KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

2018 Preliminary Examination

Secondary 4 Express

NAME			
CLASS		INDEX NUMBER	

BIOLOGY

6093/1

Additional Materials: Multiple Choice Answer Sheet

12 September 2018

Setter: Mrs Dorothy Goh

1 hour

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Answer **all** questions.
Write in soft pencil.
Do not use staples, paper clips, highlighters and glue or correction fluid.
Write your class, name and index number on the Multiple Choice Answer Sheet in the spaces provided.

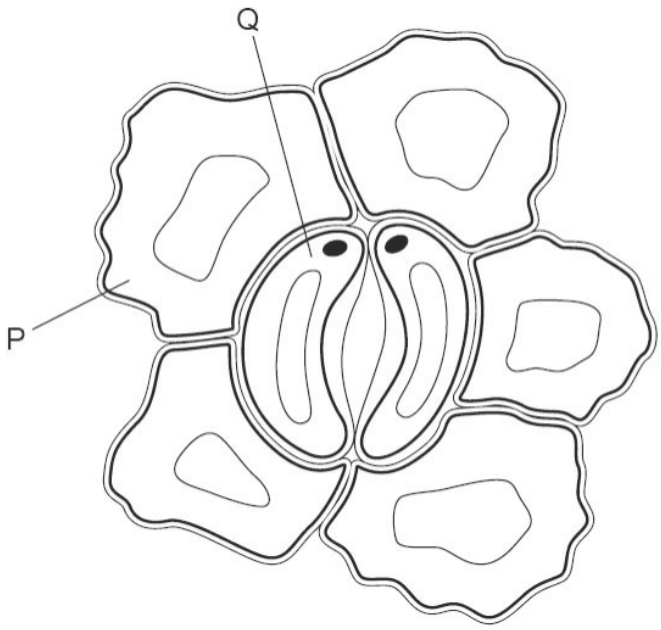
There are **forty** questions in Section A. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft** pencil on the separate Multiple Choice Answer Sheet.

This document consists of **22** printed pages including the cover page.

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1 The diagram shows cells in the epidermis of a leaf.



To complete the diagram, which structural features should be added to the cells P and Q?

	P		Q	
	chloroplast	nucleus	chloroplast	nucleus
A	✓	✓	✗	✗
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✗	✗	✗	✓

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2 Which of the following is not a property of the plasma membrane?

A composed of cellulose and protein

B fully impermeable to starch

C fully permeable to water

D fuses with ribosomes to release protein out of cell

3 Absorption of mineral ions in plants requires energy from respiration.
Which observation best supports this idea?

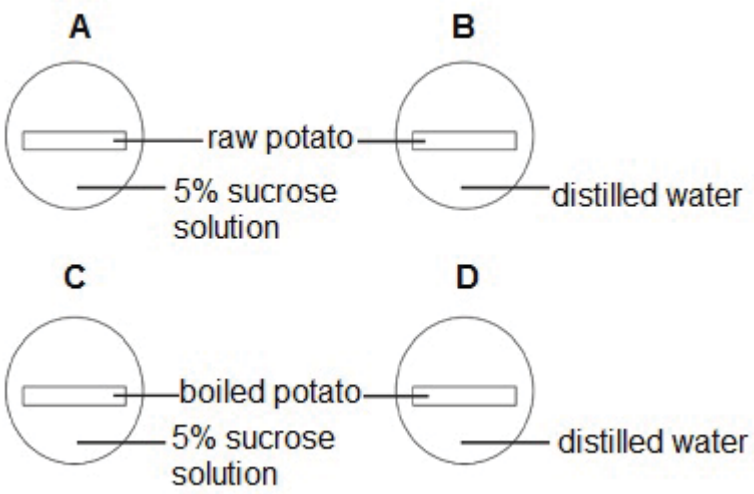
A Carbohydrates is stored in the roots.

B Living roots give off carbon dioxide.

C The root hairs have a large surface area.

D Uptake of nitrates is reduced at lower oxygen concentrations.

4 Four potato strips were each placed in a petri dish of either 5% sucrose solution or distilled water for 20 minutes.
In which of the following petri dishes will result in the potato cells being plasmolysed?



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5 Ethanol emulsion test and biuret test were carried out separately on peanuts. Which of the following correctly describes the results?

	ethanol emulsion test		biuret test	
	observation	conclusion	observation	conclusion
A	remains clear	fats is absent	blue solution remains	protein is absent
B	remains clear	fats is present	violet mixture observed	protein is present
C	white emulsion formed	fats is absent	blue solution remains	protein is absent
D	white emulsion formed	fats is present	violet mixture observed	protein is present

6 Which of the following statements describe the fate of excess glucose in the liver?

I It is broken down to release energy.

II It is broken down to fats.

III It is deaminated to produce urea.

IV It is stored as glycogen.

A I and II

B I and IV

C II and III

D II and IV

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7 The cell wall of a plant cell is removed using an enzyme. What would happen if this cell is then placed in distilled water?

A It would take more time for the cell to become turgid.

B Proteins in the cytoplasm would leave through the cell surface membrane.

C The cell would become smaller as water passes out.

D The cell would burst as water moves into it.

8 Two hours after eating a meal of fried potatoes and vegetables, one would least expect

A a decrease in concentration of fats in lymph vessels.

B a high concentration of glucose in the veins leaving the liver.

C an increase in urea in blood leading to the liver.

D less glucose in blood entering the liver than in that leaving the liver.

9 If the pancreatic duct of a mammal becomes blocked, which symptom would the mammal show?

A decreased blood insulin level

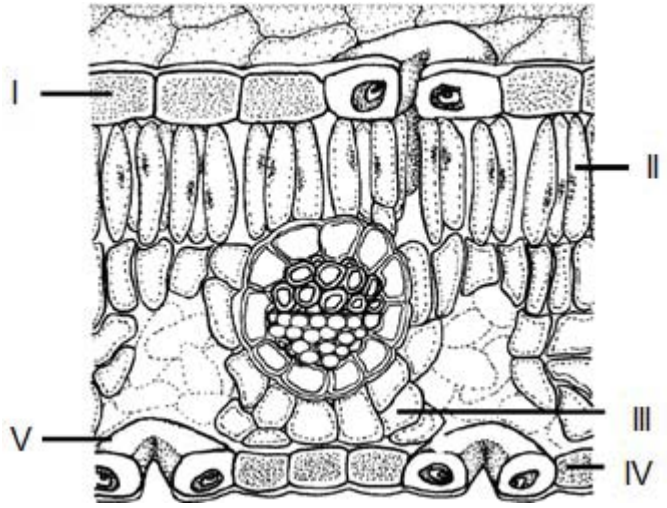
B decreased protein digestion

C increased bile in the blood

D increased blood glucose level

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10 The diagram shows the transverse section of a leaf.



Which structures are capable of carrying out photosynthesis?

A I, II and IV

B I, II and V

C II, III and IV

D II, III and V

11 A plant stem was dissected into several different tissues. Each tissue was tested for the presence of starch, protein and reducing sugar. The results are shown in the table.

Which tissue is the xylem?

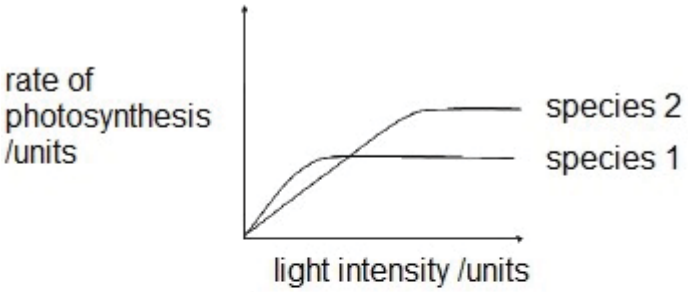
	starch	protein	reducing sugar
A	absent	absent	absent
B	absent	present	present
C	present	absent	absent
D	present	present	present

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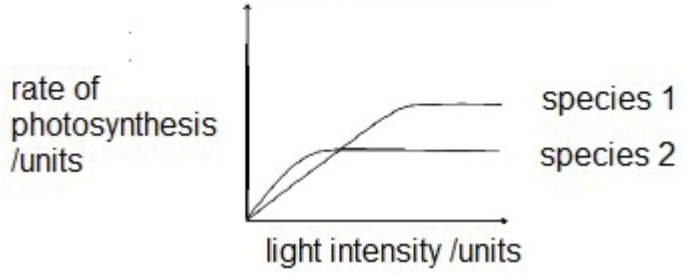
12 The effect of light intensity on the rate of photosynthesis in two plant species was investigated in a laboratory. Species 1 grows best in sunny areas and species 2 grows best in shady areas.

Which graph correctly shows how the rate of photosynthesis of these two species will vary with light intensity?

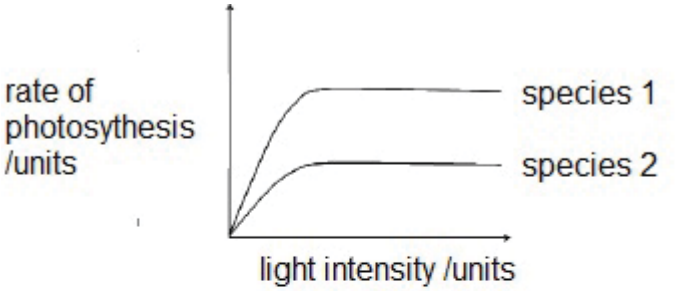
A



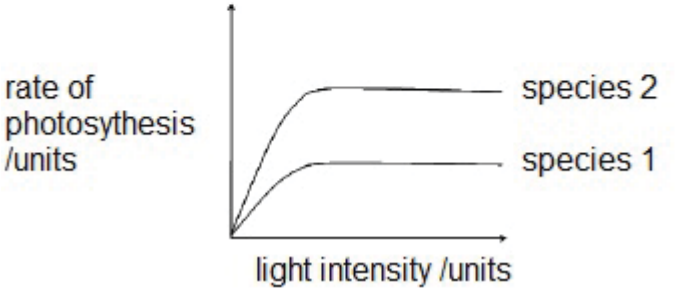
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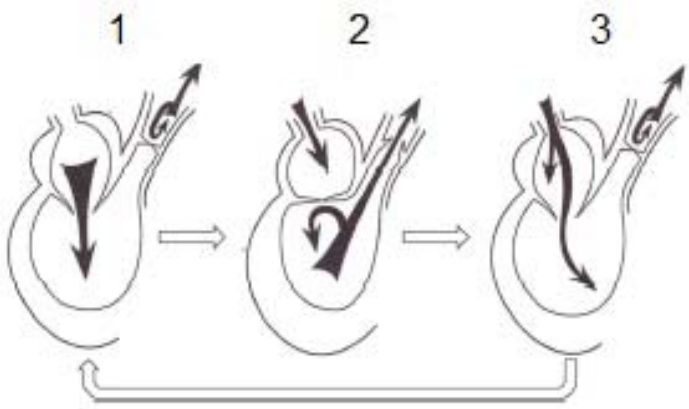


D



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13 The diagrams show the movement of blood in the right side of the heart in a cardiac cycle.



Which of the following correctly shows what is happening at stages 1, 2 and 3?

	1	2	3
A	atrial systole	ventricular systole	atrial and ventricular diastole
B	atrial systole	atrial and ventricular diastole	ventricular systole
C	atrial and ventricular diastole	ventricular systole	atrial systole
D	ventricular systole	atrial systole	atrial and ventricular diastole

14 A pulse can be felt when the thumb presses the wrist of the left hand.

This pulse is produced because

A of the alternate stretching and recoiling action of the artery.

B the arteries carry oxygenated blood.

C the veins have larger lumen than the arteries.

D the wall of the arteries is thicker than that of the veins.

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15 The active ingredient in brand A pesticide inhibits the synthesis of the plasma protein prothrombin in the liver. This pesticide most likely kills pests by

A causing the accumulation of amino acids in the blood.

B preventing the clotting process when bleeding.

C preventing the maintenance of glucose level in the blood.

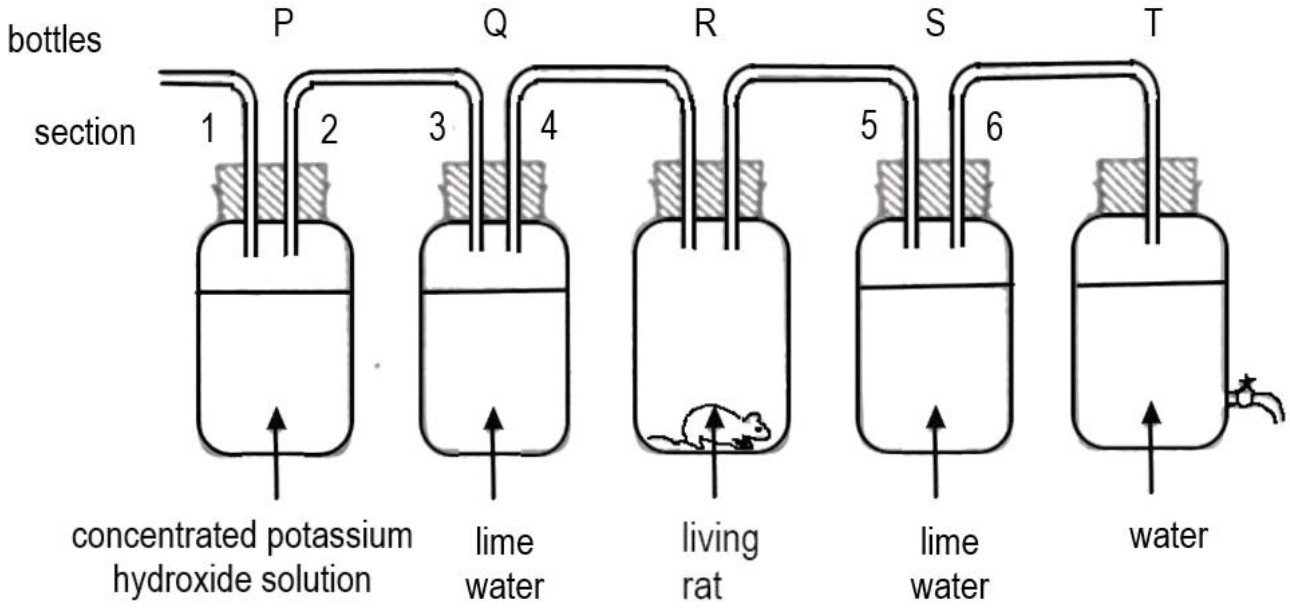
D stimulating the breakdown of red blood cells.

16 Tar and carbon monoxide are present in tobacco smoke. What are their effects on health?

	tar	carbon monoxide
A	causes high blood pressure	binds to haemoglobin irreversibly
B	causes high blood pressure	is addictive
C	causes lung cancer	binds to haemoglobin irreversibly
D	causes lung cancer	is addictive

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For questions **17** and **18**, refer to the diagram.



17 The primary aim of this experiment is to demonstrate that

A carbon dioxide is present in the atmosphere.

B oxygen is absorbed to support the metabolic activities of the rat.

C the rat releases carbon dioxide.

D the rat releases energy in the form of heat.

18 This experiment is improperly set up. Correction should be made by

A covering bottle R with a piece of black cloth throughout the experiment.

B immersing sections 1, 3 and 5 into the solutions.

C immersing sections 2, 4 and 6 into the solutions.

D replacing the lime water with hydrogen carbonate indicator solution.

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19 Which of the following does not help to promote survival of an organism living in a dry environment?

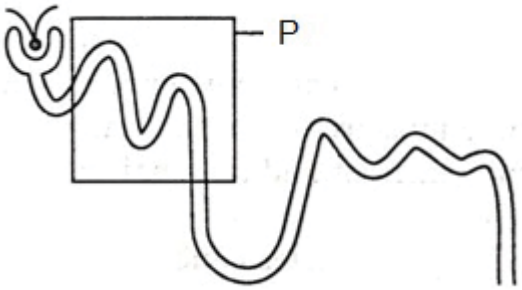
A larger glomerulus

B longer large intestine

C longer loop of Henle

D more sebaceous glands in skin

20 The diagram below shows a nephron. Reabsorption of glucose and amino acids takes place in the section labeled P.



How is section P adapted to carry out its function?

A A high hydrostatic pressure is created at section P as the renal tubule becomes narrower.

B The cells lining the walls of the tubule at P have numerous mitochondria to release energy for active transport.

C The cells lining the walls of the tubule at P have numerous pores to help in passive transport only.

D The walls of the tubule at P is a few layers thick to ensure effective reabsorption.

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21 The table shows a medical report of a patient after some diagnostic tests. He had been given cakes for breakfast eight hours before the tests.

diagnostic test	glycogen content in liver	protein in urine	sugar in urine	urea in urine
result	normal amount	present	present	present

Which diagnosis about the patient's body is correct?

	pancreas	Bowman's capsule in kidney	convoluted tubules in kidney
A	-	+	+
B	-	+	-
C	+	-	-
D	+	-	+

Key

\+ = healthy

\- = malfunctioning

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22 How does the sweat glands and hair respond to an increasing body temperature?

	sweat glands	hair
A	Decreased production of sweat leads to greater heat loss by evaporation.	Hair lays down and allows heat to be lost easily via the skin surface.
B	Decreased production of sweat prevents greater heat gain from the environment.	Hair stands and creates a layer of air that prevents heat gain from environment.
C	Increased production of sweat leads to greater heat loss by evaporation.	Hair lays down and allows heat to be lost easily via the skin surface.
D	Increased production of sweat prevents greater heat gain from the environment.	Hair stands and creates a layer of air that prevents heat gain from environment.

23 Which of the following statements is not an example of homeostasis?

A Increase in the rate of expiration to remove excess carbon dioxide from the body.

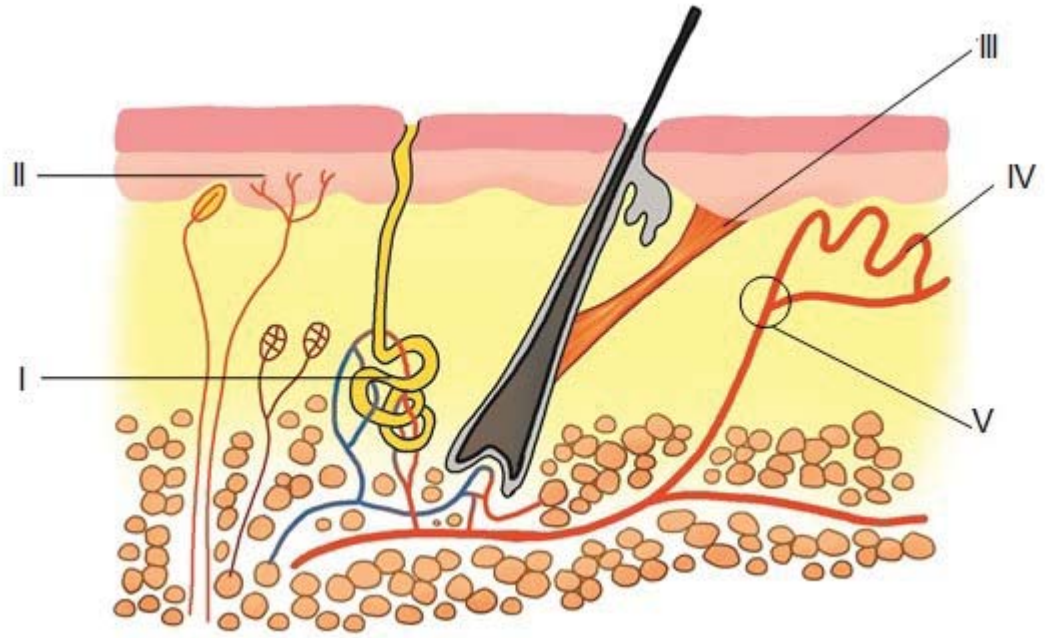
B Sweating during strenuous physical activity.

C The conversion of excess blood glucose into glycogen for storage.

D The removal of undigested waste materials from the body.

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The diagram shows the structure of the mammalian skin. Refer to the diagram for Questions **24** and **25**.



24 Identify the structures labelled I, II, III and IV.

	I	II	III	IV
A	blood capillary	nerve ending	sweat gland	hair erector muscle
B	hair erector muscle	blood capillary	nerve ending	sweat gland
C	sweat gland	hair erector muscle	blood capillary	nerve ending
D	sweat gland	nerve ending	hair erector muscle	blood capillary

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25 Which of the following would be the result of an increase in the diameter of V?

A decreased sensation of pain

B heat loss is increased at the skin surface

C heat loss is reduced at the skin surface

D increased sensation of pain

26 Which structure causes the greatest refraction of light that enters the eye?

A conjunctiva

B cornea

C lens

D iris

27 Adrenaline not only functions as a hormone in our body but can also be administered as a drug in life-saving situations. Under which condition(s) would the administration of adrenaline be useful?

1 low blood glucose concentration
2 low heart rate
3 low water potential of blood

A 3 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

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28 The trigeminal nerve in humans connects the brain with both the teeth and the skin of the face. When the dentist administers a local anesthetic by injection, the patient can no longer feel the pain and cannot smile properly.

What does this conclude about the trigeminal nerve?

A It carries impulses from the brain to the teeth and back to the skin.

B It contains both motor and sensory neurones.

C It contains mainly motor neurones.

D It contains mainly sensory neurones.

29 Which statement about pollen grains is correct?

A An embryo is formed when a pollen grain fuses with the female gamete.

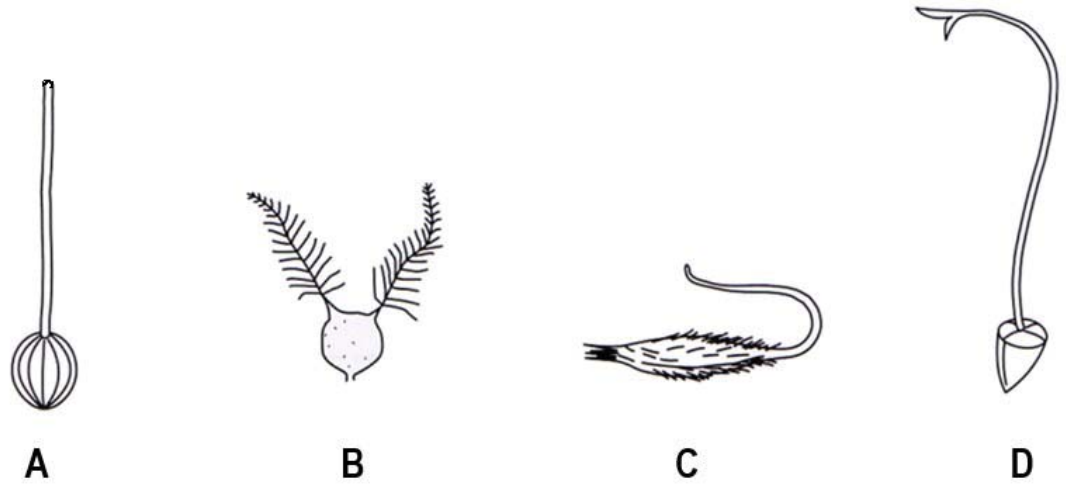
B Pollen grains are the male gametes of a plant.

C Pollen grains can only germinate if they land on the stigma of another flower.

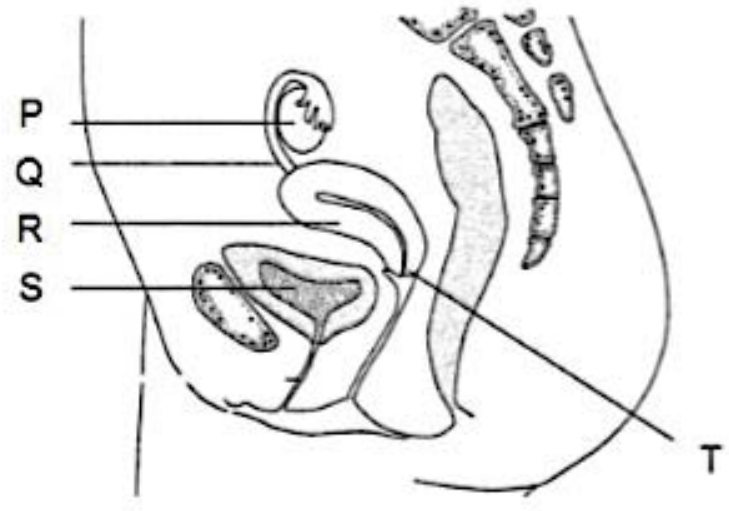
D The sugary fluid of a stigma stimulates pollen grains to germinate.

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30 The diagrams show carpels from four different flowers. Which carpel is associated with wind pollination?



31 The diagram shows a female reproductive system.

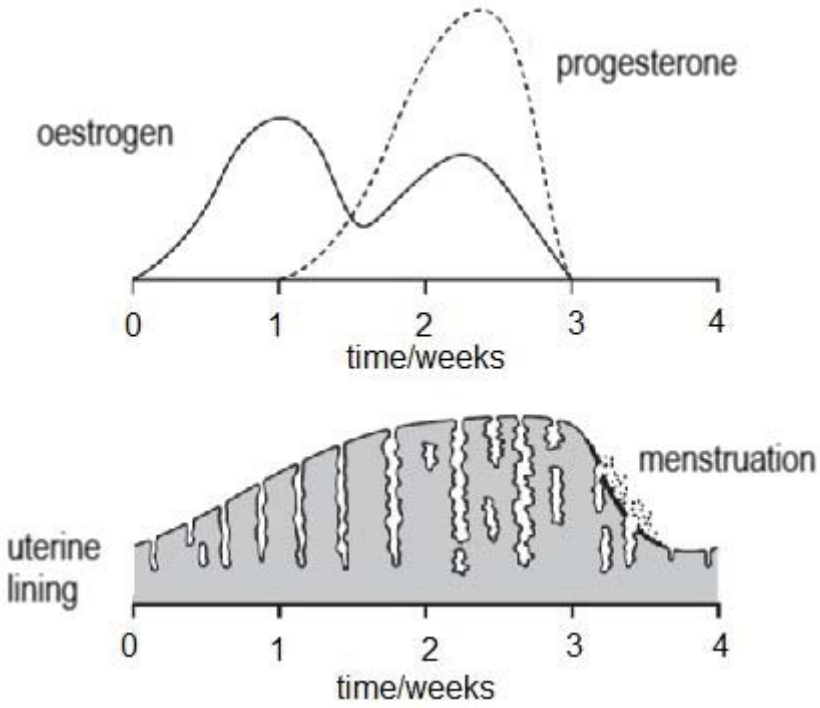


Which correctly shows the regions where the following events occur?

	implantation	fertilisation	meiosis
A	P	Q	R
B	R	P	Q
C	R	Q	P
D	T	R	P

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32 The diagram shows the changes which take place during a woman's menstrual cycle.



What is occurring at the time of ovulation?

A A fall in the level of oestrogen and a rise in progesterone.

B A fall in the level of progesterone and a rise in oestrogen.

C A fall in the levels of oestrogen and progesterone.

D A rise is the levels of oestrogen and progesterone.

33 *Drosophila melanogaster* is a type of fruit fly with a diploid number of chromosomes. Cell division occurs in the *Drosophila melanogaster* in a similar way to humans. Each somatic cell has 8 chromosomes. Which statement about this type of fruit fly is correct?

A After fertilisation, the zygote has 8 chromosomes.

B After mitosis, the daughter cells produced have 4 chromosomes each.

C It can produce gametes with 4 different genetic combinations.

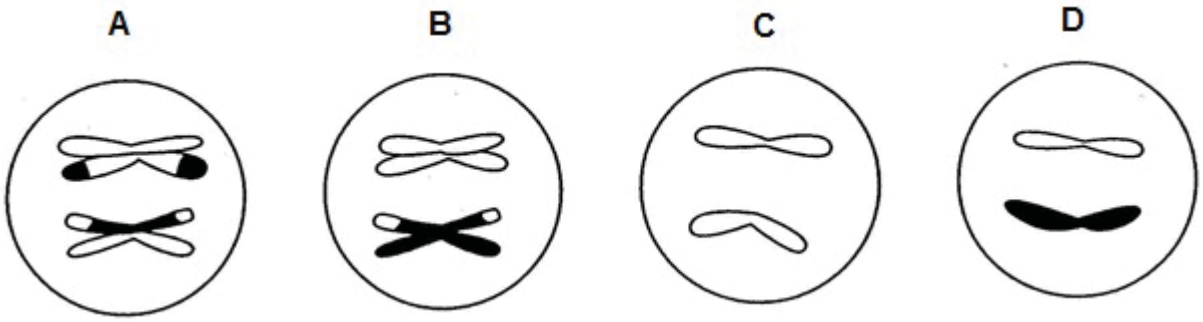
D It can produce gametes with 8 chromosomes.

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34 The diagram shows a cell at anaphase I of meiosis.



Which diagram shows a normal gamete that can be produced from this cell?



35 The table shows the percentage of nucleotides found in an octopus and a starfish.

source of DNA	adenine (%)	cytosine (%)	guanine (%)	thymine (%)
octopus	28	22	22	28
starfish	28	22	22	28

Which of the following best explains why these two animals differ greatly in their physical characteristics?

A Amino acids used to produce proteins are different in both animals.

B Deoxyribose is used in the DNA of the octopus but ribose is used in the DNA of starfish.

C The sequences of DNA are different in both animals and thus code for different proteins in their bodies.

D The two animals follow different base pairing rules in their DNA strands.

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36 A short length of DNA has 80 thymine and 60 cytosine bases. What is the total number of nucleotides in this DNA segment?

A 120

B 140

C 280

D 560

37 Samuel and Sandy made four statements about themselves.

	Samuel	Sandy
1	I am a man.	I am a woman.
2	I am 175cm tall.	I am 160cm tall.
3	I have brown eyes.	I have blue eyes.
4	I am poor at Biology.	I am very good at Biology.

Which statements describe characteristics that show discontinuous variation?

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

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38 A species of snails has an inherited condition that affects its shell. The table shows the phenotypes and genotypes of this species:

genotype	phenotype
S^NS^N	Snails with hard shells.
S^AS^N	Snails with brittle shells.
S^AS^A	No embryo formed.

Two heterozygous snails were crossed. Which proportion of their offspring will have hard shells?

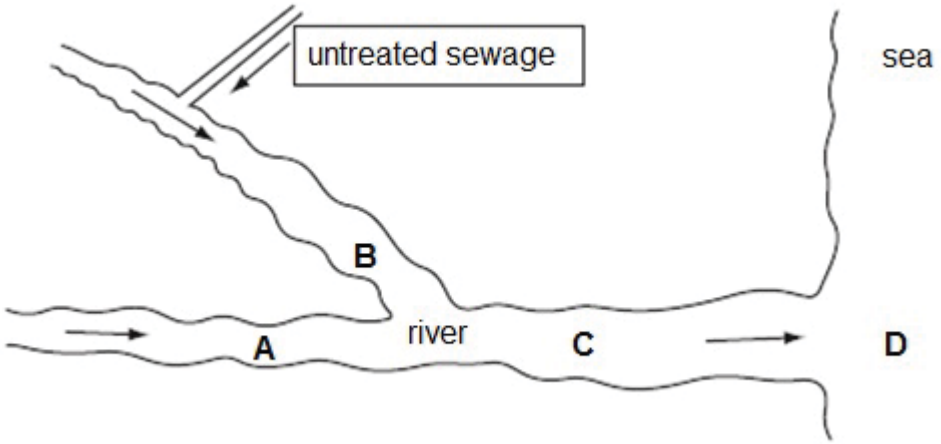
A 0%

B 25%

C 33%

D 75%

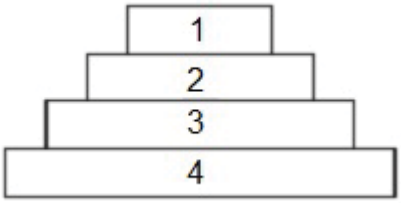
39 The diagram shows a river flowing into the sea. The river is polluted by untreated sewage. At which point (**A**, **B**, **C** or **D**) will the oxygen level be the lowest?



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40 The following diagram shows an ecological pyramid of energy.



Which statement is always true?

A Energy flows upwards from organisms in level 4 to organisms in level 1.

B Level 1 is occupied by a photosynthetic organism.

C The number of organisms in level 4 exceeds those in level 3.

D Toxins become more concentrated from organisms in level 1 down to organisms in level 4.

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KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL

2018 Preliminary Examination

Secondary 4 Express

NAME			
CLASS		INDEX NUMBER	

BIOLOGY

6093/2

No Additional Materials are required.

23 August 2018

Setter: Mrs Dorothy Goh

1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your Class, index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.

Section B
Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
At the end of the examination fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Parent's Signature	
For Examiner's Use	
Section A	
Section B	
Total	100

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Section A

Answer **all** questions.
Write your answer in the spaces provided.

1 Fig. 1.1 shows a section of a person's head and throat.
Fig. 1.2 shows the same person swallowing a bolus of food.

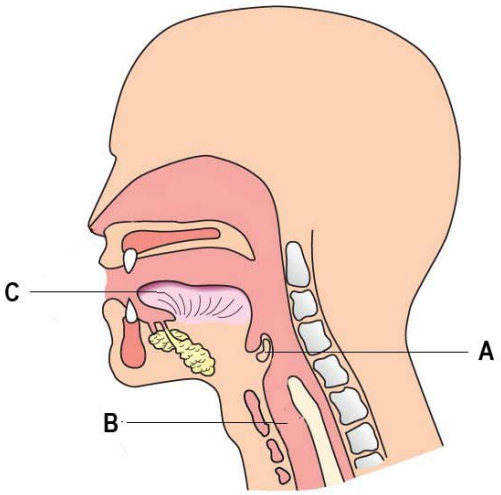


Fig. 1.1

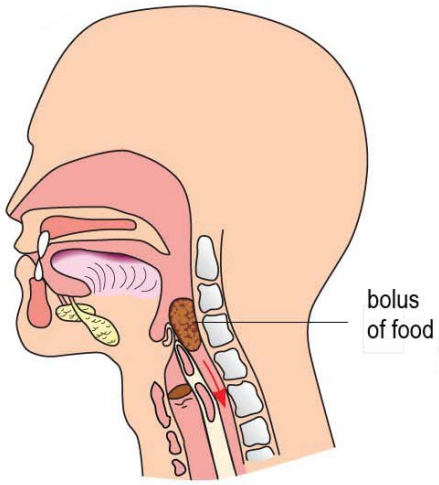


Fig. 1.2

(a) Identify structures **B** and **C** shown on Fig. 1.1.

B: .....

C: ..... [1]

(b) Name the process that will carry the bolus from the oesophagus to the stomach.

..... [1]

(c) Describe and explain what happens to structure **A** when the person swallows the bolus.

.....

.....

..... [2]

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(d) **(i)** Name a chemical process that may be taking place in the bolus.

…… [1]

(ii) Describe the process in **(d) (i)**.

……

……

……

…… [2]

[Total:7]

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2 Fig. 2.1 shows an experimental set-up measuring the rate of photosynthesis by counting the number of bubbles released per minute.

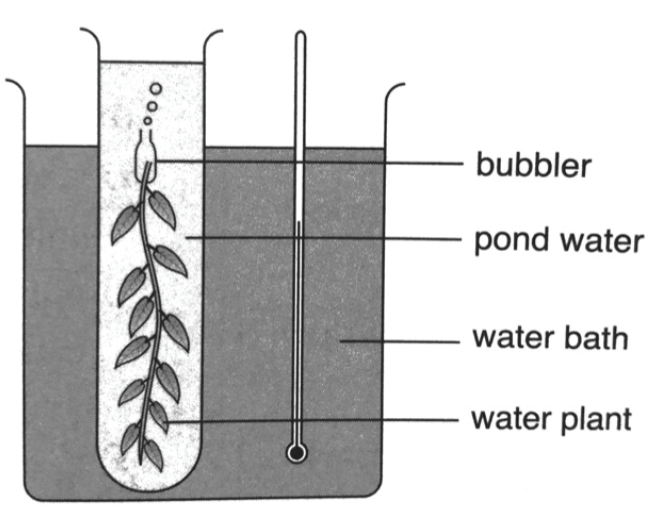


Fig. 2.1

(a) Suggest a purpose for the use of the bubbler.

……..

……. [1]

(b) **(i)** Identify the type of gas found in the bubbles produced.

……..…… [1]

(ii) State the chemical equation for photosynthesis.

…… [1]

(c) **(i)** Describe why the rate of bubbles evolved can be taken as a measure of the photosynthetic rate.

……

……

……

…… [2]

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(ii) Suggest two reasons why the rate of photosynthesis measured by this method may be less than expected.

……

……

……

…… [2]

(d) State the importance of photosynthesis to animals.

……..

……..

…….. [2]

[Total:9]

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3 Fig. 3.1 shows the changes in the blood pressure during the cardiac cycle.

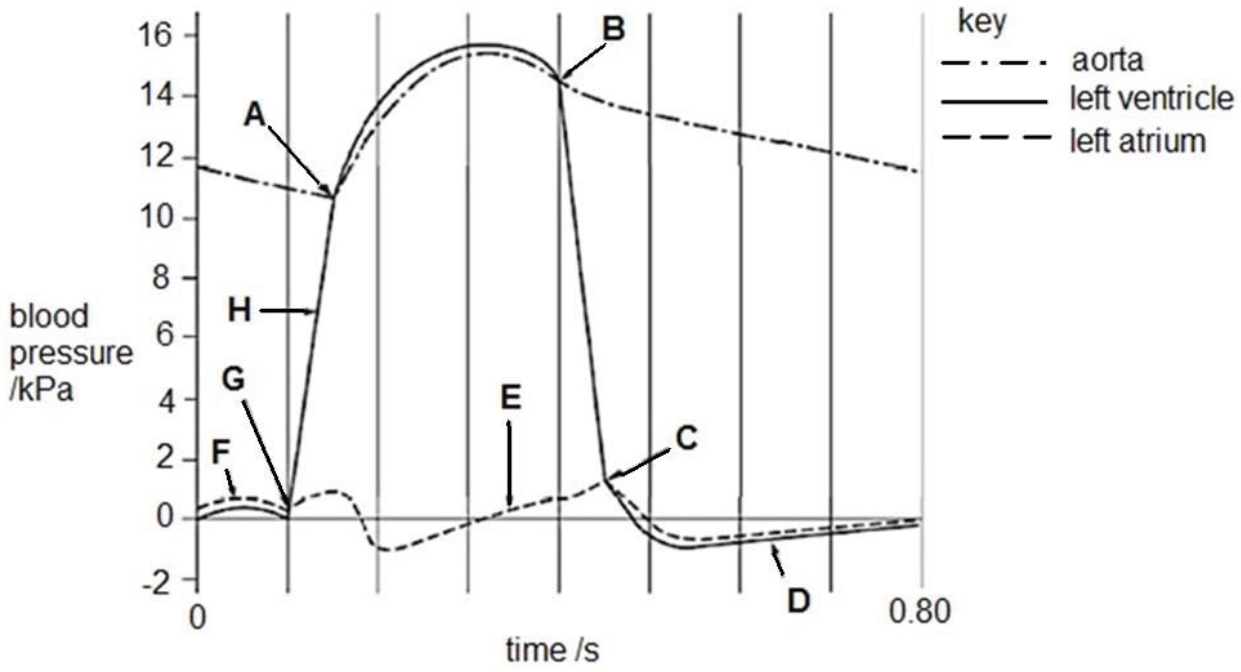


Fig. 3.1

(a) State the duration of ventricular systole.

…… [1]

(b) Using points **A** to **H**, identify when

(i) the bicuspid valve is first closed: …… [1]

(ii) the semi-lunar valve is first opened: …… [1]

(iii) the ventricles have the least volume of blood: …… [1]

[Total: 4]

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4 Fig. 4.1 shows the model of a nephron. It is used to demonstrate how the nephron functions.

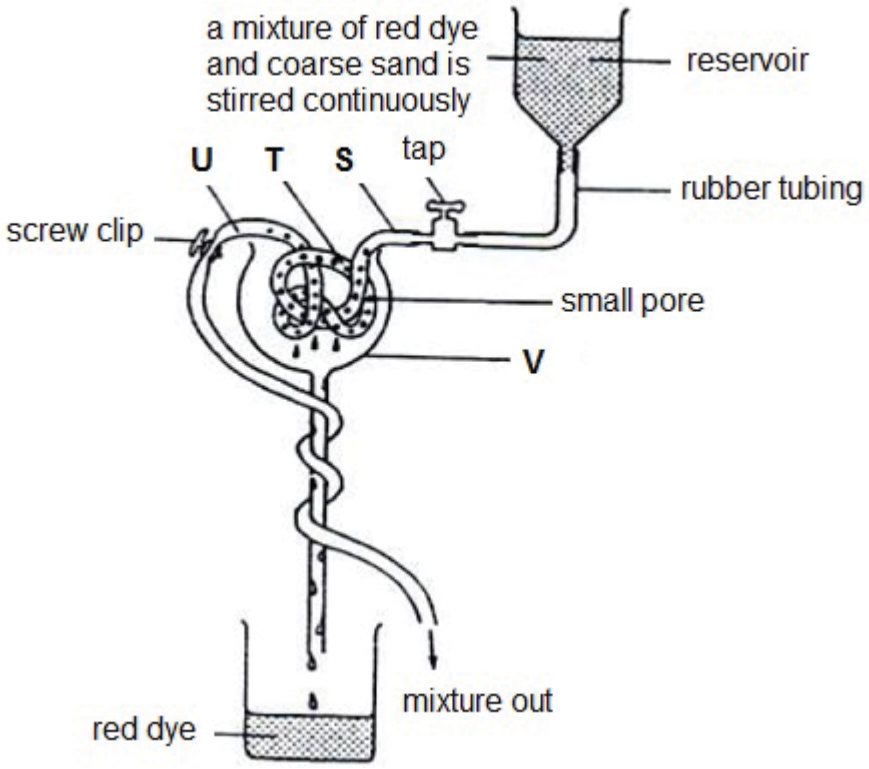


Fig. 4.1

(a) Identify the labelled structures in the mammalian body that are represented by:

T: ……

U: …… [1]

(b) State and describe the purpose of tightening the tubing near part **U** with a screw clip.

……...

……...

……...

……... [2]

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(c) Suggest one type of cell or organic compound in the mammalian body that can be represented by the coarse sand in the mixture present in the reservoir.

…….. [1]

(d) Identify one biological process illustrated by the above model. State the significance of this process in the human body.

……...

……...

……...

…….. [2]

.

[Total:6]

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5 Fig. 5.1 shows the structure of a flower.

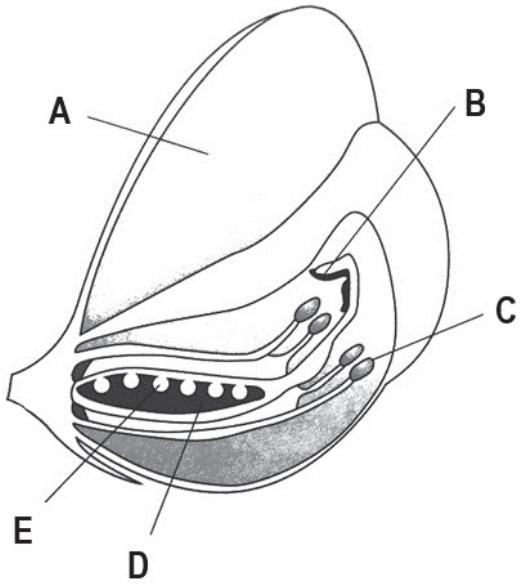


Fig. 5.1

(a) Identify structures **B** and **C** in Fig. 5.1 and suggest how cross pollination can be ensured in this species.

……

……

…….. [2]

(b) Using Fig. 5.1, outline the events occurring following pollination leading to fertilisation of **E**.

……

……

……

……

……

……

…….. [4]

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(c) Table 5.2 shows a recording of the lengths of 5000 fully grown standard petals of this species growing in a certain area.

Table 5.2

standard petal length, x /mm	frequency
5 ≤ x < 10	2
10 ≤ x < 15	0
15 ≤ x < 20	0
20 ≤ x < 25	0
25 ≤ x < 30	1755
30 ≤ x < 35	925
35 ≤ x < 40	50
40 ≤ x < 45	100
45 ≤ x < 50	975
50 ≤ x < 55	1193
55 ≤ x < 60	0

(i) State the type of variation shown by the standard petal length in this species.

…….. [1]

(ii) State one possible cause to account for the frequency recorded for a standard petal length of 5 ≤ x < 10.

……

……... [1]

[Total:8]

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6 Scientists have created *RR2*, a genetically engineered soybean plant resistant to a variety of chemical herbicides. This was done by transferring a gene from a bacterium to the soybean plant.

(a) Outline the necessary steps used to transfer the gene from a bacterium to a plant cell.

……

……

……

……

……

……

……

……

…… [4]

(b) *RR2* soybean plants and wild-type soybean plants have yellow flowers. In a genetic experiment, pollen grains from a wild-type soybean plant were brushed onto the stigmas of an *RR2* plant.

Results showed that there were 115 offspring plants with yellow flowers and 41 offspring plants with purple flowers.

Using F^Y and F^P to represent the alleles for yellow and purple flowers respectively,

(i) write out all the possible genotypes for flower colours in the offspring plants;

…….. [1]

(ii) write out the genotypes for flower colours of the parent plants.

RR2 soybean plant genotype ……..

wild-type soybean plant genotype …….. [2]

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(c) State two reasons why the observed phenotypic ratio of the offspring plants in **(b)** was not the same as the expected ratio.

……

……

…… [2]

[Total:9]

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7 Fig. 7.1 shows what happens to the energy as it passes through an herbivorous ox.

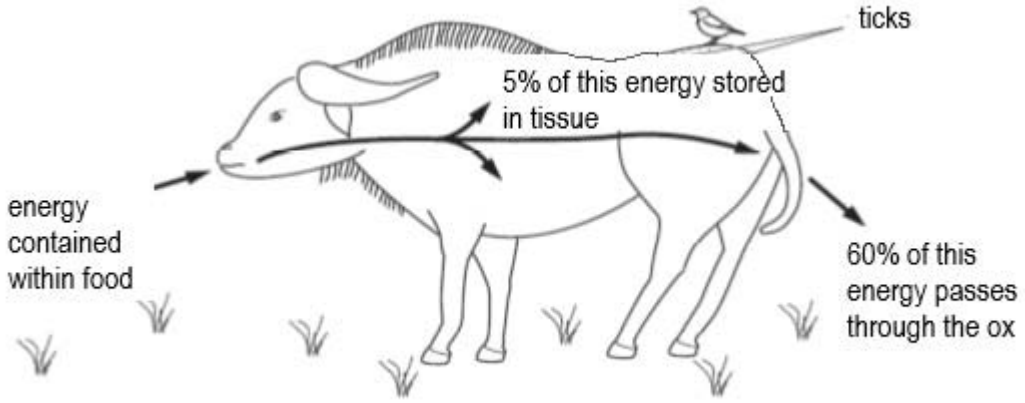


Fig. 7.1

(a) State two ways in which energy may be used within the ox.

1. ……

2. ……... [2]

(b) The bird on the ox's back is an oxpecker that feeds both on blood-sucking parasites (ticks) living on the ox, and on blood from the ox's wounds.

(i) In the space below, draw one possible food chain linking the organisms shown. Indicate on your drawing where energy enters the chain.

[2]

(ii) Explain why there must always be fewer oxpeckers than ticks in this food web.

……

……

……

…… [3]

[Total:7]

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Section B (30 marks)

Answer **three** questions in the spaces provided.
Question 10 is in the form of Either/Or question.

8 Fig. 8.1 shows the concentration of dissolved oxygen and the number of bacterial cells along a river, 100m downstream from point **X**. The river is polluted due to human activities.

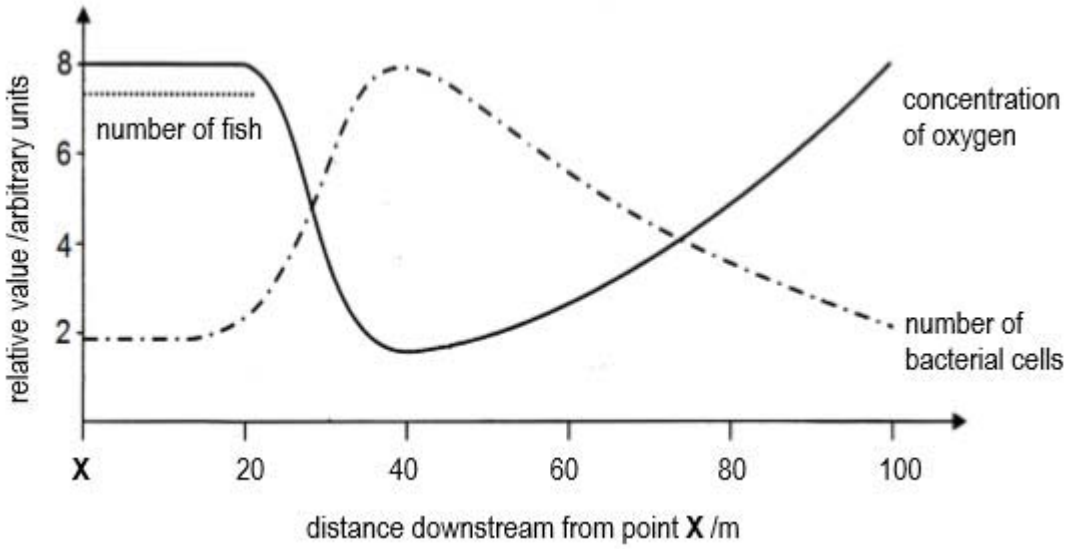


Fig. 8.1

Biological oxygen demand (BOD) is used by ecologists to measure the oxygen amount required by aerobic microorganisms to decompose organic matter in a sample of water.

Table 8.2 shows the data for relative BOD value for the same river length.

Table 8.2

distance from point X of river /m	relative BOD value /arbitrary unit
0	1.0
20	2.0
40	6.0
60	5.0
80	3.0
100	2.0

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(a) **(i)** Using the data provided in Table 8.2, sketch a graph of relative BOD in Fig. 8.1 over the distance of 100 m. Label this graph as relative BOD. [2]

(ii) Describe the relationship between the relative BOD value and the number of bacterial cells between 20m and 40m downstream of point **X**.

……..

…….. [1]

(b) **(i)** Using the information provided in Fig. 8.1, estimate the distance downstream from point **X** where the river was polluted.

……. [1]

(ii) On Fig. 8.1, complete the graph for the number of fish in the river till 100m downstream from point **X**. [1]

(c) A factory was built some distance away from the river.
Five weeks later, samples of water taken from the river downstream showed traces of a non-excretable toxin.
It was observed that the dead bodies of herons (large birds that feed on fish) were found. It was also observed that the population of fish remained in healthy numbers.
With reference to bioaccumulation and bioamplification, explain the observations.

…….

…….

…….

…….

…….

…… [5]

[Total:10]

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9 **(a)** Describe the significance of each of the following features of a dicotyledonous leaf in terms of the process named:

(i) the distribution of chloroplasts in the process of photosynthesis.

……..

……..

……..

……..

…….. [4]

(ii) stomata in the process of gas exchange.

……..

……..

…….. [2]

(b) Describe how **two named tissue** involved in transport are arranged in the roots and stems.

……

……

……

……

……

……

……

…… [4]

[Total:10]

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10 Either

(a) A bacterial gene, which can boost photosynthesis, has been inserted into a new variety of soybean plant. These new plants are resistant to glyphosate, a herbicide that disrupts photosynthesis by killing plants including weeds.

Suggest and explain the advantages and disadvantages of growing this new variety of soybeans in the field.

……

……

……

……

……

……

……

……

……

……

…… [6]

(b) Explain, using a named example, how mutations may lead to genetic diseases.

……

……

……

……

……

…… [4]

[Total:10]

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10 Or

Fig. 10.1 shows how a frog was cloned.

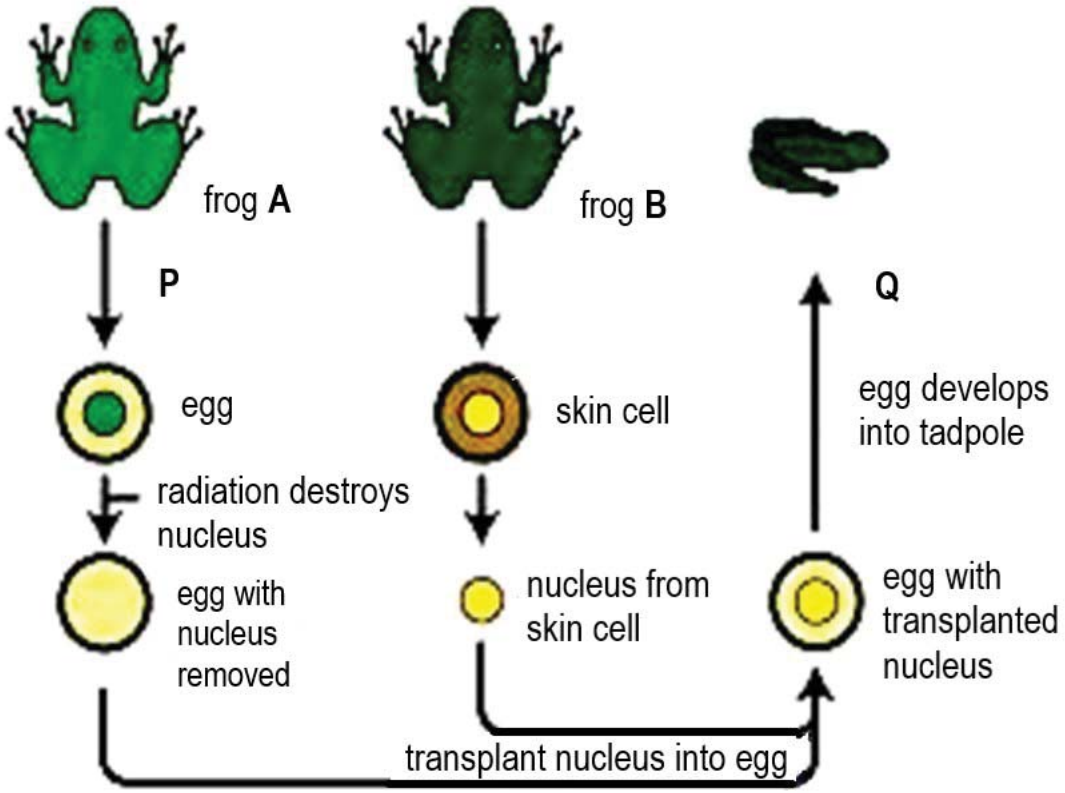


Fig. 10.1

(a) State the type of cell division that occurs at **P** and **Q**.

……

…… [2]

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(b) Is the transfer of nucleus from the cell of frog **B** to the egg of frog **A** a process of fertilisation? Explain your answer.

……

……

……

……

……

…… [4]

(c) Describe the behaviour of the chromosomes during mitosis.

……

……

……

……

……

…… [4]

[Total:10]

End of paper

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KUO CHUAN PRESBYTERIAN SECONDARY SCHOOL
PRELIMINARY EXAM 2018
BIOLOGY
SECONDARY 4 EXPRESS

MARKING SCHEME

Paper 1 – Multiple Choice Questions (40 marks)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	A/D	D	A	D	B	D	A	B	D

Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
A	B	A	A	B	C	C	B	A	B

Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
C	C	D	D	B	B	B	B	D	B

Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
C	A	A	D	C	C	A	C	B	A

Paper 2(Section A) – Structured Questions (50 marks)

1	(a)	B: trachea C: tongue Both correct 1 mark, 1/0 correct no marks		1
	(b)	peristalsis		1
	(c)	1. [describe] structure covers the trachea 2. [explain] prevents the entry of food / prevents food from going to the lungs / prevents choking		1 1
	(d)	(i)	Digestion / enzyme action / hydrolysis	1
		(ii)	1. [describe the enzyme action] amylase from saliva acting on the bolus 2. [describe final product] digesting starch into maltose	1 1
			Total	**7**

2	(a)	1. To ensure all the bubbles are the same size 2. Act as an electronic counter 3. To slow down bubbling to make it more visible Accept any other plausible answers		1
	(b)	(i)	Oxygen	1
		(ii)	$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 6O_2 + 6H_2O$ No marks if 1 no condition stated	1

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			2 imbalance equation 3 word equation	
	(c)	(i)	1. The gas produced is a by-product of photosynthesis 2. The rate of gas production is related quantitatively to the formation of carbohydrates / proportional to the rate of photosynthesis	1 1
		(ii)	1. [suggest] Some oxygen is used during respiration while the plant is photosynthesizing 2. [suggest] some oxygen produced is dissolved in the water	1 1
	(d)		1. During photosynthesis, light energy is converted into chemical energy which is stored in carbohydrates 2. Animals cannot produce their own food and hence depends on the photosynthesis for the energy source.	1 1
			Total	**9**

3	(a)		0.3s (units included)	1
	(b)	(i)	G	1
		(ii)	A	1
		(iii)	B (to C)	1
			Total	**4**

4	(a)	T: glomerulus U: efferent arteriole	1
	(b)	1. [state] The purpose is to reduce the lumen size of the tubing near U / making tubing narrower 2. [describe] so as to set up a high pressure in T and enables the small molecules to pass through tubing at a fast rate	1 1
	(c)	Red blood cells / blood plasma proteins / fats / platelets	1
	(d)	1. [biological process] Ultrafiltration 2. [state the significance] Filters the excretory products e.g. urea and water which may be in excess amounts in the body while retaining cells and nutrients e.g. red blood cell and plasma proteins which are essential in maintaining the water potential of blood OR 3. [biological process] Excretion 4. [state the significance] the removal of metabolic waste from the body as accumulation of such waste may harm the body processes	1 1
		Total	**6**

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5	(a)	1. B is stigma and C is anther 2. Anther will mature first, releasing pollen grains before stigma mature mature/ OWTTE OR 3. Anther is located below the stigma / OWTTE OR 4. Pollen grains of flowers on one plant can only be accepted by mature stigmas of flowers on another plant.		1 Max 1
	(b)	1. When the pollen grain lands on the mature B, pollen grain germinates to form pollen tube 2. As pollen tube grows, it secretes enzymes to digest through the stigma and style, growing towards the ovary, carrying two male gametes 3. When it reaches D at an opening known as micropyle, it absorbs the cell sap and burst to release the male gametes 4. One of the male gametes fuses with ovum, and E is formed.		1 1 1 1
	(c)	(i)	continuous variation	1
		(ii)	Mutation took place, resulting in very short petals.	1
			Total	**8**

6	(a)	1. [isolate the desirable gene] using a restrictive enzyme to cut the gene from bacterium to produce sticky ends 2. [prepare a plasmid] cut open the bacterial plasmid using the same restrictive enzymes to produce complementary sticky ends on the plasmid 3. [insert the desirable gene into the plasmid] join the two cut ends together with DNA ligase 4. [uptake of the vector by the plant] mix the cells with the plasmid and using heat shock to allow plasmid to enter the plant cell.	1 1 1 1
	(b)	(i) F^YF^Y, F^YF^P, F^PF^P (ii) RR2 soybean plant: F^YF^P Wild-type soybean plant genotype: F^YF^P	1 1 1
	(c)	1. Each <u>fertilisation is random and independent</u> 2. When the <u>sample size is too small</u>, the observed ratio may not be the same as the expected ratio	1 1
		Total	**9**

7	(a)	1. muscle contraction / movement 2. impulses	Max 2

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		3. temperature maintenance 4. cell division / growth / repair 5. metabolic or anabolic reactions 6. active transport any two rej: excretion / digestion / reproduction / respiration	
	(b) (i)	sun → grass → ox → oxpecker OR grass → ox → tick → oxpecker	1 1
	(b) (ii)	1. [overall energy description] energy is lost along the food chain resulting in less energy received by the last organism compared to its prey 2. [reason] as organisms use energy for various activities 3. [conclusion] hence to supply sufficient energy and nutrients for oxpeckers, the number of oxpeckers need to be less than ticks	1 1 1
		Total	**7**

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Paper 2 (Section B) - Free Response (30 marks)

8	(a)	(i)	1. Correct plotting of points 2. Best fit line (smooth curve) Penalise 1 mark for no label	 1 1
		(ii)	1. Between 20m to 40m downstream, as the bacterial cells increase from 2 arbitrary units to 8 arbitrary units, the BOD value increase from 2 arbitrary units to 6 arbitrary units	1
	(b)	(i)	20m ± 5m	1
		(ii)	The shape of the fish population should follow the pattern of the oxygen graph as closely as possible.	1
	(c)		1. The toxic has entered the small fish and is not excreted and stored in the fatty tissue 2. Over time, the toxic level accumulates in the body, the process is known as bioaccumulation. 3. However, the concentration may not be high enough to cause the fish to die, that is why the fishes appear healthy 4. When the herons consume more of these fishes, the toxin entered the body of the heron, and as it cannot be excreted, it is also stored in the fatty tissue of the heron. 5. The concentration of the toxic substance increases to a fatal level in the heron and as a result, the herons die. This effect is known as bioamplification.	1 1 1 1 1
			Total	**10**

9	(a)	1. [state the location of chloroplasts] palisade mesophyll, spongy mesophyll, guard cells R: stomata 2. [state why chloroplast are found in palisade and spongy mesophyll] chloroplasts are found in palisade and spongy mesophyll because the leaf is the main site for photosynthesis 3. [explain for distribution] as palisade mesophyll layer / cells are found nearer the leaf surface, palisade mesophyll has more chloroplasts to allow the leaf to absorb more sunlight to allow rapid rate of photosynthesis to take place 4. [explain why chloroplast are found in guard cells] to allow guard cells to photosynthesise and in turn control the size of the stomata	1 1 1 1
	(b)	1. [purpose of stomata] allow the exchange of gases (oxygen given out and carbon dioxide taken in) to take place via diffusion during photosynthesis 2. [purpose of stomata] allow the exchange of gases (oxygen taken in and carbon dioxide given out) to take place via diffusion during respiration 3. [purpose of stomata] to allow water vapour to diffuse out during transpiration	1 1 1

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	(c)	1. [arrangement of xylem in the roots] xylem occupies the centre of the roots 2. [arrangement of xylem] xylem <u>arranged in bundles / in pairs with phloem</u> around the edge of the stem with xylem being on the inner side. 3. [arrangement of phloem in roots] phloem is arranged around the xylem 4. [arrangement of phloem in stems] phloem are <u>arranged in bundles / in pairs with xylem</u> around the edge of the stem with phloem being on the outer side.	1 1 1 1
		Total	**10**

10 E	(a)	1. [advantage] farmers can obtain higher yield when growing this new variety of soya plants 2. [explain] as the rate of photosynthesis increase, faster growth is observed. OR 3. [advantage] farmers can use herbicides to kill weeds 4. [explain] as soya beans are unaffected by herbicide but weeds are affected 5. [explain] leading to lesser competition for the soya bean plants. 6. [disadvantage] Formation of superweeds, weeds that are not easily removed in future by the same herbicide. 7. [explain] This will create even greater competition for nutrients and space for growth with the soya bean crops. OR 8. [disadvantage] Population of insects that feeds on weeds and help in pollination will be reduced 9. [explain] since there will be drastic drop in weed population in the field / useful insects will be killed, links in food web are broken which will upset the ecological balance	Any 3 pair
	(b)	[named condition] Sickle cell anaemia. 1. Mutation results in change in structure of gene controlling haemoglobin production 2. Mutated gene leads to production of haemoglobin S, which causes red blood cells to become sickle-shaped 3. The shape interferes with the oxygen-carrying property of red blood cells and condition can be fatal/ clogging OR [named condition] Down syndrome 1. During meiosis, the female gamete produced have one having an extra chromosome in the 21st pair 2. Fertilization between a normal sperm and a ovum subsequently results in the zygote having one extra	1 1 1 1 1 1 1

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		chromosome in the 21st pair; 3. Affected child has characteristic facial features and exhibits mental and physical difficulties OR [named condition] Albinism 1. Mutation in the gene controlling production of pigment (melanin) 2. Results in absence of pigment in the skin, hair and eyes of animals 3. Individual has reddish white skin, white hair, iris appears red, very sensitive to light	1 1 1 1 1
		Total	**10**

10 O	(a)	1. [correct identification] Step P: meiosis and Step Q: mitosis	1;1
	(b)	1. [state] it is not fertilisation 2. [explain for frog A] frog A contributed an egg without nucleus 3. [explain for frog B] frog B contributed a diploid nucleus 4. [explain why it is not fertilisation] it does not involve fusion of nuclei of two different gametes]	1 1 1 1
	(c)	1. [stages in mitosis] At prophase, sister chromatids condense and the chromosomes becomes visible. 2. [stages in mitosis] At metaphase, chromosomes are aligned at the equatorial plane. 3. [stages in mitosis] At anaphase, daughter chromosomes are pulled towards the opposite poles 4. [stages in mitosis] At telophase, chromosome unwinds to become chromatin threads	1 1 1 1
		Total	**10**

END

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