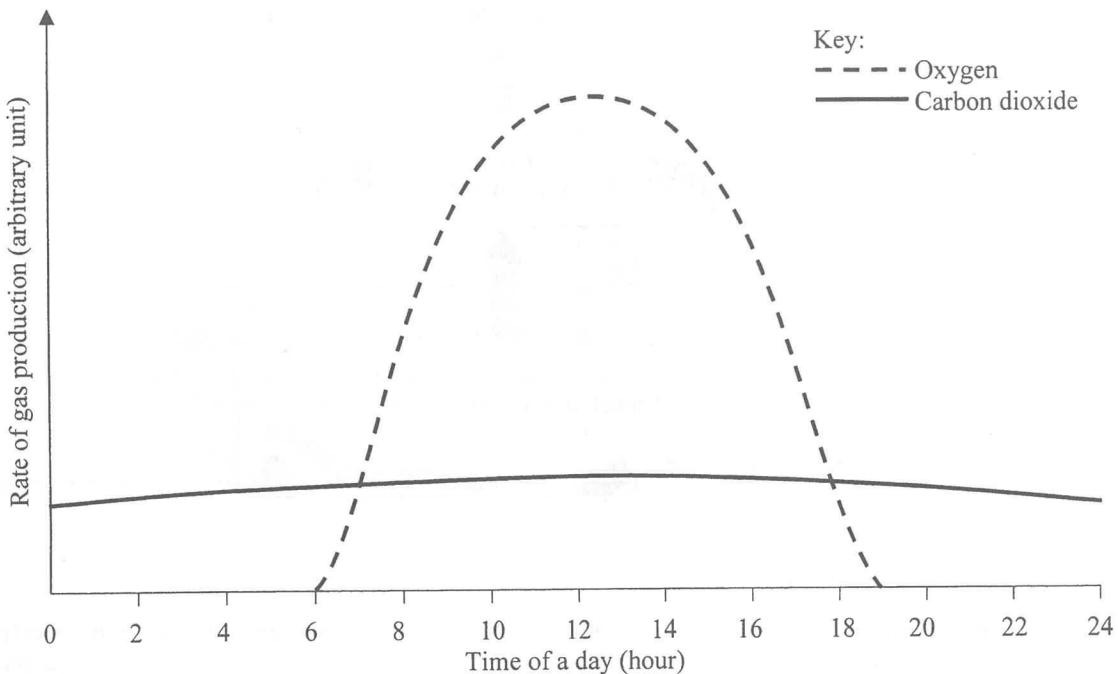
- (d) Suggest **one** way to collect more information which can be used for deciding whether organism Y belongs to this phylum. (2 marks)

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5. The graph below shows the oxygen production rate and carbon dioxide production rate of a local plant on a summer day:



- (a) State the times at which there is no net exchange of gases into or out of the leaves. (1 mark)

- (b) Sketch a line on the above graph to show the oxygen production rate of the plant on a winter day. (2 marks)

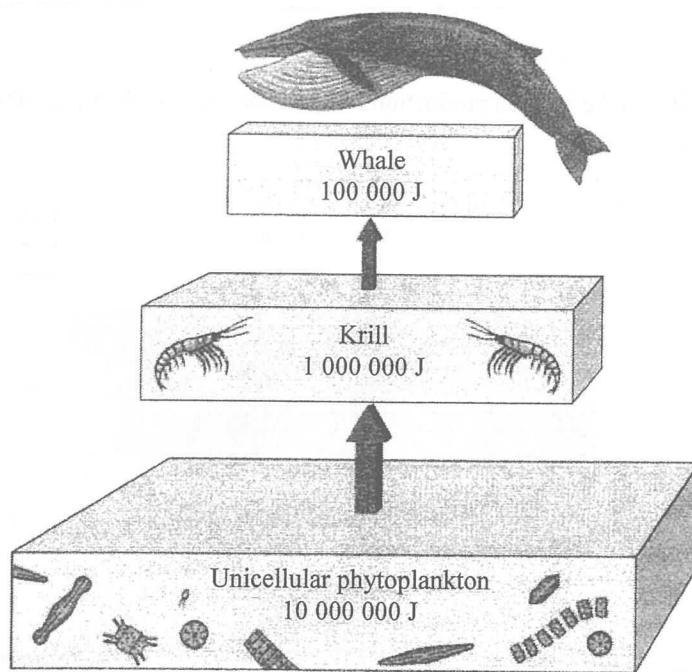
- (c) The area below the line showing the oxygen production rate is usually greater than the area below the line showing the carbon dioxide production rate. Explain the importance of this observation. (4 marks)

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Answers written in the margins will not be marked.

6. The diagram below shows a food chain in an ocean. The energy content of each trophic level is shown in the boxes:



Answers written in the margins will not be marked.

- (a) In the space below, calculate the percentage decrease in energy content from unicellular phytoplankton to krill. (2 marks)

- (b) Give **two** reasons why there is a decrease in energy content from a lower trophic level to a higher one. (2 marks)

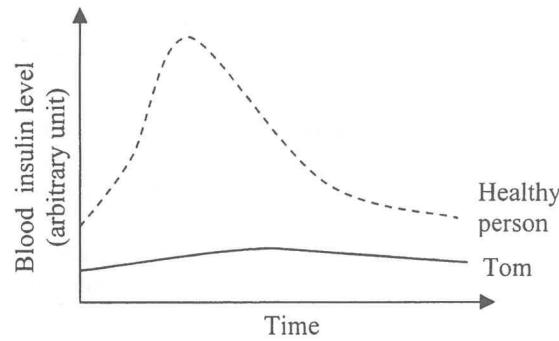
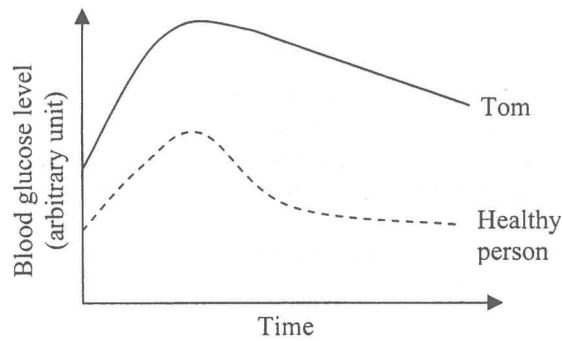
- (c) In another food chain, the producer is tree and the primary consumer is caterpillar. Would the percentage decrease in energy content be greater or smaller than the value found in (a)? Explain your answer. (2 marks)

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7. Tom suffers from diabetes. His doctor asked him to drink, after overnight fasting, a large volume of a glucose solution. After that, blood samples were taken at regular time intervals, to measure insulin and glucose contents. The following graphs show the changes in Tom's blood glucose level and blood insulin level after the test, and those of a healthy person:



- (a) Which type of diabetes does Tom suffer from? Explain your answer. (4 marks)

- (b) Explain the difference in blood glucose response to the oral consumption of glucose solution between Tom and the healthy person. (3 marks)

- (c) What medical treatment should Tom be given? (1 mark)

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Answers written in the margins will not be marked.

8. The photograph below shows the appearances of some kernels of a corn:

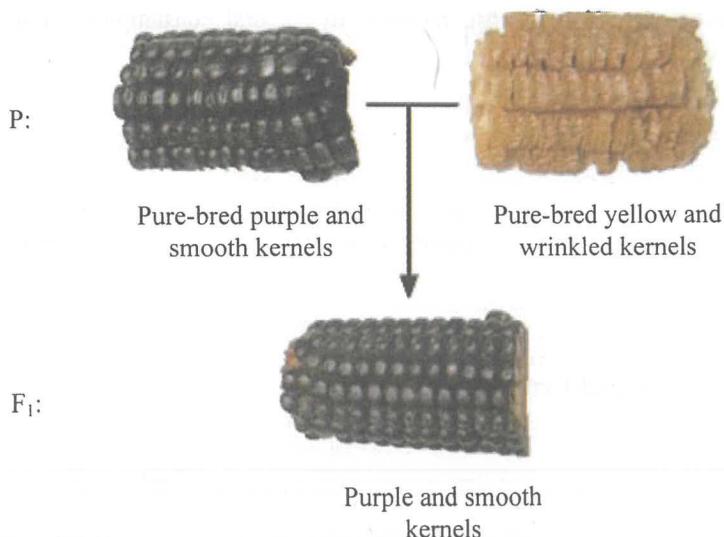


Kernel	Appearance
A	Purple and smooth
B	Purple and wrinkled
C	Yellow and smooth
D	Yellow and wrinkled

The purple colour is produced by a pigmented layer within the kernels. If the layer is not pigmented, the yellow colour of the inner tissue becomes visible. Whether the kernel is smooth or wrinkled is due to the type of food stored inside it. Smooth kernels (starchy corn) store starch while wrinkled kernels (sweet corn) store soluble sugars. The surface of the sweet corn becomes wrinkled when the corn dries up.

- (a) With reference to osmosis, explain why the kernels of sweet corn become wrinkled when they dry up but the kernels of starchy corn remain smooth. (4 marks)

- (b) The two traits of the kernels are controlled by genes located on different homologous chromosomes. The following diagram shows the result of a cross between two pure-bred corn plants, one with purple and smooth kernels and the other with yellow and wrinkled kernels:

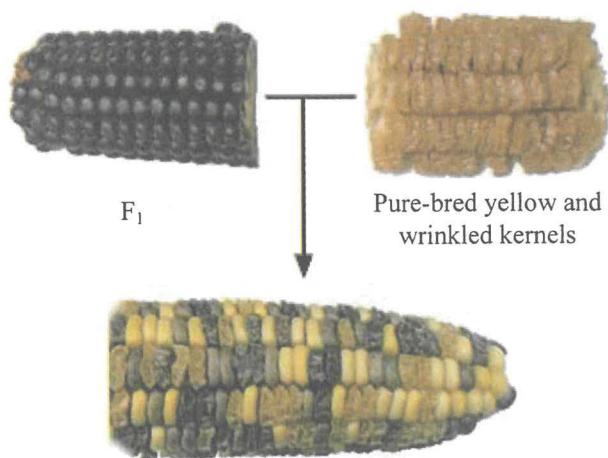


Answers written in the margins will not be marked.

(i) Based on the results of the cross, deduce which phenotypes are dominant.

(3 marks)

(ii) The F₁ generation produced was crossed with pure-bred corn plants with yellow and wrinkled kernels, as shown below:



Explain the results of the cross using Mendel's law of inheritance.
(Marks will not be awarded for genetic diagrams.)

(4 marks)

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Answers written in the margins will not be marked.

- (c) When Mendel proposed how traits are inherited, chromosomes had not yet been discovered. In your opinion, how did Mendel come up with his hypothesis? (3 marks)

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9. Drugs X and Y may inhibit enzymes involved in glycolysis, the Krebs cycle or oxidative phosphorylation. To study the effects of the drugs, some muscle cells were isolated and treated with these two drugs separately in the presence of oxygen. The cellular levels of ATP, NADH, and pyruvate were determined. The results are shown in the table below:

	ATP	NADH	Pyruvate
Control (without treatment)	100%	100%	100%
Drug X	2%	3%	5%
Drug Y	20%	15%	150%

The data for the control are set as 100% for comparative purpose.

- (a) Suggest the key process that is inhibited by drug X. Explain your answer. (3 marks)

- (b) Suggest the key process that is inhibited by drug Y. Explain why there is an accumulation of pyruvate in the muscle cells after treatment with drug Y. (3 marks)

- (c) Instead of incubating in the presence of oxygen, the untreated muscle cells were incubated under anaerobic conditions. Predict the change in the cellular ATP, NADH and lactate levels. (3 marks)

- (d) A student would like to study the enzymes involved in glycolysis, the Krebs cycle and oxidative phosphorylation separately. Suggest which cellular components he needs to isolate for the investigation. (3 marks)

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10. In mammals, the production of bile salts is very limited at birth and during early developmental stages. In an investigation of the effect of bile supplementation on fat digestion in piglets, four groups of piglets were fed with the same diet except that bile was added to diets in the proportion of 0, 0.15%, 0.30% and 0.45% respectively for 15 days. Faecal samples were collected each day for analysis and the body weights of the piglets were monitored. The results are shown in the table below:

	Bile level in diet (%)			
	0	0.15	0.30	0.45
Average initial body weight (kg)	4.90	4.46	4.65	4.52
Average final body weight (kg)	7.15	7.36	7.81	7.92
Average dry weight of fat in the faeces (%)	6.52	5.81	4.65	3.78

- (a) How do bile salts help with fat digestion? (2 marks)

- (b) What was the effect of bile supplementation on fat digestion in the above investigation? Explain your answer. (2 marks)

- (c) Suggest why it is important to monitor the body weight of the piglets in this investigation. (1 mark)

- (d) Suggest an *in vitro* experimental method that allows a direct measurement of the digestion of fat in a laboratory. (3 marks)

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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.

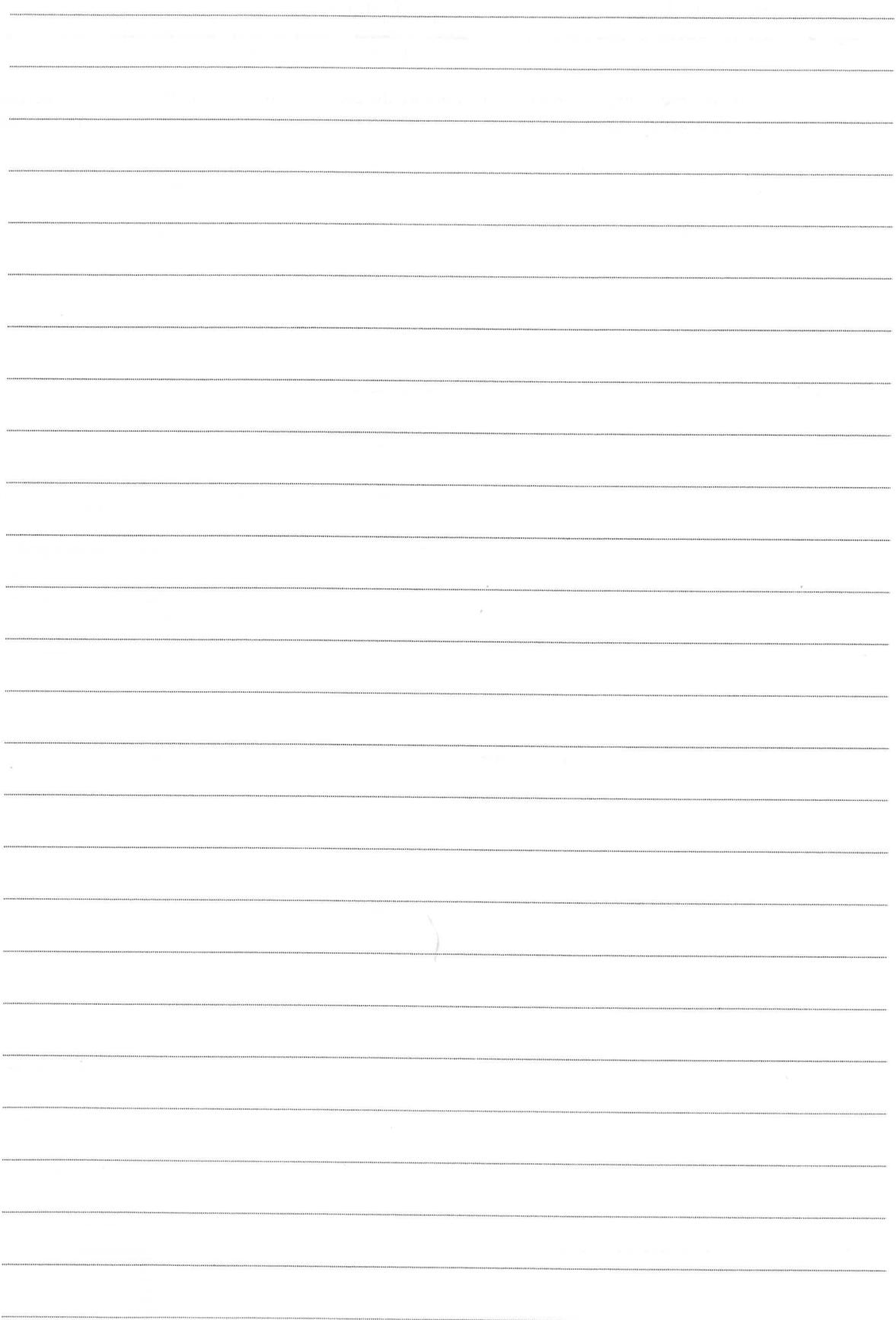
11. Mitosis and meiosis are important processes that ensure the continuity of life. Contrast the two processes and state the significance of their differences. (11 marks)

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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.