

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://www.twitter.com/freetestpaper)



ANG MO KIO SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2017
SECONDARY FOUR EXPRESS

BIOLOGY

5158/01

Paper 1 Multiple Choice

Total Mark: 40

17 August 2017 / Thursday

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your Name, Class and Index Number in the spaces on the Multiple Choice Answer Sheet.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

There are **forty** questions on this paper. 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 Multiple Choice Answer Sheet.

Read the instructions on the Multiple Choice Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

This document consists of **17** printed pages, including the cover page.

[Turn over]

1 Which two structures are found in all plant epidermal cells?

- A cell wall and chloroplasts
- B cell wall and nucleus
- C chloroplasts and starch grains
- D nucleus and starch grains

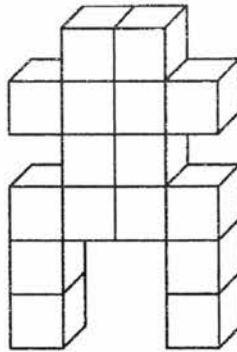
2 What are the levels of organisation of the retina and of the eye?

	retina	eye
A	cell	organ
B	cell	organ system
C	tissue	organ
D	tissue	organ system

3 Four cylinders of potato tissue were weighed and each was placed into a salt solution of a different concentration. The cylinders were reweighed after one hour and the results are shown below. In which salt solution would most potato cells be plasmolysed?

Salt solution	Initial mass of potato cylinder (g)	Final mass of potato cylinder (g)
A	10.0	7.0
B	10.0	9.4
C	10.0	11.2
D	10.0	12.6

- 4 The diagram below shown a body shape made up of cubes.



The surface area to volume ratio of this body is

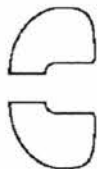
- A 4 : 1
 - B 6 : 1
 - C 15 : 4
 - D 29 : 8
- 5 The diagram represents an enzyme molecule.



What could be substrates for this enzyme?



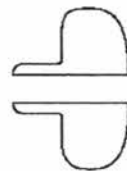
W



X



Y



Z

- A W only
- B W or X
- C Y only
- D Y or Z

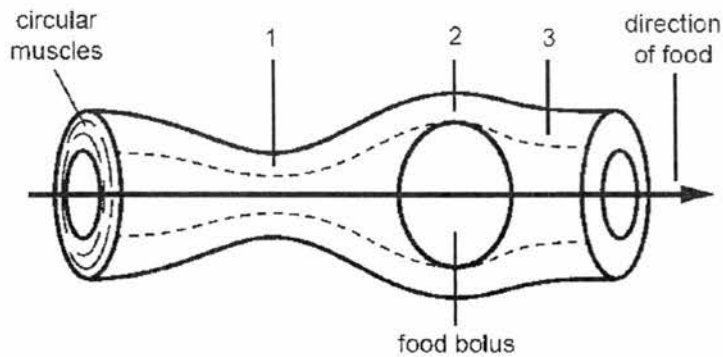
- 6 Two reagents used in testing for the presence of carbohydrates are iodine solution, and Benedict's solution. In an investigation of the breakdown of starch into maltose by the enzyme amylase, which of the following would be a positive control?
- A Maltose alone turns Benedict's solution brick red.
 - B Starch treated with amylase turns Benedict's solution brick red.
 - C Starch alone tested with Benedict's solution remains blue.
 - D Starch treated with amylase does not change the colour of iodine solution.
- 7 Which biological molecules always contain the element nitrogen?
- A amino acids, cellulose, DNA
 - B amino acids, DNA, lipids
 - C enzymes, plasma proteins, DNA
 - D membrane proteins, starch, lipids
- 8 The process of digestion changes the size and solubility of food molecules. Which correctly describes the changes in food due to digestion?

	food molecule	
	size	solubility
A	increases	increases
B	decreases	increases
C	increases	decreases
D	decreases	decreases

- 9 Which line in the table states a function of the blood in the hepatic portal vein?

	chemical carried	from	to
A	carbon dioxide	liver	vena cava
B	amino acid	ileum	liver
C	glycerol	ileum	liver
D	urea	liver	kidney

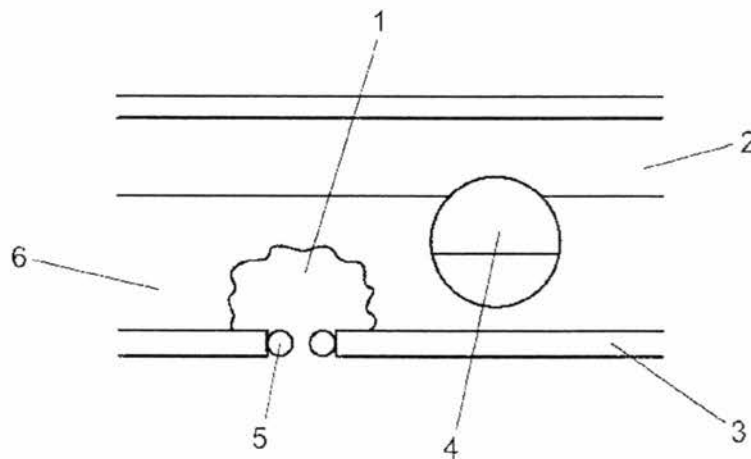
- 10 The diagram below shows the movement of food along the oesophagus.



Which correctly describes the state of the circular muscles at points 1, 2 and 3 on the diagram?

Circular muscles			
	Point 1	Point 2	Point 3
A	contracted	relaxed	contracted
B	relaxed	contracted	contracted
C	contracted	relaxed	relaxed
D	relaxed	contracted	relaxed

- 11 The diagram shows a cross-section of a dicotyledonous leaf.

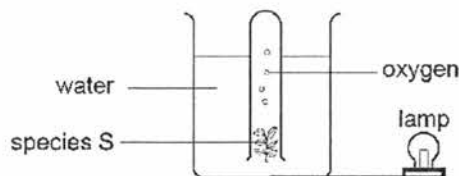


Which labelled parts of the leaf carry out photosynthesis?

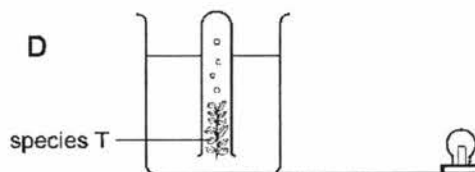
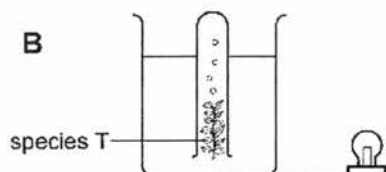
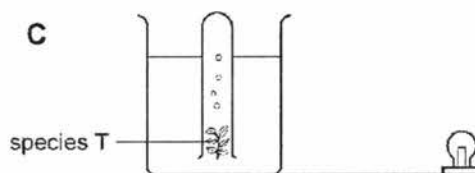
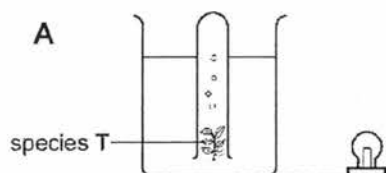
- A 1, 2 and 3
 B 1, 3 and 4
 C 2, 5 and 6

D 4, 5 and 6

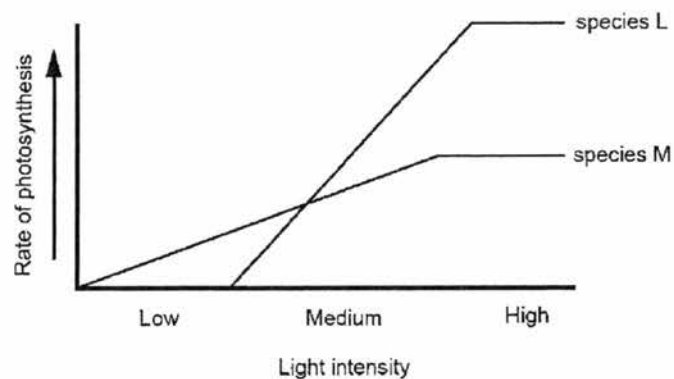
- 12 An investigation was carried out to compare the rate of oxygen gas production by two different species of water plant, S and T.



Which diagram below shows the correct set-up for species T that would allow a valid comparison in the rate of oxygen production of the two species?



- 13 The effect of high light intensity on the rate of photosynthesis was measured for two species of plants, L and M. Both species grow in a range of conditions. The results are shown in the graph below.

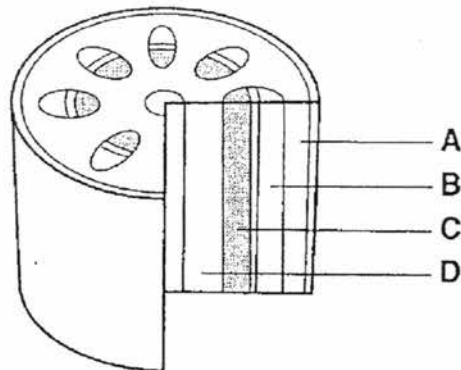


The rate of photosynthesis of species M is

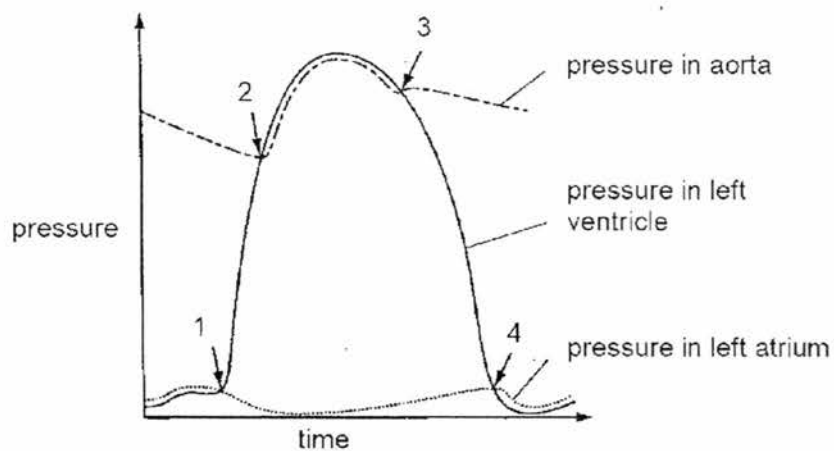
- A slower than L in low light intensities.
 B slower than L in high light intensities.
 C faster than L in medium light intensities.

D faster than L in high light intensities.

- 14 The diagram shows a section of a stem. Which tissue transports sugars and amino acids from the leaves to other parts of the plant?



- 15 The graph below shows changes in pressures in the chambers of the heart and aorta.



Which one of the following statements is correct?

- A At 1, a heart sound can be heard.
- B At 2, the semi-lunar valves start to close.
- C At 3, the semi-lunar valves opens.
- D At 4, the bicuspid valves closes.

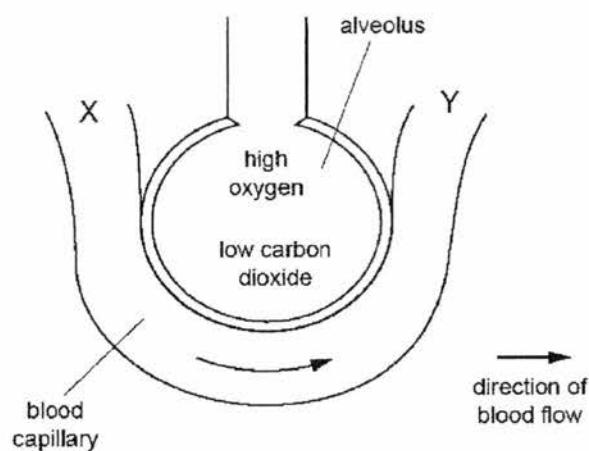
- 16 The duration of ventricular diastole and systole are shown below.

Diastole 0.4 seconds

Systole 0.2 seconds

What is the heart rate for this individual?

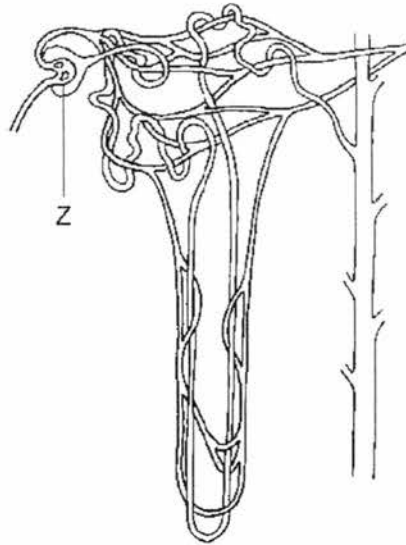
- A 60 beats per minute
 B 72 beats per minute
 C 100 beats per minute
 D 120 beats per minute
- 17 The diagram below shows an alveolus and an associated blood capillary.



As blood flows from X to Y, gases are exchanged with the alveolus. Identify the concentrations of gases at X and Y.

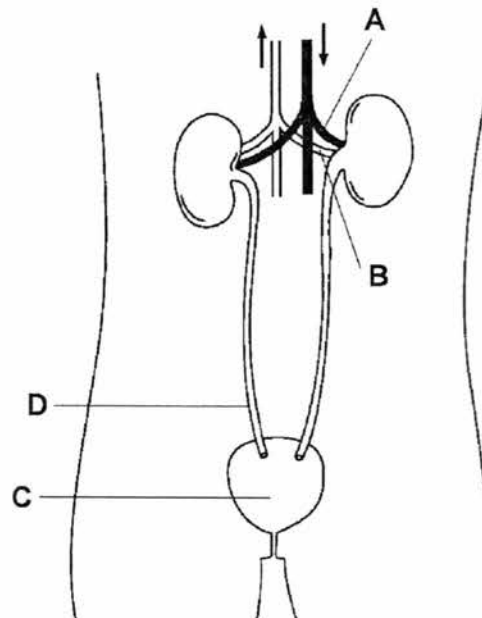
	Concentration at X	Concentration at Y
A	high oxygen	high carbon dioxide
B	low oxygen	high carbon dioxide
C	low oxygen	low carbon dioxide
D	high oxygen	low carbon dioxide

- 18 The diagram below represents a kidney nephron.

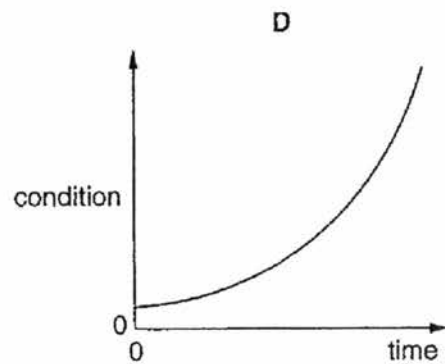
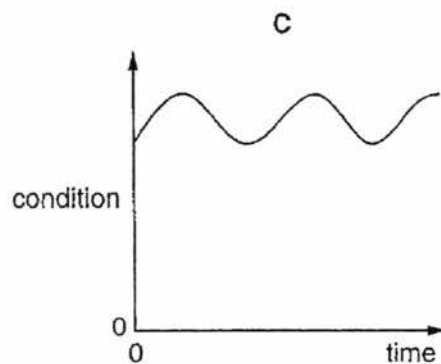
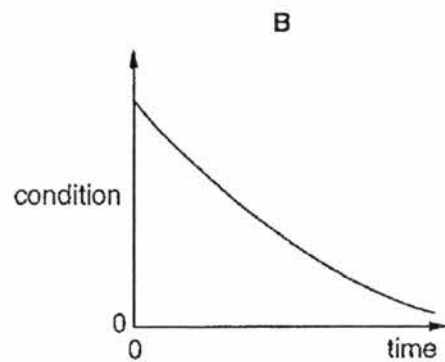
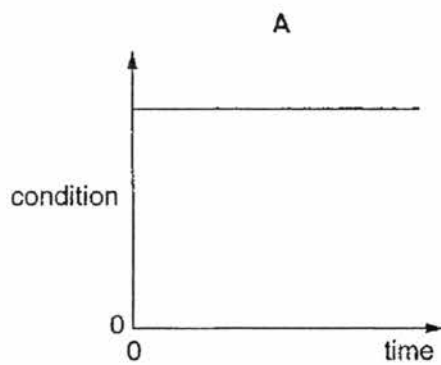


The process taking place in part Z is

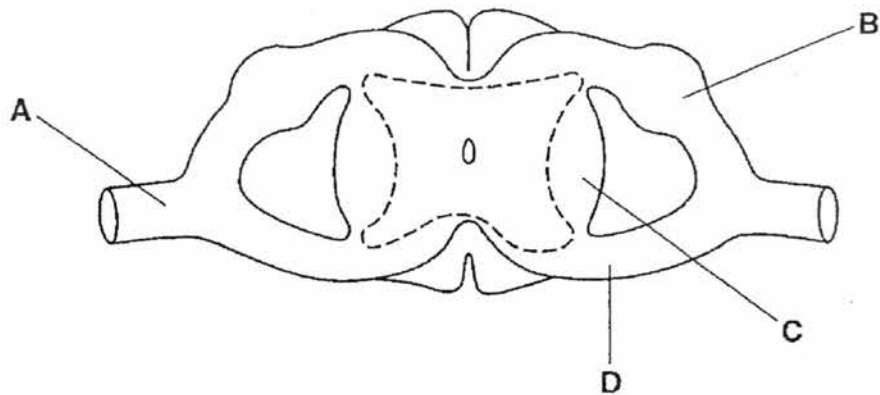
- A filtration.
 - B reabsorption.
 - C osmoregulation.
 - D urea production.
- 19 The diagram below shows the human urinary system. Which labelled part has the lowest concentration of urea?



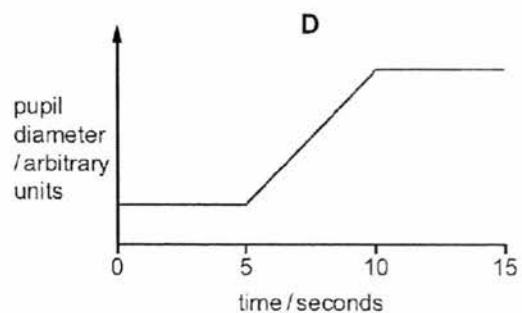
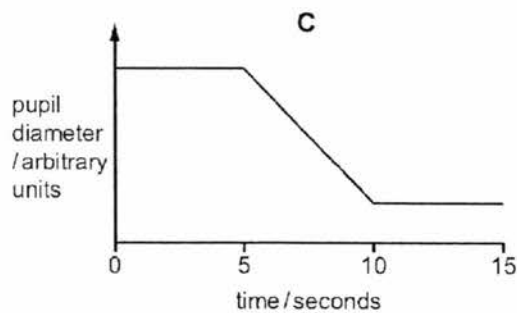
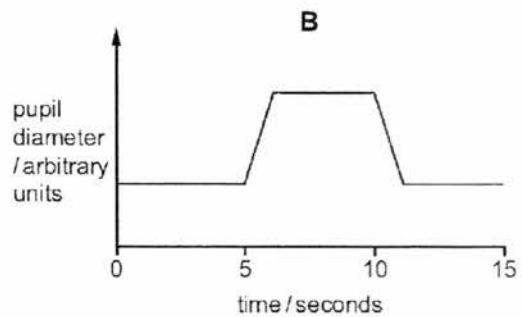
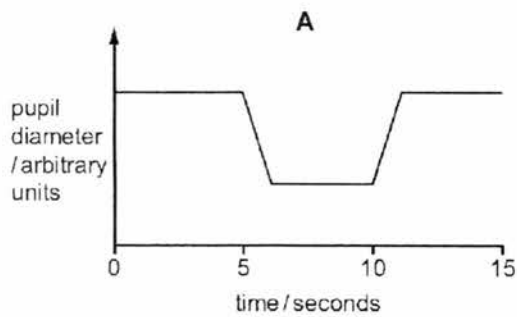
- 20 Which process is *not* a result of negative feedback?
- A A decrease in the surrounding temperature leads to a decrease in respiration rate.
 - B A decrease in the surrounding temperature leads to a decrease in sweating.
 - C A decrease in the surrounding temperature leads to a decrease in blood flow through the skin surface.
 - D A decrease in the surrounding temperature leads to shivering.
- 21 The graphs show how four different conditions in the body may change with time. In which graph is the condition being controlled by negative feedback?



- 22 The diagram below shows a cross-section of the spinal cord of a mammal. Which region contains the axons (fibres) of motor neurones, but **not** those of sensory neurones?



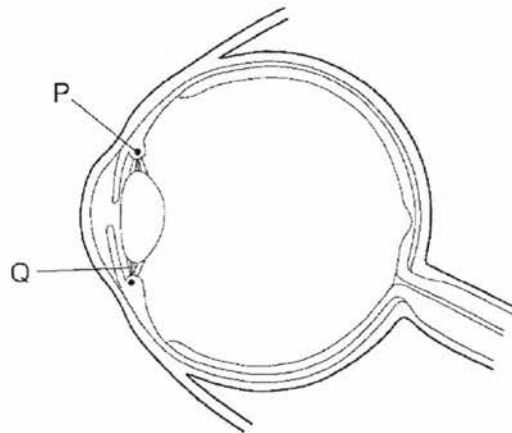
- 23 A person is sitting in a darkened room. After five seconds, a light is turned on. Five seconds after that, the light is turned off again. Which graph shows the changes in the diameters of their pupils?



24 Which structures cover the pupil at the front of a human eye?

- A conjunctiva and cornea
- B conjunctiva and sclera
- C cornea and retina
- D retina and sclera

25 The diagram shows a section through a human eye.



When focusing on a close object at night, what is the state of structures P and Q?

	P	Q
A	contracted	tight
B	contracted	slack
C	relaxed	tight
D	relaxed	slack

26 Hormones are composed of

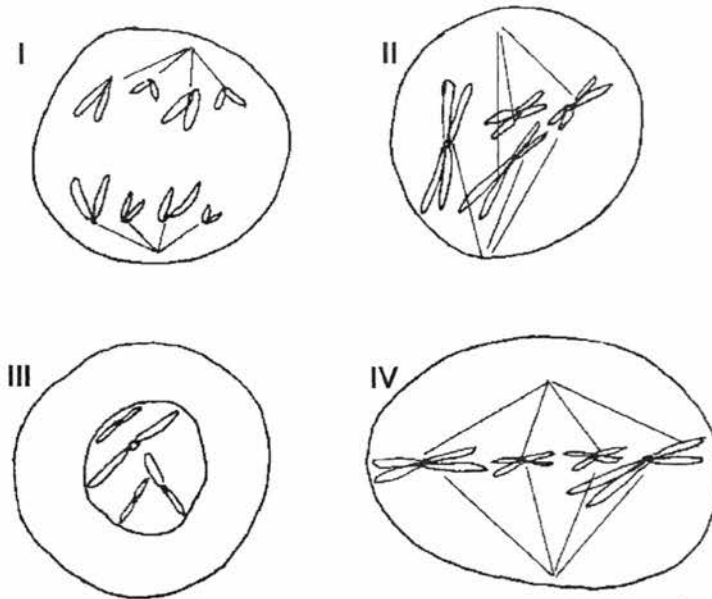
- A glycerol.
- B glucose.
- C protein.
- D starch.

27 Adrenaline secretion in the human body decreases the

- A heart rate.
- B blood sugar level.

- C digestive activity.
- D pupil size in the eyes.

28 The diagrams below show four different stages of a type of cell division.

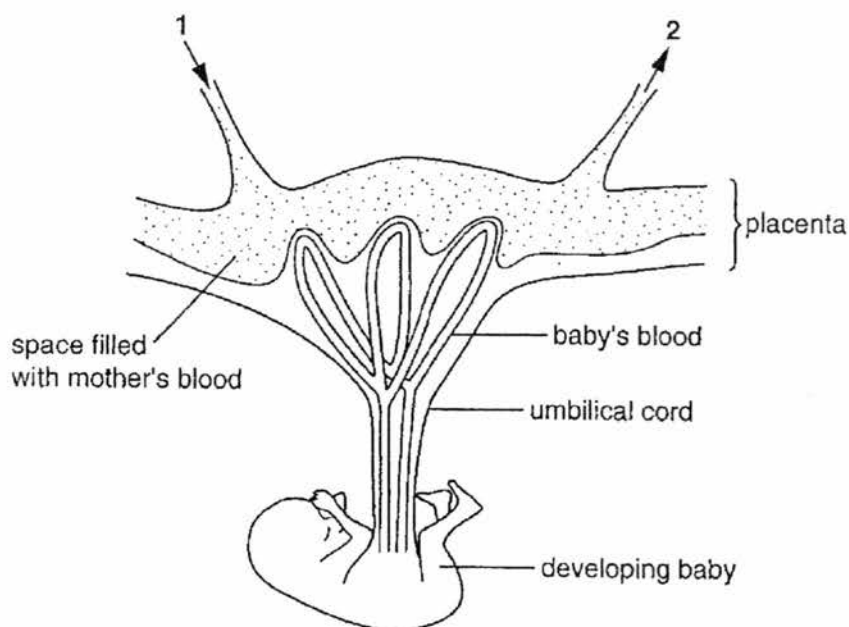


Where will the above type of cell division **not** occur?

- A in the anther sac
 - B in the bone marrow
 - C in the root cap
 - D in the matured cells of the petal
- 29 How many adenine molecules are present in a DNA molecule of 4000 bases, if 20% of the base molecules are cytosine?
- A 400
 - B 600
 - C 800
 - D 1200
- 30 Siamese cats kept in cool conditions have pale body fur. If they are moved to warm conditions for a few months then their body fur becomes darker. The change during this time is due to the
- A effect of the environment on the genotype.
 - B effect of selective breeding on the phenotype.
 - C effect of selective breeding on the genotype.

- D effect of the environment on the phenotype.
- 31 Which of the following is a source of new alleles in a population?
- A Environmental conditions
 - B Isolation
 - C Mutation
 - D Natural selection
- 32 Which of the following is/are the function(s) of the style in a flower?
- I to act as a reservoir for storing pollen grains
 - II to act as a place where fertilisation takes place
 - III to provide a passage and nutrients for the growth of pollen tubes to the ovules
 - IV to support the anthers for facilitating the trapping of pollen grains
- A I only
 - B III only
 - C I and II only
 - D III and IV only
- 33 Many flowering plants have structures to ensure cross-pollination rather than self-pollination because cross-pollination
- A is a simpler process.
 - B can make use of the external agents to bring about pollination.
 - C produces more genetic variation.
 - D saves more male gametes.
- 34 Which of the following is/are the possible adaptive feature(s) exhibited by insect-pollinated flowers?
- I Flower produces a large number of small, dry, powdery pollen grains.
 - II Petals are brightly coloured with conspicuous shape.
 - III Long pendulous styles which bear feathery stigmas at their tips.
 - IV Individual flowers are small and inconspicuous but group together as an inflorescence.
- A II only

- B I and III only
 C II and IV only
 D I and IV only
- 35 As an ovum develops within the ovary, it becomes surrounded by
 A a Graafian follicle.
 B seminal fluid.
 C a corpus luteum.
 D the endometrium.
- 36 After sexual intercourse, sperm can survive for 3 days in the uterus and oviducts. Assuming that ovulation can occur any time from day 13 to day 15 and an egg cell can live up to 2 days after ovulation, how long is the fertile phase of the menstrual cycle?
 A 5 days
 B 6 days
 C 7 days
 D 8 days
- 37 The diagram shows the arrangement of blood vessels in the uterus wall and placenta of a pregnant woman.

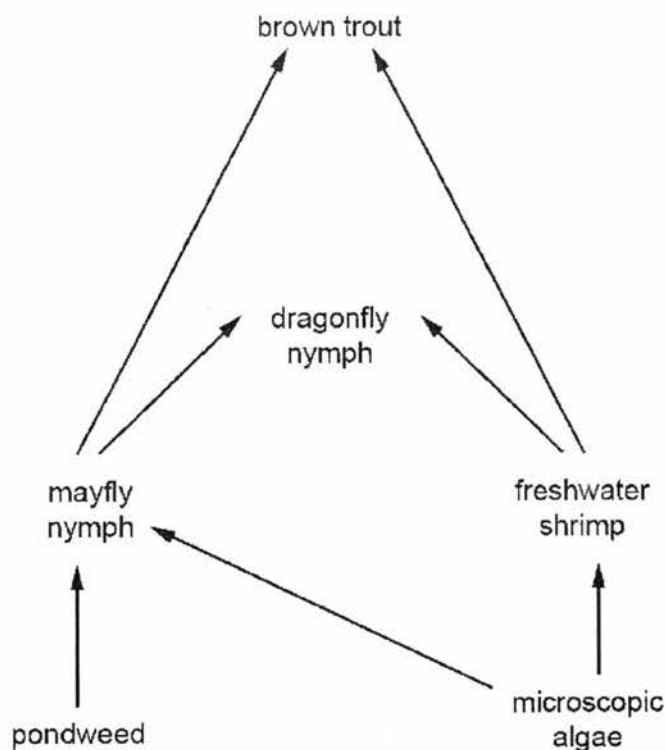


Which will increase in concentration in the blood as it flows from 1 to 2?

- A amino acids

- B carbon dioxide
- C glucose
- D oxygen

38 The diagram below represents a freshwater food web.



The number of freshwater shrimps was found to have decreased dramatically. What effect will this have on the numbers of dragonfly nymphs and microscopic algae?

- A Both populations would decrease.
- B Both populations would increase.
- C Microscopic algae would decrease and dragonfly nymphs would increase.
- D Microscopic algae would increase and dragonfly nymphs would decrease.

39 Why does the oxygen concentration in a river decrease when sewage is discharged into it?

- A Less oxygen is absorbed from the air.
- B There is a decrease in the number of plants.
- C There is an increase in the number of bacteria.
- D There is an increase in the number of fish.

- 40 Which best describes eutrophication and its effect on a river?
- A Nutrients are depleted in the river, causing bacteria to die. This allows plants to grow and deoxygenate the water.
 - B Nutrients are depleted in the river, causing plants to die. These decompose, so the water is deoxygenated.
 - C Nutrients enter the river, causing algae to grow. Plants die and decompose, so the water is deoxygenated.
 - D Nutrients enter the river, causing plants to grow. These provide extra food for animals, which deoxygenate the water.

End of paper

Name	Class	Index Number
------	-------	--------------



**ANG MO KIO SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2017
SECONDARY FOUR EXPRESS**

BIOLOGY (SPA)

5158 / 02

Total Mark: 80

17 August 2017 / Thursday

1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

Write your Name, Class and Index Number in the spaces at the top of this paper.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer **all** questions. Question 9 is in the form of an Either/Or question. Answer only one part.
Write an **E** (for Either) or an **O** (for Or) next to the number **9** in the grid below to indicate which part you have answered.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.
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, submit the entire booklet.

For Examiner's use		
Section A		
Section B		
7		
8		
9		
TOTAL		

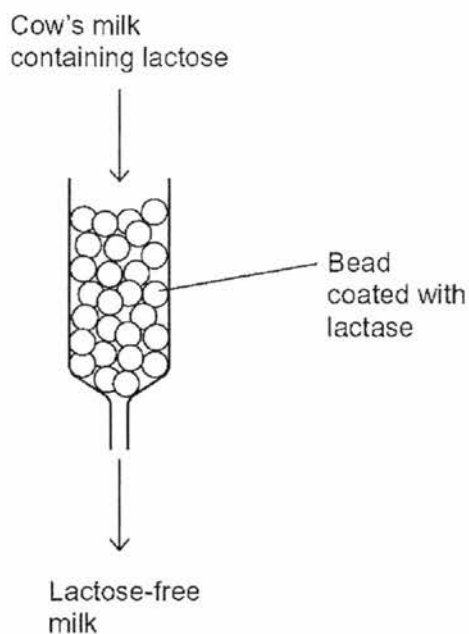
This document consists of **20** printed pages, including the cover page.

[Turn over]

Section AAnswer **all** questions.

Write your answers in the spaces provided.

- 1 Cow's milk contains the sugar lactose. Many cats are unable to digest cow's milk because they are lactose intolerant. Cow's milk can be made suitable for these cats by treating it with the enzyme lactase to hydrolyse lactose. This makes the cow's milk lactose-free. Beads are covered with lactase and placed in a tube, as shown in **Figure 1**. 1. Cow's milk flows over the beads and the lactose is hydrolysed.

**Figure 1**

- (a) Attaching lactase to the beads is a more efficient use of lactase than adding the lactase directly to cow's milk. Suggest two reasons why it is more efficient to attach lactase to the beads.

1.....

.....

2.....

.....[2]

[Turn over]

- (b) A fault in the production of the lactose-free cow's milk resulted in boiling water running over the lactase enzyme. Predict how the milk produced would differ from the expected product and explain your answer.

prediction

.....

explanation

.....

.....[3]

- (c) Suggest why the lactose-free milk made after hydrolysis with lactase tastes sweeter than the cow's milk containing lactose.

.....

.....

.....

.....[2]

[Total: 7]

[Turn over

- 2 (a) **Figure 2** below shows an open stomatal pore in the epidermis of a green plant leaf.

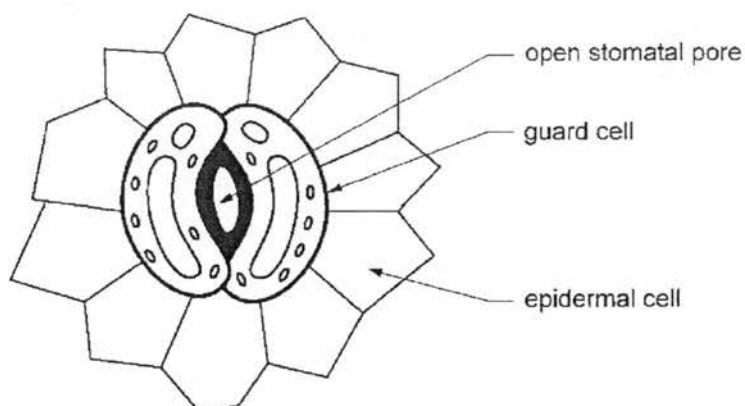


Figure 2

- (i) Explain how osmosis is involved in the opening of the stomata.

.....

.....

.....

.....[2]

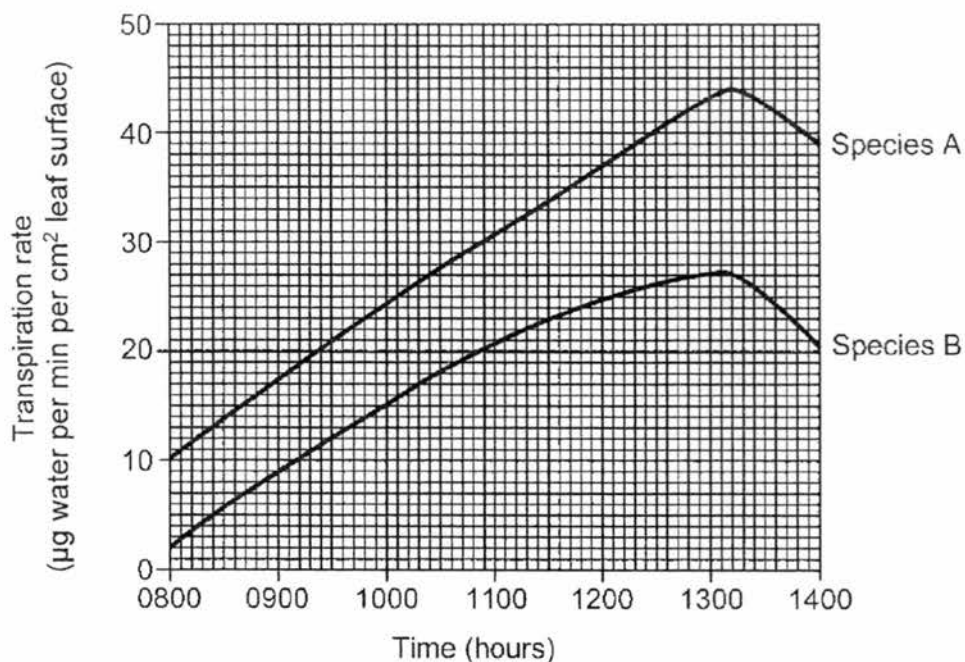
- (ii) Stomata open as conditions change from dark to light. Explain the importance of this for photosynthesis in green plants.

.....

.....

.....[2]

- (b) The graph below shows the rates of transpiration from leaves of two species of green plant kept under identical environmental conditions over a six hour period.



- (i) Calculate the mass of water lost per minute at 1300 hours from a leaf of species B which had a surface area of 10 cm^2 .

.....[1]

- (ii) Calculate the difference in rate of transpiration between species A and species B at 1100 hours.

.....[1]

- (iii) Explain why the units of transpiration used allowed a valid comparison of transpiration rate between the two species.

.....[2]

- (c) Give one benefit of transpiration to plants.

.....[1]

[Total: 9]

[Turn over]

- 3 **Figure 3** below shows the nervous relationship between the spinal cord and the pricking of the hand.

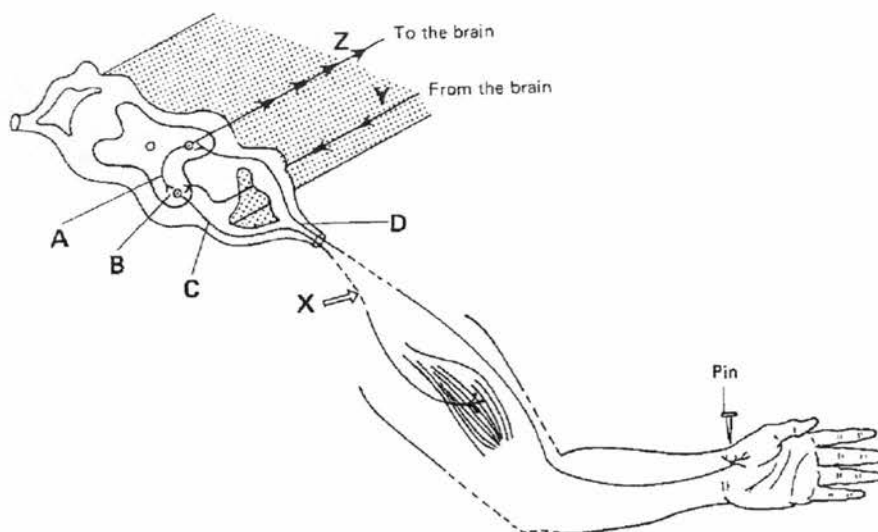


Figure 3

- (a) (i) What type of receptor will be stimulated by pricking the hand with a pin?

.....[1]

- (ii) What will be produced by this receptor?

.....[1]

- (iii) What spontaneous response is produced?

.....[1]

- (iv) Describe the events which occur after the receptor in (a)(i) is stimulated to cause the response in (a)(iii).

.....

[3]

[Turn over

(b) A cut is made at X in **Figure 3**.

- (i) Will the same response be produced when the hand is pricked by a pin?
Explain your answer.

.....
.....
.....[2]

- (ii) Will this man be aware of the pricking action? Explain your answer.

.....
.....
.....[2]

[Total: 10]

[Turn over

- 4 **Figure 4** shows three cells **B**, **C** and **D**, from different tissues in the *same* organism. Each cell is in a stage of either mitosis or meiosis.

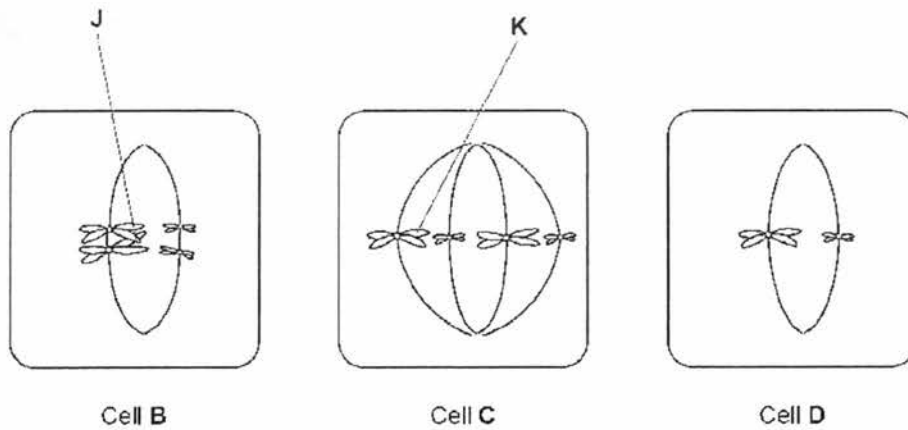


Figure 4

- (a) Complete the table below with a tick if the cell shows the feature.

	Cell B	Cell C	Cell D
homologous chromosomes are present			
a stage in mitosis			

[2]

- (b) Name the type of nuclear division and the stage that each cell is in.

Cell	Type of nuclear division	Stage
A		
B		
C		

[3]

[Turn over]

- (c) Explain what is happening at point J in cell B.

.....

.....

.....[2]

- (d) Use information from all three cells in **Figure 4** to explain how the number of chromosomes in cell D was produced.

.....

.....[1]

[Total: 8]

- 5 (a) Polydactyly is an inherited condition caused by a dominant allele.

Figure 5 shows the hand of a man, Sam, with polydactyly. Sam has an extra finger on each hand.

Sam's mother also has polydactyly but his father does not.



Figure 5

[Turn over]

- (i) Explain why Sam is most likely heterozygous for polydactyly.

.....

.....

.....

.....

.....

.....[3]

- (ii) Sam marries a woman who does not have polydactyly. What is the probability that their first child will have polydactyly?

.....[1]

- (b) Sam has red hair. His sister has brown hair. Both of their parents have brown hair. Using B and b to represent the dominant and recessive alleles for hair colour respectively, complete the genetic diagram below to show how Sam's parents were able to have a child with red hair and a child with brown hair.

[3]

[Total: 7]

[Turn over]

- 6 The arrows in **Figure 6.1** shows the energy flowing through part of a food chain.

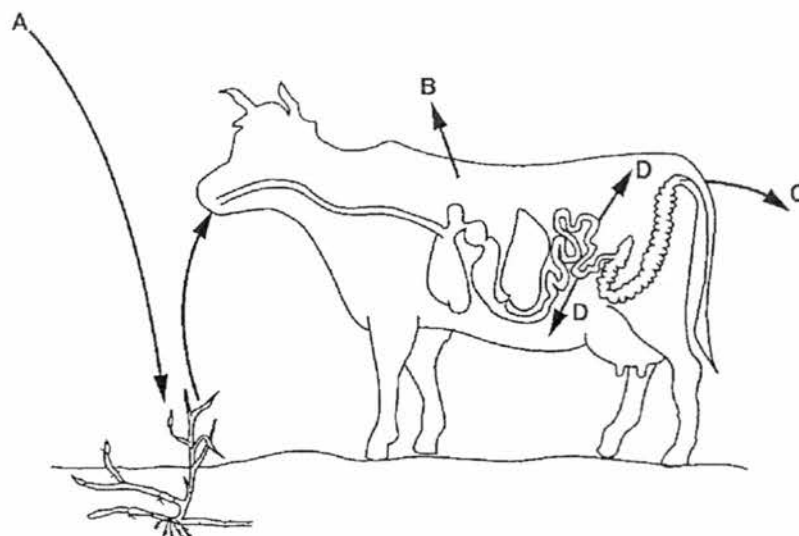


Figure 6.1

- (a) (i) Identify the form of energy indicated at **A** in **Figure 6.1**.
[1]
- (ii) State the form in which energy is lost at **B** and a different form in which energy is lost at **C**.
B
C[2]
- (iii) State two ways in which the cow can use the energy represented by **D** in **Figure 6.1**.
 1
 2[2]
- (b) (i) State a type of organism that might use the energy lost by the cow at **C**.
[1]

[Turn over

- (ii) Explain how the activity of this type of organism could eventually be of benefit to the cow.

.....

.....

.....[2]

- (c) Figure 6.2 below shows a pyramid of biomass.

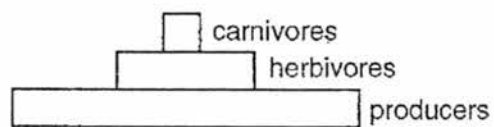


Figure 6.2

Explain why the carnivores have the smallest biomass in this pyramid.

.....

.....[1]

[Total: 9]

End of Section A

[Turn over]

Section B [30 marks]Answer **three** questions.Question 9 is in the form of an **Either/Or** question.

Only one part should be answered.

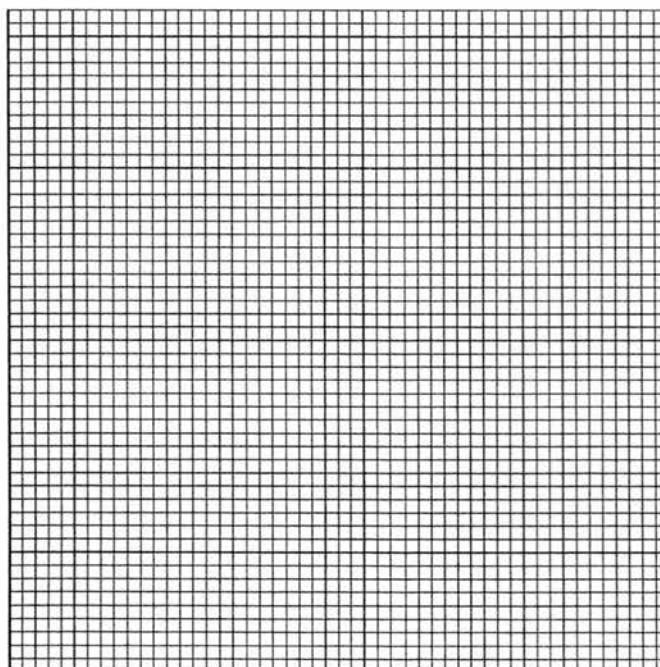
- 7 An investigation was carried out to study the effect of physical activity on breathing. The breathing rate (number of breaths per minute) of a student was measured at rest. The student then cycled at a speed of 10 km per hour for 2 minutes and their breathing rate was measured immediately after. They then rested for five minutes before cycling at 15 km per hour for 2 minutes. Their breathing rate was measured again. This investigation was repeated for cycling speeds of 20 km per hour and 25 km per hour. The results are shown in **Table 7.1**.

Table 7.1

cycling speed /km per hour	breathing rate /number of breaths per minute
rest	12
10	14
15	17
20	20
25	27

- (a) (i) Plot a graph of the data shown in **Table 7.1**.

[4]



[Turn over]

- (ii) Using the information from the graph, state the general relationship between cycling speed and breathing rate.

.....[1]

- (iii) Suggest an explanation for this relationship.

.....

[3]

- (b) The volume of air breathed in and out by the student also changed during this investigation, as shown in Table 7.2.

Table 7.2

cycling speed /km per hour	volume of air breathed in and out in each breath /cm ³
rest	600
25	3000

The *minute volume* is found by multiplying the volume of air breathed in and out in each breath by the breathing rate. Using the information in Table 7.1 and Table 7.2, calculate the minute volume after cycling at 25 km per hour.

minute volume =cm³ [1]

[Total: 9]

[Turn over

- 8 Nutritional information helps people make an informed choice about the food they eat. **Table 8.1** shows a nutrition label from a bar of chocolate and **Table 8.2** shows guidelines on salt content.

Table 8.1

<i>Nutritional information</i>	<i>per 100 g</i>	<i>per bar</i>	<i>% RI*</i>
Energy (KJ)	2251	630	7.5
Sugar	65 g	18 g	15.6
Protein	10 g	2.8 g	3.0
Total fat	25 g	7 g	10.0
Saturated fat	20 g	5.6 g	28.0
Salt	0.4 g	0.1 g	1.7

*RI = Recommended Intake per day

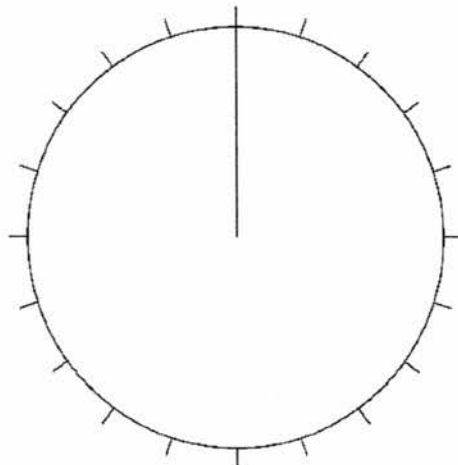
Table 8.2

Salt category	Salt content (g/100g)
High	More than 1.5
Medium	0.3 to 1.5
Low	Less than 0.3

- (a) Using information from **Table 8.1** and **Table 8.2**, identify the salt category to which this chocolate bar belongs.

.....[1]

- (b) Use the information in **Table 8.1** to complete the pie chart below to show the composition of protein, sugar and total fat in 100 g of the chocolate.



[2]

[Turn over]

- (c) As shown in **Table 8.1**, saturated fat makes up part of the total fat in this chocolate bar. Calculate the percentage of total fat which is saturated.

.....[1]

- (d) Jeff recently suffered from a heart attack. Before he had the heart attack, he often ate three chocolate bars in a day. His doctor has now recommended that he avoids eating them. Suggest why Jeff was given this advice.

.....
.....
.....
.....
.....
.....[3]

- (e) Apart from the heart attack, Jeff was otherwise quite healthy and did not suffer from any other health conditions. A bar of chocolate contains 18 g of sugar. Explain how Jeff's blood glucose concentration was regulated after the chocolate bars had been digested and absorbed into his blood.

.....
.....
.....
.....
.....
.....
.....
.....[4]

[Total: 11]

[Turn over

9 Either

Dengue is a disease caused by a virus transmitted by the *Aedes aegypti* mosquito. The virus is transferred to humans when adult female mosquitoes feed on human blood. Figure 9.1 shows the life cycle of a mosquito.

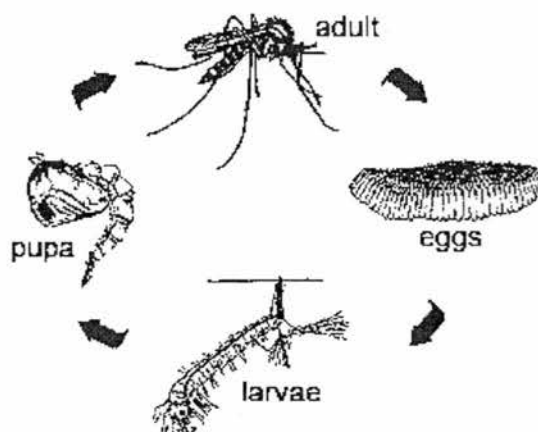


Figure 9.1

- (a) In a bid to control the mosquito population, insecticides are often used. The use of insecticides is, however, frowned upon by many environmental activists. State two reasons why using insecticides to kill mosquitoes is discouraged.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) An internet article states:

- Mosquito larvae are at the start of the food chain for some fish.
- Adult mosquitos provide food for bats and birds.
- Mosquitoes are also important in plant production because they feed from flowers of crop plants.

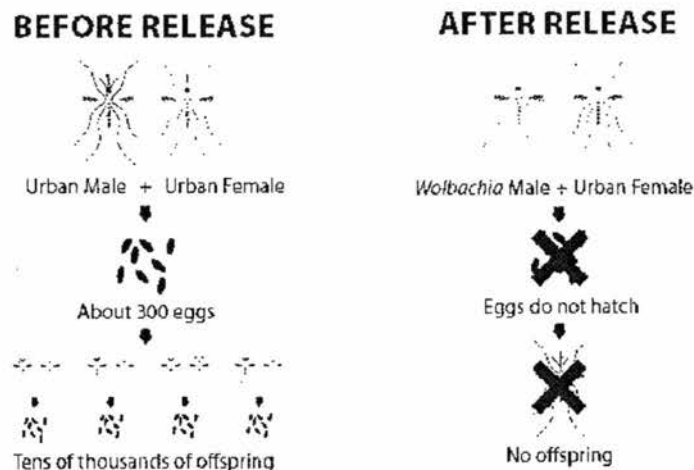
The first sentence in the article is incorrect. Explain why.

.....

[2]

(c) The National Environment Agency of Singapore (NEA) has recently conducted Project Wolbachia on a small scale to help suppress the *Aedes* mosquito population in Singapore. This project sees the production of genetically modified (GM) adult male mosquitoes which carry a gene from bacteria. The gene causes the death of offspring before they become adults.

Male mosquitoes do not feed on blood and during the small scale study, NEA has released these male GM mosquitoes into the wild. Figure 9.2 shows how the process works.



Picture taken from NEA website <http://www.nea.gov.sg/public-health/environmental-public-health-research/wolbachia-technology>

Figure 9.2

[Turn over

Suggest two advantages and two disadvantages of releasing the GM mosquitoes into the wild.

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 10]

[Turn over

9 Or

- (a) Table 10 shows the concentrations of some substances in the urine of a non-diabetic person and in the urine of a diabetic person.

Table 10

Substance	Concentration of substance in urine in g per dm ³	
	Non-diabetic person	Diabetic person
Protein	0	0
Glucose	0	2
Urea	20	19.5
Sodium ions	6	5.8

Compare the results for the non-diabetic person and the diabetic person. Using your knowledge of how the kidney works, give reasons for any differences.

.....

.....

.....

.....

.....

.....

.....

.....

.....[6]

- (b) (i) One way of treating kidney failure is with a kidney transplant. A transplanted kidney can be rejected. Explain why the new kidney may be rejected.

.....

.....

.....

.....[3]

- (ii) Describe one way in which doctors try to prevent kidney rejection.

.....

.....[1]

End of paper

[Total: 10]

ANG MO KIO SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2 2017
SECONDARY FOUR EXPRESS
5158 BIOLOGY (SPA)

MARKING SCHEME

Paper 1

Q	Ans
1	B
2	C
3	A
4	C
5	D
6	A
7	C
8	B
9	B
10	C

Q	Ans
11	C
12	A
13	B
14	B
15	A
16	C
17	C
18	A
19	B
20	A

Q	Ans
21	C
22	D
23	A
24	A
25	B
26	C
27	C
28	A
29	D
30	D

Q	Ans
31	C
32	B
33	O
34	C
35	A
36	C
37	B
38	D
39	C
40	C

Paper 2
Section A

Question 1

Q	Answer	Mark	Remarks
(a)	Any 2: • Lactase/beads can be reused / not washed away • No need to remove lactase from milk • Allows for a continuous process • Avoid end-product inhibition	2	Reject: *less lactase used
(b)	Prediction: • Contains lactose / not lactose-free Explanation: • Boiling water denatures lactase • Destroying active sites of lactase and hence, no longer complementary to lactose to hydrolyse it	1 1 1	
(c)	Any 2: • Lactose hydrolysed to galactose and glucose • More sugar molecules • Galactose and glucose sweeter than lactose	2	

[Total: 7]

Question 2

Q	Answer	Mark	Remarks
(a)(i)	Water molecules enter guard cells (with lower water potential) from epidermal cells (with higher water potential) by osmosis	1	
	Guard cells become turgid and due to uneven cell wall / thicker inner cell wall (next to stoma), they pull apart and stoma opens	1	
(a)(ii)	Allows carbon dioxide to diffuse in for photosynthesis	1	
	Allows transpiration to occur to pull stream of water up from roots to leaves / mesophyll cells	1	
(b)(i)	$27 \times 10 = 270 \mu\text{g}$ per minute	1	*note unit
(b)(ii)	$31 - 21 = 10 \mu\text{g}$ water per min per cm^2 leaf surface	1	*note unit
(iii)	Unit is expressed in per cm^2 / per unit area	1	
	Allows leaves of different sizes / surface areas to be compared	1	
(c)	Any 1: - Transports nutrients/minerals - Supplies water for photosynthesis - Cools plant - For support/turgor	1	

[Total: 9]

Question 3

Q	Answer	Mark	Remarks
(a)(i)	• Pain/touch/pressure receptor	1	
(ii)	• Nerve impulse	1	
(iii)	• Muscle contracts to move arm away from pin	1	
(iv)	• Sensory/receptor neurone transmits nerve impulse across a synapse to relay neurone in spinal cord	1	
	• Relay neurone then transmits nerve impulse across another synapse to motor/effector neurone to effector	1	
	• Muscles in arm, which is effector, contracts to move arm away	1	
(b)(i)	• No • Nerve impulse travelling on sensory neurone and then relay neurone cannot be transmitted across X to stimulate effector / muscle OR motor neurone has been cut and nerve impulse cannot be transmitted to effector / muscle	1 1	
(ii)	• Yes	1	
	• Nerve impulse produced by pain receptors can still travel along sensory neurone to the spinal cord and brain.	1	

[Total: 10]

Question 4

Q	Answer				Mark	Remarks
(a)		Cell B	Cell C	Cell D		
	homologous chromosomes are present	✓	✓		1	*For both
	a stage in mitosis		✓		1	
(b)	Cell	Type of nuclear division	Stage			
	A	Meiosis	Late prophase 1 / early metaphase 1		1	
	B	Mitosis	Metaphase		1	
	C	meiosis	Metaphase 2		1	
(c)	• Crossing over				1	
	• Exchange of parts of chromatids between homologous chromosomes				1	
(d)	• Result of meiosis 1 where homologous chromosomes separate				1	

[Total: 8]

Question 5

Q	Answer	Mark	Remarks
(a)(i)	Sam's father does not have polydactyly which means he is homozygous recessive (since polydactyly is caused by dominant allele)	1	
	and he would have passed one recessive allele to Sam	1	
	Sam's mother has polydactyly so she must have passed on the dominant allele to Sam	1	
(ii)	50% / $\frac{1}{2}$	1	
(iii)	Parents' phenotypes: brown x brown		
	Parents' genotypes: Bb x Bb	1	
	Gametes: (B), (B), (b), (b)		*allow ecf
	Offspring genotypes: BB, Bb, Bb, bb	1	*allow ecf
	Offspring phenotypes: Brown, Brown, Brown, Red	1	

[Total: 7]

Question 6

Q	Answer	Mark	Remarks
(a)(i)	• Light energy	1	
(a)(ii)	• B: Heat energy	1	
	• C: chemical energy	1	
(a)(iii)	Any 2 below: • Growth • Active transport • Muscle contraction • Nerve impulse transmission • Any other possible answer	2	
(b)(i)	• Decomposers / bacteria	1	
(b)(ii)	• Breaks down faeces into simpler substances	1	
	• Provides nutrients to soil which would encourage plant growth which the cow feeds on	1	
(c)	• The biomass of the herbivores could only support a small group of carnivores as energy is lost from one trophic level to the next / as only 10% energy gets passed down from one trophic level to the next	1	

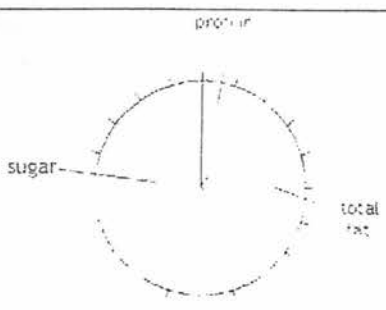
[Total: 9]

Question 7

Q	Answer	Mark	Remarks
(a)(i)	breathing rate / no. of breaths per min cycling speed / km per hour	4	S, P, A, L
(ii)	As cycling speed increases, breathing rate increases	1	
(iii)	- When cycling speed increases, more energy is required - Respiration rate increases to release more energy to meet demand - Increase in breathing rate as more oxygen is taken in for respiration and more carbon dioxide is given off / removed at a faster rate	1 1 1	
(b)	$3000 \times 27 = 81000 \text{ cm}^3$	1	

[Total: 9]

Question 8

Q	Answer	Mark	Remarks
(a)	Medium salt	1	
(b)		2	1m: divisions 1m: labels
(c)	$(20/25) \times 100 = 80\%$	1	
(d)	- Chocolate is high in saturated fats which builds up easily on inner walls of coronary arteries / atherosclerosis, resulting in CHD - Coronary arteries become narrowed and reduces blood flow / oxygen and nutrients to cardiac muscles - Cardiac muscles experience lack of oxygen and may not contract resulting in another heart attack	1 1 1	
(e)	- Increase in blood glucose concentration / above norm stimulates Islets of Langerhans in pancreas to secrete more insulin which is transported to liver and muscles - Insulin stimulates the liver and muscle cells to convert excess glucose to glycogen to be stored - Insulin increases permeability of cell membrane to glucose - Insulin production falls when blood glucose concentration decreases and returns to normal	1 1 1 1	

[Total: 12]

Question 9 Either

Q	Answer	Mark	Remarks
(a)	• Insecticides may become ineffective after some time as mosquitoes may become resistant to the insecticides • They pass on these genes to offspring and population of mosquitoes will increase again • Insecticides may end up affecting organisms/insects other than mosquitoes • If they leak into rivers and lakes, they can accumulate in high concentrations in bodies of aquatic organisms / cause bioaccumulation	1 1 1 1	
(b)	• Food chains should start with a producer which is able to make its own food / harness light energy from sun • Larvae are not producers / are consumers	1 1	
(c)	Advantages (any 2): • More environmentally friendly • Does not kill other insects • Reduction in people infected with dengue • fewer mosquitoes biting / spreading dengue Disadvantages (any 2): • may lead to extinction of the Aedes mosquito • production might be expensive • fewer crops yield • less food for bats / birds • bacterial gene might get transferred into other species / wildlife	2 2	

[Total: 10]

Question 9 Or

Q	Answer	Mark	Remarks
(a)	• No proteins found in both as they are too large to pass through	1	
	• Glucose concentration higher in diabetic than non-diabetic	1	
	• Reason: high blood glucose in blood due to lack of insulin	1	
	• Reason: too much glucose in glomerular filtrate and cannot be reabsorbed back into blood fast enough	1	
	• Urea and sodium ions similar in both but slightly lesser in diabetic	1	
	• Reason: less water reabsorbed in diabetic due to high concentration of glucose in filtrate (water potential difference)	1	
(b)(i)	• Immune system / white blood cells / lymphocytes detect the transplanted organ as foreign	1	
		1	
	• Produces antibodies	1	
	• Attack antigens on transplanted kidney		
(b)(ii)	Any one:	1	
	• Find a matching donor		
	• Treat patient with drugs to suppress immune system		

[Total: 10]